

## Latex glove use among health care workers in Australia

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## Abstract

**Background:** Exposure to natural rubber latex, primarily through the use of gloves, is a well-recognised cause of occupational asthma. We investigated latex glove use among Australian workers and estimated the resultant burden of occupational asthma among health care workers (HCWs).

**Methods:** Data were collected in 2014 as part of the Australian Work Exposures Study (AWES) – Asthma, a telephone survey investigating the prevalence of current occupational exposure to asthmagens, including latex. We estimated adjusted prevalence ratios (aPR) to determine variables associated with the use of latex gloves among HCWs and calculated the asthma-related disability-adjusted-life-years (DALY) due to latex exposure among HCWs.

**Results:** Latex gloves were used by 22% of respondents. Almost two-thirds (63%) of HCWs reported wearing latex gloves, with 26% using powdered latex gloves. The use of latex gloves was more common among those employed in micro (less than 5 employees) than large (200+ employees) companies (aPR=1.5, 95% CI 1.1-2.0). Latex exposure in HCWs was estimated to contribute 3% of the total asthma-related burden.

**Discussion:** Latex gloves are still widely used by Australian workers and HCWs in particular.

**Conclusions:** This is the first estimate of the burden of asthma attributable to occupational exposure to latex among HCWs. These results can be used to guide decisions regarding the control of occupational exposure to latex.

### Keywords:

Asthma, DALY, health care worker, latex, occupation, prevalence

## **Latex glove use among health care workers in Australia**

### **Background**

Natural rubber latex is a well-recognised allergen which is commonly associated with contact dermatitis, asthma, and other allergic conditions [1]. The prevalence of latex allergy in the general population has been estimated at 4%, and is much higher among particular groups of workers such as health care workers (HCWs), with around 10% of HCWs thought to be sensitised [2, 3]. Accordingly, latex exposure is one of the main causes of occupational asthma in developed countries [1, 4].

A major source of exposure to latex, particularly among HCWs, is through the use of latex gloves [1]. Gloves are primarily used as a barrier against infections and contaminants [5], with their use increasing in the 1990s due to rising concerns about blood borne viral infections [6]. Latex gloves are the preferred choice of glove for many workers [5], with a British study finding that 47% of medical practitioners preferred latex over other types of gloves due to their comfort and improved dexterity [7]. Limited data exist regarding the prevalence of use of latex gloves, particularly in Australia, although one study found that 85% of HCWs undertaking wet work were provided with disposable latex gloves [8]. Latex gloves are also used by many other workers in Australia, including hairdressers and food handlers [6, 9].

The use of powder-free latex gloves may be an effective way to reduce latex exposure and sensitisation in the workplace. Powders such as corn-starch are commonly used to lubricate latex gloves, which have a naturally adherent surface when untreated [5]. However, these powders also have a high affinity for latex proteins and can therefore act to increase airborne allergens, particularly during the donning and removal of gloves [10]. Substitution of powder-free for powdered latex gloves has been shown to decrease the presence of latex allergens as well as reduce sensitisation and asthma symptoms in workers, including HCWs

[4, 11]. The use of powder-free gloves, particularly in HCWs, is recommended by the National Health and Medical Research Council in Australia [12], while powdered latex gloves have been banned in other countries, including Germany [1]. However, policies regarding the use of latex gloves, both powdered and powder-free, vary among Australian health care facilities.

The current study aimed to investigate the prevalence of use of both powdered and powder-free latex gloves across the Australian working population, with a particular focus on their use by HCWs as they have been identified as a population at high risk of latex sensitisation [1, 4]. We also aimed to estimate the burden of occupational asthma resulting from the use of latex gloves among Australian HCWs.

### **Material and methods**

Data for this study were collected as part of the Australian Work Exposures Study (AWES) – Asthma. AWES-Asthma was a cross-sectional telephone survey conducted in 2014 to investigate the prevalence of current occupational exposure to 27 groups of asthmagens, including latex, among the Australian working population. Ethics approval for this study was obtained from the [redacted for review] Human Research Ethics Committee. Full details of the methodology have been published elsewhere [13].

In brief, Australian residents aged between 18 and 64 years old who were currently employed were eligible to participate. Informed consent was presumed by the approval to continue with the survey questions following a description of the study. Using computer-assisted telephone interviews, all participants (n=4,878) were asked to provide basic demographic information including age, gender, country of birth, and highest level of education completed, as well as occupational information including the size of the company for which they worked and whether they had any managerial or supervisory duties. We derived socioeconomic status (according to the Socio-Economic Indexes for Areas disadvantage score) [14] and remoteness

of residence (according to the Accessibility/Remoteness Index of Australia) [15] from the respondent's residential postcode. We also collected preliminary information on the respondent's current job to determine whether the job was unlikely to be exposed to asthmagens (e.g. office and clerical workers, customer service workers; n=2,255 classified as unexposed).

For the remaining 2,623 workers, additional information regarding their current job was collected and used to assign one of 53 job specific modules (JSMs) using the web-based tool OccIDEAS [16]. Each JSM contained questions about specific tasks which had been identified as potential determinants of exposure to one or more of the asthmagen groups.

Fifty-two of these JSMs (all excluding Driver) included a standard set of questions related to glove use. These questions collected information regarding the use of gloves while working, the type of gloves worn (including latex), the presence of powder on the inside of the gloves, and the frequency with which gloves were worn (defined as *rarely, half of the time, most of the time, always, or only during specific tasks*). Where respondents could not identify the type of gloves worn, they were asked whether the gloves were "stretchy and creamy white in colour" in an attempt to ascertain whether the gloves were made from latex. A total of 2,476 respondents answered these questions.

At the completion of data collection, each job was coded according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO) [17] and then categorised into one of 24 occupational groups determined to be relatively homogenous with regard to the relevant tasks undertaken and hence potential for exposure to asthmagens. Two members of the study team independently grouped the occupations and any differences between the two members were then resolved by discussion.

All analyses were performed using Stata v14 [18]. Prevalence of latex glove use was extrapolated to the Australian working population with reference to the 2011 Census [19] to

provide an estimate of how many workers in Australia are likely to use latex gloves in their current jobs. As our sample has previously been found to be non-representative in terms of age, remoteness, and manager/other occupation (for males only) [13], extrapolations were weighted by age group and remoteness (and manager/other for males) and stratified by gender.

For this paper we also conducted a supplementary analysis restricted to those assigned an ANZSCO code identifying them as HCWs (n= 411, 8.4% final sample). For the purposes of this analysis, HCWs included allied health workers (e.g. pharmacists, physiotherapists), carers (e.g. personal care attendants, nursing support and personal care workers), medical laboratory scientists, and nurses and other medical personnel (e.g. dental practitioners, general practitioners, surgeons) (see Supplementary Table 1 for a full list of included ANZSCO codes). Adjusted prevalence ratios (aPR) and 95% confidence intervals (CIs) were estimated using modified Poisson regression models incorporating the robust sandwich variance [20] in order to determine which if any demographic and occupational variables were associated with the use of latex gloves among HCWs. The demographic variables of gender, age group, country of birth (Australia/other), highest level of education, socioeconomic status, and remoteness of residence, as well as the occupational variables of occupational group, company size, and manager status, were adjusted for in all such analyses. We then calculated the asthma-related disability-adjusted life years (DALY) due to occupational exposure to latex among HCWs. We first calculated the weighted years lived with disability (YLD) due to asthma as a function of the number of prevalent asthma cases and a disability weight. The disability weight (0.054) was derived from the 2003 Australian Burden of Disease and Injury report [21], while the number of prevalent cases by 10-year age group was obtained from the National Health Survey 2014-15 [22]. We then calculated the years of life lost to premature mortality (YLL) as a result of asthma, by multiplying the

number of deaths due to asthma in 2014 (obtained from the General Record of Incidence of Mortality maintained by the Australian Institute of Health and Welfare [23]) by the life expectancy at the age of death (using the life tables for 2013-15 obtained from the Australian Bureau of Statistics [24]). Both YLD and YLL were calculated separately by gender and restricted to ages 18 to 64 (considered the working population for our purposes). We then summed the YLD and YLL to derive the DALY due to asthma.

Finally we derived the population attributable fraction (PAF), or the proportion of asthma cases due to occupational exposure to latex among HCWs, using Levin's formula [25]. The proportion of the population who were latex glove-wearing HCWs (i.e. the proportion of the population exposed) was derived from AWES-Asthma, while the relative risk of asthma from latex exposure among HCWs was derived from a meta-analysis conducted by Bousquet and colleagues (OR = 1.55, 95% CI 1.15-2.08) [4]. The PAF was then multiplied by the DALY to obtain the burden of asthma due to occupational exposure to latex among HCWs. We also conducted a secondary PAF analysis restricted to those HCWs who reported only wearing latex gloves and doing so at a high frequency (defined as "always" or "most of the time").

## **Results**

Of the 4,878 respondents, 1,710 (35.1%) reported wearing gloves at work. Latex gloves were the most frequently reported type of glove worn and were used by 1,057 respondents (21.7% of total), with 49.8% of these (n=526) reporting exposure to powdered latex gloves. Other glove types worn included leather (n=341, 7.0%), nitrile (n=228, 4.7%), polyvinyl chloride (PVC; n=145, 3.0%), and vinyl (n=100, 2.1%). Of those who reported wearing gloves, just under half (n=784, 45.8%) wore latex gloves exclusively, with 256 of those (5.3% of respondents) wearing latex gloves "always" or "most of the time".

When extrapolated to the 2011 Australian working population, we estimated that 22.2% (95% CI 20.6-23.9; n=2,104,150) of workers wore latex gloves at work, with 16.2% (95% CI 14.8-

17.8; n=1,539,000) of workers exclusively wearing latex gloves and 5.6% (95% CI 4.7-6.7; n=533,850) doing so “always” or “most of the time”. Powdered latex gloves were estimated to be used by approximately 11.4% (95% CI 10.2-12.8; n=1,084,750) of workers.

The occupational groups with the highest prevalence of use of latex gloves were carers, hairdressers, food preparation workers, and nurses or medical personnel (Table 1). These were also generally the groups with the highest use of gloves overall. The use of powdered latex gloves differed across occupational groups, with hairdressers, carers, and food preparation workers having the highest prevalence of use.

#### *Latex glove use in health care workers*

Based on ANZSCO codes, we identified 411 workers as HCWs. These included workers from four different occupational groups: namely, allied health (e.g. pharmacists, physiotherapists), carers (e.g. nursing support and personal care workers), nurses and other medical personnel (e.g. dental practitioners, general practitioners, surgeons), and technical/engineering (i.e. medical laboratory scientists).

The majority of HCWs reported wearing gloves at work, and just under two-thirds reported wearing latex gloves (Table 1). Other glove types worn by HCWs included nitrile (n=88, 21.4%), vinyl (n=26, 6.3%), neoprene (n=16, 3.9%), and PVC (n=14, 3.4%). Of those HCWs who reported wearing gloves, just under half (n=189, 46.0%) wore latex gloves exclusively, with 93 of those (22.6% of all HCWs) wearing latex gloves “always” or “most of the time”.

Among HCWs, the use of latex gloves was found to be less common among allied health workers (aPR=0.7, 95% CI 0.5-1.0) than among nurses or other medical personnel, and more common among those employed in micro (less than 5 employees) compared with large (200+ employees) companies (aPR=1.5, 95% CI 1.1-2.0). The use of powdered latex gloves was also found to be marginally more common among carers (aPR=1.5, 95% CI 1.0-2.3) than among nurses or other medical personnel. The use of latex and powdered latex gloves did not



differ by any other demographic or occupational variable (data not shown).

Table 1. Glove use and latex glove use by occupational group

Occupational Group	N	Any gloves		Latex gloves		Powdered latex gloves	
		n	%	n	%	n	%
Carers	124	116	93.6	96	77.4	44	35.5
Hairdressers	24	20	83.3	18	75.0	10	41.7
Food preparation	150	120	80.0	93	62.0	51	34.0
Nurse/medical	272	262	96.3	166	61.0	62	22.8
Cleaning	107	83	77.6	61	57.0	31	29.0
Food service	60	36	60.0	29	48.3	16	26.7
Allied health	45	28	59.6	21	44.4	12	26.7
Technical/engineering	77	61	79.2	34	44.2	10	13.0
Mechanical	65	46	70.8	28	43.1	19	29.2
Painting/printing	49	36	73.5	21	42.9	14	28.6
Other (NOS*)	34	21	61.8	14	41.2	11	32.4
Gardening	79	58	73.4	32	40.5	19	24.1
Education	431	183	42.5	153	35.5	83	19.3
Security/safety	55	30	54.6	19	34.6	7	12.7
Farming/animal workers	238	172	72.3	81	34.0	39	16.4
Construction	186	117	62.9	57	30.7	26	14.0
Electrical/electronic	75	53	70.7	21	28.0	12	16.0
Wood workers	78	43	55.1	19	24.4	13	16.7
Manufacturing	86	54	62.8	16	18.6	5	5.8
Mining	27	23	85.2	5	18.5	3	11.1
Metal workers	84	59	70.2	11	13.1	6	7.1

Retail	348	49	14.1	31	8.9	15	4.3
Transport	184	13	7.1	8	4.4	7	3.8
Manager/administration	2,000	27	1.4	23	1.2	11	0.6
<i>Health care workers</i>	<i>411</i>	<i>383</i>	<i>93.2</i>	<i>259</i>	<i>63.0</i>	<i>106</i>	<i>25.8</i>

\* NOS: Not otherwise specified

*Burden of asthma due to latex glove use among health care workers*

Approximately 88,000 years of healthy life (or DALY) were found to be lost to asthma among Australians aged 18 to 64 (Table 2). The vast majority of this burden (95.7%) was non-fatal (i.e. due to YLD). A total of 2,505 DALY (or 2.8% of the total due to asthma) were attributable to occupational latex exposure among HCWs. The majority of this burden was experienced by female HCWs.

Table 2. Burden of asthma (DALY) among Australians aged 18 to 64, and proportion attributable to occupational exposure to latex among HCWs

	<b>Males</b>	<b>Females</b>	<b>Overall</b>
<i>All asthma</i>			
Years lived with disability (YLD)	35,052	49,439	84,491
Years of life lost (YLL)	1,878	1,914	3,792
Disability-adjusted life years (DALY)	36,930	51,353	88,283
<i>Asthma attributable to occupational exposure to latex among HCWs</i> *			
Population attributable fraction (PAF)	1.0%	4.6%	2.8%
Attributable Burden (in DALY)	387	2,345	2,505
<i>Asthma attributable to exclusive latex glove use at high frequency among HCWs</i> †			
Population attributable fraction (PAF)	0.4%	1.7%	1.0%
Attributable Burden (in DALY)	141	866	916

\* Any use of latex gloves by HCWs (regardless of other glove types worn and/or frequency)

† HCWs who reported only wearing latex gloves and doing so “always” or “most of the time”

When restricting the analysis to those who reported only wearing latex gloves and doing so at a high frequency, 1.0% (916 DALY) of the total burden of asthma was attributable to latex glove use among HCWs (Table 2). Again, the majority of this burden was experienced by female HCWs.

## **Discussion**

The current study found that approximately 22% of Australian workers wear latex gloves at work. Those occupational groups with the highest prevalence of use included carers, hairdressers, and food preparation workers. Powdered gloves were still frequently used, with half of all latex gloves worn being powdered. The use of latex gloves was also found to be high among HCWs, with such use found to be an important contributor to the burden of asthma among the Australian working age population.

Latex gloves were worn by almost two-thirds of all HCWs, in line with previous Australian research which found that 85% of those in the health and community services industry undertaking wet work were provided with latex gloves [8]. The use of latex gloves was also more common among those working in smaller companies (in particular, those with less than five employees), suggesting that messages regarding latex sensitisation and allergy may have been differentially received by different groups of HCWs. This is in accordance with anecdotal evidence suggesting that large hospitals would be less likely to provide latex gloves due to their awareness of latex hazards [11, 26].

Accordingly, a review of latex interventions found primary prevention programs were targeted at hospital and dental staff but not other HCWs [11], while a large German intervention study focused on hospitals and dental practices but not smaller health care settings [27]. These interventions, including substituting powder-free for powdered latex gloves or nitrile gloves and banning powdered latex gloves, have been found to be effective in reducing latex-related symptoms and sensitisation [11]. The results of the current study

suggest that such interventions should be extended to other HCWs, and in particular carers, who were more likely to wear powdered latex gloves and may represent an especially overlooked group in the health care field.

Occupational latex exposure among HCWs was also an important contributor to the burden of asthma. We found that almost 3% of all DALY due to asthma were attributable to occupational latex exposure among HCWs, with 1% of all asthma-related DALY being attributable to exclusive and frequent use of latex gloves among HCWs. The majority of this burden was experienced by female HCWs. Previous estimates of the burden of asthma attributable to occupational exposures have not generally divided the attributable fraction by specific asthmagen and so a direct comparison of our results is not possible. The Global Burden of Disease project conducted by the World Health Organisation, for example, found that 9% of all asthma-related DALY in the Western Pacific Region (including Australia) were work-related [28], while the Australian Burden of Disease study estimated that 9.5% of asthma-related DALY were caused by occupational exposures [29]. However, there has been no indication of the proportion of this burden which is due to specific occupational asthmagens, including latex. Regardless, it is clear that latex exposure represents a substantial preventable health concern, particularly among HCWs.

Strengths of this study include the ability to generalise our results to the Australian working population and large sample size, enabling the analysis of the HCW subgroup. However, some limitations should also be noted, including non-response and the use of self-report data. We do not have any further information on non-responders, and so the impact of this bias is unknown. In addition, while glove type has commonly been self-reported in previous research [8], it is unclear how accurately respondents were able to classify the glove type they wore. We used a common description of latex gloves (“stretchy and creamy white in colour”) in order to ascertain whether gloves were latex in the case that a respondent was unsure.

However, this may not describe all latex gloves available, with a simple internet search revealing advertisements for many different coloured latex gloves including black and blue. The extent to which these results may be generalizable to international populations is also unknown, particularly given the differences in policies surrounding the use of latex gloves. However, countries in which latex gloves are not banned may potentially have a similar pattern of use.

Furthermore, the accuracy of the disability weight used in our burden analysis is unknown. We used a disability weight from 2003 provided by the Australian Institute of Health and Welfare [21] as this was the most suitable given the available data as well as being Australia-specific; however, other estimates have used different disability weights and it is unclear which is the most appropriate. While more recent estimates exist (for example, a 2013 weight from the Global Burden of Disease study [30]), these are not specific to Australia and thus may not be relevant to our data. The choice of relative risk in these analyses is another potential limitation. We used a pooled risk estimate derived from a meta-analysis of studies in HCWs [4]; however, this did not include any Australian studies and so the relevance of this estimate to current exposure in Australian workers is unknown. It is also unclear how the duration and intensity of exposure in the studies used to calculate this risk estimate relates to the exposures in our sample.

## **Conclusions**

The current study provides the first estimate of the burden of asthma attributable to occupational exposure to latex among HCWs, both in Australia and internationally. It also presents detailed information regarding the use of latex gloves across the entire Australian workforce and among HCWs in particular. The results of this study should be used to guide decisions regarding the control of occupational exposure to latex, and suggest particular areas where intervention may be of most use.



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