

# Evaluation Of Exposure Analysis On People Exposed To Traffic Congestions.

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**Abstract**— Traffic is a major contributor of air pollution. Mixed traffic rise and the rise of pollution are proportional to each other. This paper is an effort to set a relationship of human being to the exposures of traffic pollution. Human being is exposed to traffic pollution in short term and long term exposures which further leads to acute and chronic symptoms of the human body. Traffic contributes to pollutants that are emitted from auto- exhausts .Exhaust pollutants like SO<sub>2</sub>, NO<sub>2</sub>, PM (Particulate Matter), RSPM are found to be contributing the rise in pollution levels. Traffic related pollution RSPM2.5 is drawing more concern for physiological functions of human body. Study and analysis is done to evaluate the relationship between human, traffic and RSPM and RSPM with asthma. Case considers Kalbadevi, Bandra station road, A.B. Road, K C Road junctions of a metropolitan city Mumbai.These junctions have mixed traffic flow and maximum time of congestions. Further evaluation of mixed traffic, traffic congestions and asthma is related. Human health is considered for the diagnosis of the physiological functions and respiratory diseases such as asthma, pulmonary obstructions.Further impact study is done on the basis of questionnaire.Prevalance of asthma is monitored among people exposed to congestions directly and when compared with the control group.

**Index Terms**— Asthma, Exhaust Emissions, Exposure, Health, RSPM, Respiratory Symptoms, Traffic Congestions, Traffic .

## 1 INTRODUCTION

Mumbai, with a population of approximately 20.5 million[1] along with the neighbouring urban areas, including the cities of Navi Mumbai and Thane, is home to 18.77 lakh[2] vehicles, placing traffic police in an environment highly exposed to air and noise pollution. Urban air pollution is associated with an increased incidence of allergic respiratory diseases.

The issue of traffic congestion has been a subject of great deal of study and interest in recent times. It is a unique, serious and common problem among the major cities in various countries throughout the world.

Traffic congestion is a part of problems associated with urban development, the other problems of urbanization being homelessness, restlessness and loneliness. Movement of population towards cities for better opportunities and better life style has created its own unique problems among the major ones like 'climate changes' and the present civilization is struggling to find solutions. Given its ongoing pervasive effect on urban residents, both real and perceived, these problems have been a very important political issues in recent times.

The causes of traffic congestion are various and common among major cities, like more people drive further and far, limited transport choice, high density of vehicles per unit of road availability, limited transit service, scattered and unplanned development of cities. The growth of population and vehicles always outs numbers and out sizes growth of surface transport facilities.Environmental factors are believed to play a significant role in the development of allergic respiratory diseases, such as asthma and rhinitis.

The presence of various particles and gases from vehicular

emission like carbon dioxide, carbon monoxide, sulphur, benzene, lead, nitrogen dioxide, nitric oxide and black smoke etc. may play a role in the pathogenesis respiratory diseases. The toxic chemicals and gases released from vehicular emission produce irritation and allergy in the lungs and air passage of individuals who are exposed to them for a long time[3]. Traffic policemen who work in the busy traffic signal areas for years together are exposed to the risk of air traffic pollution. In the long run, the pollutants may produce disease like asthma and bronchitis in the exposed individuals with changes in normal lung functions. Pulmonary function tests using a computerized spirometer assess all the parameters of the respiratory functions and give a fair idea about the respiratory health of an individual. Therefore, these changes can be observed even before the disease becomes symptomatic by a detailed assessment of pulmonary function tests. In urban areas mobile or vehicular pollution is predominant and significantly contributes to air quality problems. Road traffic produce volatile organic compounds, suspended particulate matter (SPM), oxides of sulphur (SO<sub>x</sub>), oxides of nitrogen (NO<sub>x</sub>), and carbon monoxide (CO), which makes adverse health effects on the exposed population. The particles emitted from the vehicular exhaust of more than 10-micron size are held in upper respiratory tract and particles less than 10-micron size (PM10) accumulates in the lung and produces respiratory abnormalities. Hence, PM10 are of great concern in air pollution studies[4]. The effects of air pollution include breathing and respiratory problems, aggravation of existing respiratory and cardiovascular disease, alterations in the body defense systems against foreign materials, damage to lung tissue, carcinogenesis and premature death. The major subgroups of the population that appear to be most sensitive to the effects of particulate matter include individuals with chronic obstructive Pulmonary, cardiovascular disease, influenza and asthmatics. The prevalence of obstructive, restrictive and mixed type of functional impairment of the lung was found to have direct relationship

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with the dust concentration and duration of exposure. Prolonged exposure to dust can result in chronic bronchial problems.[5] Investigations of the respiratory health effects from vehicular pollution exposures are necessary in order to predict the risk factors that may cause an asthmatic response. Several research works has confirmed the effects of air pollutants on respiratory function of human being. This study shows a link between exposure to vehicular exhaust, traffic congestions and link to pulmonary function. Studies have shown reversible decrement in pulmonary function in population exposed to traffic pollution. The continuous vehicular exhaust inhalation can lead in the symptoms of lower respiratory tract such as cough, shortness of breath and pain with inspiration Prominent effect was observed above 60 yr of the age, considered as age induced asthma reported in India.[6]

## 2 MATERIALS AND METHODS

### 2.1 Descriptions and details of experimental site and analysis

Traffic junctions are consider as hot spot of air pollution, as vehicles have to wait in idling mode of operation for signals and so the amount of pollution increases. Several times it is observed that the signal lane is so long that the vehivles have to wait for second turn of signal. Five sites Bandra West station, Kalbadevi, Worli, lower Parel and front of lilawati hospital as control site. were selected for ambient air monitoring and traffic congestions. Traffic density and congestion period was recorded. Traffic Police (Police constables, police naik, police head constables having outdoor duties and admistrative work along with street vendors were diagnosed for asthma and and other respiratory disorders. Spirometric analysis was done for finding asthma in the the traffic police.

### 2.2 Survey

Survey was conducted along the traffic junctions and congestion spots. Street Vendors , shopkeepers , traffic police were considered for survey through questionnaire. It was observed from the data that these people were exposed to traffic pollution and heavy traffic during peak hours of the day for short durations. A majority of the people surveyed, were found to be suffering from breathing/respiratory problems. A lot of them have been diagnosed with asthma at some time or the other.

Acute and chronic symptoms were observed among the exposed people. 1582 no of people were surveyed for various respiratory tract infections which includes sinusitis, tonsilitis, bronchitis, pneumonia etc. Results obtained from the survey are represented in fig.1

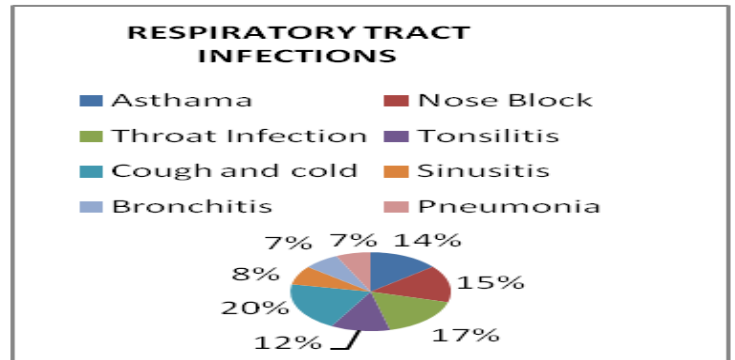


Fig 1: Survey for Respiratory Tract Infections

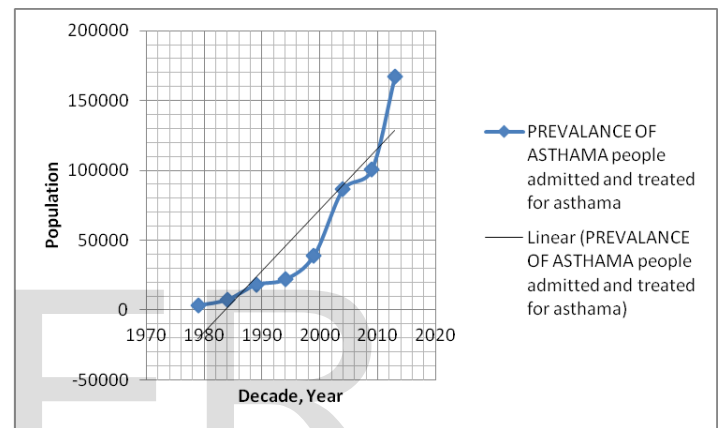


Fig 2: Prevalance of asthma from year 2008 to 2013

The rises in number of patients treated at the municipal wards are represented in the above fig.2. The Indian Council of medical research has already presented the prevalnce of respiratory tract infections due acute and chronic exposures [11].

#### 2.2.1 Monitoring of vehicles: Volume and Speed

Monitoring of vehicles was done to count the number of vehicles passing from one junction. No of vehicles along with their speed were considered asa criteria for congestions.

#### Conventional Evaluation of Traffic Congestion:

This study consists of conventional evaluation of traffic congestions in order to cover environmental, social and economical impacts. It is framework which can support the impact evaluation to be more comprehensive in future. Impacts are evaluated in the Table no.1.

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Factors Considered	Traffic Congestions
Environmental Impact	<ul style="list-style-type: none"> <li>Impact on human beings</li> <li>Impact on surrounding structures</li> <li>Impact on plants</li> </ul>
Economical Impact	<ul style="list-style-type: none"> <li>Increase consumption of fuel</li> <li>Negative benefit from travelling</li> <li>Increase in frequent visits to hospital for acute and chronic symptoms due to traffic congestions.</li> </ul>
Social Impact	<ul style="list-style-type: none"> <li>Public health concern</li> <li>Mobility of vehicles</li> <li>Increase in Public anxiety</li> </ul>

Table.1: Traffic congestions and its impact

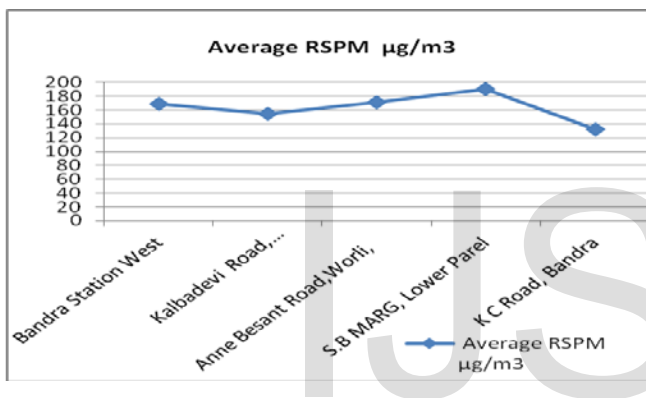


Fig 2. Average rspm at the traffic junctions

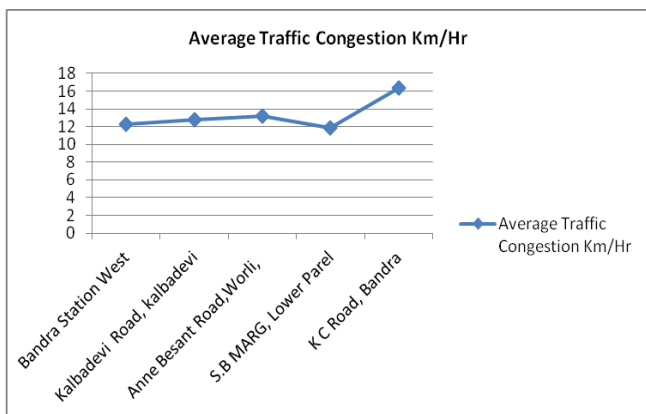


Fig: 3: Average traffic congestions at the traffic junctions.

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### 2.2.2 Ambient Air Monitoring: RSPM 2.5

Ambient air monitoring was done to measure RSPM 2.5 at the five traffic junctions of Bandra station West, Kalbadevi road, Anne Besant Road. Worli, Lower Parel and Lilawati hospital kc road. High Volume ampler, Model-PEMHVS 310 - rspm is used to measure RSPM from the traffic junction areas. This study comprises of measurement of RSPM 2.5 in  $\mu\text{g}/\text{m}^3$  to further study prevalence of Asthma on the people. The results are interpreted in the Fig.3. Traffic congestions and rspm are measure on the same day of the month. Average readings are been taken for 8 months a year. Data is collected from the month of January to May and October to January. Data was not collected from June to October due to Monsoon.

Traffic Congestions and rspm 2.5 was measured at same sight on the same day. The graph of congestion and rspm correlates to each other stating rise in congestion raises the concentration of rspm simultaneously. As per the permissible standards of India the rspm concentration is high at these sites.

### 2.2.2 Spirometric Analysis for Asthma: Spirometric analysis

was done among the traffic exposed people and the non exposed group. Healthy males aged between 24 to 30 and non smokers were selected for significance test.

Breathing tubes are narrowed in existance of asthma [3]. Breath - O - Meter, Sponsored by cipla was used for measuring peak flow. Peak flow is an indication of movement of air through the lungs. The person diagnosed is asked to take the deepest breath they can and then exhales into the sensor as hard as possible, preferably at least 6 seconds.

Following results were observed after the people performed the test with breath-o-meter. Comparison was made on the exposed group at the traffic junctions and traffic congestion daily and unexposed group on the various age groups. It is observed that exposed group is more prevalent. Measures are required to be taken for getting the levels low.

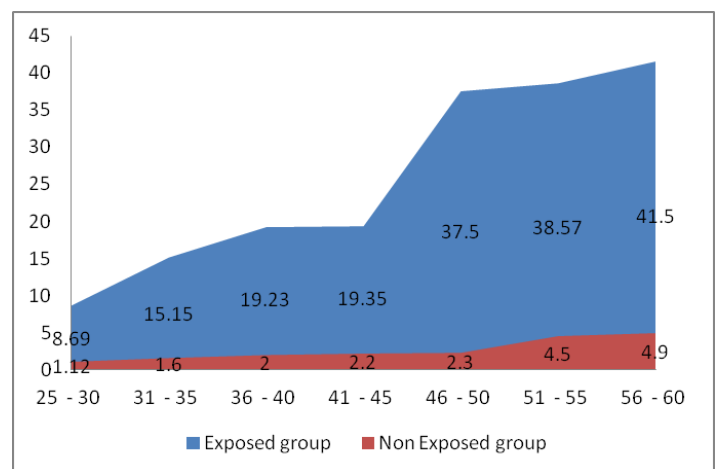


Fig: 4: % of asthma diagnosed in age groups of exposed group of people to traffic congestions and unexposed group.

Asthma morbidity rise above can be evaluated from the fig.4. Statistical analysis of the data is done to get the significance of the test.

## 7.2 Acknowledgments

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## 4 CONCLUSION

After the survey for respiratory tract infections it is observed that cough, cold and asthma are found to be dominant and exposed people. Further need is developed to monitor congested areas and people exposed to. There is emergency to take precaution for respiratory infections. Regulations are needed to switch off the vehicles at the signals. Measures to avoid congestions should be priority for avoiding asthma.

## REFERENCES

- [1] C.Commissioner. "[Cities having population 1 lakh and above.](#)" CEN-SUSINDIA, Oct .17, 2011[Oct 17, 2011]
- [2] P.Biava. "An Epidemiological Study Of The Health Conditions Of Milan Traffic Police With Respect To Pollution From Vehicular Traffic". Medical Journal of Human Health, vol 83, pp. 249-258, Sep 1999.
- [3] N. Roa, T Patel and C Raiyani "Pulmonary Function Status Of Shopkeepers Of Ahemadabad Exposed To Auto Exhaust Pollutant". Indian JPhysiol Pharmacol, vol 36, pp.60-64 1992.
- [4] P.Pal and j.robert "Pulmonary Function Test In Traffic Police Personnel In Pondicherry". Indian J Physiol Pharmacol, vol 54, pp. 329-336 2010.
- [5] H.Xianglu, P.Luke and Naeher "A Review Of Traffic-Related Air Pollution Exposure Assessment Studies In The Developing World", Environment International, vol 32, pp. 106 – 120, 2006.
- [6] M.Ashmore, K.Batty, F.Machin, "Effects Of Traffic Management And Transport Mode On The Exposure Of School Children To Carbon Monoxide", Environ Monit Assess, vol 65, pp. 49– 57, 2000.
- [7] D.Settle, C.Patterson."Lead In Albacor; Guide To Lead Pollution In Americans". Env Science,vol 207pp.1167-1176,1980.
- [8] S.Ingle, D.Panchpade," Exposure to Vehicular Pollution and Respiratory Impairment of Traffic Policemen in Jalgaon City", Industrial health, vol 43, pp.656-662, 2005.
- [9] A.Bashyal,A.Kamruzzaman, Majumder,"Quantification Of Pm10 Concentration In Occupational Environment Of Traffic Police Personnel In Pokhara Sub-Metropolitan City, Nepal", Kathmandu university journal of science, engineering and technology, vol 1, No. V, pp.73-80, Sep 2008.
- [10] G.Thippanna, S.Lakhtakia,"Spirometric Evaluation Of Traffic Police Personnel Exposed To Automobile Pollution In Twin Cities Of Hyderabad And Secunderabad".Ind.J.Tuberculosis, vol 46, pp.129-131 1999.
- [11] J.N. Mathur, "Indoor Air Pollution In India – A Major Environmental And Public Health Concern", ICMR Bulletin, Vol.31, No.5, May 2001.
- [12] A.Agashe and V.Deshpande,"Study Of Pulmonary Wheat Grinding Machine Operators In India Using Spiro Metric Testing".Journal of Environ Science & Engg, vol 52/2 pp.163-166, 2000.
- [13] C.Chitra, H.Vishwanathan, E.Deepa and Rani MVU. "Cytogenetic Monitoring Of Men Occupationally Exposed To Air Borne Pollutants". Environ Pollut, vol 112, pp.391-398 2001.
- [14] Ec.gc.ca."Environment Canada - Air - AQHI categories and explanations". <http://www.ec.gc.ca/cas-aqhi/default.asp?lang=En&n=79A8041B-1>, April 16,2008 [Nov 11 2011].
- [15] A.Agha, S. Sadaruddin1, N. Khatoon , " Effect Of Environmental Pollution On Blood Levels In Traffic Police Constables In Islamabad, Pakistan."J Pak Med Assoc, Vol. 55, No. 10, pp. 410-414, Oct 2005.
- [16] U.S. Environmental Protection Agency. Review of the National Ambient Air Quality Standards for Particulate Matter: Policy assessment of scientific and technical information—OAQPS staff paper, Preliminary Draft, Office of Air Quality Planning and Standards, Research Triangle 2003; 111: 1188–1193).