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## Respiratory Health of Auto Rickshaw Drivers.

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### ABSTRACT

Air pollution affects the respiratory health of persons exposed to air pollution. It shows in terms of increased respiratory symptoms and reduction in lung function. This case-control cross sectional study was done at Pimpri, Pune; to assess effects of air pollution on auto rickshaw drivers. The assessment was done using a self administered respiratory health questionnaire and spirometry. A total of 77 auto rickshaw drivers were evaluated and compared with 71 matched controls. There was a statistically significant reduction in FEV<sub>1</sub>, FVC, PEFR and FEF 25-75 values on spirometry. Auto rickshaw drivers had increased prevalence of both acute and chronic respiratory symptoms. Chronicity was related to the duration of their work as auto rickshaw drivers. There were 20 symptomatics among auto rickshaw drivers and 7 among healthy controls. 16 auto rickshaw drivers lost 10 working days in last 1 year (3 auto rickshaw drivers lost more than 10 working days) compared to 3 among healthy controls. There were 5 auto rickshaw drivers who complained of worsening of symptoms at the end of working day. There were 7 auto rickshaw drivers who gave history of reduction in intensity of symptoms when on vacation.

**Keywords:** Auto Rickshaw, spirometry, lung health, air pollution, traffic

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## INTRODUCTION

Air pollution, a byproduct of industrialization and urbanization, is a major environmental problem affecting the developing and the developed countries alike. The effects of air pollution on health are very complex as there are many different sources and the effects of individual air pollutants vary. Air pollution has very serious effect on respiratory system and has also been proved as a risk factor for progression of many respiratory diseases like allergic rhinitis, bronchial asthma, COPD etc.

In urban areas, vehicular exhaust predominantly contributes to air pollution. These pollutants include volatile organic compounds, suspended particulate matter (spm), oxides of sulphur (Sox), oxides of nitrogen (Nox) & carbon monoxide (CO) which cause adverse health effects on the exposed population. [1]

Auto rickshaws are high contributors to air pollution due to poor maintenance, misuse of lubricants and use of mineral oils other than specially formulated 2T oil recommended by vehicle manufacturers, taking extra passenger load etc. These autorikshaws run on specified routes as licensed by the municipal corporation. The rickshaw drivers themselves are at high risk of exposure as they spend more than 8 hours a day on the same routes and due to low height of their vehicle that increases the exposure level significantly. The vehicle smoke also makes them vulnerable to develop various allergic disorders. [2]

We therefore decided to study these auto rickshaw drivers within PCMC territory of Pune city, for their respiratory health status, lung functions and symptoms scores using necessary equipments and a respiratory health questionnaire.

## AIMS AND OBJECTIVES

- To assess the respiratory health status of the city auto rickshaw drivers in comparison to a control group by history, physical examination, spirometry and quality of life questionnaire.
- To evaluate the hypothesis that occupational exposure to vehicular exhaust adversely affects the respiratory health of auto-rickshaw drivers.

## Study Design

This was an open label case control cross sectional study. The project was done by the department of pulmonary medicine, Padmashree Dr. D.Y. Patil Medical College, hospital & Research centre. Prior approval was obtained from ethics committee of the institute.

## Study Methodology

Auto rickshaw drivers driving 3 sitter and 6 sitter rickshaws were included in the study. The purpose of the study was explained to them in their local language and written consents

were obtained individually from all participants. During working hours, it was not feasible for most of them to visit the department of pulmonary medicine. Therefore, a respiratory camp was conducted at each of the various auto rickshaw stands as an outreach activity. Total six camps were conducted in PCMC area. During the camp, physical examination including respiratory system examination was done. Complete spirometry was performed and a respiratory QOL questionnaire designed in local language was given to them which had to be self administered.

The Study group consisted of auto rickshaw drivers with age group of 25-45 years. Those in the same profession for more than five years and working minimum eight hours daily were included in the study. Those with any variables that may affect the spirometry and QOL, such as past/ current respiratory illness, tobacco smoking, lung surgery etc. were excluded. Persons with contraindication to performing spirometry were also excluded. Total 77 participants qualified for analysis.

The control group consisted of persons matched for age, socio-economic status and other inclusion/ exclusion criteria except that they were not auto rickshaw drivers. It was ensured that these were not working as traffic policemen and not staying or working in a shop in crowded locality with high vehicular density; as this would bias the study findings. A total of 71 participants qualified for analysis.

The pre-requisites for spirometry were explained to all the study participants. All the standard ATS/ERS (Task Force guidelines for standardization of Spirometry) norms were followed while conducting the spirometry and interpreting the spirometry results. [3] All the tests were done by Easy One (made in Germany) spirometer. All the Spirometry tests were done in sitting position and subjects used nose clip. The subjects performed at least 3 reproducible attempts. The criteria used for acceptable exhalation was forced expiratory time for 6 seconds and a plateau in volume-time curve for at least 1 second. The criterion for repeatability was the two highest values for FEV1 and FVC taken from acceptable forced expiratory maneuvers with difference within 200 ml.

## OBSERVATIONS AND RESULTS

A total of 77 auto rickshaw drivers (study group) and 71 non drivers (control group) were evaluated for the lung functions test (Spirometry), physical examination and respiratory health questionnaire. The groups were matched well as evident in Table 1.

**Table 1: Demographic characteristics**

Parameters	Study Group	Control Group	Z Value	P Value
	Mean $\pm$ SD (n=77)	Mean $\pm$ SD (n=71)		
Age (Yrs)	38 $\pm$ 6.67	36.62 $\pm$ 7.12	1.22	>0.05
Height (Cm)	168 $\pm$ 7.75	166.15 $\pm$ 4.62	1.79	>0.05
Weight (Kg)	62 $\pm$ 10.53	58.9 $\pm$ 9.6	1.87	>0.05

All the data obtained in the study was analyzed with the help of a biostatistician using Multivariate analysis (MVA).

The lung function parameters of auto rickshaw drivers showed statistically significant reduction in FEV1%, FVC and PEFR values as compared to control group. FEF 25-75 was significantly less in auto rickshaw drivers as compared to control group. (Table 2)

**Table2: Comparison of spirometry parameters**

Parameter	Study Group	Control Group	P Value
	Mean± SD (n=77)	Mean ± SD (n=71)	<0.0001
FEV1 %	70.36 ± 16.92	92.14 ± 16.18	<0.0001
FVC %	76.7 ± 20.8	92.25 ± 18.08	<0.0001
FEV1/FVC (%)	98.2 ± 13.48	103.88 ± 8.68	>0.05
PEFR %	71.3 ± 22.64	88.92 ± 19.34	<0.0001
FEF 25 – 75%	58 ± 29.19	84.96 ± 24.6	<0.0001

The auto rickshaw drivers suffered from respiratory symptoms such as breathing difficulty, cough with expectoration, wheezing, chest tightness, running nose, and eye symptoms much more frequently as compared to control group. (Table 3)

**Table 3: Comparison of symptoms and their frequency**

Symptoms	Auto Rickshaw	control	Total
Trouble with breathing	18/77	4/71	22/148
Breath out less easily than others of same age	15/77	4/71	19/148
Cough with sputum on most of the days in last 12 months	15/77	3/71	18/148
Wheezing or whistling in last 12 months	15/77	1/71	16/148
Chest tightness in last 12 months	15/77	1/71	16/148
Sneezing, blocked or runny nose	20/77	4/71	24/148
Itching or watering of the eyes	21/77	4/71	25/148

Auto rickshaw drivers had increase in symptoms during their work suggesting occupation related occurrence/ worsening of symptoms. 16 auto rickshaw drivers had lost between 1 to 10 days of work due to respiratory illness as compared to 3 in control group. 3 auto rickshaw drivers had lost more than 10 days in last 12 months compared to none in the control group.

## DISCUSSION

Pune is the academic capital of Maharashtra. It is also known as Oxford of India. Prior to industrialization, Pune was also a city for retired people and vacationers alike due to its unpolluted climate. Today however, Pune has joined the list of the country's most polluted cities, with high level of air pollutants as indicated by data generated by SAFAR (System of Air Quality Forecasting and Research. [4] In Pune, common mode of public transport is auto rickshaws. Auto rickshaw drivers are constantly exposed to air pollution. Air pollution affects the respiratory health of persons exposed to it by modifying the defense mechanisms of the respiratory system. People exposed to air pollution can develop chronic bronchitis, bronchial

asthma or impairment of pulmonary function. Those already suffering from chronic bronchitis or bronchial asthma can develop an exacerbation during episodes of heavy pollution. The incidence of lung cancer is also known to be high in persons living in highly polluted areas.

Combustion in the diesel engine produces soot along with smoke. The size of the diesel soot particles makes it easily respirable. Approximately 40-50 % of the inhaled particles in diluted exhaust can be expected to deposit in the lungs and airways of humans. [5] Pollutants released in automobile exhaust are oxides of nitrogen (Nox), CO, hydrocarbons, respirable particles, sulphur dioxide and volatile organic compounds. Increased Volatile Organic Compounds (VOCs) in ambient air of urban areas are observed because of vehicular exhausts, petrol bunk emissions and industrial activities prevailing within the areas. Nitroaromatic compounds found in diesel soot have been identified as potential human carcinogen. [6]

The present study was done to look for the effect of air pollution on the lungs of auto rickshaw drivers with the help of spirometry, respiratory system examination and a QOL questionnaire. This was an open labeled case control study and we compared the affects of air pollution on the respiratory health of auto rickshaw drivers with healthy controls who were not exposed to the same levels of air pollution.

The reduction in FEV<sub>1</sub>, FVC, PEF and FEF 25-75 can be correlated to exposure to air pollutants. Reduction in PEF is a warning indicator of early obstructive changes in larger and more proximal bronchi and suggests increased risk of occupational related obstructive airway disorder in auto rickshaw drivers. Reduction in FEF<sub>25-75</sub> denotes the early obstructive changes in smaller airways, mainly involving the more peripheral bronchi and bronchioles. There was a 22% reduction in mean FEV<sub>1</sub>, 16% reduction in mean FVC, 18% reduction in PEF and 27% reduction in FEF<sub>25-75</sub> among auto rickshaw drivers as compared to healthy controls. These changes suggest possible beginning of COPD in these people. Similar results have been shown in other studies done on auto rickshaw drivers at Patiala (Punjab) and Gulbarga (Karnataka). [7-8]

In yet another study conducted by Pope A et al in Utah valley among the school children, found that elevation in particulate levels (PM<sub>10</sub>) was associated with an increased reduction in PEF values among these children. [9]

Similarly in a study on traffic related air pollution, Mats Rosenlund et al found a strong association between estimated NO<sub>2</sub> exposure and lung functions. They found that FEF<sub>25-75</sub> reduced more significantly than other parameters as in our study. [10]

The respiratory health questionnaire administered to the participants evaluated respiratory condition with respect to various upper and lower respiratory symptom scores. Auto rickshaw drivers had a higher risk of developing various respiratory symptoms. Among the several respiratory symptoms analyzed between these two groups, auto rickshaw drivers presented with breathlessness, cough with expectoration, wheezing, chest tightness,

intermittent sneezing, blocked or running nose and the intermittent episodes of itching or watering of eyes.

Studies conducted by AIIMS (Delhi) and central pollution control board(CPCB) found that most common respiratory problems related to air pollution were irritation of eyes, cough, pharyngitis, dyspnoea and nausea; similar to our study. [11-12]

Similarly, a study in Mumbai done by Kamat SR et al, found an increase in symptoms like cough, breathlessness, headache, eye irritation, chest pain among the adult population who were residing in more pollutant areas. [13]

There were 5/77 auto rickshaw drivers who complained of worsening of symptoms at the end of working day. There were 7/77 auto rickshaw drivers who gave history of reduction in intensity of symptoms when on vacation.16/77 auto rickshaw drivers lost between 1 to 10 working days compared to 3/71 in control group in last 1 year 3 /77auto rickshaw drivers lost more than 10 working days. These suggest strong association of the occupational exposure to loss of wages. There has been no reference in literature regarding the above findings.

One of the limitations of our study is that we have not done complete set of pulmonary function evaluation that includes body box measurements and DLCO. These tests could have helped us in detecting early changes in lung functions. Though these equipments are available at our institute, they are not transportable to the road side where the study was conducted keeping in view the convenience of the study participants. Chest X ray also could not be done for the same reasons.

### CONCLUSION

The results of this study suggest that air pollution adversely affects the respiratory health of auto rickshaw drivers. Regular screening by respiratory questionnaire and / or spirometry is highly recommended for them. Screening interval can be determined depending on the pollution levels in the locality of their operation. We also recommend the use of protective mask while driving auto rickshaws though this was not evaluated in the present study.

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