Ann. Occup. Hyg., 2015, Vol. 59, No. 7, 862–871
doi:10.1093/annhyg/mev021
Advance Access publication 6 April 2015

BOHS
The Chartered Society for Worker Health Protection

Demographic and Occupational Differences Between Ethnic Minority Workers Who Did and Did Not Complete the Telephone Survey in English

Terry Boyle[1,2,3*], Renee N. Carey[4], Susan Peters[5], Deborah C. Glass[6], Lin Fritschi[4] And Alison Reid[4]

1.Cancer Control Research, British Columbia Cancer Agency, Vancouver, British Columbia, Canada
2.School of Population and Public Health, The University of British Columbia, Vancouver, British Columbia, Canada
3.Harry Perkins Institute of Medical Research, The University of Western Australia, Perth, Western Australia, Australia
4.School of Public Health, Curtin University, Perth, Western Australia, Australia;
5.School of Population Health, The University of Western Australia, Perth, Western Australia, Australia
6.Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Victoria, Australia
*Author to whom correspondence should be addressed. Tel: +1-604-675-8066; fax: +1-604-675-8180; e-mail: tboyle@bccrc.ca
Submitted 24 September 2014; revised 19 January 2015; revised version accepted 24 February 2015.

ABSTRACT

Background/Objectives: Limited research indicates that using English language only surveys in prevalence studies conducted in the general population or in specific ethnic populations may result in unrepresentative samples and biased results. In this study, we investigated whether participants from ethnic minorities who chose to answer a study interview in a language other than English (LOTE) differed from those who completed the interview in English.

Methods: This study was conducted within an Australian population-based telephone survey that assessed the prevalence of occupational exposure to carcinogens among 749 ethnic minority workers. We used modified Poisson regression to determine the factors associated with completing the interview in a LOTE.

Results: Participants who elected to complete the interview in a LOTE differed from those who completed it in English on several factors, including sex, country of birth, education, occupation, and occupational exposure to carcinogens (40% compared with 29%, $P < 0.01$).

Conclusions: The participants who chose to complete the study interview in their native language had several demographic differences from those participants who completed it in English, and were more likely to be exposed to carcinogens at work. Prevalence studies that offer only English language study instruments are unlikely to produce representative samples of minority groups, and may therefore produce biased results.

KEYWORDS: bias; carcinogens; ethnicity; language; minority groups; occupation; prevalence

INTRODUCTION

In 2013, more than 3% of the world's population lived outside their birth nation (United Nations Department of Economic and Social Affairs, 2013). This proportion is higher in most English-speaking countries. For example, more than 20% of the people living in Australia, Canada, and New Zealand were born elsewhere, as were more than 10% of the populations of the UK and USA (United Nations Department of Economic and Social Affairs, 2013). The proportion of immigrants in these countries has increased over the last few decades, a trend which is expected to continue (United Nations Department of Economic and Social Affairs, 2013). Australia in particular has a high proportion of first- and second-generation immigrants; in 2011, 27% of the population were born abroad and a further 20% had at least one parent who was born abroad (Australian Bureau of Statistics, 2013). Australia has an ethnically diverse population; over 300 ancestry groups were identified in the 2011 Census (Australian Bureau of Statistics, 2013).

In studies that aim to estimate the prevalence of a given exposure or disease, obtaining a representative sample of the population is vital in order to ensure valid estimates (Richiardi *et al.*, 2013). However, despite the large number of immigrants in most English speaking countries, research indicates that non-English speaking persons are explicitly or implicitly excluded from a large proportion of health and medical research studies (Frayne *et al.*, 1996; Murray and Buller, 2007). Although prior research indicates that this exclusion may have a negative effect on the representativeness of a recruited sample (Lee *et al.*, 2008), lead to biased prevalence estimates (Lee *et al.*, 2008) and limit generalizibilty (Frayne *et al.*, 1996; Lee *et al.*, 2011), there is very limited research concerning what bias may be introduced by using only English-language surveys in studies conducted in the general population or in specific ethnic populations (Wong and Wang, 2008).

In this study, we investigate whether baseline characteristics differed between participants who chose to do the interview in a language other than English (LOTE) and participants who did the interview in English, and estimate whether the prevalence of occupational exposure to carcinogens would have been different if participants were only able to complete the survey in English.

MATERIALS AND METHODS

Ethnic minority Australian workplace exposure study

The main aim of the Ethnic Minority Australian Workplace Exposure Study (EM-AWES) was to assess the prevalence of current exposure to carcinogens in the workplace among workers of Chinese, Vietnamese, or Arabic origin (Boyle *et al.*, 2015). The secondary aim was to determine whether the recruitment method resulted in a representative sample.

The EM-AWES was a telephone-based survey conducted in the cities of Melbourne, Perth and Sydney between May and July 2013. To be eligible for the study, participants had to be aged between 18 and 65 years, currently in paid employment, and identify as being of Chinese, Vietnamese, or Arabic ancestry. We attempted to recruit participants in the ratio of two males for every female, to ensure the sample was in keeping with the sex distribution in the Australian labour force. Informed verbal consent was obtained from all study participants, and ethics committee approval for the study was received from the Human Research Ethics Committee at The University of Western Australia.

Potential participants were recruited from two sources: (i) electronic telephone listings (White Pages); and (ii) a list purchased from a commercial survey sampling firm. The purchased list contained names, addresses, and telephone numbers drawn from several data sources in the public domain. For both sources, the telephone numbers of surnames of Chinese, Vietnamese, or Arabic origin were selected in the cities of Melbourne, Sydney, and Perth. A total of 1399 eligible people were contacted in the course of this study, 749 (53.5% response) of whom participated in the study. Of the 749 participants, 307 (41%) were Chinese, 232 (31%) were Vietnamese, and 210 (28%) were Arabic. The response fractions in the Chinese, Vietnamese, and Arabic groups were 53, 62, and 47%, respectively.

Data collection

The interview and assessment procedures used in this study were identical to those described elsewhere (Carey *et al.*, 2013), with the exception that participants were able to complete the interview in English, Mandarin, Cantonese, Vietnamese, or Arabic, depending on their preference. Participants were able

to choose the language of the interview after a brief (two sentences) introductory script. If the participant chose to complete the interview in a LOTE, the interview questions were directly translated into the target language by a bilingual interviewer (i.e. a bilingual interviewer interpreted all of the interview questions into the target language 'on the spot'). The telephone interviews took approximately 15 min to complete and were conducted by trained interviewers using a computer-administered telephone interview system and a web-based application (OccIDEAS). OccIDEAS is an online program that automates the assessment of occupational exposures (Fritschi *et al.*, 2009).

All participants were asked to provide basic details about their current employment, such as job title and main job tasks. These basic job details were used to determine whether the participant worked in a job in which they were potentially exposed to any of the 38 carcinogens on a predetermined list (Fernandez *et al.*, 2012). The carcinogens on the list included combustion products (e.g. diesel engine exhaust, second-hand tobacco smoke), dusts (e.g. asbestos, wood dust), metals (e.g. lead, nickel), radiation (e.g. ionizing radiation, solar radiation), and various other carcinogens (e.g. benzene, nitrosamines, shift work). If the participant worked in a job in which it had been predetermined that there was no exposure to any of the carcinogens on the list, the interview concluded. Predetermined unexposed jobs included customer service, retail, teaching (except art, science, or technical subjects) and home duties. All other participants were administered a job-specific module (JSM) in OccIDEAS. Participants were allocated the JSM that was most applicable to their occupation. For example, taxi drivers, delivery drivers and bus drivers were all allocated the 'Driver' JSM. Each of the JSMs included questions about the specific tasks that were performed as part of the job, how often the tasks were performed, how the tasks were performed, and what (if any) protective measures were used while conducting the task. Based on the answers to these questions, the participant was assessed as being exposed or not exposed to each of the 38 carcinogens on the list. These assessments were done automatically according to rules based on scientific literature and expert opinion, then manually reviewed by the study coordinator and/or an occupational hygienist. Full details of the interview and exposure assessment are available elsewhere (Carey *et al.*, 2013).

Measures

All participants were asked about basic demographic characteristics including age, sex, level of education, or training, country of birth, year of arrival in Australia (if born outside of Australia), and language commonly spoken at home. Socioeconomic status was derived from postcode of residence and based on Index of Relative Socio-Economic Disadvantage (IRSD) from the Australian Bureau of Statistics Socio-Economic Indexes for Areas (Australian Bureau of Statistics, 2011).

Analysis

A modified Poisson regression approach was used to determine the factors associated with completing the interview in a LOTE (Zou, 2004). The regression model included ethnicity, sex, age group, city of residence, socioeconomic status, country of birth/year of arrival in Australia, language spoken at home, highest level of education, and occupational group. Occupations were grouped according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO), which categorises all occupations and jobs in the Australian and New Zealand labour markets based on skill (Australian Bureau of Statistics, 2006). All variables were mutually adjusted. In additional analyses, we stratified by ethnicity. Data were missing for age (n = 33), socioeconomic status (n = 23), education (n = 16), and country of birth (n = 5), so these variables were imputed using multiple imputation by chained equations (White *et al.*, 2011). Ten datasets were added in the imputation procedure, which contained all the exposure and outcome variables included in the regression model outlined above, along with a binary variable indicating whether a participant was or was not exposed to one or more of the carcinogens measured in this study.

Pearson chi-square tests were used to compare the overall prevalence of occupational exposure to carcinogens, as well as the prevalence of exposure to the five most common individual carcinogens (solar ultraviolet radiation, environmental tobacco smoke, diesel engine exhaust, polycyclic aromatic hydrocarbons, and silica), in participants who completed the interview in English with those who completed it in a LOTE. Finally, we investigated whether the estimated prevalence of occupational exposure to carcinogens would have been different if participants were only

able to complete the survey in English, assuming that participants who did the interview in a LOTE would not have taken part in the study if they had not been able to conduct the interview in their chosen language. We also used modified Poisson regression to determine whether interview language was associated with being exposed to carcinogens at work, after controlling for ethnicity, sex, age group, city of residence, socioeconomic status, country of birth/year of arrival in Australia, language spoken at home, and highest level of education. A subsequent analysis included ANZSCO occupational group as an additional covariate.

RESULTS

The demographic and occupational characteristics of the participants in the EM-AWES are summarized in Table 1. The most common types of occupations in all three ethnic groups were office worker, health and personal support, and food service (data not shown).

Language of interview

A total of 197 (26.3%) of the participants chose to complete the interview in a LOTE. Arabic (29.5%) or Chinese (31.6%) participants were more likely than Vietnamese participants (16.4%) to have chosen to complete the interview in a LOTE, and this difference was statistically significant in multivariate analyses (Table 2). Age, sex, and socioeconomic status were not significantly associated with interview language. Vietnamese participants from Melbourne and Perth were two and four times more likely to have completed the interview in a LOTE than those from Sydney respectively. Across all ethnicities, participants with no post-school qualifications were more likely to have completed the interview in a LOTE than participants with a technical/trade qualification. Participants who spoke a LOTE at home were significantly more likely to have completed the interview in a LOTE. Arabic and Chinese participants who were born outside of Australia were more likely to have completed the survey in a LOTE than their Australian-born counterparts; however this was not the case among Vietnamese participants. In all three ethnic groups, labourers were more likely to have completed the interview in a LOTE than managers and professionals. Among Chinese participants, technicians/trade workers and machinery operators/drivers were also more likely to have completed the interview in a LOTE compared with managers and professionals.

Prevalence of occupational exposure to carcinogens by interview language

Among the overall sample, 31.6% of the participants were exposed to one or more carcinogens at their workplace (Table 3). Higher exposure prevalence was found among Arabic workers (38.6%) than among Chinese (27.4%) or Vietnamese (31.0%) workers. Similar exposure prevalence was seen in participants born in Australia (33.3%) and elsewhere (31.5%).

A significantly higher prevalence of carcinogen exposure was found among participants who completed the interview in a LOTE (39.6%) compared with those who completed the interview in English (28.8%) (Table 3). Excluding the participants who completed the interview in a LOTE decreased the overall prevalence of exposure from 31.6 to 28.8%, a relative decrease of 8.9%. Excluding those who chose to take the survey in a LOTE resulted in the overall prevalence decreasing from 38.6 to 34.5% among Arabic workers (relative decrease = 10.6%), from 27.4 to 24.8% among Chinese workers, (9.5% relative decrease) and from 31.0 to 28.9% among Vietnamese workers (6.8% relative decrease).

The prevalence of occupational exposure to each of the five most common carcinogens (solar ultraviolet radiation, environmental tobacco smoke, diesel engine exhaust, polycyclic aromatic hydrocarbons, and silica) was higher among participants who completed the interview in a LOTE than in those who completed the interview in English (Table 3).

The results of multivariate analyses without ANZSCO occupational group in the model indicated that participants who completed the interview in a LOTE were 20% more likely to be exposed to one or more carcinogens at their workplace (RR = 1.19, 95% CI = 0.94, 1.52). Adjusting for occupational group in this model attenuated the risk estimate to 1.08 (95% CI = 0.86, 1.36).

DISCUSSION

In this study, we found that participants who completed the interview in a LOTE differed from those who completed the interview in English on several factors, including ethnicity, sex, city of residence, educational level, language spoken at home, country of

Table 1. Demographic and occupation characteristics of the participants in the Ethnic Minority Australian Workplace Exposure Survey.

	Arabic (n = 210) (%)	Vietnamese (n = 232) (%)	Chinese (n = 307) (%)
Sex			
Female	38.6	45.3	47.6
Male	61.4	54.7	52.4
Age			
18–34 years	31.8	27.1	25.3
35–44 years	31.8	22.2	20.0
45–54 years	23.1	31.2	29.3
55–65 years	13.3	19.5	25.3
Location			
Sydney	52.9	45.3	44.6
Melbourne	31.0	41.8	42.0
Perth	16.2	12.9	13.4
Socioeconomic status			
Group 1 (most disadvantaged).	25.4	38.4	11.0
Group 2	26.4	22.7	19.7
Group 3	26.4	24.0	29.7
Group 4 (least disadvantaged).	21.8	14.8	39.7
Highest level of education			
No further education	30.6	38.1	25.3
Technical/trade qualification	20.9	15.2	15.1
University degree or higher	48.5	46.6	59.5
Language spoken at home			
English	52.9	37.9	35.8
Other	47.1	62.1	64.2
Country of birth			
Born in Australia	26.3	21.1	14.2
Born outside of Australia	73.7	78.9	85.8
ANZSCO occupational group			
Managers/professionals	26.7	25.6	44.1
Technicians and trades workers	14.8	15.0	9.2
Community and personal service workers	16.2	13.7	10.2

Table 1. *Continued*

	Arabic (*n* = **210**) (%)	**Vietnamese** (*n* = **232**) (%)	**Chinese** (*n* = **307**) (%)
Clerical and administrative workers/sales workers	24.8	27.9	20.7
Machinery operators and drivers	9.5	7.5	7.6
Labourers	8.1	10.2	8.2

birth, and occupation. The overall prevalence of occupational exposure to carcinogens was higher among participants who completed the interview in a LOTE, as was the prevalence of occupational exposure to each of the five most common individual carcinogens.

The results of this study suggest that not giving participants the option to complete the survey in their preferred language is likely to lead to several groups being underrepresented, specifically males, people born outside of Australia, people with no post-school qualifications, and people working in particular occupations. Previous research among minority ethnic groups has also shown differences between participants who complete surveys in a LOTE and those who complete surveys in English. For example, data from the United States National Health and Nutrition Examination Survey showed that immigrants who completed the survey in a LOTE had lower awareness of some cardiovascular disease risk factors than immigrants who completed the survey in English (Langellier *et al.*, 2012). In the Behavioral Risk Factor Surveillance System, Hispanic participants who completed the telephone survey in Spanish had different demographic, behavioural, health, healthcare, and health knowledge profiles than Hispanic participants who completed the survey in English (DuBard and Gizlice, 2008; Pearson *et al.*, 2009; Grimm and Blanck, 2011; Suneja *et al.*, 2013). Similarly, previous Australian research found that participants who completed the study in Chinese were older, more likely to be married and more likely to be born in mainland China or Taiwan than those who responded in English, while those who responded in English had a higher income, had lived in Australia longer, were more likely to be born in Hong Kong, and were more likely to be in a professional occupation (Wong and Wang, 2008). These results indicate that prevalence studies that offer only English-language study instruments are unlikely to produce representative samples of minority groups and may therefore produce biased estimates.

In addition to demographic differences among participants who answered the questionnaire in English or a LOTE, the prevalence of exposure to carcinogens also differed by interview language. Approximately 32% of participants were exposed to one or more carcinogens at work; however, this figure varied by the language in which the study interview was completed. The prevalence among participants who completed the interview in a LOTE was 40%, compared with 29% who completed the interview in English, and the prevalence of occupational exposure to each of the five most common carcinogens (solar ultraviolet radiation, environmental tobacco smoke, diesel engine exhaust, polycyclic aromatic hydrocarbons, and silica) was higher among participants who completed the interview in a LOTE. After controlling for occupation in multivariate analyses this difference was attenuated, suggesting that it was caused in part by the distribution of occupations differing between those who did and did not complete the interview in English. For example, compared with managers and professionals, labourers, technicians and trades workers, and machinery operators and drivers were more likely to have completed the interview in a LOTE, and were also more likely to be exposed to carcinogens in the workplace.

The results of this study indicate that we would have underestimated the prevalence of occupational exposure to carcinogens by 2.8% had participants not been able to complete the interview in a LOTE. The prevalence of occupational exposure to carcinogens also varied by ethnicity, with a higher prevalence found among Arabic workers than among Chinese or Vietnamese workers. Given this variability among the three ethnic groups, it is possible that not offering the interview in a LOTE in studies of other ethnic groups

Table 2. Demographic factors associated with completing the study interview in a language other than English in the Ethnic Minority Australian Workplace Exposure Survey

	Total	Arabic	Vietnamese	Chinese
	RR (95% CI)[a]	RR (95% CI)[a]	RR (95% CI)[a]	RR (95% CI)[a]
Ethnicity				
Arabic	1.00			
Vietnamese	0.45 (0.32–0.63)			
Chinese	0.86 (0.67–1.12)			
Sex				
Female	1.00	1.00	1.00	1.00
Male	1.11 (0.88–1.40)	1.13 (0.77–1.64)	0.69 (0.40–1.21)	1.28 (0.93–1.78)
Age				
18–34 years	1.00	1.00	1.00	1.00
35–44 years	0.81 (0.56–1.19)	0.66 (0.39–1.14)	1.23 (0.40–3.83)	1.09 (0.59–2.02)
45–54 years	0.90 (0.63–1.29)	1.03 (0.61–1.76)	0.68 (0.23–2.04)	1.17 (0.65–2.08)
55–65 years	1.03 (0.72–1.49)	0.95 (0.55–1.66)	0.56 (0.18–1.80)	1.55 (0.87–2.76)
Location				
Sydney	1.00	1.00	1.00	1.00
Melbourne	1.07 (0.85–1.35)	1.05 (0.68–1.63)	2.19 (1.05–4.59)	0.93 (0.69–1.26)
Perth	1.21 (0.86–1.70)	1.17 (0.74–1.85)	4.09 (1.72–9.74)	0.70 (0.34–1.47)
Socioeconomic status				
Group 1 (most disadvantaged)	1.00	1.00	1.00	1.00
Group 2	1.07 (0.76–1.51)	1.45 (0.77–2.73)	0.91 (0.41–2.01)	0.87 (0.55–1.37)
Group 3	1.27 (0.92–1.75)	1.32 (0.69–2.50)	0.79 (0.35–1.79)	1.35 (0.90–2.02)
Group 4 (least disadvantaged)	1.03 (0.71–1.49)	1.35 (0.67–2.70)	0.46 (0.14–1.48)	0.91 (0.59–1.41)
Highest level of education				
No further education	1.00	1.00	1.00	1.00
Technical/trade qualification	0.66 (0.45–0.97)	0.63 (0.33–1.19)	0.65 (0.21–2.04)	0.68 (0.40–1.17)
University degree or higher	0.85 (0.63–1.15)	0.98 (0.61–1.58)	0.71 (0.33–1.52)	0.96 (0.63–1.46)
Language spoken at home				
English	1.00	1.00	1.00	1.00
Other	4.91 (2.98–8.10)	4.95 (2.54–9.67)	5.15 (1.14–23.30)	4.37 (1.95–9.80)
Country of birth				
Born in Australia	1.00	1.00	1.00	1.00
Born outside of Australia	2.12 (1.06–4.24)	3.44 (1.15–10.25)	1.15 (0.27–5.00)	1.86 (0.56–6.12)

Table 2. *Continued*

	Total	Arabic	Vietnamese	Chinese
	RR (95% CI)[a]	RR (95% CI)[a]	RR (95% CI)[a]	RR (95% CI)[a]
Occupational group				
Managers/professionals	1.00	1.00	1.00	1.00
Technicians and trades workers	1.64 (1.09–2.46)	1.05 (0.55–2.01)	1.12 (0.31–4.08)	2.34 (1.34–4.09)
Community and personal service workers	1.44 (0.95–2.17)	1.26 (0.66–2.39)	1.12 (0.36–3.52)	1.57 (0.86–2.84)
Clerical and administrative workers/sales workers	1.08 (0.72–1.63)	0.95 (0.50–1.81)	1.15 (0.35–3.77)	1.02 (0.54–1.90)
Machinery operators and drivers	1.45 (0.94–2.22)	1.00 (0.53–1.87)	1.59 (0.44–5.78)	1.80 (1.05–3.09)
Labourers	2.14 (1.41–3.25)	1.40 (0.70–2.81)	3.94 (1.29–12.01)	1.94 (1.11–3.38)

[a]All variables are mutually adjusted.

may result in even greater underestimation than we found here. Data from the California Health Interview Survey has also shown that using only English-language surveys can produce biased prevalence estimates; in that study, using only English surveys would have resulted in significantly different estimates of health conditions and health care access in the total sample, as well as among all examined minority groups (Latino, Chinese, Korean, and Vietnamese) (Lee *et al.*, 2008). Thus the current and previous findings indicate that studies of ethnic groups that offer only English-language study instruments may produce biased results.

This study has several limitations that should be taken into account. Firstly, it is possible that the results may have been influenced by the translation method, as direct translation has lower validity and reliability than other translation methods (Weeks *et al.*, 2007). Secondly, although our sample was broadly representative of the employed population of these ethnic groups in Australia several groups were under-represented, including younger people, people with no post-school qualifications, and immigrants (Boyle *et al.*, 2015). The telephone listings-based sampling frame used in this study is one likely reason for the under-representation of these groups (Boyle *et al.*, 2015). Thirdly, we used an area-level assessment of socioeconomic status rather than an individual level assessment, which may have resulted in some misclassification of socioeconomic status. Finally, the validity of our assumption that those who chose to complete the interview in a LOTE would have opted out of the study if the interview was only available in English is not known, as we did not ask participants if that was indeed the case.

Strengths of this study included the population-based design, which meant that we were able to examine the prevalence of occupational exposure to carcinogens in a wider range of occupations than would have been possible in an industry-based study. The exposure assessment used in this study was also a strength, as asking participants about their tasks rather than their exposure to specific occupational exposures is likely to have minimized any possible recall bias.

CONCLUSIONS

In summary, this prevalence study of occupational exposure to carcinogens in Chinese, Vietnamese, and Arabic workers in Australia found that people who completed the interview in a LOTE differed from those who completed it in English. The prevalence of occupational exposure to carcinogens would have been underestimated if participants were not able to complete the interview in their preferred language.

Table 3. Proportion of participants classified as having probable occupational exposure to one or more carcinogens in the Ethnic Minority Australian Workplace Exposure Survey, by ethnicity and interview language, and bias that may have been introduced if the study interview was not offered in a language other than English

	Total	Arabic	Vietnamese	Chinese
All carcinogens				
All participants (%)	31.6	38.6	31.0	27.4
Interviewed in English (%)	28.8	34.5	28.9	24.8
Interviewed in LOTE (%)	39.6	48.4	42.1	33.0
$P_{Difference}$	<0.001	0.059	0.107	0.133
Solar ultraviolet radiation				
All participants (%)	13.0	22.4	12.1	7.2
Interviewed in English (%)	11.6	17.6	10.8	8.1
Interviewed in LOTE (%)	16.8	33.9	18.4	5.2
$P_{Difference}$	0.064	0.010	0.189	0.353
Environmental tobacco smoke				
All participants (%)	12.7	18.3	10.3	10.4
Interviewed in English (%)	11.1	17.6	9.3	8.1
Interviewed in LOTE (%)	17.3	21.0	18.5	15.5
$P_{Difference}$	0.025	0.563	0.228	0.049
Diesel engine exhaust				
All participants (%)	9.7	17.6	9.1	4.9
Interviewed in English (%)	8.5	13.5	8.2	5.2
Interviewed in LOTE (%)	13.2	27.4	13.2	4.1
$P_{Difference}$	0.057	0.016	0.335	0.674
Silica				
All participants (%)	5.9	10.0	6.0	2.9
Interviewed in English (%)	5.3	8.8	5.2	2.9
Interviewed in LOTE (%)	7.6	12.9	10.5	3.1
$P_{Difference}$	0.226	0.364	0.204	0.909
Polycyclic aromatic hydrocarbons				
All participants (%)	5.7	3.8	5.6	7.2
Interviewed in English (%)	4.9	3.4	4.1	6.7
Interviewed in LOTE (%)	8.1	4.8	13.2	8.2
$P_{Difference}$	0.094	0.614	0.027	0.618

FUNDING AND CONFLICT OF INTEREST

This work was supported by the Australian Research Council (Grant Number DP110101262), the National Health and Medical Research Council (Fellowship Number 37614900 to LF), and Cancer Council Western Australia (Fellowship to LF). None of these funding bodies played any role in this study. None of the authors have any conflicts of interest to declare.

ACKNOWLEDGEMENTS

The authors wish to acknowledge Vicki Graham and Theresa Wilkes at the Survey Research Centre, Edith Cowan University, Western Australia for coordinating the data collection for this study.

REFERENCES

Australian Bureau of Statistics. (2006) *Australian and New Zealand Standard classification of occupations*. Canberra, Australia: Australian Bureau of Statistics.

Australian Bureau of Statistics. (2011) *Census of population and housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2011. Catalogue Number 2033.0.55.001*. Canberra, Australia: Australian Bureau of Statistics.

Australian Bureau of Statistics. (2013) *Reflecting a nation: stories from the 2011 census, 2012–2013, Cat. No. 2071.0*. Canberra, Australia: Australian Bureau of Statistics.

Boyle T, Carey RN, Peters S *et al.* (2015) Prevalence of occupational exposure to carcinogens among workers of Arabic, Chinese and Vietnamese ancestry in Australia. *Am J Ind Med*, in press. doi:10.1002/ajim.22428.

Carey RN, Driscoll TR, Peters S *et al.* (2014) Estimated prevalence of exposure to occupational carcinogens in Australia (2011-2012). *Occup Environ Med*; 71: 55–62.

DuBard CA, Gizlice Z. (2008) Language spoken and differences in health status, access to care, and receipt of preventive services among US Hispanics. *Am J Public Health*; 98: 2021–8.

Fernandez RC, Driscoll TR, Glass DC *et al.* (2012) A priority list of occupational carcinogenic agents for preventative action in Australia. *Aust N Z J Public Health*; 36: 111–5.

Frayne S, Burns R, Hardt E *et al.* (1996) The exclusion of non-English-speaking persons from research. *J Gen Intern Med*; 11: 39–43.

Fritschi L, Friesen MC, Glass D *et al.* (2009) OccIDEAS: retrospective occupational exposure assessment in community-based studies made easier. *J Environ Public Health*; 2009: 957023.

Grimm KA, Blanck HM. (2011) Survey language preference as a predictor of meeting fruit and vegetable objectives among Hispanic adults in the United States, Behavioral Risk Factor Surveillance System, 2009. *Prev Chronic Dis*; 8: A133.

Langellier B, Garza J, Glik D *et al.* (2012) Immigration disparities in cardiovascular disease risk factor awareness. *J Immigr Minor Health*; 14: 918–25.

Lee S, Nguyen HA, Jawad M *et al.* (2008) Linguistic minorities in a health survey. *Public Opin Q*; 72: 470–86.

Lee S, Nguyen HA, Tsui J. (2011) Interview language: a proxy measure for acculturation among Asian Americans in a population-based survey. *J Immigr Minor Health*; 13: 244–52.

Murray S, Buller AM. (2007) Exclusion on grounds of language ability–a reporting gap in health services research? *J Health Serv Res Policy*; 12: 205–8.

Pearson WS, Dube SR, Nelson DE *et al.* (2009) Differences in patterns of alcohol consumption among Hispanics in the United States, by survey language preference, Behavioral Risk Factor Surveillance System, 2005. *Prev Chronic Dis*; 6: A53.

Richiardi L, Pizzi C, Pearce N. (2013) Commentary: Representativeness is usually not necessary and often should be avoided. *Int J Epidemiol*; 42: 1018–22.

Suneja G, Diaz JA, Roberts M *et al.* (2013) Reversal of associations between Spanish language use and mammography and pap smear testing. *J Immigr Minor Health*; 15: 255–61.

United Nations Department of Economic and Social Affairs. (2013) *Trends in International Migrant Stock: The 2013 Revision (United Nations database POP/DB/MIG/Stock/Rev.2013)*. New York, NY: United Nations Department of Economic and Social Affairs.

Weeks A, Swerissen H, Belfrage J. (2007) Issues, challenges, and solutions in translating study instruments. *Eval Rev*; 31: 153–65.

White IR, Royston P, Wood AM. (2011) Multiple imputation using chained equations: Issues and guidance for practice. *Stat Med*; 30: 377–99.

Wong KC, Wang Z. (2008) Importance of native language in a population-based health survey among ethnic Chinese in Australia. *Aust N Z J Public Health*; 32: 322–4.

Zou G. (2004) A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol*; 159: 702–6.