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Research Article
Factors Associated with Chronic Bronchitis Among Municipal Sanitary Workers in Varanasi, India

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Abstract

Background and Objectives: Sanitary workers are exposed to a number of morbidities, including musculoskeletal disorder, gastrointestinal problems, skin problems, eye problems and lung disease, etc. The aim of this study was to estimate the prevalence of chronic bronchitis among sanitary workers and to identify the risk factors associated with it. **Materials and Methods:** This is a cross-sectional study designed to investigate the factors related to the development of chronic bronchitis among sanitary workers in the city of Varanasi. A total of 11 census wards were selected, two being from the ghat areas, two from the non-ghat areas and seven from the core city by using the probability proportional to size sampling technique. All sanitary workers working in the selected census wards were respondents for this study. The total sample size was 316. CSPro 6.1 was used for data entry and SPSS 22 was used for data analysis. Chi-square test and binary logistic regression analysis were used to determine the association of the risk factors with chronic bronchitis. **Results:** The result from the analysis indicates that the overall prevalence of chronic bronchitis was 20%, whereas it was 9, 19 and 32% in the age groups of less than or equal to 30, 31-44 and 45 years and above respectively. Sewage workers had a greater risk of chronic bronchitis as compared to waste collectors and drivers. Smokers and workers with poor health showed a higher risk as compared to non-smokers and healthy workers. **Conclusion:** The study concludes that chronic bronchitis is highly associated with age and type of workers and also slightly associated with gender, tobacco use and health condition.

Key words: Chronic bronchitis, waste collector, sewage worker, cross-sectional study, Varanasi municipal corporation

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

In India, a study on chronic bronchitis was done with a large sample size of 85105 males and 84470 females covering metropolitan and large cities except in the state of Jammu and Kashmir. The study concludes that the overall prevalence of chronic bronchitis was low in India as compared to global estimates and the same as in the other Asian countries[1]. Recently, a study on chronic bronchitis done in selected districts of Kashmir valley found a higher prevalence of chronic bronchitis as compared to the India estimates[2]. Both the studies suggested that use of coal, wood, etc., for cooking is another factor responsible for the development of chronic bronchitis other than smoking[1,2].

A very few[3] studies have been carried out in North India to study the health risk of municipal sanitary workers which is the most vulnerable section of the society and have high risk of mortality and morbidity due to their unhygienic conditions. Most of the studies conducted in metropolitan, large cities and district of India like Chennai, Mumbai, Nagpur, Kolkata and Guwahati etc., neglecting the small and old cities and towns[1]. During the last few decades, the quantity of municipal solid waste generated in urban India has been rising consistently because of rapid population growth, mass migration from rural to urban areas, change in lifestyle of the urban people and also increase in purchasing power which has resulted a tremendous amount of solid waste. In India, municipal sanitary workers are the most vulnerable section of the society. They are generally migrants from rural India or refugees from neighboring countries[3,4]. Health is a major concern for municipal workers engaged in cleaning of streets, drainage and sewage and also for loader and unloader of waste materials. Municipal sanitary workers are more exposed to life threatening toxic gases mainly hydrogen sulphide (H_2S) and methane which causes the loss of functional capacity of the respiratory system of the workers[5].

Few studies[6] have been done to investigate the cause of chronic bronchitis other than tobacco smoking. A study done in Peru, with a sample size of 2947 participants from rural and urban areas, found the overall prevalence of chronic bronchitis to be 5.9% (95% CI 5.1-6.9%) with variations by settings. The prevalence was lower in the semi-urban Tumbes (1.3%) and higher in the urbanized Lima (8.9%). It was also higher among participants with COPD as compared to those without COPD. Findings suggested that the prevalence of chronic bronchitis increased with both urbanization and daily exposure to biomass fuel smoke[6].

The Global Alliance against Chronic Respiratory Disease (GARD) estimates that at least four million people die annually due to chronic respiratory disease. In a cross-sectional epidemiological study using the GARD questionnaire and spirometry on adults from 12 regions of the Russian Federation, it was found that the prevalence of asthma was 25.7%, that of acute respiratory disease was 18.2% and that of chronic bronchitis was 8.6%. The study concluded that the prevalence of respiratory disease and the risk factor was high in Russia when compared to the available data[7].

It is a well-known fact that smoking is the primary cause of chronic bronchitis in adults, but other factors also contribute to it[8]. In present study, an attempt has been made to study the potential risk factor associated with the development of chronic bronchitis in sanitary workers.

MATERIALS AND METHODS

This is a cross-sectional study to investigate the factors associated with the development of chronic bronchitis among sanitary workers in Varanasi city. The city was divided into three different sections, namely ghat areas, non-ghat areas and the core city as shown in Fig. 1. Based on the information given by the Varanasi municipal corporation of there being around 3000 workers in 90 wards and based on previous studies suggesting a sample size of 350 being sufficient for this study[4,9], the study selected 11 census wards. Two census wards were selected from the ghat and the non-ghat areas each and seven from the core city of Varanasi by using the probability proportional to size sampling technique (Fig. 2). All sanitary workers, including waste collectors (224), sewage workers (51) and drivers (41), working in the selected census wards were taken as respondents. After the complete enumeration of the 11 census wards, the total sample size came out to be 316. The data collection was done from November, 2015-February, 2016 using standard diagnostic criteria.

Standard diagnostic criteria were used to diagnose chronic bronchitis. A person is said to have chronic bronchitis if he/she has regular cough and expectoration for at least three consecutive months in a year and for more than two successive years.

Inclusion/exclusion criteria:

- **Inclusion:** Respondent willing to participate in the study and having working experience of at least 1 year
- **Exclusion:** Respondent refuse to participate in the study and having working experience of less than 1 year
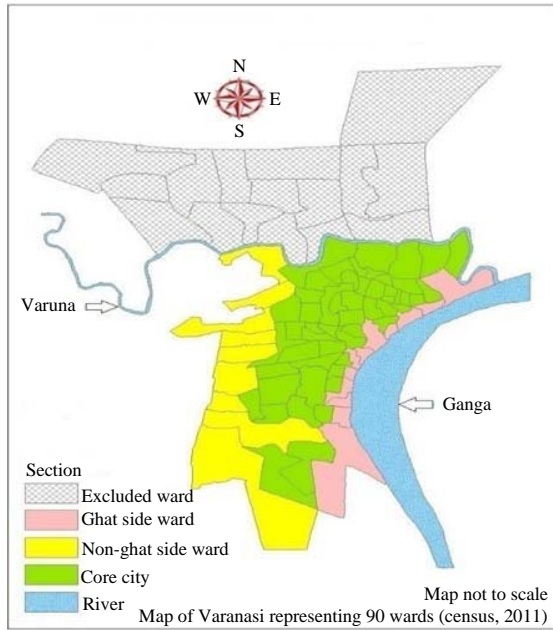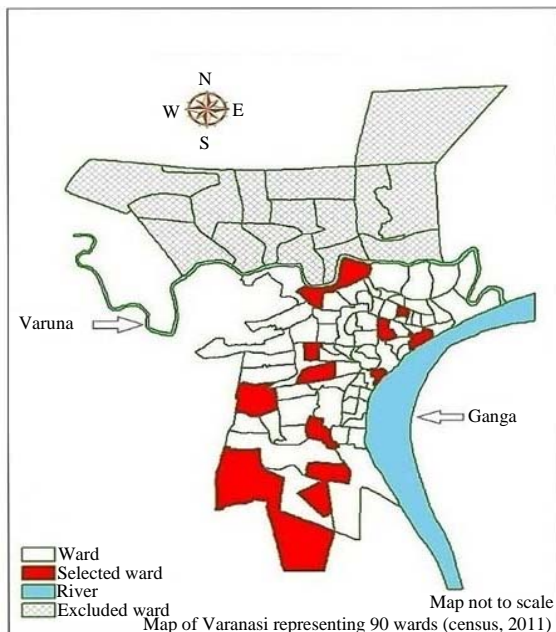
Fig. 1: Three sections of Varanasi

Fig. 2: Study area in Varanasi

Statistical analysis: The CSPro 6.1 was used for data entry and SPSS 22 was used for data analysis at 95% confidence interval. The study calculated the percentage distribution of the samples by selected background characteristics. Chi-square test[5] and binary logistic regression[5] analysis was used to determine the association of the risk factors with chronic bronchitis. The principal component analysis

technique was used to create a standard of living index based on the household assets of the respondents. The household assets included pressure cooker (no = 0, yes = 1), mobile phone (no = 0, yes = 1), cot/bed (no = 0, yes = 1), LPG connection (no = 0, yes = 1), hot plate (no = 0, yes = 1), electric fan (no = 0, yes = 1), dining table (no = 0, yes = 1), color television (no = 0, yes = 1), mixer-grinder (no = 0, yes = 1), bicycle (no = 0, yes = 1), motorcycle/scooter (no = 0, yes = 1) bank account (no = 0, yes = 1), sofa set (no = 0, yes = 1), refrigerator (no = 0, yes = 1), geyser (no = 0, yes = 1) and washing machine (no = 0, yes = 1).

Ethical considerations: The Students Research Ethics Committee (SREC) of the International Institute for Population Sciences, Mumbai (Sr. No.: 12/3361) approved the research proposal on October 30, 2015. A duly signed letter was taken from the Institute. Permission was also taken from the municipal commissioner of Varanasi.

RESULTS

Table 1 gives the percentage distribution of the respondents in terms of different socio-economic and demographic characteristics of the study population. One third of the respondents were found to be in the age group of less than or equal to 30 years, thirty eight percent were in the age group 31-44 years and the remaining thirty percent were above 45 years of age. The proportion of the males was found to be much higher than that of the females. Education is one of the most important factors determining human behavior and in the present study a high proportion of the respondents were found to be illiterate. The respondents for this study were municipal sanitary workers of the Varanasi municipal corporation, consisting of waste collectors, sewage workers and drivers of whom 69% were temporary or daily wage workers and the remaining 31% were permanent workers. More than half of the respondents were found not using any safety equipment at the workplace; the same number of workers was found to have working experience of more than 10 years. One third of the respondents reported smoking tobacco. Thirty three percent of the respondents reported a lower standard of living, while 31% reported an upper standard of living. A question enquiring about the perceived health condition of the workers had been included in the survey. It was found that 38% of them were in good health, while remaining 62% of the respondents reported poor health.

Table 2 shows the prevalence of chronic bronchitis among the respondents in terms of different socio-economic

Table 1: Percentage distribution of municipal sanitary workers by some selected background characteristics in Varanasi city, India, 2015-16

Background characteristics	Percent	No.
Age (years)		
≤30	32.3	102
31-44	38.0	120
≥45	29.7	94
Sex		
Male	85.8	271
Female	14.2	45
Education		
Illiterate	44.0	139
Literate	56.0	177
Type of worker		
Waste collector	70.9	224
Sewage worker	16.1	51
Driver	13.0	41
Type of job		
Temporary job	68.7	217
Permanent job	31.3	99
Personal protective equipment (PPE)		
Yes	46.8	148
No	53.2	168
Working experience (years)		
≤10 years	47.2	149
>10 yeas	52.8	167
Working (h)		
≤10 h	81.3	257
>10 h	18.7	59
Smoked tobacco		
Yes	32.6	103
No	67.4	213
Standard of living index		
Lower	33.2	105
Middle	35.4	112
Upper	31.3	99
Perceived health condition		
Good	38.0	120
Poor	62.0	196
Total	100.0	316

Table 2: Prevalence of chronic bronchitis (CB) among municipal sanitary workers by some selected background characteristics in Varanasi city, India, 2015-16

Background characteristics	CB (%)	CB (N)
Age (years)	$\chi^2 = 16.57, p = 0.0003$	
≤30	8.8	9
31-44	19.2	23
≥45	31.9	30
Sex	$\chi^2 = 0.23, p = 0.635$	
Male	19.2	52
Female	22.2	10
Education	$\chi^2 = 3.69, p = 0.055$	
Illiterate	24.5	34
Literate	15.8	28
Type of worker	$\chi^2 = 13.00, p = 0.002$	
Waste collector	15.2	34
Sewage worker	37.3	19
Driver	22.0	9
Type of job	$\chi^2 = 0.62, p = 0.431$	
Temporary job	18.4	40
Permanent job	22.2	22
Personal protective equipment (PPE)	$\chi^2 = 2.05, p = 0.153$	
Yes	16.2	24
No	22.6	38
Working experience (years)	$\chi^2 = 1.44, p = 0.230$	
≤10 years	16.8	25
>10 years	22.2	37
Working hours	$\chi^2 = 0.33, p = 0.567$	
≤10 h	20.2	52
>10 h	16.9	10
Smoked tobacco	$\chi^2 = 1.31, p = 0.252$	
Yes	23.3	24
No	17.8	38
Standard of living index	$\chi^2 = 8.92, p = 0.012$	
Lower	25.7	27
Middle	10.7	12
Upper	23.2	23
Perceived health condition	$\chi^2 = 4.85, p = 0.028$	
Good	13.3	16
Poor	23.5	46
Total	19.6	62

and demographic characteristics. The overall prevalence of chronic bronchitis came out to be 20%. The prevalence of chronic bronchitis was found to increase with age, with only nine percent chronic bronchitis cases being found in the age group of less than 30 years, which increased to nineteen percent in the age group of 31-44 years and further increased to 32% in the age of more than 45 years. Females showed a higher prevalence as compared to males as did illiterates as compared to literates. Sewage workers showed a much higher prevalence as compared to waste collectors and drivers. Workers using safety equipment showed less prevalence as compared to the non-users. The number of years spent in sanitary work was found to increase the prevalence of chronic bronchitis as 22% of the workers having work experience of more than 10 years reported to have chronic bronchitis as compared to only 17% of those having less than 10 years of

work. Smokers showed a higher prevalence as compared to non-smokers but the difference was low. Workers suffering from poor health reported a higher prevalence as compared to those having good health.

Results from the logistic regression analysis have been shown in Table 3 by selected background characteristics of the respondents. Age was found to have a statistically significant association with chronic bronchitis, that is, higher ages showed an increase in the risk of having chronic bronchitis. Sewage workers were at a greater risk of chronic bronchitis as compared to waste collectors and drivers. Females were found to be two times more likely of having chronic bronchitis as their counterpart. Workers having longer working experience were found to be more likely of having chronic bronchitis. Similarly, smokers and workers with a poor health showed increased odds ratio.

Table 3: Binary logistic regression model estimates the odds ratios and confidence intervals for chronic bronchitis among municipal sanitary workers in Varanasi city, India, 2015-16

Background characteristics	Odds ratio	95% CI
Age (years)		
<30[®]		
31-44	2.38*	(0.92-6.15)
>45	4.19***	(1.38-12.77)
Sex		
Male[®]		
Female	1.69	(0.66-4.31)
Education		
Literate[®]		
Illiterate	1.10	(0.51-2.35)
Type of worker		
Waste collector[®]		
Sewage worker	3.56***	(1.52-8.38)
Driver	1.96	(0.5-7.65)
Type of job		
Temporary job[®]		
Permanent job	0.86	(0.4-1.85)
Personal protective equipment (PPE)		
No[®]		
Yes	0.62	(0.3-1.27)
Working experience (years)		
<10 years[®]		
>10 years	1.13	(0.52-2.44)
Working hours		
<10 h[®]		
>10 h	0.89	(0.26-3.03)
Smoked tobacco		
No[®]		
Yes	1.22	(0.62-2.39)
Standard of living index		
Upper[®]		
Middle	1.32	(0.6-2.91)
Lower	0.50	(0.21-1.16)
Perceived health condition		
Good[®]		
Poor	1.48	(0.64-3.43)

[®]: Reference category, *p<0.10,** p<0.05 ,***p<0.01

DISCUSSION

The aim of this study was to estimate the prevalence of chronic bronchitis and the potential risk factors associated with it. The study design was cross-sectional, with a sample size of 316. The respondents of the study were municipal sanitary workers consisting of three groups, namely waste collectors, sewage workers and drivers. In the present study, the overall prevalence of chronic bronchitis was found to be 19.6%, which is the same as that found by a study conducted by Vimercati *et al*.[10]. The study found a higher prevalence of chronic bronchitis among the sewage workers at 37.3% which is close to what a previous study (34.1%) by Giri *et al*.[9] found. The study also shows a much higher odds ratio (OR:3.6, CI:1.52-8.38) for the sewage workers because they are more exposed to sewer gases as compared to the waste collectors and drivers[5]. Findings based on several studies[8,11] indicate that smoking cigarette is a major risk factor in the development of chronic bronchitis, which was confirmed by the present study, with smokers having a higher prevalence (23.3%) as compared to nonsmokers (17.8%). This study, in an addition to the previous studies[2,12], indicates that besides smoking cigarette, other factors too constitute a risk. These include exposure to fumes, silt and sewer gases, including hydrogen sulphide, methane, esters, ammonia, carbon monoxide, sulphur dioxide and nitrogen oxides, which are more harmful than smoking[5]. After going through a series of studies based on chronic bronchitis conducted in India and abroad, this study examined eleven factors, namely age, sex, education, type of worker, type of job, safety equipment, working experience, working hours, smoking, standard of living and perceived health condition[10,13-16].

Use of personal protective equipment does not show any positive result on the health of sanitary workers because in developing countries like India, sanitary workers are still using very old equipment such as tin plates, small brooms and bamboo sticks, which are not helpful to protect them from occupational health hazards[8,9]. The result from the logistic regression analysis depicts that age is statistically significant with the development of chronic bronchitis because as age increases, the resistance or the immunity power of the body decreases, making the body susceptible to various diseases[12,17]. Also, the present study shows that sanitary workers in the age group of 31-44 years and 45 and above years are 2.4 and 4.2 times more likely to have chronic bronchitis as compared to those who are less than 30 years of age. Previous studies by Dutta and Deshmukh[12] in rural central India also support the above argument that the risk increases with the advancement of age. This study found that the respondents of ages 70 years and above are 6 times more likely to have chronic bronchitis as compared to the respondents of ages 40-49 years[12].

Working experience too represents an increased odds ratio because of more exposure to hazardous work. Females are two times more likely of having chronic bronchitis as compared to males, maybe due to biological weakness and due to the fact that they have to play a dual role in their daily lives. When working at home, female sanitary workers use the traditional methods of cooking such as coal, kerosene oil and wood, which produce a lot of smoke and many times, this is what is responsible for the occurrence of chronic bronchitis among them. The above arguments are supported by studies like those done by Dutta and Deshmukh[12], Shanthi[18] and Amra *et al*.[19].

This study found that smoking habits and perceived health condition are positively associated with chronic bronchitis, which is supported by the other studies too[17,20]. Education and standard of living did not show any consistent result maybe because despite differences regarding these characteristics, almost all workers had experienced the same exposure to hazardous waste.

CONCLUSION

The study concludes that inhalation of hydrogen sulfide, fumes, methane, silt, esters, ammonia, carbon monoxide, sulfur dioxide and nitrogen oxides are more dangerous than smoking and also chronic bronchitis is highly associated with age and type of workers and also slightly associated with gender, smoking tobacco and perceived health condition.

SIGNIFICANCE STATEMENTS

This study focused on the health issue of municipal sanitary workers under Varanasi municipal corporation. It was found that sewage worker had a higher prevalence of chronic bronchitis as compared to waste collector and driver. Several studies in India and abroad suggested that smoking and dust exposure is responsible for chronic bronchitis, but this study suggests that exposure to sewer gas is more dangerous than smoking and dust.

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