

Does exposure to workplace hazards cluster by occupational or sociodemographic characteristics? An analysis of foreign-born workers in Australia.

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Abstract (248, max 250)

Background. Disparities in exposure to occupational hazards may be linked to social position as well as the type of job a person holds. This study aimed to describe the prevalence of exposure to workplace hazards among three migrant worker groups and to assess whether social disparities in exposure for these groups remain after adjusting for occupational characteristics.

Methods. Data was collected in 2017/2018 from 1630 Australian workers born in New Zealand, India and the Philippines. Weighted estimated prevalence of exposure to 10 carcinogens and four psychosocial hazards (discrimination, job strain, vulnerability and insecurity) was calculated for socio demographics and occupation. Regression estimated the likelihood of exposure by socio demographics after adjustment for occupational characteristics.

Results. Exposure to workplace hazards ranged from 11.7% (discrimination) to 61.2% (exposed to at least 1 carcinogen). Compared with workers born in India, New Zealand born workers were over twice as likely to be exposed to diesel engine exhaust (aOR=2.60) and 60% more likely to be exposed to at least one carcinogen (aOR=1.60) but less likely to be exposed to any psychosocial hazard. Social disparities by country of birth, sex, age, education and number of years in Australia as well as company size, employment type and hours worked remained associated with greater likelihood of reporting one or more workplace hazards after adjusting for occupational characteristics.

Conclusion. Examining sociodemographic as well as occupational characteristics helps to clarify groups most likely to be exposed to workplace hazards who can be hidden when examining occupational characteristics alone.

Introduction

Exposure to hazards in the workplace can be explained by the type of job a person holds: the industrial sector, the occupation, and the tasks they perform in that job. These are key determinants of exposure to chemical or psychosocial hazards and have been shown elsewhere to explain disparities in exposure to workplace hazards. For example, farmers and transport workers have a higher risk of exposure to carcinogens at work ¹. However, the social position of the worker, as measured by socio demographic characteristics, can also explain disparities in exposure to workplace hazards ². For instance, age has been associated with work-related injuries where younger workers incur more work-related injuries than other age groups ³. However, the majority of work examining risk of exposure and socio demographic characteristics compares men with women ^{4,5}. There are some studies which compare other factors such as migrant status and gender ⁶ or education level and language mainly spoken at home ⁷ but such investigations are rare.

In many industrialised countries, migrant or foreign-born workers are found in jobs requiring fewer skills and with poorer working conditions, therefore increasing their risk of exposure to workplace hazards ^{8,9}. Australia makes an interesting case study because skilled workers became the largest migration stream from the mid-1990s ¹⁰. Skilled workers come from more than 180 countries, but in the last ten years the majority have come from India, China, the United Kingdom and the Philippines ¹¹. They are approved for migration based on their work and educational qualifications and their competence in English, but this does not guarantee them placement in work that is commensurate with these ¹². In contrast, New Zealanders migrate to Australia without any visa or skill restrictions and constitute the second largest migrant group in Australia, after the United Kingdom ¹³. By 2016, overseas-born

workers comprised 35% of the Australian workforce, with very diverse characteristics in terms of country of origin, education and income ¹⁴.

Most studies examining exposure to workplace hazards focus on single exposures or groups of exposures, for example exposure to chemicals and dusts¹⁵ or ergonomic factors ¹⁶ or psychosocial stressors ¹⁷. Yet in the workplace, workers are likely to be exposed to different types of hazards simultaneously ¹⁸. Until now, the clustering of exposure to workplace hazards by occupation and social group has not been well examined, particularly among migrant or foreign-born workers. The aims of this study are therefore to 1) describe the prevalence of exposure to workplace hazards (carcinogens and psychosocial) by occupational and sociodemographic characteristics in migrants to Australia, and 2) to determine if exposure to workplace hazards cluster by sociodemographic or occupational characteristics, within and between migrant groups.

Methods

Survey

The Migrant Worker II study was a national survey conducted in 2017/2018, that recruited workers born in New Zealand, India or the Philippines and who were living in Australia. Ethics approval was obtained from the Human Research Ethics Committee of Curtin University (HREC RDHS-55-16).

All interviews were conducted by trained interviewers using computer-assisted telephone interviews. Following a brief introductory script given in English, where consent to

continue was obtained, participants whose first language was not English were given the option of completing the interview in Hindi or Tagalog, which no one accepted.

A variety of strategies were used to obtain the necessary numbers for analysis by migrant status. Initially, we randomly sampled the latest Electronic White Pages (EWP), stratified by state and then filtered by the most common surnames for people born in the target countries and this method constituted 45.7% of our recruitment. As we had to telephone many households to achieve this percentage, the second strategy targeted those suburbs that had high proportions of the target migrant groups and telephone numbers were randomly selected within these which constituted 17.9% of our recruitment. This was also time consuming and costly so we procured sample from a commercial survey sampling firm who were able to identify members of the target migrant groups. This method constituted 32.8% of our recruitment and the last 3.6% was obtained by contacting people who had agreed to be re-contacted from a previous survey along with any additional possible recruits that they suggested.

The survey collected demographic information, including gender, age, country of birth, year of arrival in Australia, language mainly spoken at home, and highest level of education. Employment information was also collected: occupation, job title, tasks undertaken, employment status (casual, permanent or fixed term, self-employed), type of job (full-time or part-time), average weekly hours worked, company size, the industry of employment and psychosocial workplace hazards.

Definition of workplace hazards

Occupation was coded as per the Australian and New Zealand Standard Classification of Occupations (ANZSCO) ¹⁹, and industry using the Australian and New Zealand Standard

Classification of Industries (ANZSIC) ²⁰. Because of small numbers, common occupations within industries were used to group the industries.

Exposure to at least one of ten carcinogens

An online platform, OccIDEAS ²¹, that automates the assessment of occupational exposure, using predetermined rules was used to determine exposure. Based on their job title and main tasks undertaken, participants were allocated the job module most suited to their occupation. Each job module contained a series of questions about the specific tasks performed that were likely to involve exposure to carcinogens in their current job, the frequency of those tasks, how those tasks were performed, and whether any protective measures were taken. The job modules were developed by a team of epidemiologists and occupational hygienists and were specifically tailored to industry and workplace conditions in Australia ²².

We examined ten workplace carcinogens, solar and artificial ultra-violet radiation, diesel engine exhaust, environmental tobacco smoke (ETS), benzene, lead, silica, wood dust, other polycyclic aromatic hydrocarbons (other PAHs) and shift work, which have been found in our earlier work to have the highest prevalence of exposure ²²⁻²⁴. Based on the answers to the questions in the job module described above, we made an automatic assessment of the probability ('none', 'possible' or 'probable') of exposure to these ten workplace carcinogens. We then derived two dichotomous variables, any exposure to any of the ten common carcinogens and exposure to diesel engine exhaust, one of the more common workplace carcinogens in Australia. Exposure was defined as the assessment of possible or probable exposure (1) or assessment of no exposure (0).

Perceived high job strain

Using a seven point Likert scale ranging from strongly disagree to strongly agree, job demand was rated using five questions: i) how stressful the job is, ii) how fast you work, iii) how hard the work is, iv) if work is excessive, and v) if there is enough time to do the work. The ratings were then summed and divided at the 75% percentile for high demand. Job control was rated using three questions: i) whether or not the worker can determine how and ii) when the work is done, and iii) ability to have input into the job. The ratings were summed and divided at the 25% percentile for low control. Based on Karasek's model²⁵, high job strain was defined as having high demand but low control and coded no (0) yes (1).

Perceived discrimination at work

Two different questions, used in a previous study²⁶, were asked to assess whether or not there was discrimination at work: i) have you ever experienced discrimination by your boss and ii) have you ever experienced discrimination by your colleagues with responses yes, no, unsure, not applicable/self-employed and refused. We defined experiencing discrimination as answering 'yes' to either question and not experiencing discrimination as answering unsure, no and not applicable/self-employed to both questions and coded no (0) yes (1).

Perceived high job insecurity

Using a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7), job insecurity was assessed with three questions: i) worried about the future in one's job, ii) feel secure in employment iii) think company will be here in 5 years, which were used in a previous study^{27,28}. A fourth measure of job security was whether or not the respondent wanted a more secure employment contract coded as wanted less secure (0), no change (1) or wanted more secure (2). The four measures were summed into a scale from low to high. High insecurity was defined as scores at or above the 75th percentile²⁸ and coded no (0) yes (1).

Perceived high vulnerability at work

Vulnerability at work was based on the vulnerability factor from the EPRES scale²⁹ measured with five statements. With regard to the last year of employment: i) you were made to feel you could be easily replaced by boss, ii) afraid of being fired even though you did nothing wrong, iii) treated in discriminatory or unjust way on your job, iv) concerned about your safety on your job but afraid to say, and v) felt defenseless against unfair treatment directed toward you with responses agree, unsure, agree. High vulnerability was defined as agreeing with three or more of the questions and coded no (0) or yes (1)³⁰.

Statistical analyses

To produce population estimates for each migrant group, the data were weighted using Iterative Proportional Fitting³¹ with age, gender, education and area of residence for each migrant group surveyed using the 2016 Australian Bureau of Statistics Census data for the marginal proportions³². We produced weighted estimates for the socio demographic characteristics of the sample by country of birth with 95% confidence intervals. We then calculated the weighted estimate of occupational exposure for each type of workplace hazard (at least one of the ten carcinogens, diesel engine exhaust; and perceived high job strain, discrimination, high job insecurity and high vulnerability) according to socio demographic characteristics (weighted percent, 95% CI and weighted n).

Logistic regression was used to model the probability of each exposure adjusting for socio demographics, occupational characteristics, occupation and industry (as presented on Table 1). All final models used bootstrap estimations of standard errors (100 repetitions)³³ and post estimation tests conducted for goodness of fit using Hosmer-Lemeshow chi square³⁴.

Only the results for the adjusted socio demographic and occupation characteristics are presented as these were the focus of this present investigation. A p value of <0.05 was used to indicate a statistically significant difference. Data were analysed using Stata 14 software ³⁵.

Results

Using the four methods of sample identification, a total of 310,636 households were contacted, of which 2051 had someone in the household who met the criteria and of these, 1630 consented to participate giving a response rate of 79.5%. Table 1 gives unweighted sample and the estimated population percent [95% CI] of sociodemographic and occupational characteristics by country of birth and total. Although the distribution by sex is quite similar in the three groups (around 40% of women), the profiles are quite different according to country of birth. Of the three migrant groups, workers from New Zealand have the longest duration of residence in Australia, the lowest level of tertiary education and were older. In contrast, workers from India had the shortest duration of residence of all three groups, were younger, were more likely to have a tertiary level of education and to work in a professional occupation. A higher percent of workers from the Philippines were younger and had a tertiary education compared with New Zealand workers but a higher percent of Filipinos worked as labourers than either of the other migrant groups (Table I).

Prevalence of exposure to workplace hazards by sociodemographic characteristics

Exposure to workplace hazards varied from 11.7% for discrimination to 61.2% for exposure to at least one carcinogen (Table II). The prevalence of exposure to at least one carcinogen was highest among workers from New Zealand, among men and among those with non-tertiary education. A third of the participants overall reported some exposure to diesel engine exhaust which was highest among New Zealand workers, among men, among persons

aged > 44 years, among those with non-tertiary education levels, among those for persons who mainly spoke English at home and among those who had lived in Australia for > 11 years.

Exposure to high job strain was reported by a third of the sample but there were no significant differences by sociodemographic characteristics (TableII). Exposure to discrimination at work was reported by one in ten participants and was higher among workers born in India and the Philippines, and among workers who spoke a language other than English at home. High job insecurity was reported by almost a quarter of the sample and was higher for workers from India and among workers who spoke a language other than English at home. High vulnerability at work was reported by 13.3% of the sample and was higher for women than men.

Exposure to workplace hazards also varied by occupational characteristics. The prevalence of exposure to at least one carcinogen and diesel engine exhaust was highest among the self-employed, technicians and trades workers and among machinery operators and drivers (Appendix 1). Between 14 and 42% of workers reported high job strain. Self-employed workers reported the lowest prevalence while it was highest among those who were employed on a casual contract or who worked in a clerical or administrative occupation, as a sales worker or as a machinery operator and driver. Workers on casual contracts reported high job insecurity and high vulnerability and community and personal service workers and sales workers reported high vulnerability. Industrial sector also explained variation in exposure to workplace hazards. Workers in Transport, postal and warehousing and Mining and construction had the highest prevalence to at least one carcinogen and to diesel engine exhaust. High job strain was more prevalent among workers in the Retail and Manufacturing sectors. Discrimination was highest among Health care and social assistance workers. Transport and Manufacturing workers

reported the highest prevalence of high job insecurity whereas high vulnerability was reported more frequently among Retail/wholesale and real estate workers.

Sociodemographic determinants of workplace hazard exposure

Table III shows the results of the logistic regression modelling the probability of exposure to each of the six workplace hazards. After adjustment some sociodemographic characteristics remained statistically significantly associated with exposure to workplace hazards. Employment characteristics are also associated with the probability of exposure to workplace hazards (Appendix 2).

Being born in New Zealand (compared with India) was associated with a 67% increased likelihood of exposure to at least one carcinogen and twice the risk of exposure to diesel engine exhaust. Compared with workers from India, New Zealand workers were less likely to report workplace discrimination (aOR=0.32) as well as exposure to high vulnerability at work (aOR=0.57). Workers from the Philippines were less likely to report exposure to high job insecurity compared than the other two groups (aOR=0.68).

Discussion

The prevalence of exposure to workplace hazards was high among these groups ranging from 12% for discrimination to 60% for exposure to at least one carcinogen. Exposure to at least one carcinogen or specifically to diesel engine exhaust constituted the highest likelihood of exposure among these workers, followed by high job strain and high job insecurity. The prevalence of exposure to workplace hazards varied by both social position and occupational characteristics. An increased likelihood of exposure to workplace hazards for several measures of social position remained after adjusting for the occupational characteristics. This suggests that disparities in exposure to some workplace hazards occurred among this population as a result of their social position and irrespective of the type of job they undertook. The most

vulnerable groups for exposure to carcinogens were young workers who worked long hours in smaller companies, particularly if they were born in New Zealand.

Country of birth as a marker of social position was associated with disparities in exposure to at least one carcinogen, to diesel engine exhaust, to discrimination, high job insecurity and high job vulnerability after adjusting for occupational characteristics. Workers born in New Zealand were the most vulnerable group of migrant workers in terms of exposure to carcinogens while being born in India increased the likelihood of being in jobs that are both vulnerable and insecure.

Several explanations can be advanced to explain this. Firstly, for exposure to at least one carcinogen and to diesel engine exhaust, within the same occupation, workers of different origin might perform different tasks, as has been suggested elsewhere ⁷. The variables available for inclusion in the analysis for this current survey (occupation, industry, job type, and employment type and company size) would not then fully account for variations in exposure determined by job tasks. Another explanation is that there is a difference in the reporting of exposure across the three migrant groups, although this is less likely in our survey as we asked about tasks undertaken at work and other work has shown that this method is less likely to elicit any bias ²¹. Alternatively, residual confounding from factors we have measured but that are not readily available for analysis, such as use of safety equipment, might explain the observed differences.

Discrimination in the workplace is well known for its negative impact on well-being and health with associations to poor mental and self-related health, ^{36,37,38} unfavourable health behaviours {Sims, 2016 #1192, unfavourable health behaviours {Sims, 2016 #1192 and cardiovascular diseases ³⁹. However, migrants often declare less discrimination when the question is directly asked (as is the case in this survey) than when they are asked about precise situations in different spheres of life (i.e.

being unequally treated in a job interview for instance), as shown in a large representative survey among immigrants in France ⁴⁰. Therefore, the results presented here could underestimate the prevalence of discrimination in our study. The lower likelihood of exposure to workplace discrimination reported by immigrants from New Zealand compared with immigrants from India or the Philippines may be because Australia has a historical and cultural proximity to New Zealand ⁴¹. It may also be because immigrants from countries like India and the Philippines have a different skin colour to most immigrants from New Zealand and difference in skin colour compared with native skin colour is a well-documented source of discrimination and racism ⁴²⁻⁴⁵.

The migration history, characterised by duration in Australia and the language spoken at home, were not associated with occupational exposure in our survey. These may be unimportant but it could be that high-skilled immigrants do not need to spend several years or to learn the language to improve their situation. There is also the possibility that although experiencing occupational downgrading upon arrival as is often the case in other countries ^{46,47}, immigrants in Australia do not experience great mobility and the pattern of their exposures does not change over time. Also, the duration in number of years may not be an accurate measure of how well immigrants are settled in a host country, and elements such as living conditions, existing social networks could be better measures of the settlement process.

Sex and education also influence workplace exposures: immigrants with tertiary education feel more vulnerable; men feel more insecure. Do these differentials reflect real differences in exposure or different expectations towards the job? It is a possibility, for instance, that men worry more about their job future because they are still considered as “main providers” in our gendered societies. However, further research is needed to better understand these potential declaration biases.

Some limitations of this study are that cross-sectional data provide only point in time estimates of exposure and as such may not be accurately assessing the overall exposure over time. Another limitation is the difficulty in identifying recruits from selected migrant groups. Our study used four selection strategies to eventually recruit sufficient sample from each migrant group for basic analysis. The difficulty did not occur in recruiting once a household was identified as having a suitable candidate (our response rate was 79.7%) but in locating that household in the first instance. While using weighting by marginal populations helped to address this issue, it does not resolve the problems associated with unknown sources of sample. Perhaps the most important limitation in presenting the information from a sociodemographic perspective is that we did not ask any questions about income and, for this population, it is possible that the usual proxies of education and occupation may not be good measures of that. Our study showed that migrants are not always employed in jobs that are not commensurate with their level of education. We did try a multilevel model using the area-based measure of social disadvantage Socio-Economic Indexes for Areas (SEIFA) ⁴⁸ but found no relationship. It is recommended that in future studies, at least an income range is collected.

This study is important because it provides prevalence estimates for both workplace carcinogens and psychosocial hazards among three different migrant groups and migrants are an under-researched segment of the working population. Based upon a representative sample, it shows associations between sociodemographic characteristics and workplace exposures. More research is needed to better understand whether these exposure differentials are due to different attitudes towards reporting exposures across migrant groups, to imperfect characterisation of occupational situations or to real differences across groups of immigrants, which could be related to experiences of discrimination in the workplace.

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