Original Article

Assessment of respiratory morbidity among bus drivers and conductors of the state road transport corporation, Kochi, Kerala

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Abstract

Introduction: In 2012, 8% of the 2.3 million work-related deaths globally were from chronic respiratory diseases (CRDs). This study was undertaken to estimate the prevalence of respiratory morbidity among the drivers and conductors of the public road transport network in Kochi. **Methodology:** A cross-sectional study was carried out in the public bus stand (South), Kochi between September 2015 and 2017 among bus drivers and conductors. The interview was conducted among 300 bus drivers and conductors using a locally adapted version of ATS-DLD-78-A questionnaire. Lung function assessment was done using a Mini Wright peak flow meter and a portable spirometer. Data were tabulated using MS Excel and analyzed using SPSS v20. **Results:** The prevalence of CRD among bus drivers and conductors was found to be 9.97% (95% CI 7.34–14.66) and chronic respiratory symptoms were found to be 19.2% (95% CI 14.58–23.82). On logistic regression, the independent predictors for the CRD were found to be working for more than 15 h/day (OR 2.815, 95% CI 1.26–6.28) and working for more than 4 days/week (OR 2.462, 95% CI 1.12–5.39). **Conclusion:** CRD exists as a public health problem affecting approximately one in ten bus drivers and conductors in Kochi city. Applying the logical principles of ergonomics by modifying duty hours may be considered.

Keywords: Bronchial asthma, chronic respiratory disease, chronic obstructive pulmonary disease, occupational respiratory morbidity

Introduction

Work-related illnesses are on the rise, with globally 2.3 million deaths annually being attributed to work. Around 2 million of this is attributable to work-related disease and 0.3 million owing to occupational injuries.[1] There are several determinants for the health of a worker, including risk factors at the workplace leading to musculoskeletal diseases, respiratory diseases, hearing loss, circulatory diseases, stress-related disorders, cancers, accidents, communicable diseases, and others.[2]

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Among the several diseases causing work-related morbidity, chronic respiratory diseases (CRD's) play a major role. CRD's are a group of conditions affecting the airways and other structures of the lung. CRD's caused 7% of the global mortality in 2005.[3] However, the exact global burden of CRDs is not available probably due to the lack of proper surveillance systems in most countries.[4]

The two most common occupation-related CRDs are bronchial asthma and chronic obstructive pulmonary disease (COPD).[3] As per the 2013 statistics reported by the Forum of International Respiratory Societies, the global disease burden of COPD was 200 million and that of bronchial asthma was 235 million.[4] In the year 2000, WHO estimated that 13% of COPD and 11%

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of asthma globally were due to exposure to risk factors at the workplace.[5] The mortality from bronchial asthma and COPD globally i.e. 38,000 and 318,000 deaths, in the year 2000 were due to occupational airborne exposures.[6]

In India, precise studies are not available to estimate respiratory health-related disease burden. The Survey of Deaths (SSD, 2001–2003) carried out under the domain of Sample Registration System SSD (2001–2003) reported the proportion of deaths contributed by respiratory diseases in the age group above 20 years to be around 20.3%.[7] Among which COPD and asthma contributes to 10.2%.[7]

In a developing country like India, with a lack of adequate chronic disease surveillance systems, there are only limited studies which have looked at occupational airborne exposure and CRD.[8] The transport industry is one of the many professions that have exposure to dust and other airborne particles.[4] With population explosion and the increasing demand to commute, the number of motor vehicles on Indian roads has increased drastically with 10% annual growth in the motor vehicle population. Thirty-two percent of the vehicles in our country are concentrated in metropolitan cities.[9]

Drivers and conductors in the road transport corporation are one such occupational group continuously exposed to urban as well as work-related airborne particles. The current study was undertaken to assess the magnitude of chronic respiratory problems among them and to identify any occupation-related factors associated with it. The findings from the study will aid policymakers to propose targeted interventions to improve the health status of employees working in Kerala State Road Transport Corporation. The information regarding the burden is also valuable to assess the impact of any prevention or control strategies later.

Methodology

A community-based cross-sectional survey was carried out between September 2015 and 2017 in the K.S.R.T.C. South bus stand of Kochi, which is the main depot within the district. The air quality index of Kochi city ranged between 25 and 110 for PM_{10}, indicating a satisfactory index.[10] The study population comprised of K.S.R.T.C employees who were currently working as bus drivers and conductors, for a minimum period of 1 year. Employees with history of chest injuries, chest surgeries, and cardiac disease were excluded from the study considering the possible presence of respiratory symptoms and the possibility of impaired pulmonary function tests in these individuals.

A total of 300 individuals were interviewed. Data collection took place from April to September 2016. A pretested semi-structured questionnaire containing 4 parts (A, B, C, and D) was used to collect information regarding socio-demographic factors, respondent's history, respiratory morbidity, and for pulmonary function assessment. The questions in Section B and C were adapted from the American Thoracic Society's (ATS) Division of Lung Diseases (DLD) Questionnaire referred to as "Recommended Respiratory Disease Questionnaires for Use with Adults and Children in Epidemiological Research"; ATS-DLD-78-A Questionnaire. The questionnaire has been recommended for use in all epidemiological research studies involving participants more than or equal to an age of 13 years as respiratory disease questionnaire and has been designed to assess the prevalence of chronic respiratory symptoms and disease.[11]

Lung function assessment was done using a Mini Wright peak flow meter and a portable spirometer. Peak expiratory flow rate (PEFR) measurement is usually represented in 3 zones: green- 80–100%, indicating normal; yellow- 50–80% indicating mild obstruction; and red- less than 50% indicating severe disease. It is often used as a tool to assess the severity of asthma, emphysema, and chronic bronchitis. It is expressed in l/min. The measured value for PEFR is compared to the predicted value for PEFR and is expressed as a percentage.[12]

Forced vital capacity (FVC) is frequently measured clinically as an index of pulmonary function.[13] The measured value for FVC was compared to the predicted value for FVC and expressed as a percentage. Values >80% were considered normal.[14] Forced expiratory volume at 1 s, FEV_1 is the fraction of vital capacity expired during the first second of forced expiration.[13] The measured value for FEV1 was compared to the predicted value for FEV1 and expressed as a percentage. Values >80% were considered normal.[14]

COPD includes both chronic bronchitis and emphysema.[15] For this study, chronic bronchitis was used for analysis and was based on symptom profile alone. CRD was defined as the presence of a combination of symptoms including that for chronic bronchitis as well as bronchial asthma. Chronic bronchitis was defined as the presence of cough for more than 1-year duration along with episodes of cough and phlegm lasting for 3 weeks or more each year. Bronchial asthma was defined as a disease consisting of a constellation of symptoms;[16] the major symptoms considered for the diagnosis of asthma were the presence of a triad of symptoms- cough, wheezing, and dyspnoea in any person in the study population. Chronic respiratory symptoms were defined as the presence of chronic cough, chronic phlegm, and wheeze.

Data were tabulated using MS Excel and analyzed using SPSS version 20. In total, 95% confidence intervals were calculated. To test the statistical significance of the association of the CRD with various factors, Chi-square test, odds ratio, and backward logistic regression analysis were done. Variables with *P* value <0.2 in univariate analysis were entered into a backward logistic regression model.

Written informed consent was obtained from all participants. The study was approved by the Institutional Ethical Committee of Amrita Institute of Medical Sciences, Kochi, India (Ethics committee approval obtained on 30.10.2015).

Results

Details of 291 participants with complete data were included in the final analysis. The mean age of the study participants were 40.6 ± 6.8 years; the age ranged from 26 years to 55 years. All the participants were males and 91.4% of them were married. [Table 1a].

The reported use of any tobacco products for smoking was 38.8%. Of the participants who ever smoked, 13.7% were current users and 25.1% were ex-users. Among current users, 47.5% have been smoking for 1–10 years and 5% have been smoking for 31–40 years. A majority of 65.6% of the study participants reported of being exposed to second-hand smoke; 61% of whom were being exposed at the workplace.

Of them, 6.9% of the study participants used any protective masks at the workplace. Among those who used masks, 70% used disposable face masks, 20% used it daily, and 55% used it for less than 2 hours per day.

The occupational history of study participants is depicted in Table 1b and the respiratory morbidities in Table 2.

The observed PEFR ranged from 210–670 L/min with a mean value of 488.73 ± 88.05 L/min. The observed FEV_1 ranged from 1.17–3.73 L/s[13] with a mean value of 2.70 ± 0.42 L/s and the observed FVC ranged from 1.49–4.87 L/s with a mean value of 23.40 ± 4.42 L/s.

The prevalence of the CRD among bus drivers and conductors was found to be 9.97% (95% CI 7.34–14.66) and chronic respiratory symptoms were found to be 19.2% (95% CI 14.58–23.82).

The factors significantly associated with CRDs were working for more than 15 h/day (aOR = 2.815) and working for more than 4 days/week (aOR = 2.462); that for chronic bronchitis was working for more than 15 h/day (aOR = 3.058); for bronchial asthma was the presence of respiratory disease before the age of 18 years (aOR = 4.089); and for chronic respiratory symptoms were absence of a separate kitchen (aOR = 6.929), presence of family history of respiratory disease (aOR = 2.669), and the presence of respiratory disease before the age of 18 years (aOR = 3.270).[Table 3].

Table 1: Distribution of study participants according to socio-demographic features and occupational history

Sl. No	Variables	FREQUENCY (*n*=291)	PERCENTAGE
A.	**Socio-demographic features:**		
1	Education		
	SSLC	139	47.8
	Higher Education	90	30.9
	Graduate	50	17.2
	Post Graduate	12	4.1
2	Place of residence		
	Panchayath	215	73.9
	Municipality	25	12.0
	Corporation	41	14.1
3	Location of residence near		
	NH/Main roads	95	32.64
	Others	196	67.35
4	Distance of residence from main road		
	<100 m	93	32
	>100 m	198	68
5	Primary cooking fuel used		
	LPG	159	54.64
	Wood	8	2.75
	LPG/Wood/Kerosene/ Electricity	124	42.61
6	Separate kitchen		
	Present	285	97.9
	Absent	6	2.1
B.	**Occupational history**		
1	Job profile		
	Driver	124	42.6
	Conductor	167	57.4
2	Years of service in K.S.R.T.C		
	≤10 years	198	68
	>10 years	93	32
3	Number of working days/week		
	≤3	213	73.2
	≥4	78	26.8
4	Working hours/day		
	≤14 Hours	147	50.5
	>15 Hours	144	49.5
5	Route of duty		
	City service	117	40.2
	Long distance service	174	59.8
6	Type of bus		
	Air-conditioned	108	37.1
	Non air-conditioned	183	62.9

Discussion

The burden of CRDs is often underestimated because it is usually not diagnosed until it is clinically apparent.[17] In India, there are only a few studies that have looked at the occupation-related respiratory morbidities and most of these studies have been done among industrial workers.[18] The current study was undertaken to measure the prevalence of respiratory morbidities among bus drivers and conductors of Kerala State Road Transport Corporation of Ernakulam South Depot.

In our study, the prevalence of chronic bronchitis as assessed by the American Thoracic Society-Division of Lung Diseases (ATS DLD) questionnaire method was found to be 6.5%. INSEARCH,[19] the multicenter study done in India found the population prevalence of chronic bronchitis to be 4.1%, which is lower than the findings of our study. The same study reported the prevalence of chronic bronchitis among those aged more than 35 years to be 13.5% in Trivandrum, Kerala.[19] In a recently published study by Viswanathan *et al.*, among adults from a rural area of Kollam, Kerala, the prevalence of chronic bronchitis

Table 2: Distribution of study participants according to the prevalence of bronchial asthma, chronic bronchitis, and chronic respiratory disease

RESPIRATORY MORBIDITIES	FREQUENCY (*n*=291)	PERCENTAGE	95% CI
BRONCHIAL ASTHMA	13	4.5	2.06-6.94
CHRONIC BRONCHITIS	19	6.5	3.60-9.40
CHRONIC RESPIRATORY DISEASE	29	9.97	7.34-14.66
CHRONIC RESPIRATORY SYMPTOMS	56	19.2	14.58-23.82

Table 3: Univariate analysis and multivariate logistic regression analysis

Sl. No.	Variables	Chi-Square	Crude OR (95%CI)	aOR (95%CI)
Chronic Respiratory Disease				
1.	Ever smoked tobacco products-Yes	0.11	0.79 (0.43-2.11)	0.897 (0.39-2.04)
2.	Working ≥4 days/week	5.33	2.462 (1.12-5.41)*	2.46 (1.12-5.39)*
3.	Working >15 hours/day	3.31	2.08 (0.93-4.65)	2.81 (1.26-6.28)*
4.	Presence of a positive family history	3.19	2.05 (0.92-4.59)	2.04 (0.89-4.63)
5.	>10 years of service in KSRTC	2.45	1.84 (0.85-4.016)	1.56 (0.69-4.43)
Chronic Respiratory Symptoms				
6.	Ever smoked tobacco products-Yes	1.69	1.47 (0.82-2.66)	1.07 (0.41-2.81)
7.	Working ≥4 days/week	1.79	1.53 (0.82-2.86)	1.32 (0.66- 2.61)
8.	Presence of a positive family history	10.45	2.76 (1.46-5.05)*	2.67 (1.42-5.01)*
9.	Absence of a separate kitchen	3.73	4.37 (0.86-22.29)	6.92 (1.33-36.14)*
10.	Ex-smoker-yes	2.88	1.72 (0.92-3.23)	0.56 (0.28-1.08)
11.	Presence of respiratory disease before 18 years of age	6.01	3.27 (1.32-8.06)*	3.27 (1.32-8.09)*

*p value<0.05, $Nr^2$0.233, -2LL=154.45

was found to be 6.19% (95% CI 5.76–6.62), with the prevalence among males being 6.73%.[20] This is similar to the findings of our study, 6.5% (95% CI 3.60–9.40).

The prevalence of bronchial asthma varied from 0.74% in rural Mumbai to 4.45% in rural Trivandrum.[19] A study done in rural Kashmir showed an overall prevalence rate of 1.96% for asthma.[21] A cross-sectional study among adults aged ≥35 years of an urban area of Trivandrum revealed a prevalence of 11.5%.[22] The study published by Viswanathan *et al.*, among adults from a rural area of Kollam, the prevalence of bronchial asthma was found to be 2.82% (95% CI 2.52–3.12) with the prevalence of asthma among males being 2.44% (95% CI 2.05–2.85).[20] A study done by Sylla F. K *et al.* in Senegal found the prevalence of asthma among bus drivers to be 38.8%.[23] Except for the findings in Trivandrum and Senegal, the prevalence of bronchial asthma in our study (4.5%) was found to be higher than other parts of India and Kerala. The mean FEV_1 value (2.70 ± 0.42) observed in our study is comparable to the study done among transport bus drivers in Pune in 2016.[24]

The prevalence of CRD in our study was found to be 9.97% (95% CI 7.34–14.66). Although our findings are higher than the prevalence of 6.3% reported by INSEARCH study,[19] it is similar to the prevalence reported by Viswanathan *et al.* (9.01%) in her study in a rural area of Kollam, Kerala.[20] Hence, it is comparable to the general population prevalence in Kerala. Phase I of INSEARCH study in 4 centers across India reported the prevalence of respiratory symptoms to be 4.3–10.5%.[19] This is similar to our findings of 9.23%. Wheezing was reported by 7.6% rural and 2.5% urban males and dyspnoea on exertion by 14% rural and 6% urban males in Trivandrum.[19]

The Beijing Truck Driver Air Pollution study that compared the exposure to traffic pollution among truck drivers and office workers showed a significant decrease in lung function among truck drivers compared to office workers.[25] A study done by Faisal *et al.* among non-smoking bus drivers of Hyderabad found a significant reduction in lung function among drivers with >10 years of experience in A.P.S.R.T.C.[8] Although our study showed a higher odds of chronic bronchitis and CRD among those with >10 years of experience, the difference was not statistically significant. The high odds could be due to exposure to diesel exhaust and traffic-related air pollutants with ill effects on health over the years.[26]

Number of working days/week and working hours/day were considered in our study as a proxy for the duration of exposure to traffic pollution. In our study, working for >15 h/day showed 3 times and 2.8 times more risk of developing chronic bronchitis and CRD, respectively than those working for ≤14 h/day, and this was identified as an independent factor associated with chronic bronchitis and CRD. Working for more than 4 days a week was also associated with CRD [Table 3]. Similar findings were observed by Ajay KT *et al.* in his comparative study among auto drivers and urban residents of Davangere, where he reported that lung functions of auto drivers who are continuously exposed to vehicular emissions are significantly reduced.[27] Similar findings have also been reported by Sylla F. K, in their study among bus drivers.[23] Long durations of exposure to traffic-related air

pollution has been identified to be associated with increased risk of chronic respiratory illness.[26] In countries like Europe, there are set standards that define the level under which no major health risks are involved in occupational exposure.[28]

The study looked at symptom profile for identifying and categorizing disease prevalence; hence, the possibility of misclassification cannot be ruled out and spirometric measurements were done on a single day because serial measurements were not possible owing to time and resource constraints. Lack of a comparison group made it difficult to compare the results across various occupational groups. Employees on a long duration of leave were not included in the study, but those on short-term leaves were included. The response rate was 97%, and even if we had included information from the medical certificates the overall prevalence would have been higher than the current prevalence obtained.

Conclusion

Chronic respiratory disease exists as a public health problem affecting approximately one in ten bus drivers and conductors in Kochi city. Globally, only 10–15% of the working population has access to healthcare.[29] This, coupled with the various detrimental environmental and social factors, plays a significant role in further decreasing the health capacity of the working population. Although our study did not point out to a causal relationship between occupation in K.S.R.T.C and respiratory diseases, incorporating screening for chronic respiratory morbidities and history of occupational exposures at the primary care level may help to prevent further progress to chronic lung diseases. This will inadvertently help in improving health care delivery as well as the health profile of the working population in the country. The findings of routine monitoring may help to explore the possibility of applying the logical principles of ergonomics by modifying working time and duty hours per day.

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Conflicts of interest

There are no conflicts of interest.

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