Occupations with an increased prevalence of self-reported asthma in Indian adults

Citation

Published Version
doi:10.3109/02770903.2014.913619

Permanent link
http://nrs.harvard.edu/urn-3:HUL.InstRepos:13347457

Terms of Use
This article was downloaded from Harvard University’s DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA

Share Your Story
The Harvard community has made this article openly available. Please share how this access benefits you. Submit a story.

Accessibility
WORK RELATED ASTHMA

Occupations with an increased prevalence of self-reported asthma in Indian adults

Sutapa Agrawal, PhD1, Neil Pearce, PhD, DSc, FRSNZ, FMedSci2,3, Christopher Millett, PhD1,4, S.V. Subramanian, PhD5, and Shah Ebrahim, DM, FRCP, FFPHM1,6

1South Asia Network for Chronic Disease, Public Health Foundation of India, New Delhi, India, 2Centre for Global NCDs, London School of Hygiene and Tropical Medicine, London, UK, 3Centre for Public Health Research, Massey University, Wellington, New Zealand, 4School of Public Health, Imperial College, London, UK, 5Department of Society, Human Development and Health, Harvard School of Public Health, Harvard University, Boston, MA, USA, and 6Department of Non-communicable Disease Epidemiology, London School of Hygiene and Tropical Medicine, London, UK

Abstract

Objectives: Occupational asthma remains relatively under-recognized in India with little or no information regarding preventable causes. We studied occupations with an increased prevalence of self-reported asthma among adult men and women in India. Methods: Analysis is based on 64,725 men aged 15–54 years and 52,994 women aged 15–49 years who participated in India's third National Family Health Survey, 2005–2006, and reported their current occupation. Prevalence odds ratios (ORs) for specific occupations and asthma were estimated using multivariate logistic regression, separately for men and women, adjusting for age, education, household wealth index, current tobacco smoking, cooking fuel use, rural/urban residence and access to healthcare. Results: The prevalence of asthma among the working population was 1.9%. The highest odds ratios for asthma were found among men in the plant and machine operators and assemblers major occupation category (OR: 1.67; 95% CI: 1.14–2.45; \( p = 0.009 \)). Men working in occupation subcategories of machine operators and assemblers (OR: 1.85; 95% CI: 1.24–2.76; \( p = 0.002 \)) and mining, construction, manufacturing and transport (OR: 1.33; 95% CI: 1.00–1.77; \( p = 0.051 \)) were at the highest risk of asthma. Reduced odds of asthma prevalence in men was observed among extraction and building trades workers (OR: 0.72; 95% CI: 0.53–0.97; \( p = 0.029 \)). Among women none of the occupation categories or subcategories was found significant for asthma risk. Men and women employed in high-risk occupations were not at a higher risk of asthma when compared with those in low-risk occupations. Conclusions: This large population-based, nationally representative cross-sectional study has confirmed findings from high income countries showing high prevalence of asthma in men in a number of occupational categories and subcategories; however, with no evidence of increased risks for women in the same occupations.

Keywords

Epidemiology, occupational asthma, men, women, India, NFHS-3

History

Received 16 December 2013
Revised 24 March 2014
Accepted 6 April 2014
Published online 28 May 2014

Introduction

Asthma is among the most common chronic diseases in working-aged populations. Among the general adult population in high income countries, it has been estimated that 2–5% of patients with asthma have occupational asthma [1,2]; some studies from the United States and Japan have estimated the risk to be as high as 15% [3]. Among populations at risk due to their exposure to known sensitizing agents, the risk of developing occupational asthma can be as high as 5–10% per year [1].

Recent studies of the global burden of disease over the last two decades indicate that occupational lung diseases such as chronic obstructive pulmonary disease (COPD), asthma and pneumoconioses caused by exposure to airborne particulates are major contributors to mortality and disability, particularly in low-and-middle income countries [3] with much of this burden falling on working age groups. However, occupational asthma remains under-studied and under-recognized in low- and middle-income countries where diagnosis and management are considered to be poor [3]. There have been no previous studies reporting occupational risk factors for asthma in India in a nationally representative population. Also, there is a particular lack of information on occupational risk factors for women workers [4]. Women’s work has traditionally been considered safe and less hazardous to health in comparison with men’s work [5]. This has resulted in a lack of information on occupational hazards for women workers [4], and our knowledge of occupational health has mainly been based on studies of men. Differences in occupational morbidity have also been observed for men and women with the same job
title, suggesting that even in the same occupation, men and women are not equally exposed to particular risk factors for disease [6]. Very few studies in India have investigated the prevalence of occupational risk factors in women workers, or compared the distribution of risk factors between women and men. We therefore studied associations between occupation and self-reported asthma among adult men and women in India.

Methods
Study design and participants
India’s third National Family Health Survey (NFHS-3, 2005–2006) was designed on the lines of the Demographic and Health Surveys (available at www.measuredhs.com) that have been conducted in many low- and middle-income countries since the 1980s. The NFHS has been conducted in India for three successive rounds, each at an interval of 5 years. NFHS-3 collected demographic, socioeconomic and health information from a nationally representative probability sample of 124,385 women aged 15–49 years and 74,369 men aged 15–54 years residing in 109,041 households. The sample is a multistage cluster sample with an overall response rate of 98%. All states of India are represented in the sample (except the small Union Territories), covering more than 99% of the country’s population. Full details of the survey have been published elsewhere [7]. The analysis presented here focuses on 64,725 men aged 15–54 years and 52,994 women aged 15–49 years who reported their current occupation.

Outcome measure
The survey included several questions relating to the current health status of the respondents during the personal interview, including the question, “Do you currently have asthma?”. The response options were “yes”, “no” and “don’t know”. The survey was conducted using an interviewer-administered questionnaire in the native language of the respondent using a local, commonly understood term for asthma. A total of 18 languages were used with back translation to English to ensure accuracy and comparability. However, no physician diagnosis of asthma was obtained and it was not feasible to clinically test for the disease.

Occupational categories
In NFHS-3, information on respondent’s current occupation was obtained through self-reports at the time of personal interview. Altogether, there were 98 categories of occupations reported. These occupations were then coded using the Revised Indian National Classification of Occupations [8]. NCO 2004 is based on and is compatible with ILO’s (International Labour Organization) International Standard Classification of Occupations 1988 (ISCO-1988; available at www.ilo.org) which serves as a model for development of national standards for classification of occupations for individual nations. The NCO of an occupation describes the duties, skills, competencies and aptitudes required for an occupation in the Indian labour market. NCO 2004 has been prepared by the Director General of Employment & Training (DGET) under the Ministry of Labour and Employment, Government of India, after extensive consultation with Governments, industries and academicians. A detailed survey of about 28,000 establishments all over India was conducted for job descriptions and job analyses before finalizing the NCO 2004. It is extensively used for economic planning by the Government and by economists and statisticians for research.

The NCO is a hierarchical skills-based classification of occupation which consists of 10 divisions (one-digit code); 30 sub-divisions (two-digit code); 116 groups (three-digit code); 439 families (four-digit code) and 2945 occupations (six-digit code). Table 1 shows an example of different levels of classifications in NCO. The choice of the most applicable six-digit occupation code was based on the self-reported job title as well as the respondent’s description of tasks. A broad list of occupational categories provided in the NFHS-3 data is provided in the Appendix with corresponding NCO codes.

Covariates
The socio-demographic factors considered in the present analysis included current smoking status (not smoking, smoking – data on former smoking is not available in the data); household cooking fuel use (clean fuel which include kerosene, liquefied petroleum gas/natural gas, biogas or electricity; solid fuel-less clean which include coal/lignite or charcoal; biomass fuel-not clean which include wood, straw/shrubs/grass, agricultural crop waste, dung cakes, others); age (15–19, 20–34, 35–49 and 50–54 years); education (no education, primary, secondary and higher); wealth index (measured by an index based on household ownership of assets and graded as lowest, second, middle, fourth and highest) was computed using previously described methods [7]; place of residence (urban and rural); and access to health care (public medical sector, NGO or trust hospital/clinic, private medical sector and other sources). For a definition of variables, refer Table 2.

Statistical analyses
The analysis was conducted separately for women and men, because they may have different occupational exposures (even in the same job category), as well as different non-occupational exposures [6]. From the analysis, we removed occupation category such as “workers not classified by occupations” (NCO 2004 Code 10; men n = 9549; 12.8% and women n = 71343; 57.4%), since this include new workers seeking employment and currently not working. We first examined asthma prevalence by various occupational categories in bivariate analysis stratified by gender. Prevalence odds ratios (Ors) [9] and 95% confidence intervals (CIs) were

<table>
<thead>
<tr>
<th>Division (one-digit code)</th>
<th>2</th>
<th>Professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>SubDivision (two-digit code)</td>
<td>22</td>
<td>Life Science and Health Professionals</td>
</tr>
<tr>
<td>Group (three-digit code)</td>
<td>222</td>
<td>Health Professionals (except nursing)</td>
</tr>
<tr>
<td>Family (four-digit code)</td>
<td>2222</td>
<td>Physicians and Surgeons, Ayurvedic</td>
</tr>
<tr>
<td>Occupations (six-digit code)</td>
<td>2222.10</td>
<td>Physicians, Ayurvedic</td>
</tr>
</tbody>
</table>
Table 2. Characteristics of the study participants (men and women reporting their current occupation).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Men age 15–54 years</th>
<th>Women age 15–49 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Currently Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>40737</td>
<td>62.9</td>
</tr>
<tr>
<td>Yes</td>
<td>23988</td>
<td>37.1</td>
</tr>
<tr>
<td>Household cooking fuel use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean</td>
<td>28065</td>
<td>43.4</td>
</tr>
<tr>
<td>Solid-less clean</td>
<td>1351</td>
<td>2.1</td>
</tr>
<tr>
<td>Biomass-not clean</td>
<td>35285</td>
<td>54.5</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–19</td>
<td>6381</td>
<td>9.9</td>
</tr>
<tr>
<td>20–34</td>
<td>30154</td>
<td>46.6</td>
</tr>
<tr>
<td>35–49</td>
<td>23756</td>
<td>36.7</td>
</tr>
<tr>
<td>50–54</td>
<td>4434</td>
<td>6.9</td>
</tr>
<tr>
<td>Mean</td>
<td>32.8</td>
<td>30.5</td>
</tr>
<tr>
<td>SD</td>
<td>±10.2</td>
<td>±9.4</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>13542</td>
<td>20.9</td>
</tr>
<tr>
<td>Primary</td>
<td>12252</td>
<td>18.9</td>
</tr>
<tr>
<td>Secondary</td>
<td>31432</td>
<td>48.6</td>
</tr>
<tr>
<td>Higher</td>
<td>7482</td>
<td>11.6</td>
</tr>
<tr>
<td>Wealth index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest</td>
<td>10991</td>
<td>17.0</td>
</tr>
<tr>
<td>Second</td>
<td>12251</td>
<td>18.9</td>
</tr>
<tr>
<td>Middle</td>
<td>13415</td>
<td>20.7</td>
</tr>
<tr>
<td>Fourth</td>
<td>14159</td>
<td>21.9</td>
</tr>
<tr>
<td>Highest</td>
<td>13909</td>
<td>21.5</td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>22810</td>
<td>35.2</td>
</tr>
<tr>
<td>Rural</td>
<td>41915</td>
<td>64.8</td>
</tr>
<tr>
<td>Access to health care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public medical sector</td>
<td>27511</td>
<td>42.5</td>
</tr>
<tr>
<td>NGO or trust hospital/clinic</td>
<td>309</td>
<td>0.5</td>
</tr>
<tr>
<td>Private medical sector</td>
<td>36570</td>
<td>56.5</td>
</tr>
<tr>
<td>Other sources</td>
<td>317</td>
<td>0.5</td>
</tr>
<tr>
<td>Current Asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>63478</td>
<td>98.1</td>
</tr>
<tr>
<td>Yes</td>
<td>1238</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Table 2 shows the characteristics of the study participants. The prevalence of current asthma was 1.9% both among men and women. Three-fifths men (62.9%) were currently smoking while only 2.3% women were current smokers. More than half of the respondent’s (both men and women) were residing in households using biomass – not a clean fuel for cooking. Two out of five respondents were in age group 20–34 years and 1 in 5 men and 1 in 10 women belonged to households with highest wealth. A majority of the respondents lived in rural areas. More than half the women were not educated while almost half of men were with secondary education. A majority of the respondents have access to private medical sector health services.

Results

Characteristics of the study participants

Table 2 shows the characteristics of the study participants. The prevalence of current asthma was 1.9% both among men and women. Three-fifths men (62.9%) were currently smoking while only 2.3% women were current smokers. More than half of the respondent’s (both men and women) were residing in households using biomass – not a clean fuel for cooking. Two out of five respondents were in age group 20–34 years and 1 in 5 men and 1 in 10 women belonged to households with highest wealth. A majority of the respondents lived in rural areas. More than half the women were not educated while almost half of men were with secondary education. A majority of the respondents have access to private medical sector health services.

Asthma prevalence for major occupation categories by gender (adjusted odds ratios)

Table 3 shows the prevalence odds ratios of asthma in major occupational categories separately for men and women. Of the 10 major NCO-2004 occupational categories, statistically significant elevated asthma risks in men was observed only among plant and machine operators and assemblers (OR: 1.67; 95% CI: 1.14–2.45; p = 0.009). In women, the odds of self-reported asthma were not significantly higher in any major occupational category.

Asthma prevalence for major occupation subcategories by gender (adjusted odds ratios)

Table 4 shows the prevalence odds ratios of asthma in various occupational subcategories separately for men and women. Of the major NCO-2004 occupation subcategories, statistically significant elevated odds of asthma in men was observed among machine operators and assemblers (OR: 1.85; 95% CI: 1.24–2.76; p = 0.009), and among labourers in mining, construction, manufacturing and transport (OR: 1.33; 95% CI: 1.00–1.77; p = 0.051). Reduced odds of asthma in men was observed among extraction and building trades workers (OR: 0.72; 95% CI: 0.53–0.97; p = 0.029). In women, no occupation was found significant for asthma risk.

Asthma prevalence for high-risk occupations by gender (adjusted odds ratios)

Table 5 shows the prevalence odds ratios of asthma for high-risk occupation separately for men and women. Both men and
### Table 3. Odds ratios for asthma prevalence for major occupational categories by gender, India 2005–2006.

<table>
<thead>
<tr>
<th>NCO 2004 codes</th>
<th>Occupation categories</th>
<th>Total sample N [%]</th>
<th>Current Asthma Prevalence N [%]</th>
<th>OR [95% CI]</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2,4</td>
<td>Legislators, managers, administrators, clerks and reminder professionals</td>
<td>11,526 [17.8]</td>
<td>180 [1.6]</td>
<td>1.00 [ref]</td>
<td>1.00</td>
</tr>
<tr>
<td>3</td>
<td>Technicians and Associate professionals</td>
<td>1,102 [1.7]</td>
<td>19 [1.7]</td>
<td>1.23 [0.76–1.97]</td>
<td>0.399</td>
</tr>
<tr>
<td>5</td>
<td>Service workers and shop and market sales workers</td>
<td>6,199 [9.5]</td>
<td>95 [1.6]</td>
<td>0.89 [0.69–1.16]</td>
<td>0.379</td>
</tr>
<tr>
<td>6</td>
<td>Skilled agricultural and fishery workers</td>
<td>11,931 [18.4]</td>
<td>251 [2.1]</td>
<td>0.96 [0.77–1.19]</td>
<td>0.694</td>
</tr>
<tr>
<td>7</td>
<td>Crafts and Related Trade Workers</td>
<td>11,322 [17.5]</td>
<td>174 [1.5]</td>
<td>0.90 [0.72–1.12]</td>
<td>0.344</td>
</tr>
<tr>
<td>8</td>
<td>Plant and Machine Operators and Assemblers</td>
<td>10,951 [1.7]</td>
<td>34 [3.1]</td>
<td>1.67 [1.14–2.45]</td>
<td>0.000</td>
</tr>
<tr>
<td>9</td>
<td>Elementary Occupations</td>
<td>21,631 [33.4]</td>
<td>486 [2.2]</td>
<td>1.06 [0.86–1.29]</td>
<td>0.626</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>64,725</td>
<td>1239 [1.9]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*aOdds ratios adjusted for age, current smoking, household cooking fuel use, urban/rural residence, and access to health care.

### Table 4. Adjusted odds ratios for asthma prevalence for major occupational subcategories by gender, India 2005–2006.

<table>
<thead>
<tr>
<th>NCO 2004 codes</th>
<th>Occupation subcategories</th>
<th>Total sample N [%]</th>
<th>Current asthma prevalence N [%]</th>
<th>OR [95% CI]</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.12,21,22,23,</td>
<td>Legislators, managers, administrators, clerks and reminder professionals</td>
<td>11,526 [17.8]</td>
<td>180 [1.6]</td>
<td>1 [ref]</td>
<td>1.00</td>
</tr>
<tr>
<td>24,41,42</td>
<td>Physical and Engineering Science Associate Professionals</td>
<td>65 [0.1]</td>
<td>2 [0.3]</td>
<td>1.93 [0.42–8.80]</td>
<td>0.398</td>
</tr>
<tr>
<td>31</td>
<td>Life Science and Health Associate Professionals</td>
<td>13 [0.0]</td>
<td>0 [0.0]</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>32</td>
<td>Other Associate Professionals</td>
<td>1,024 [1.6]</td>
<td>18 [1.8]</td>
<td>1.20 [0.73–1.97]</td>
<td>0.474</td>
</tr>
<tr>
<td>34</td>
<td>Personal protective service workers</td>
<td>2,946 [4.6]</td>
<td>51 [1.7]</td>
<td>1.00 [0.73–1.37]</td>
<td>0.984</td>
</tr>
<tr>
<td>51</td>
<td>Models, sales persons and demonstrators</td>
<td>3,172 [4.9]</td>
<td>44 [1.4]</td>
<td>0.78 [0.55–1.10]</td>
<td>0.150</td>
</tr>
<tr>
<td>52</td>
<td>Market Oriented Skilled Agricultural and Fishery Workers</td>
<td>11,931 [18.4]</td>
<td>251 [2.1]</td>
<td>0.94 [0.75–1.17]</td>
<td>0.569</td>
</tr>
<tr>
<td>61</td>
<td>Extraction and Building Trades Workers</td>
<td>5,004 [7.7]</td>
<td>66 [1.3]</td>
<td>0.72 [0.53–0.97]</td>
<td>0.029</td>
</tr>
<tr>
<td>71</td>
<td>Metal, Machinery and Related Trades Workers</td>
<td>3,103 [4.8]</td>
<td>53 [1.7]</td>
<td>1.06 [0.77–1.45]</td>
<td>0.736</td>
</tr>
<tr>
<td>72</td>
<td>Precision, Handicraft, Printing and Related Trades Workers</td>
<td>774 [1.2]</td>
<td>8 [1.0]</td>
<td>0.68 [0.33–1.40]</td>
<td>0.294</td>
</tr>
<tr>
<td>73</td>
<td>Other Craft and Related Trades Workers</td>
<td>2,441 [3.8]</td>
<td>47 [1.9]</td>
<td>1.11 [0.79–1.55]</td>
<td>0.556</td>
</tr>
<tr>
<td>74</td>
<td>Stationary Plant and Related Operators</td>
<td>191 [0.3]</td>
<td>3 [1.6]</td>
<td>0.82 [0.27–2.45]</td>
<td>0.721</td>
</tr>
<tr>
<td>82</td>
<td>Machine Operators and Assemblers</td>
<td>904 [1.4]</td>
<td>31 [3.4]</td>
<td>1.85 [1.24–2.76]</td>
<td>0.002</td>
</tr>
<tr>
<td>91</td>
<td>Sales and Services Elementary Occupations</td>
<td>8,361 [12.9]</td>
<td>151 [1.8]</td>
<td>0.85 [0.66–1.09]</td>
<td>0.195</td>
</tr>
<tr>
<td>92</td>
<td>Agricultural, Fishery and Related Labourers</td>
<td>10,186 [15.7]</td>
<td>259 [2.5]</td>
<td>1.08 [0.86–1.36]</td>
<td>0.488</td>
</tr>
<tr>
<td>93</td>
<td>Labourers in Mining, Construction, Manufacturing and Transport</td>
<td>3,084 [4.1]</td>
<td>76 [2.5]</td>
<td>1.33 [1.00–1.77]</td>
<td>0.051</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>64,725</td>
<td>1240 [1.9]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*aOdds ratios adjusted for age, current smoking, household cooking fuel use, urban/rural residence, and access to health care.

DOI: 10.3109/02770903.2014.913619

Occupational risk factors for asthma in India 817
women working in high risk occupations were not at significantly higher risk of self-reported asthma when compared with low-risk occupations (men: OR: 0.99; 95% CI: 0.82–1.19; \( p = 0.910 \); women: OR: 0.91; 95% CI: 0.68–1.22; \( p = 0.527 \)).

**Discussion**

**Main findings**

This study examined the prevalence of asthma in a range of occupational categories, subcategories and high-risk occupations as reported by the current working population in India. This population-based survey has shown increased risks of asthma among men in a number of occupation categories, such as plant and machine operators and assemblers, and subcategories, such as mining, construction, manufacturing and transport, machine operators and assemblers, but has found no risk for women in the same occupations. Both men and women working in high risk occupations were not at significantly higher risk of self-reported asthma when compared with low-risk occupations. Our study adds to the currently sparse evidence on occupations with an increased prevalence of self-reported asthma in Indian adults.

Our study has confirmed findings from previous studies in high-income countries showing elevated risks in a number of occupation categories and subcategories among men. The European Community Respiratory Health Survey (ECRHS) consistently found elevated risks of current asthma symptoms for farmers across the 12 participating countries with an overall risk of OR: 1.73 (95% CI: 1.00–3.01) [15]. The New Zealand component of the ECRHS reported an excess risk of asthma symptoms of OR: 1.95 (95% CI: 0.74–5.11) compared to the professional, administrative, clerical and service group [16]. There is limited evidence on the risk of asthma symptoms in sales workers around the globe. Examining the industry in addition to the occupation may provide some insight into the excess risks observed in this group. Although the evidence is sparse, other population based surveys have also identified excess asthma risks in the protective services industry [13] and in stock clerks [17]. The potential causative agents in the high risk occupation categories may be respiratory allergens and irritants [18] including sterilizers and disinfectants such as glutaraldehyde or bleach [12] in the case of nurses and health professionals; exposure to dust and oils and solvents in case of trade workers [6]; exposure to pesticides and acids or alkalis in the case of agriculture and fishery workers [6]; exposure to smoke/fume/gas [19,20], working night shift and working irregular hours [21] in the case of plant and machine operators and assemblers [6,22]; lifting [23], exposure to loud noise [24], and the use of personal protective equipment in case of manual occupational groups [6,25].

Gender differences in occupational distribution, i.e. men and women working in different jobs and therefore being exposed to different risk factors, play an important role in many of these differential outcomes [26]. In the present analyses, we found no effect of occupation on asthma among women in India. This might be because, our analyses only assessed asthma prevalence in the current occupation and did not take into account duration or intensity of exposure (not available in the survey), which may also impact on gender differences in exposure and ultimately gender differences in occupational health. For example, female workers are more often employed part time and, therefore, more likely to experience shorter exposure duration [6].

**Some differences compared with previous studies**

Although many epidemiological studies in high risk workplaces have been conducted in high-income countries, studies in low- and middle-income countries are few with the exception in Africa where studies in occupational exposure of asthma have been conducted in South Africa [27], Morocco [28], Nigeria [29], Ethiopia [30] and Tanzania [31]. However, very few studies have been reported in other low- and middle-income countries. Two earlier studies in India reported of occupational asthma prevalence in specific occupations. An earlier study of two silk filatures (processing natural silk) in India reported a 17% prevalence of asthma due to silkworm allergens [32]. Another study which examined the long-term effects of metal dusts on the broncho-pulmonary system among 104 polishers and 90 unexposed controls reported that a prevalence of 4.8% of occupational asthma and 6.7% of chronic bronchitis, confined only to polishers. Workers in a cement factory in the United Arab Emirates had a two-fold higher prevalence of asthma compared to an unexposed group (6% versus 3%) [33]. Women performing indoor jobs in Iran had an 11% prevalence of asthma, which was more prevalent among those involved with bread baking, carpet weaving and poultry feeding activities [34]. A few small-scale studies among Chinese workers have reported a high prevalence (27%) of work-related wheeze and lung function impairment among workers at the furniture factory [35], food harvesting and processing industry [36] and fruit farms in Korea [37]. Certain occupational groups are known to be at particular high risk of occupational asthma, including laboratory workers, healthcare workers, construction workers, bakers, woodworkers handling western red cedar and chemical
workers exposed to isocyanates [10]. However, many of these findings are from studies in specific industries, and only some have been investigated in epidemiological studies of the general population.

**Strengths and weaknesses of the study**

This study has several important strengths. Our study includes a large nationally representative study sample, which allows comparisons to be made between men and women and the ability to examine occupational asthma risk. The men and women covered by this survey were representative of the total working population, as opposed to similar studies that were limited to selected occupation or industry groups [38,39]. We could also quantify gender differences in asthma prevalence in occupational categories and subcategories at the population level and among men and women working in the same occupation. This is the first study that not only quantified the gender differences in occupational asthma at the population level, but also investigated whether any gender differences in occupational exposure exist for men and women working in the same occupation. However, it was not possible to investigate whether the observed gender differences in occupational asthma were entirely due to (a) the segregation of men and women into different occupations or could also be due to (b) men and women with the same occupation carrying out different tasks [6].

This study has other limitations. First, we found that the prevalence of self-reported asthma (both in general population and currently employed population) in this large, nationally representative survey was low compared to other Indian studies carried out clinically or in specific geographical locations [40–43] where the prevalence ranged from 1% to over 3%. Although several studies have been conducted in India on asthma prevalence in children and adolescents [44,45] but very few studies have been conducted in adults [46–48]. Due to the general challenges of measuring asthma in population-based studies [49], the measurement of asthma in the NFHS also has apparent limitations. The NFHS assessment of asthma prevalence was based on a single question, in contrast to a hierarchy of asthma/wheeze outcomes based on responses to standardized respiratory questionnaires. No effort was made in NFHS-3 to clinically test for asthma or to inquire whether the response was based on a physician’s diagnosis. Given the marked variation in recognition and presentation to a physician by an individual with recurrent wheezing or asthma episodes, considerable differences in diagnostic labelling and treatment by doctors between populations [50] and suboptimal levels of access to health care, physician-diagnosed asthma prevalence or use of asthma medication is equally problematic in the Indian context [51]. Furthermore, neither asthma severity nor the frequency of asthma attacks was ascertained in NFHS-3. Overall, the NFHS data appear to under estimate asthma prevalence compared with other studies in India [42,43], including those from the International Study of Asthma and Allergies in Childhood (ISAAC) [52], although prevalence is similar to those of other countries in the subcontinent, such as Bangladesh and Nepal [53,54].

Other possible sources of bias should be considered when interpreting the findings of this study. First, asthma prevalence was based on self-reports of asthma itself rather than asthma symptoms, and respondents may have been more likely to report some disease conditions such as chronic bronchitis or chronic obstructive pulmonary disease with similar symptoms to asthma due to their lack of awareness, low educational status and hesitation to disclose diseases. However, rigorous efforts were employed in NFHS-3 to obtain reliable self-reported data [55]. The survey used local terminology and commonly understood terms to describe the disease, rigorously trained interviewers, supervisors and standard quality checks such as cross checks and back checks (refer Appendix for detail). It is also important to recognise here that self-report of asthma is not as accurate as clinical measures of asthma and there is a risk of underreporting of mild asthma in self-reporting as well. Further, a higher proportion of healthcare workers in the female reference population may explain why the association between occupation category and asthma was not significant in women.

We studied a large number of occupational groups and subgroups and it is therefore possible that some of our results may have been due to chance. Nevertheless, we obtained more significantly positive findings in some occupations than would have been expected by chance alone. Also, several of the occupational groups identified in our analyses have been consistently reported by other studies to be at high-risk of asthma, and the consistency of excess risks in certain occupations in this study independent of the disease definition (current asthma) used suggests that the findings are relatively robust. We also adjusted for other high-risk occupations in the analyses and this only had a small effect on the results. Furthermore, there are several potential problems with selecting a single reference group which includes: (i) weak statistical power to detect associations due to small numbers; (ii) issues of bias arising from comparing to an “unexposed” group who are likely to differ on a number of factors other than the one under study; and (iii) previous studies have acknowledged that the assumption of lack of exposure in the reference group is not entirely plausible [56].

**Conclusions**

This population-based nationally representative large scale cross-sectional study has confirmed the findings of high-income countries showing high prevalence of asthma in a number of occupational categories and subcategories with no evidence of increased risks for women in the same occupations. Our study adds to sparse evidence on occupations with an increased prevalence of self-reported asthma in adult working population in India and also illustrates that the influence of gender should not be overlooked in occupational health research. Occupational asthma is also widely under-recognized by employers, employees and healthcare professionals. Raising awareness among working population that this is an almost entirely a preventable disease would be a major step in reducing its incidence especially in low- and middle-income countries.
What is the key question: Occupational asthma remains relatively under-recognized in India with little or no information regarding preventable causes.

What is the bottom line: No previous studies reported occupations with increased prevalence for asthma in India in a nationally representative population, more specifically among women workers.

Why read on: This large population-based nationally representative study has confirmed findings from high income countries showing high prevalence of asthma in men in a number of occupation categories and subcategories; however, with no evidence of increased risks for women in the same occupations. Our study adds to the currently sparse evidence on occupations with an increased odd of asthma in adults in India, but did not identify higher odds of asthma among persons working in high-risk occupations.

Acknowledgments
We would like to acknowledge the support of Macro International (Calverton, MD, USA) and International Institute for Population Sciences (Mumbai, India) for providing access to the 2005–2006 Indian National Family Health Survey 3 data. An earlier version of this paper is presented as a poster (P-4-3) at the Population Association of America Annual Meeting, Boston, MA, USA, 1-3 May 2014. Further, valuable comments and suggestions from the two anonymous reviewers are also acknowledged.

Declaration of interest
SA is supported by a Wellcome Trust Strategic Award Grant No Z/041825. CM is funded by the Higher Education Funding Council for England and the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care scheme.

References


Appendix
Cross checks and back checks as a part of standard quality check

Standard quality checks such as cross-checks and back-checks are normally employed in a cross-sectional survey to obtain reliable self-reported data during the time of personal interview. Cross check is the method applied during personal interview to check if the respondent has answered a given question correctly and that she/he has not forgotten anything. For example, during this interview, the investigator cross-check to see if the interval between brothers and sisters is not very long (5 years and above). If there is a long interval between births, it is ensure that the respondent has forgotten something. For example, during this interview, the investigator cross-check to see if the respondent has answered a given question correctly and that she/he has not forgotten anything. Therefore, he/she has to probe more the right answer.

If an interview is not completed on the first visit, further attempts were made with the sampled household or respondent, up to three times and over three different days, before classifying the case as non-response. This is known as back-check. It is important to make callbacks to reach those people who are not at home, since they may be different from people who are at home. The subsequent contacts are scheduled at times when the respondent is more likely to be at home. For example, it may be that people who have no children are more likely to be working away from the house, and if we do not call back to interview them, we may bias the fertility estimates.
<table>
<thead>
<tr>
<th>NCO2004 codes</th>
<th>Occupation categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Legislators, senior officials and managers</strong></td>
</tr>
<tr>
<td>111</td>
<td>Elected and legislative officials</td>
</tr>
<tr>
<td>112</td>
<td>Administrative and executive officials government and local</td>
</tr>
<tr>
<td>1129</td>
<td>Administrative, executive and managerial workers, n.e.c</td>
</tr>
<tr>
<td>113</td>
<td>Village officials</td>
</tr>
<tr>
<td>121</td>
<td>Directors and managers, financial institutions</td>
</tr>
<tr>
<td>1212</td>
<td>Working proprietors, directors and managers mining construct</td>
</tr>
<tr>
<td>1214</td>
<td>Working proprietors, directors and managers, wholesale and retailers</td>
</tr>
<tr>
<td>1215</td>
<td>Working proprietors, directors managers and related executives in transport &amp; communication</td>
</tr>
<tr>
<td>1219</td>
<td>Working proprietors, directors and managers, other services, n.e.c</td>
</tr>
<tr>
<td>1224</td>
<td>Production and Operations Department Managers in Wholesale and Retail Trade</td>
</tr>
<tr>
<td>1229</td>
<td>Other Department Managers, n.e.c.</td>
</tr>
<tr>
<td>2.</td>
<td><strong>Professionals</strong></td>
</tr>
<tr>
<td>2119</td>
<td>Physical scientists, n.e.c</td>
</tr>
<tr>
<td>2129</td>
<td>Mathematicians, Statisticians, and related professionals, n.e.c</td>
</tr>
<tr>
<td>2132</td>
<td>Programmer, Engineering and Scientific</td>
</tr>
<tr>
<td>214</td>
<td>Architects, engineers, technologists and surveyors</td>
</tr>
<tr>
<td>2143</td>
<td>Engineering technicians</td>
</tr>
<tr>
<td>222</td>
<td>Health professionals-except nursing (physicians and surgeons)</td>
</tr>
<tr>
<td>2229</td>
<td>Health professionals (except nursing), n.e.c</td>
</tr>
<tr>
<td>223</td>
<td>Nursing and other medical and health technicians</td>
</tr>
<tr>
<td>23</td>
<td>Teaching professionals</td>
</tr>
<tr>
<td>24</td>
<td>Other Professionals</td>
</tr>
<tr>
<td>2411</td>
<td>Accountants, auditors and related works</td>
</tr>
<tr>
<td>2422</td>
<td>Jurist</td>
</tr>
<tr>
<td>244</td>
<td>Economist and related workers</td>
</tr>
<tr>
<td>2444</td>
<td>Social science and related professionals</td>
</tr>
<tr>
<td>2451</td>
<td>Authors, journalist and other writers</td>
</tr>
<tr>
<td>2452</td>
<td>Sculptors, painters and related artists</td>
</tr>
<tr>
<td>2453</td>
<td>Composers, musicians and singers</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Technicians and associate professionals</strong></td>
</tr>
<tr>
<td>311</td>
<td>Physical and engineering science technicians</td>
</tr>
<tr>
<td>3122</td>
<td>Broadcasting and Telecommunication Equipment Operators</td>
</tr>
<tr>
<td>314</td>
<td>Ship and aircraft controllers and technicians</td>
</tr>
<tr>
<td>32</td>
<td>Life Science and Health associate Professionals</td>
</tr>
<tr>
<td>3411</td>
<td>Securities and finance dealers and brokers, Insurance Representatives, Estate agents, business services agents and trade brokers, n.e.c</td>
</tr>
<tr>
<td>3415</td>
<td>Technical Salesmen and Commercial Travellers, Other</td>
</tr>
<tr>
<td>3429</td>
<td>Business Services Agents and Trade Brokers, n.e.c</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Clerks</strong></td>
</tr>
<tr>
<td>4111</td>
<td>Stenographers and key board-operating clerks</td>
</tr>
<tr>
<td>4114</td>
<td>Calculating Machine operators</td>
</tr>
<tr>
<td>4121</td>
<td>Accounting and book keeping clerks</td>
</tr>
<tr>
<td>4133</td>
<td>Transport and communication supervisors</td>
</tr>
<tr>
<td>4142</td>
<td>Mail Carriers and Sorting Clerks</td>
</tr>
<tr>
<td>4190</td>
<td>Office clerks-others</td>
</tr>
<tr>
<td>41</td>
<td>Office clerks</td>
</tr>
<tr>
<td>4214</td>
<td>Pawnbrokers and Money Lenders</td>
</tr>
<tr>
<td>4222</td>
<td>Telephone Switch Board operators</td>
</tr>
<tr>
<td>5.</td>
<td><strong>Service workers and shop and market sales worker</strong></td>
</tr>
<tr>
<td>51</td>
<td>Personal and Protective Service Workers</td>
</tr>
<tr>
<td>5112</td>
<td>Transport conductors</td>
</tr>
<tr>
<td>5121</td>
<td>House keepers and related workers</td>
</tr>
<tr>
<td>5122</td>
<td>Cooks, waiters and bartenders</td>
</tr>
<tr>
<td>512</td>
<td>Housekeeping and restaurant services workers</td>
</tr>
<tr>
<td>5139</td>
<td>Personal care and related workers, n.e.c</td>
</tr>
<tr>
<td>5141</td>
<td>Hair dresser, barbers, beauticians and related workers</td>
</tr>
<tr>
<td>516</td>
<td>Protective service workers</td>
</tr>
<tr>
<td>5220</td>
<td>Shop salesperson and Demonstrators</td>
</tr>
<tr>
<td>6.</td>
<td><strong>Skilled agricultural and fishery workers</strong></td>
</tr>
<tr>
<td>61</td>
<td>Market Oriented Skilled Agricultural and Fishery Workers</td>
</tr>
<tr>
<td>6111</td>
<td>Cultivator, Crop</td>
</tr>
<tr>
<td>6121</td>
<td>Farmer, Livestock</td>
</tr>
<tr>
<td>6121.50</td>
<td>Dairy Farm Workers, Other</td>
</tr>
<tr>
<td>615</td>
<td>Fishery Workers, Hunters and Trappers</td>
</tr>
<tr>
<td>7.</td>
<td><strong>Craft and related trades worker</strong></td>
</tr>
<tr>
<td>711</td>
<td>Miners, Shotfirers, Stone Cutters and Carvers</td>
</tr>
<tr>
<td>7113</td>
<td>Stone Splitters, Cutters and Carvers</td>
</tr>
<tr>
<td>7124</td>
<td>Carpenters and Joiners</td>
</tr>
</tbody>
</table>
Table A1. Continued

<table>
<thead>
<tr>
<th>NCO2004 codes</th>
<th>Occupation categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>7136</td>
<td>Plumbers and Pipe Fitters, Other</td>
</tr>
<tr>
<td>7141</td>
<td>Painters and Related Workers, Other</td>
</tr>
<tr>
<td>721</td>
<td>Metal moulders, Welders, Sheet Metal Workers, Structural Metal Prepares and Related Trades Workers</td>
</tr>
<tr>
<td>722</td>
<td>Blacksmiths, Toolmakers and Related Trades Workers</td>
</tr>
<tr>
<td>723</td>
<td>Machinery Mechanics and Fitters</td>
</tr>
<tr>
<td>7233</td>
<td>Mechanic, Stationary Steam Engine</td>
</tr>
<tr>
<td>724</td>
<td>Electrical and Electronic Equipment Mechanics and Fitters</td>
</tr>
<tr>
<td>7313</td>
<td>Jewellery and Precision Metal Workers</td>
</tr>
<tr>
<td>7322</td>
<td>Glass Makers, Cutters, Grinders and Finishers</td>
</tr>
<tr>
<td>7432</td>
<td>Weavers, Knitters &amp; Related Workers, Other</td>
</tr>
<tr>
<td>7433</td>
<td>Tailors, Dress Makers and Hatters</td>
</tr>
<tr>
<td>7441</td>
<td>Pelt Dressers, Tanners and Fell Mongers, Other</td>
</tr>
<tr>
<td>7442</td>
<td>Shoemakers and Related Workers</td>
</tr>
<tr>
<td>8</td>
<td>Plant and machine operators and assemblers</td>
</tr>
<tr>
<td>814</td>
<td>Wood Processing and Paper Making Plant Operators</td>
</tr>
<tr>
<td>815</td>
<td>Chemical-Processing-Plant Operators</td>
</tr>
<tr>
<td>823</td>
<td>Rubber and Plastic Products Machine Operators</td>
</tr>
<tr>
<td>8258</td>
<td>Printing, Binding and Paper Products Machine Operators, Other</td>
</tr>
<tr>
<td>827</td>
<td>Food and Related Products Machine Operators</td>
</tr>
<tr>
<td>8279</td>
<td>Tobacco Preparers and Tobacco Product Makers, Others</td>
</tr>
<tr>
<td>9</td>
<td>Elementary occupations</td>
</tr>
<tr>
<td>9133</td>
<td>Hand Launderers and Pressers</td>
</tr>
<tr>
<td>9141</td>
<td>Building Caretakers</td>
</tr>
<tr>
<td>9162</td>
<td>Sweepers and Related Labourers, Other</td>
</tr>
<tr>
<td>9201</td>
<td>Labourer, Agriculture</td>
</tr>
<tr>
<td>9202</td>
<td>Forestry Labourer</td>
</tr>
<tr>
<td>9202.10</td>
<td>Labourer, Plantation</td>
</tr>
<tr>
<td>9331</td>
<td>Transport Equipment Operators and Drivers, Other</td>
</tr>
<tr>
<td>X0</td>
<td>New workers seeking employment</td>
</tr>
<tr>
<td>X9</td>
<td>Workers without occupations, Other</td>
</tr>
</tbody>
</table>

n.e.c – not elsewhere classified.

Table A2. Asthma prevalence in the full sample; among men age 15–54 years (n = 74 369) and women age 15–49 years (n = 124 385) by occupational categories.

<table>
<thead>
<tr>
<th>Occupational categories</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample</td>
<td>Asthma prevalence N [%]</td>
</tr>
<tr>
<td>Physical scientists</td>
<td>17</td>
<td>1 [0.4]</td>
</tr>
<tr>
<td>Architects, engineers, technologists and surveyors</td>
<td>147</td>
<td>20 [5.2]</td>
</tr>
<tr>
<td>Aircraft and ships officers</td>
<td>5</td>
<td>1 [0.6]</td>
</tr>
<tr>
<td>Life scientist/life science technicians</td>
<td>13</td>
<td>5 [0.6]</td>
</tr>
<tr>
<td>Physicians and surgeons</td>
<td>155</td>
<td>67 [3.4]</td>
</tr>
<tr>
<td>Nursing and other medical and health technicians</td>
<td>280</td>
<td>372 [3.2]</td>
</tr>
<tr>
<td>Scientific, medical and technical persons, others</td>
<td>51</td>
<td>12 [2.3]</td>
</tr>
<tr>
<td>Mathematicians, statisticians and related workers</td>
<td>19</td>
<td>7 [0.4]</td>
</tr>
<tr>
<td>Economists and related workers</td>
<td>8</td>
<td>12 [2.3]</td>
</tr>
<tr>
<td>Accountants, auditors and related workers</td>
<td>247</td>
<td>117 [4.9]</td>
</tr>
<tr>
<td>Jurists</td>
<td>174</td>
<td>17 [0.4]</td>
</tr>
<tr>
<td>Teachers</td>
<td>1396</td>
<td>2346 [3.4]</td>
</tr>
<tr>
<td>Poets, authors, journalists and related workers</td>
<td>41</td>
<td>10 [2.3]</td>
</tr>
<tr>
<td>Sculptors, painters, photographers and related creative art</td>
<td>176</td>
<td>18 [0.4]</td>
</tr>
<tr>
<td>Composer and performing artists</td>
<td>130</td>
<td>19 [0.4]</td>
</tr>
<tr>
<td>Elected and legislative officials</td>
<td>39</td>
<td>3 [2.3]</td>
</tr>
<tr>
<td>Administrative and executive officials government and local</td>
<td>274</td>
<td>2 [1.1]</td>
</tr>
<tr>
<td>Working proprietors, directors and managers, wholesale and retailers</td>
<td>55</td>
<td>7 [0.4]</td>
</tr>
<tr>
<td>Directors and managers, financial institutions</td>
<td>128</td>
<td>18 [0.4]</td>
</tr>
<tr>
<td>Working proprietors, directors and managers mining construct</td>
<td>136</td>
<td>22 [0.4]</td>
</tr>
<tr>
<td>Working proprietors, directors managers and related executives</td>
<td>74</td>
<td>6 [0.4]</td>
</tr>
<tr>
<td>Working proprietors, directors and managers, other services</td>
<td>103</td>
<td>19 [0.4]</td>
</tr>
</tbody>
</table>

DOI: 10.3109/02770903.2014.913619

Occupational risk factors for asthma in India
Table A2. Continued

<table>
<thead>
<tr>
<th>Occupational categories</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative, executive and managerial workers, not elsewhere classified</td>
<td>136 –</td>
<td>44 2 [4.5]</td>
</tr>
<tr>
<td>Clerical and other supervisors</td>
<td>472 3 [0.6]</td>
<td>83 2 [2.4]</td>
</tr>
<tr>
<td>Village officials</td>
<td>63 –</td>
<td>128 7 [5.5]</td>
</tr>
<tr>
<td>Stenographers, typist and card and tape punching operators</td>
<td>73 –</td>
<td>44 –</td>
</tr>
<tr>
<td>Book keepers, cashiers and related workers</td>
<td>155 2 [1.3]</td>
<td>42 2 [4.8]</td>
</tr>
<tr>
<td>Computing machine operators</td>
<td>251 2 [0.8]</td>
<td>136 –</td>
</tr>
<tr>
<td>Clerical and related workers</td>
<td>1135 19 [1.7]</td>
<td>424 10 [2.4]</td>
</tr>
<tr>
<td>Transport and communication supervisors</td>
<td>131 –</td>
<td>12 –</td>
</tr>
<tr>
<td>Transport conductors and guards</td>
<td>181 3 [1.7]</td>
<td>2 –</td>
</tr>
<tr>
<td>Mail distributors and related workers</td>
<td>110 4 [3.6]</td>
<td>21 1 [4.8]</td>
</tr>
<tr>
<td>Telephone and telegraph operators</td>
<td>95 6 [6.3]</td>
<td>65 1 [1.5]</td>
</tr>
<tr>
<td>Merchants and shopkeepers, wholesale and retail trade</td>
<td>4443 76 [1.7]</td>
<td>798 16 [2.0]</td>
</tr>
<tr>
<td>Manufacturers, agents</td>
<td>221 4 [1.8]</td>
<td>40 –</td>
</tr>
<tr>
<td>Technical salesmen and commercial travellers</td>
<td>74 –</td>
<td>6 –</td>
</tr>
<tr>
<td>Salesmen, shop assistants and related workers</td>
<td>3173 44 [1.4]</td>
<td>873 27 [3.1]</td>
</tr>
<tr>
<td>Insurance, real estate, securities and business service</td>
<td>730 14 [1.9]</td>
<td>182 2 [1.1]</td>
</tr>
<tr>
<td>Money lenders and pawn brokers</td>
<td>59 –</td>
<td>10 –</td>
</tr>
<tr>
<td>Sales workers, not elsewhere classified</td>
<td>140 1 [0.7]</td>
<td>82 2 [2.4]</td>
</tr>
<tr>
<td>Hotel and restaurant keepers</td>
<td>282 2 [0.7]</td>
<td>111 2 [1.8]</td>
</tr>
<tr>
<td>House keepers, matron and stewards (domestic and institutional)</td>
<td>33 –</td>
<td>47 2 [4.3]</td>
</tr>
<tr>
<td>Cooks, waiters, bartenders and related workers (domestic and international)</td>
<td>424 7 [1.7]</td>
<td>560 6 [1.1]</td>
</tr>
<tr>
<td>Maids and related housekeeping service workers, not elsewhere classified</td>
<td>103 –</td>
<td>1652 43 [2.6]</td>
</tr>
<tr>
<td>Building caretakers, sweepers, cleaners and related workers</td>
<td>382 13 [3.4]</td>
<td>455 4 [0.9]</td>
</tr>
<tr>
<td>Launderers, dry-cleaners and pressers, not elsewhere classified</td>
<td>237 3 [1.3]</td>
<td>250 1 [0.4]</td>
</tr>
<tr>
<td>Hairdresser, barbers, beauticians and related workers</td>
<td>394 10 [2.5]</td>
<td>203 3 [1.5]</td>
</tr>
<tr>
<td>Protective service workers</td>
<td>884 21 [2.4]</td>
<td>60 2 [3.3]</td>
</tr>
<tr>
<td>Service workers</td>
<td>642 8 [1.2]</td>
<td>286 7 [2.4]</td>
</tr>
<tr>
<td>Farm plantation, dairy and other managers and supervisors</td>
<td>160 –</td>
<td>50 1 [2.0]</td>
</tr>
<tr>
<td>Cultivators</td>
<td>7902 185 [2.3]</td>
<td>7594 112 [1.5]</td>
</tr>
<tr>
<td>Farmers, other than cultivators</td>
<td>3154 61 [1.9]</td>
<td>5198 91 [1.8]</td>
</tr>
<tr>
<td>Agricultural labourer</td>
<td>9854 246 [2.5]</td>
<td>17242 312 [1.8]</td>
</tr>
<tr>
<td>Plantation labourers and related workers</td>
<td>141 9 [6.4]</td>
<td>678 20 [2.9]</td>
</tr>
<tr>
<td>Other farm workers</td>
<td>311 2 [0.6]</td>
<td>211 4 [1.9]</td>
</tr>
<tr>
<td>Forestry workers</td>
<td>192 5 [2.6]</td>
<td>169 4 [2.4]</td>
</tr>
<tr>
<td>Hunters and related workers</td>
<td>–</td>
<td>1 –</td>
</tr>
<tr>
<td>Fishermen and related workers</td>
<td>403 3 [0.7]</td>
<td>122 4 [3.3]</td>
</tr>
<tr>
<td>Miners, quarrymen, well drillers and related workers</td>
<td>290 11 [3.8]</td>
<td>66 2 [3.0]</td>
</tr>
<tr>
<td>Metal processors</td>
<td>147 2 [1.4]</td>
<td>43 –</td>
</tr>
<tr>
<td>Wood preparation workers and paper makers</td>
<td>127 2 [1.6]</td>
<td>55 –</td>
</tr>
<tr>
<td>Chemical processors and related workers</td>
<td>63 1 [1.6]</td>
<td>5 –</td>
</tr>
<tr>
<td>Tanners, fellmongers and pelt dressers</td>
<td>16 –</td>
<td>7 –</td>
</tr>
<tr>
<td>Food and beverage processors</td>
<td>438 14 [3.2]</td>
<td>210 6 [2.9]</td>
</tr>
<tr>
<td>Tobacco preparers and tobacco product makers</td>
<td>103 9 [8.7]</td>
<td>153 23 [1.7]</td>
</tr>
<tr>
<td>Tailors, dress makers, sewers, upholsterers and related worker</td>
<td>1415 25 [1.8]</td>
<td>3203 69 [2.2]</td>
</tr>
<tr>
<td>Shoemakers and leather goods makers</td>
<td>297 13 [4.4]</td>
<td>85 –</td>
</tr>
<tr>
<td>Carpenters, cabinet and related wood workers</td>
<td>929 17 [1.8]</td>
<td>26 2 [7.7]</td>
</tr>
<tr>
<td>Stone cutters and carvers</td>
<td>181 –</td>
<td>74 –</td>
</tr>
<tr>
<td>Blacksmiths, tool makers and machine tools operators</td>
<td>383 3 [0.8]</td>
<td>32 –</td>
</tr>
<tr>
<td>Machinery fitters, machine assemblers and precession instruments</td>
<td>1161 17 [1.5]</td>
<td>9 1 [1.1]</td>
</tr>
<tr>
<td>Broadcasting station and sound equipment operators and cinema</td>
<td>60 2 [3.3]</td>
<td>2 –</td>
</tr>
<tr>
<td>Plumbers, welders, sheet metal and structural metal preparers</td>
<td>543 7 [1.3]</td>
<td>10 –</td>
</tr>
<tr>
<td>Jewellery and precious metal workers and metal engravers</td>
<td>645 8 [1.2]</td>
<td>108 2 [1.9]</td>
</tr>
<tr>
<td>Glass formers, potters and related workers</td>
<td>129 –</td>
<td>81 –</td>
</tr>
<tr>
<td>Rubber and plastic product makers workers</td>
<td>81 –</td>
<td>32 –</td>
</tr>
<tr>
<td>Paper and paper board products makers/printing and related works</td>
<td>283 8 [2.8]</td>
<td>91 6 [6.6]</td>
</tr>
<tr>
<td>Painters/production and related workers, bricklayers and others, not elsewhere classified</td>
<td>3057 30 [1.0]</td>
<td>570 7 [1.2]</td>
</tr>
<tr>
<td>Stationery engines and related equipment operators, oils</td>
<td>356 5 [1.4]</td>
<td>147 2 [1.4]</td>
</tr>
<tr>
<td>Transport equipment operators</td>
<td>3083 76 [2.5]</td>
<td>13 –</td>
</tr>
<tr>
<td>Labourers, not elsewhere classified</td>
<td>7739 134 [1.7]</td>
<td>4494 81 [1.8]</td>
</tr>
<tr>
<td>Others (new workers seeking employment, workers reporting occupation)</td>
<td>– 87 –</td>
<td>85 1 [1.2]</td>
</tr>
<tr>
<td>None (workers not reporting any occupation, including housewives)</td>
<td>9462 116 [1.2]</td>
<td>71231 1108 [1.6]</td>
</tr>
<tr>
<td>Do not know</td>
<td>4 –</td>
<td>3 –</td>
</tr>
<tr>
<td>Totala</td>
<td>74 273 1359 [1.8]</td>
<td>124 289 2104 [1.9]</td>
</tr>
</tbody>
</table>

*aNumber of men and women varies slightly for individual variables depending on the number of missing values.*