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Original Research Article

A study on the respiratory effects in road construction workers in Mysore, India

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ABSTRACT

Background: The process of road formation involves lot of chemicals which harm the respiratory tract. This leads to many health problems faced by road construction workers due to occupation. This study was done to find out the respiratory problems in road construction workers in Mysore.
Methods: 128 workers were asked questions about their respiratory symptoms and knowledge of protection from occupational hazards, and their peak expiratory flow rate and oxygen saturation were measured.
Results: Only 31.25% workers had appropriate PEFR. The oxygen saturation was more than 95% for all the workers studied. 30% of the workers suffered from cough and 30% from breathlessness. There was poor knowledge and practice of using protective clothing, especially masks (46% and 5%).
Conclusions: Policy changes in preventive precautions for occupational hazards need to be brought in.

Keywords: Road construction workers, PEFR, Occupation health, Safety

INTRODUCTION

India has the second largest road network in the world, at more than 4 million kilometres second only to the United States of America. Half of Indian roads are paved (about 2 million kilometres).[1] Government of India, under the National Highways Development Project and various private builders are implementing multiple projects for construction or up gradation of paved roads. The process of tarring the roads in India consists of various steps with potential exposure to allergens, pollutants, and carcinogens. It begins with laying down large stones, followed by small stones, then pouring molten bitumen (asphalt) over it and finally dusting it with stone dust.[2]

Brushing of dust in preparation of the surface, crushing of stones, and mixing of cement for adjacent concrete works expose the workers to air borne particles. Handling of concrete mixture and molten bitumen, coupled with ignorance of protective clothing causes prolonged skin contact with these particles. Asphalt fumes are mixtures of various organic compounds including polycyclic aromatic compounds.[2] Chronic exposure to these could possibly lead to respiratory or dermatological adverse health effects.[3,4] There is also a risk posed by exhaust from the passing traffic.[5]

Studies done in Europe show that bitumen fumes cause respiratory symptoms and increased mortality among road construction workers.[3,6] There is sparse evidence for the adverse pulmonary effects suffered by road construction workers in India, although there are studies on drivers, and other construction workers. This study was aimed at assessing the occurrence of respiratory

symptoms, peak expiratory flow rate and oxygen saturation, and awareness and practice of occupational hygiene among road construction workers of Mysore.

METHODS

A cross-sectional study involving a group of 128 road construction workers in Mysore was carried out during June 2013 to September 2013. Sample size required was calculated assuming expected proportion to be 40%, with 5% alpha error and 20% relative precision as 144. But due to non-availability of workers only a sample size of 128 could be achieved.

Road construction workers in multiple construction projects in Mysore who had been involved in road construction for at least 1 year were included in the study. Those with pre-existing chronic respiratory conditions like asthma, COPD were excluded. The study was approved by the Ethics Committee of Mysore Medical College and Research Institute.

A questionnaire was administered by the investigators to assess the presence of lower airways symptoms, physician diagnosed asthma or COPD, details about cough, expectoration, breathlessness, wheezing, hemoptysis, and smoking history.

Peak expiratory flow rate was measured using peak flow meter from Life Line Medical Devices, Gurgaon. The accuracy of this device was indicated as ±5%. The reference values were adapted from European Union scale according to Kodgule et al.[7] The subjects were given a demonstration of how to get the maximum expiratory flow before their attempt. The best of 5 values were chosen. A portable fingertip pulse oximeter from Beijing Choice Electronic Technology Ltd was used for non-invasive measurement of oxygen saturation with accuracy of measurements ±2%.

Data analysis was done to find association between respiratory symptoms and number of years of having worked in the occupation, smoking history, and PEFR value. Descriptive analysis of the symptoms, and knowledge and use of protective equipment was done. Statistical analysis were carried out using GNU PSPP version 0.8.4 and R version 3.1.2

RESULTS

The median PEFR was 250mL, with interquartile range 150 ml. Comparing individual values to reference values appropriate for age, gender, and height, it was discovered that only 40 (31.25%) workers had normal PEFR. The rest 85 (66.41%) had PEFR lower than what was expected for their age, gender, and height. The median Oxygen saturation was 98% with minimum 95%, 1st and 3rd quartiles 98%, and maximum 99%.

Table 1: The occurrence of respiratory symptoms.

Symptom	Frequency	Percent (n=125)
Cough	39	30.47
Breathlessness	38	29.69
Wheeze	12	9.38
Hemoptysis	3	2.34

59 (46%) workers had knowledge about the importance of using masks. Only 7 (5%) wore masks while working. 42 (33%) responded positively about needing goggles, but only 7 (5%) had ever worn them.52 (41%) had knowledge about gloves, 18 (14%) used them.55 (43%) had knowledge about boots, 34 (27%) used them, often during concrete mixing.79 (62%) believed that they needed to keep separate protective work dress. 67 (52%) kept them.105 (82%) felt they should scrub themselves at the end of the day. 83 (65%) said they scrub every day.

Table 2: Factors that cause presence of symptoms.

Variable	Symptoms	No symptoms	chi-square	P value
Years working				
1-5	31 (38%)	50 (62%)	6.37	0.272
6-10	6 (35%)	11 (65%)		
11-15	3 (50%)	3 (50%)		
16-20	5 (38%)	8 (62%)		
21-25	3 (100%)	0		
26-30	0	2 (100%)		
Smoking history				
Smoker	32 (42%)	44 (58%)	4.62	0.099
Non-smoker	19 (39%)	30 (61%)		
PEFR				
Normal	17 (40%)	25 (60%)	0.67	0.715
Low	34 (40%)	51 (60%)		

The association between number of years spent working in road construction activity and presence of symptoms were found to have chi-square value of 6.37 with p value 0.272 and is not significant. People with history of

smoking showed increased prevalence of symptoms compared to non-smokers (Table 2).

DISCUSSION

Almost 70% of workers had reduced respiratory functions. This finding was similar to study on asphalt exposed worker.[6] This study also suggested that those working in road construction have high respiratory symptoms on chronic basis and acute symptoms due to repeated exposures.[6,8] This study also suggested that road construction work is associated with acute irritant and respiratory symptoms. These acute symptoms of fatigue, laryngo-phayngeal irritation and watering of eyes are due to asphalt, which has many organic compounds. Particle bound PAHs, such as those occurring in bitumen fume and diesel exhaust, may contribute to oxidative stress and exert pro-inflammatory and tissue damaging effect that can contribute to respiratory morbidity.[4] in addition the chronic symptoms may be due to silicosis caused due to the silica exposure in road construction.[9] there are studies which measured the levels of these chemicals like silica, organic compounds and noise at these road construction sites.[10]

It was noticed that the workers were not adequately protected with required equipment. In our conversations with them, it was clear that they were neither asking for such protective equipment, nor proactively given them by the supervisors. Policy changes that mandate use of gloves, masks, and other pieces of clothing can improve this condition. There are no studies with regard to occupational hygiene aspects of road construction workers. However, there are studies on occupational hygiene of other construction workers, which also found to be very poor and needs intervention.[11,12] There are some case studies reporting the poor hygiene by road construction workers.[13]

Smoking is an important factor for developing respiratory illnesses and the adverse effects of it cannot be ruled out.[14,15]

The study had two limitations. One, that we did not have full occupational and exposure histories for the studied subjects. Therefore, they may have been exposed to chemical agents outside of road construction work. This may bias estimates of lung function in any direction. Other limitation of the study is that the poorly educated workers could not give their best PEFR by blowing powerfully into the meter. This could be the cause of decreased PEFR among many of them.[16]

The present study estimates respiratory morbidities and demonstrates the inadequacy in protection of road construction workers.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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