

Estimating the size of the female construction workforce is necessary to assess the safety of female construction workers in Delhi

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INTRODUCTION

Although construction continues to be a most male-dominated industry,[1] in India, the construction sector provides the main alternative to agricultural work - seasonal migration to and from construction work is widespread and construction work remains the second-largest employer of women in the country behind agriculture.[2] Women are often required to do the lift-and-carry work, climbing scaffolding with bricks and soil on their heads.[3]

To assess the safety of construction workers and to make reliable comparisons of worker safety between countries, epidemiological investigations are needed where estimates of risks and relative risks are calculated. To make comparisons of risks between groups it is necessary to account for the number of people 'at risk' (i.e., exposed to a hazard) in the group. For example, the annual construction injury incidence rate should be estimated by dividing the frequency of new occurrences of construction injury arising in the studied population at risk of a construction injury over a one-year period by the number of people at risk.[4] To estimate the annual construction injury incidence rate of women in Delhi we required estimates of the female construction workforce in Delhi by year.

Authoritative data on the size of the construction workforce and its distribution by gender, are not available in India.[5] Therefore, we estimated the size of the female construction workforce in Delhi.

METHODS

We estimated the number of construction workers in Delhi over a 10 year period using data on the total population of Delhi as per the 2011 population census, the estimated annual growth rate of the population,[6] the labour force participation in Delhi by gender,[6] and the proportion of workers in the labour force that works in construction.[7]

The proportion of workers in the construction sector in urban areas of India is 11.7% among males and 4.1% among females.[7] As 97.5% of the population of Delhi lives in urban areas,[6] we assumed Delhi to be entirely urban for the purposes of this study and we applied these proportions of workers in the labour force that work in construction to our estimates of the size of the Delhi workforce in each year.

RESULTS

The population of Delhi as per the 2011 census was 16.78 million, comprising 8,987,326 males and 7,800,615 females. The estimated annual growth rate of the population is 2.12%. The estimated male and female populations of Delhi in each subsequent year assuming this annual growth rate are shown

in table 1. Assuming a labour force participation in Delhi of 59.7% for males and 12.4% for females,[6] the size of the male workforce in Delhi was estimated to be 5,365,434 in 2011, increasing to 6,085,127 by 2017 and to 6,480,404 by 2020. Similar estimates for the size of the female workforce in Delhi are shown in table 1. After applying the proportions of male and female workers in the labour force that work in construction, our estimates of the size of the male and female construction workforce in Delhi are shown the right-hand side columns of table 1.

Table-1: Estimated population size and numbers of construction workers in Delhi by year and by gender

year	Delhi population			Workforce		Construction workers	
	male	female	total	male	female	male	female
2011	8,987,326	7,800,615	16,787,941	5,365,434	967276.3	627,756	39,658
2012	9,177,857	7965988	17,143,845	5,479,181	987782.5	641,064	40,499
2013	9,372,428	8134867	17,507,295	5,595,339	1008724	654,655	41,358
2014	9,571,123	8307326	17,878,450	5,713,961	1030108	668,533	42,234
2015	9,774,031	8483441	18,257,473	5,835,097	1051947	682,706	43,130
2016	9,981,241	8663290	18,644,531	5,958,801	1074248	697,180	44,044
2017	10,192,843	8846952	19,039,795	6,085,127	1097022	711,960	44,978
2018	10,408,931	9034508	19,443,439	6,214,132	1120279	727,053	45,931
2019	10,629,601	9226039	19,855,640	6,345,872	1144029	742,467	46,905
2020	10,854,948	9421631	20,276,579	6,480,404	1168282	758,207	47,900

We estimate that there were 44,978 female construction workers in Delhi in 2017, approximately 6% (one sixteenth) of the total number of construction workers in that year.

DISCUSSION

Principal findings

One in 16 construction workers in Delhi is female. The estimates of the size of the construction workforce can be used in epidemiological studies of the safety of construction workers in Delhi and will help when making comparisons of worker safety between countries.

Strengths and weaknesses of the study

We assumed that the proportions of male and female workers in the labour force of Delhi that work in construction are the same as the national estimates. If a greater proportion of female workers in the labour force of Delhi works in construction we will have underestimated the size of the female construction workforce in Delhi. Similarly, we may have overestimated the size of the female construction workforce in Delhi. Moreover, our calculations are based on the average annual growth rate of population determined by the 2011 population census. If the population growth rate has declined over the years, we will have overestimated the size of the construction workforce, both male and female.

Strengths and weaknesses in relation to other studies

Our estimate of the size of the construction workforce in Delhi in 2012, 681,563 workers, is higher than in a previous study which estimated that there were 619,767 workers,[8] which suggests that our estimate of the annual population growth rate of 2.12% may be an over-estimate. Another study of

Delhi and nearby areas estimated that 17% of construction workers in Delhi was female as compared to 6% estimated in our study.[9] However, this study was based on a random sample of only 94 workers, such that the observed difference in these percentages estimated may well be entirely due to chance and sampling error.[9] Our estimate of the size of the construction workforce in Delhi is also higher than official estimates of the federal Ministry of Labour and Employment which informed Parliament on 11th February 2019 that the number of construction workers registered with the Delhi Building and Other Construction Workers Welfare Board (DBOCWWB) as on 30.09.2018 was 539,421 while our estimate for 2018 was 772,985. [10] This, again, may suggest that our estimate of the annual population growth rate of 2.12% might be an over-estimate or could also be due to the lower registration of construction workers in Delhi by the DBOCWBB. Moreover, as per the DBOCWBB's website, this figure is the cumulative number of construction workers registered since 2007.[11] As the registration is an annual requirement, some workers may have registered in more than one year since 2007 possibly leading to double counting.

Meaning of the study: implications for policymakers

Official estimates of the number of construction workers in Delhi are not available. The Delhi Building and Other Construction Workers Welfare Board (DBOCWWB) maintains data on the cumulative number of workers registered with it. However, our estimates suggest that not all construction workers are registered with the Board. Moreover, data on the number of construction workers by gender are not available. There is therefore a need for a construction workforce survey that can reliably estimate the size and nature of the construction workforce in Delhi. In addition to collecting information on gender of workers, it might usefully collect information on age, trade, education level, type of construction site, type of construction work, deployment during different seasons and times of the day. Besides this, there is need to step up efforts to register all construction workers with the Board.

Unanswered questions and future research

Future researchers may focus on estimating the construction workforce deployed at different types of construction sites (e.g., government, corporate, and private sites); and that deployed in different types of construction work (e.g., buildings, roads, rail, water supply and power distribution works). These workforce estimates will help in estimating relative risks and associations with fatal and non-fatal injuries occurring on construction sites.

Conclusions:

Female workers represent approximately 6% (one sixteenth) of the total construction workforce in Delhi. We estimate there were 711,960 male and 44,978 female construction workers in Delhi in 2017. These estimates can be used in epidemiological studies of the safety of construction workers in Delhi and will help when making comparisons of worker safety between countries. Further research is needed to estimate the construction workforce by other characteristics such as: age, trade, education level, type of construction site and construction work; and by deployment according to time of day and season.

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