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Research Article

Respiratory Symptoms in Urban Traffic Policemen: A Cross-Sectional Study in Bangladesh

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Abstract

There is accumulating evidence that roadside pollution is detrimental to health. This study aims to asses and compare the risk of adverse respiratory symptoms in different categories of traffic police by job title including constables, sergeants, and inspectors working in the polluted urban environment.

A Cross-sectional study was conducted among 369 randomly selected traffic police personnel in the Chittagong city of Bangladesh. Information on occupation including job title and respiratory health symptoms were collected. Logistic regression analysis was conducted after adjusting for potential confounders. The risk of coughing [adjusted Odds Ratio (AOR) = 4.469, 95% CI=1.265-15.793], coughing sputum [AOR= 3.687, 95% CI= 1.004 - 13.540], coughing up blood [AOR=1.040, 95% CI=0.227-6.162], shortness of breathing [AOR=3.937, 95% CI=1.069-14.500], wheezing [AOR= 2.464, 95% CI= 0.613-9.906] and chest pain with deep breathing [AOR=2.163,95% CI= 0.560-8.349] was higher in traffic constables assigned to traffic control and

management duty by the roadside in comparison to traffic inspectors assigned to coordination of transport system and periodical investigation. Odds increased for coughing up blood [AOR=1.102, 95% CI= 0.283-4.286] and wheezing [AOR=1.260, 95% CI= 0.304-5.229] in traffic sergeants assigned to petrol duties. Study findings show that there is a substantial difference in the risk of studied respiratory symptoms between different categories of traffic police jobs.

Keywords: Occupational and environmental health; Traffic police; Respiratory symptoms; Epidemiology; Bangladesh

1. Introduction

Environmental exposures during work activities can affect health. Traffic police personnel spend a long duration of time by roadside due to the nature of their job and are exposed to roadside vehicular emissions that can cause both long- and short-term health problems. Previously conducted epidemiological studies reported the association of occupational health hazards such as environmental pollution due to vehicular emission and adverse respiratory health outcomes in traffic police personnel [1, 2]. Road traffic generates volatile organic compounds, suspended particulate matter, oxides of nitrogen, sulfur oxides, and carbon monoxide which impose a wide range of adverse health effects on the exposed population [3]. Vehicular emission-related deterioration in air quality has been shown to produce significant morbidity and mortality by affecting multiple organs and systems [4]. These pollutants cause respiratory morbidities, reduced lung function, and chronic exposure may even cause lung cancers and COPD [5, 6].

Bangladesh, one of the most densely populated countries in the world, is going through economic transition and rapid urbanization in recent years. Major cities of Bangladesh, particularly Chittagong and capital city Dhaka is congested with a large number of motor vehicles, including local transport buses, long route buses, diesel-run local passenger vans, passenger cars, commercial vans, private cars, compressed natural gas (CNG)-run auto-rickshaws, and heavy-duty diesel-powered lorry trucks for the shipment of garment products to the Chittagong port, most of which are run by high-sulfur diesel [7]. The air quality of Dhaka is considered to be one of the most polluted in the world, at 82 µg/m3 annual average PM2.5 concentration from a variety of pollution sources and ranked as the third most polluted city among the megacities with at least 14 million people [8]. According to the Bangladesh Road and Transport Authority (BRTA), there were 504,130.000 registered motor vehicles in 2019 in Bangladesh, most of which were decades old and unfit for the road, polluting the environment severely [9]. Exhaust and fumes of these vehicles are a major source of NO2 emissions and CO emissions in Chittagong and Dhaka, accounting for some 58.6% of the total annual NO2 emissions and 40.5% of the total CO emissions [10]. The concentration of PM particles, SO2, Ozone, Carbon monoxide in some cities of Bangladesh including Chittagong city has been found well above the recommended level of the World Health Organization (WHO) [11, 12].

Despite the high pollution and vulnerability of the traffic police personnel in Bangladesh, there are hardly any studies that have been done to assess their health staus. Therefore, this study aims to assess the risk of adverse respiratory health outcomes in different categories of traffic police including constables, sergeants, and inspectors in Bangladesh.

2. Methods

2.1 Study setting

A cross-sectional study was conducted in Chittagong city of Bangladesh. The data collection process was carried out from August 31st, 2018 to January 15th 2019.

2.2 Study population and work environment

Study participants were traffic police personnel working in different areas of Chittagong city in Bangladesh. In Bangladesh, traffic police constables, by job definition are assigned to traffic control and management at traffic junctions, traffic inspectors coordinate scheduled service within assigned territory of streetcar, bus, or railway transportation system with the periodical investigation in schedule delays for accidents, equipment failures, complaints and files written report, and sergeants perform patrol duties to address traffic infringement or violation and is responsible for the initial scene management of incidents.

The road traffic is very dense at most of the traffic junctions in Chittagong city either because of nonfunctional traffic lights or due to traffic snarl-ups. Traffic police personnel aged 20 years or over were invited for the study.

2.3 Determination of sample size

The sample size for the prevalence of the respiratory disease among traffic police was determined using single proportion formula with the following assumptions: level of significance (α) =5%, (at a confidence level of 95%), p= 68% (According to a study done in India, 68% traffic police personnel had frequent coughing and other complications with various percentages due to occupational exposure. India was considered for expectation prevalence for this study since India and Bangladesh are located in the same geographical region and both countries share similar types of exposures) [13].

Z value=1.96, marginal error d=7% of p,

n= z2 * p * (1-p)/d=369

A simple random sampling technique was used to collect police personnel following STROBE guidelines (https://www.strobe-statement.org/index.php?id=available-checklists).

2.4 Variables

The survey about respiratory symptoms in traffic policemen was based on a questionnaire adapted from the Standard Respirator Medical Evaluation Questionnaire [14].

The questionnaire covered the following respiratory symptoms: coughing, coughing sputum, wheezing, coughing up blood, shortness of breathing, and chest pain with deep breathing. Respiratory symptoms were recorded as being present if a participant answered, "Yes", to a relevant question. The participants were provided with explanations about each respiratory symptom.

The questionnaire also included socio-demographic information of the participants including age, height, weight, marital status, job information including job title, preventive measures such as use of face mask at work place, information about behavioral factors including smoking and workout habit (exercise), and history of a previous respiratory disease diagnosed by a doctor including Asthma, Tuberculosis, Chronic Bronchitis, Emphysema, Pneumonia, Pneumothorax, Cancer, Tuberculosis, chest injury or surgery, broken ribs, allergic reaction interfering with breathing.

Three trained data collectors went to the site with the questionnaire after obtaining approval from the local police authority and conducted face-to-face interviews. Validation of respiratory symptoms was done by a registered medical doctor (first author).

2.5 Research approach

The research approach of the present study was the identification of the type of industries where there is an excess risk of adverse health outcomes. Focus on workers in this occupation can lead to recognition of one or several factors, which may have independent or synergic effects [15].

2.6 Data management and analysis

All data were recorded and analyzed in Statistical Package for the Social Sciences (SPSS) version 22. Traffic inspectors were used as a reference category to compare the risk of respiratory health outcomes among traffic police as traffic inspectors are considered least exposed to roadside pollution.

To determine the risk of respiratory outcomes among traffic police, a two-step statistical model approach was undertaken. First, the prevalence of adverse respiratory health outcomes in different traffic police by job title was measured. Second, the risk of adverse respiratory outcomes was compared to different traffic jobs by job title. Odds Ratio with 95% confidence interval (CI) was the measure of association. Logistic regression analysis was conducted to estimate adjusted Odds Ratio where covariates such as age, BMI, education, smoking status, use of mask, workout (exercise), previous respiratory disease were adjusted for each of the other.

3. Results

Table 1 describes the sample characteristics according to the job title. Out of a total of 369 traffic police personnel, 25(6.7%) were inspectors, 145(39.3%) were sergeants, and 199(53.9%) were constables. There was a substantial difference was in the distribution of socio-demographic determinants, which could be partly explained by relatively small numbers in some groups. For example, the prevalence of using masks at workplace was 16.0% in traffic inspectors, 34.5% in traffic sergeants, and 13.6% in traffic constables. However, the distribution of workout habits and smoking status was found almost the same in all the occupational groups.

VARIABLE		**JOB TITLE**			
		Inspector (n/%)	**Sargent (n/%)**	**Constable (n/%)**	**Total (n/%)**
Age(years)	<30	0(0.0%)	4(2.9%)	21(23.6%)	25(6.8%)
	30-40	48(33.8%)	86(62.3%)	11(12.4%)	145(39.3%)
	>40	94(66.2%)	48(34.8%)	57(64.0%)	199(53.9%)
	X^2 =101.019,df=4,p=0.000				
Education	School	9(36.0%)	0(0.0%)	25(12.6%)	34(9.2%)
	High school	9(36.0%)	0(0.0%)	141(70.9%)	150(40.7%)
	Undergraduate and higher	7(28.0%)	145(100.0%)	33(16.6%)	185(50.1%)
BMI	Underweight	0(0.0%)	2(1.4%)	3(1.5%)	5(1.4%)
	Normal	4(16.0%)	81(55.9%)	113(56.8%)	198(53.7%)
	Overweight	16(64.0%)	62(42.8%)	79(39.7%)	157(42.5%)
	Obese	5(20.0%)	0(0.0%)	4(2.0%)	9(2.4%)
	X^2 =101.019,df=6,p=0.000				
Marital status	Single	4(16.0%)	12(8.3%)	63(31.7%)	79(21.4%)
	married	21(84.0%)	133(91.7%)	136(68.3%)	290(78.6%)
	X^2= 27.723,df=2,p=0.000				
Physical exercise (workout)	Yes (always)	3(12.0%)	11(7.6%)	14(7.0%)	28(7.6%)
	No	4(16.0%)	83(57.2%)	72(36.2%)	159(43.1%)
	Sometimes	18(72.0%)	51(35.2%)	113(56.8%)	182(49.3%)
Workplace	Yes	4(16.0%)	50(34.5%)	27(13.6%)	81(21.9%)
	Sometimes	14(56.0%)	60(41.4%)	124(62.3%)	198(53.7%)
	No	7(28.0%)	35(24.1%)	48(24.1%)	90(24.4%)
	X^2 =24.168,df=4,p=0.000				
Smoking status	No	25(100.0%)	125(86.2%	189(95.0%)	339(91.9%)
	Yes	0(0.0%)	20(13.8%)	10(5.0%)	30(8.1%)
	X^2 = 11.007,df=2,p=0.004				

Table 1: Characteristics of participants according to job title (N=369).

RESPIRATORY SYMPTOMS	JOB TITLE			
	Inspectors (n/%)	**Sergeants (n/%)**	**Constables (n/%)**	**Total (n/%)**
Coughing	6(24.0%	11(7.6%)	43(21.6%)	60(16.3%)
Coughing sputum	6(24.0%)	11(7.6%)	38(19.1%)	55(14.9%)
Coughing up blood	5(20.0%)	11(7.6%)	41(20.6%)	57(15.4%)
Shortness of breathing	6(24.0%)	11(7.6%)	39(19.6%)	56(15.2%)
Wheezing	4(16.0%)	11(7.6%)	39(19.6%)	54(14.6%)
Chest pain with deep breathing	12(48.0%)	12(8.3%)	41(20.6%)	65(17.6%)

Table 2: Prevalence of respiratory symptoms accordingto the job title (n=369).

Table 2 shows the prevalence of present respiratory symptoms and previous respiratory illness diagnosed by a doctor according to the job title. There was a substantial difference in the prevalence of all studied respiratory symptoms according to job title. For example, the prevalence of coughing was 24 % in the inspectors, 7.6% in the sergeants, and 21.6% in constables while corresponding estimates for coughing sputum were 24.0%,7.6%, and 19.1% respectively.

RESPIRATORY SYMPTOMS	JOB TITLE			
	Inspectors (n/%)	**Sergeants (n/%)**	**Constables (n/%)**	**Total (n/%)**
History of pneumonia	0	1(0.7%)	1(0.5%)	1(0.3%)
History of tuberculosis	0	0	0	0
History of chronic bronchitis	0	0	1(0.5%)	1(0.3%)
History of asthma	0	0	0	0
History of pneumothorax	0	0	0	0
History of lung cancer	0	0	0	0
History of chest injury or surgery	0	0	0	0
History of broken ribs	0	0	0	0
Allergic reaction interfering with breathing	0	1(0.7%)	1(0.5%)	2(0.5%)

Table 3: Distribution of previous respiratory illness according to the job title (n=369).

Table 3 shows the distribution of previous respiratory illnesses in the traffic police personnel according to the job title. The participating traffic inspectors, sergeants, and constables were found to have almost no history of previous respiratory diseases, which could be partly explained by the recruitment of personnel with no history of a previous disease or chronic illness in the police service including the traffic police service of Bangladesh.

OUTCOMES	JOB TITLE	Crude Odds Ratio		Adjusted Odds Ratio*	
		PE	95% CI	PE	95% CI
Coughing	Inspector	reference		-	
	Sergeants	1.429	0.299- 6.817	0.841	0.230-3.075
	Constables	3.358	1.665- 6.771	4.469	1.265-15.793
Coughing sputum	Inspector	reference		-	
	Sergeants	1.727	0.467-29.761	0.573	0.151- 2.169
	Constables	2.875	1.415- 5.843	3.687	1.004 -13.540
Coughing up blood	Inspector	reference		-	
	Sergeants	1.038	0.367- 2.932	1.102	0.283-4.286
	Constables	3.161	1.563- 6.392	1.040	0.227-6.162
Shortness of breathing	Inspector	Reference			
	Sergeants	.772	0.289- 2.061	0.612	0.163- 2.291
	Constables	2.969	1.464- 6.024	3.937	1.069-14.500
Wheezing	Inspector	reference		-	
	Sergeants	1.280	0.415- 3.942	1.260	0.304- 5.229
	Constables	2.969	1.464- 6.024	2.464	0.613-9.906
Chest pain with deep breathing	inspector	reference		-	
	sergeants	0.281	0..119- 0.662	0.741	0.302- 1.821
	Constables	2.876	1.452- 5.696	2.163	0.560-8.349

*Logistic regression analysis adjusting for age, BMI (body mass index), education, marital status, smoking, use of mask and work out (exercise), history of respiratory disease.

Table 4: Logistic regression analysis of respiratory symptoms according to job title.

Table 4 shows logistic regression analysis of respiratory symptoms according to job title (duty type). Constables were found at risk of coughing (adjusted Odds Ration=4.469, 95% CI = 1.265-15.793), coughing sputum (adjusted odds ratio=3.687, 95% CI= 1.004 -13.540), shortness of breathing (Adjusted Odds Ratio = 3.937, 95% CI=1.069-14.500) in comparison to inspectors. Risk also

increased for wheezing (adjusted odds ratio=2.464, 95% CI=0.613-9.906), chest pain with deep breathing (adjusted Odds Ratio=2.163, 95% CI=0.560-8.349),and coughing up blood (adjusted odds ration=1.040, 95% CI=0.227-6.162), however, the risk was not significant statistically. Risk moderately increased in sergeants for coughing up blood [AOR=1.102, 95% CI= 0.283-4.286] and wheezing [AOR=1.260, 95% CI= 0.304-5.2] in comparison to traffic inspectors, however, the risk was not significant.

4. Discussion

Air pollution in Bangladesh is a major public health concern, especially among those who live and work in cities. The growing number of vehicles is one of the contributing factors for the deteriorating air quality. Traffic police personnel who are continuously exposed to air pollutants are at high risk. The present study was designed to assess the prevalence and risk of respiratory symptoms in traffic police personnel. The study explored a high prevalence of respiratory symptoms in different categories of traffic police by job title. This finding corroborates with the result of studies conducted before among traffic police personnel in Thailand and India [16, 17].

The use of a questionnaire was useful to take into account a large number of potential confounders in the current study. After adjustment of potential covariates, constables were found at risk of coughing, coughing sputum, coughing up blood, shortness of breath, wheezing, and chest pain in comparison to the inspectors. Similar to the present study, an epidemiological study conducted before in Italy also reported that traffic police personnel assigned for traffic control and management by the roadside are at high risk of adverse respiratory symptoms including coughing, wheezing, shortness of breathing in comparison to traffic police personnel assigned for coordination and administrative duties at the office [18].

The elevated risk of studied respiratory symptoms in constables could be explained by direct and continuous roadside exposure to roadside pollution which has been shown to be a direct correlate in studies conducted before [19, 20]. A recently conducted comparative study in Malaysia explored that traffic police personnel who work by the roadside are at high risk of adverse respiratory outcomes in comparison to unexposed occupational groups due to continuous and direct roadside exposure [21]. Continuous and direct exposure to toxic chemicals and gases of vehicular emission cause irritation and allergy in the lungs and airways, airway obstruction, and increased mucus production leading to obstructive lung diseases [22, 23]. Although the human bronchopulmonary tract has multiple protective mechanisms, such as the air-blood barrier and mucosal cilia, air pollutants can accumulate in or pass through lung tissues depending on the size and chemical nature of pollutants [24]. The vapor of air pollutants is prone to be absorbed by human tissues or dissolved in body fluids, relying mostly on hydrophilicity and hydrophobicity. The ultrafine particles are capable of translocation through blood circulation to distal organs and tissues, such as liver tissue for detoxification [25]. Particles deposited in the respiratory tract in sufficient amounts can induce pulmonary inflammation. Controlled human and animal exposure studies have demonstrated increased

markers for pulmonary inflammation following exposure to a variety of different particles [26]. Airway inflammation increases airway responsiveness to irritants such as particle pollution, allergens, and gases reducing lung function by causing bronchoconstriction. At the cellular level, inflammation may damage or kill cells and compromise the integrity of the alveolar-capillary barrier. Repeated exposure to particle pollution aggravates the initial injury and promotes chronic inflammation with cellular proliferation and extracellular matrix reorganization [27].

As regards to subjective symptoms of the current study, investigated by means of the questionnaire, positive results were more prevalent among the constables than inspectors, this difference being a statistically significant agreement with what was observed by a study conducted before in China which showed an increase in respiratory symptoms in road traffic workers [28]. Regarding the research approach of the study, the identification of the type of industries and occupations where there is an excess risk of adverse respiratory health outcomes is in agreement with a study done before in Italy [29].

This study, to the best knowledge of the authors, is the first of its kind that measures the risk of adverse respiratory health outcomes among traffic police personnel in Bangladesh. However, there are some limitations in the present study.

Given the cross-sectional design of the study, it has limited capability to infer causality, and the relatively small number in the reference group can affect the validity of the outcome. Further epidemiological studies, on larger samples and environmental air quality data provided, are required to better understand and define the pollution-related respiratory outcomes in traffic police personnel.

5. Conclusion

The finding of this study suggests a valuable need for targeted occupational health interventions such as the use of protective masks at the workplace and periodic medical surveillance to prevent respiratory morbidity and mortality in traffic police personnel working in polluted environments.

Ethical Consideration

The study was approved by the Research and Ethics Committee of the Asian University for Women, Bangladesh. Informed verbal consents of the participants were obtained before the interview.

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