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Emergency Room Visits due to Cardio Vascular Illness from Major Hospitals of Chennai – A Preliminary Study

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ABSTRACT

BACK GROUND OF THE STUDY: Air pollution results in increased exacerbations of chronic cardiopulmonary disease which in turn is reflected in the form of increased emergency room visits (ERV). Emergency room visits can be a direct result of short-term exposure to air pollution. ERV is more experienced by urban populations in both developed and developing countries and cardio-respiratory illness is among the leading causes of hospitalization. The Harvard Six Cities study inferred that every 10 µg / m³ increase in fine particle mass was associated with 2.1% increase in deaths due to ischemic heart disease. **Aim of the study:** To evaluate the emergency room visits in major government hospitals of Chennai city for a select period and to evaluate the feasibility of using the data on particulate matter levels in examining the association between PM 10 and emergency room visits. **Materials and Methods:** Hospital data of emergency room visits (ERV) for the years 2006, 2007 & 2008 due to cardio vascular illness was collected from the Medical Records Department of two of the three major government hospitals of Chennai and was categorized by gender and age as well as the relevant ICD codes (ICD version 10) for the period January 2006 to December 2008. **Results:** The incidence of cardiovascular related health hazards were analysed accordingly. The number of males reported for emergency room visits was higher than females. The maximum number of visits among the adults was in the age group of 45-65. The PM10 level has shown a 50% increase from 2006 to 2008. **Conclusion:** The study reveals an alarming increase in ERV due to cardiovascular causes in the urban population of Chennai which could be due to increased levels of ambient air pollution (PM 10) due to rapid urbanisation and poor hygiene. ERV can be used as a health indicator in the on-going air pollution study and has potential applications in future in assessing the trend of health status in urban population.

Key words: Emergency room visits (ERV), ambient air pollution, and urban population. Cardio vascular disease.

INTRODUCTION

Health status is determined by both host and environmental factors. Thus health of an individual should be considered as an integration of his / her physical, biological, and social surroundings.

Among the environmental factors, outdoor air pollution has recently received attention for its public health importance. Increasing urbanization and unprecedented vehicular growth in developing countries such as India exacerbate air quality culminating in polluted environment. There is good evidence that the health of 900 million urban people across the world is deteriorating daily because of high levels of ambient air pollutants and the adverse effects of air pollution are more pronounced in developing countries¹. WHO estimates that around 800,000 people die prematurely worldwide every year and almost two thirds of these occur in developing countries of Asia as a result of cardiovascular caused by outdoor pollution. Approximately 150,000 of these deaths are estimated to occur in South Asia alone .Over 180,000 people die worldwide each year due to myocardial infraction and India has an estimated 15–20 million of cardiovascular mortality patients. Such significant reduction in life expectancy of the average population is linked to the long-term exposure to high levels of air pollution with particulate matter. Air pollution results in increased exacerbations of chronic cardiopulmonary disease which in turn is reflected in the form of increased emergency room visits (ERV). Emergency room visits can be a direct result of short-term exposure to air pollution. ERV is more experienced by urban populations in both developed and developing countries and cardio-respiratory illness is among the leading causes of hospitalization³. Atmospheric pollution has been increasing at an alarming rate all over the globe. Most of the traditional pollutants directly affect the respiratory and cardiovascular system and are more serious for certain sections of the population that may be at greater risk like the young, the elderly and those already suffering from respiratory and cardiac diseasesThe Harvard Six Cities study inferred that every 10 µg/ m³ increase in fine particle mass was associated with 2.1% increase in deaths due to ischemic heart disease. Though the association of air pollution with health outcomes is weak, it still has strong public health implications because air pollution is ubiquitous and affects the whole population⁴. In most metropolitan cities the residents are continuously and permanently exposed to air pollution, which may lead to both short and long-term health outcomes. Hence, the present study has been done to evaluate the ERV from two major hospitals in Chennai, India and to understand the association between cardio respiratory health outcomes due to air pollution in this city.

Air pollution in India

The environmental problems in India are growing rapidly. Vehicular pollution is increasing in Indian cities and is responsible for 70% of the country's air pollution which may lead to increased number of patients with diseases related to air pollution. There is a growing concern about increasing outdoor air pollution in several metropolitan cities with high vehicular density, particularly in the developing countries where the emission standards for motor vehicles are lax. Exhaust from vehicles has increased eight-fold in twenty years and industrial pollution has risen four times over the same period. The increasing economic development and a rapidly growing population that has taken the country from 300 million people in 1947 to more than one billion people today is a strain on the environment, infrastructure, and the country's natural resources. Air quality is worse in big cities like Kolkata, Delhi, and Mumbai & Chennai⁵.

Air pollution in Tamil Nadu

In Tamil Nadu, air pollution is widespread in urban areas where vehicles are the major contributors and in a few other areas with a high concentration of industries and thermal power plants. The number of motor vehicles has increased in the State from 46.0 lakhs in 1999- 2000 to 67.5 lakhs in 2003-04 (TNPCB, 2008). Out of these, 48 per cent are concentrated in major cities like Chennai, Coimbatore, Salem, Madurai, Thiruchirapalli and Tirunelveli. Chennai itself accounts for about 24.5 per cent of the total registered vehicles and has more registered vehicles than those in the other cities. The registered vehicular population has increased more than two folds during the year 1996-2004⁶.

Air pollution in Chennai

Chennai, one of the major and fast developing metropolitan cities of India is the capital of Tamil Nadu state in Southern India. It is India's fourth largest city and ranks 35th among the fifty most populous urban agglomerations in the world and also one of the most important industrial cities of the sub-continent.

Further the air of the city is adversely affected by the continuous growth of industries and motor vehicles. Exhaust from vehicles, dust from construction debris, industrial waste, burning of municipal and garden waste are all on the rise in the city. The need of the hour is to monitor the air quality and implement drastic measures to improve the same⁷.

Particulate matter (PM)

Airborne PM consists of a heterogeneous mixture of solid and liquid particles suspended in air, continually varying in size and chemical composition in space and time. Primary particles are emitted directly into the atmosphere, such as diesel soot, whereas secondary particles are created through physicochemical transformation of gases, such as nitrate and sulphate formation from gaseous nitric acid and sulphur dioxide (SO₂), respectively.

The numerous natural and anthropogenic sources of PM include motor vehicle emissions, tire fragmentation and suspension of road dust, power generation and other industrial combustion, smelting and other metal processing, agriculture, construction and demolition activities, residential wood burning, windblown soil, pollens and molds, forest fires and combustion of agricultural debris, volcanic emissions, and sea spray⁷.

HEALTH EFFECTS OF AIR POLLUTION: Air pollution is a major problem faced by people across the globe. In recent years many epidemiological studies, time-series studies in particular, have emerged that show statistically significant associations between exposure to classical air pollutants and adverse health effects including mortality and morbidity. Nevertheless, more evidence is needed to establish a causal relationship, and the underlying mechanism needs to be further explored. Poor quality of air seriously affects the body's respiratory and cardiovascular system. The most susceptible to air pollution exposure are the elderly patients, people with underlying heart or lung disease, lower socioeconomic population and diabetics. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the concentration of the chemicals, the degree of exposure, the individual's health status and genetics. Children and new-born are also sensitive to the health effects of air pollution since they take in more air than adults for their body weight and consequently, a higher level of pollutants. The health effects caused by air pollutants may range from subtle biochemical and physiological changes to difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac conditions. These effects can result in increased medication use, increased doctor or emergency room visits, more hospital admissions and even premature death. Air pollution can affect our health in many ways with both short-term and long-term effects. Short-term effects include irritation to the eyes, nose and throat, headaches, nausea and upper respiratory infections such as bronchitis, pneumonia and allergic reactions. Short-term air pollution can aggravate the medical conditions of individuals with asthma and emphysema. Long-term health effects can include chronic respiratory disease, lung cancer, heart disease, and even damage to the brain, nerves, liver, or kidneys. Continual exposure to air pollution affects the lungs of growing children and may aggravate or complicate medical conditions in the elderly. Studies in many countries have confirmed that long-term exposure to common air pollutants and living in urban areas may be associated with increased incidence of respiratory infections, lung function disturbances, cardiovascular irregularities and rising adult and infant mortality^{8,9}.

MATERIALS AND METHODS

Study design is Time series analysis study and the study centres are tertiary care hospitals, Govt. General Hospital & Govt. Kilpauk medical college Hospital, Chennai. Selection of representative zones within the study area for environmental and health data collection. Ethical clearance was obtained from Institutional Ethics Committee. Permissions to retrieve the information were obtained from the Directorate of Medical Education and Deans of the corresponding medical college hospitals. Hospital data of emergency room visits (ERV) for the years 2006, 2007 & 2008 due to cardiovascular illness was collected from the Medical Records Department of two of the three major government hospitals of Chennai and was categorized by gender and age as well as the relevant ICD codes (ICD version 10) for the period January

2006 to December 2008. Raw data were abstracted manually in the field and the compiled electronic data was used for analysis.

Statistical Analysis-The data collected was analysed using R statistical software version - 2.8.1. Box plots have been used to give a detailed description of the selected variables.

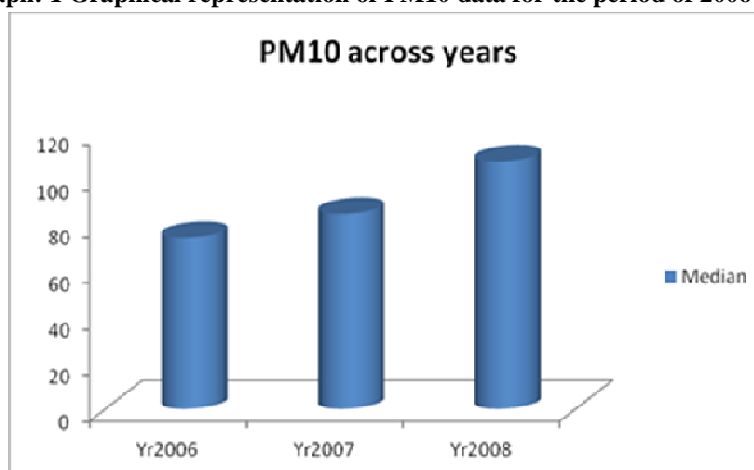
RESULTS

From our study, we retrieved the data on ERV due respiratory illness from two major Government hospitals in Chennai city and the PM10 data from Tamilnadu Pollution Control Board in order to examine the association between PM 10 and emergency room visits.

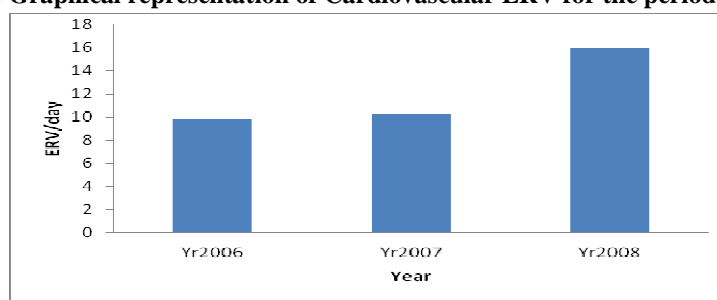
Table: 1

Cardiovascular diseases	ICD-10
Atrial fibrillation	I 48
Angina	I20.9
Heart block (LBBB/RBBB)	I44.2
Cardiomegaly	I51.7
Cardiomyopathy	I 42.0
Heart failure	I50
Chest pain	R07.4
Hypertension	I10
Ischemic heart disease	I20
Palpitations	R00.2
Rheumatic heart disease	I09.9
Mitral valve prolapse syndrome	I34.1
Mitral stenosis/Mitral regurgitation	I39.0
Myocardial Infarction	I21
Ventricular fibrillation	I49.0

Graph: 1 Graphical representation of PM10 data for the period of 2006-2008

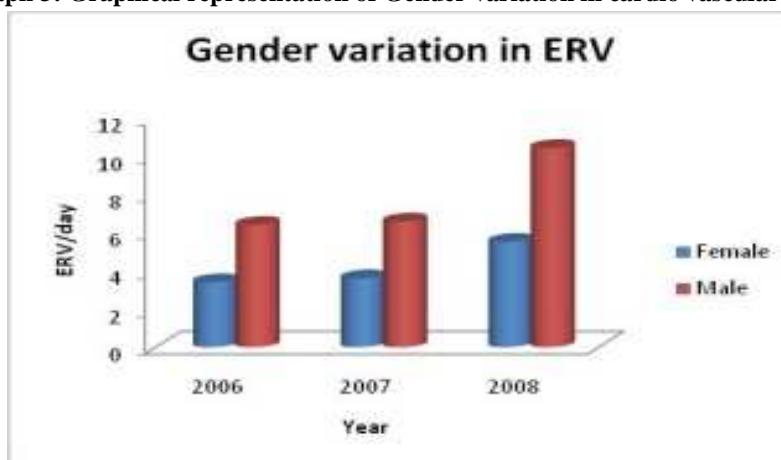


Graph 2: Graphical representation of Cardiovascular ERV for the period 2006-2008



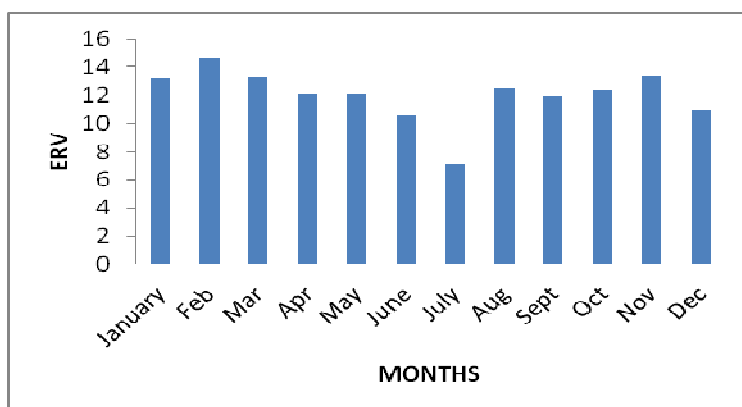
Graph 2: Shows that there is an increasing trend in the number of emergency room visits due to cardiac cause from 2006 to 2008. A 60% increase in Emergency room visits due to cardiovascular diseases is observed.

Graph 3: Graphical representation of Gender variation in cardio vascular ERV



Graph 3: Shows the gender variation in the number of emergency room visits due to cardiac cause from 2006 to 2008. ERV due to cardiac causes is observed more in males when compared with that of females each year and it is 63% in males when compared with that of females.

Graph 4: Graphical representation of Cardio vascular ERV month wise for the period of 2006-2008



Graph: 4 Show the general trend in the ERV in various months of a year. Similar trend is observed in all the three years. ERV due to cardiac causes is more in the months of January, February and March.

DISCUSSION

Particulate air pollution is an important environmental risk factor for causing adverse health effects. Comparative risk ranking of environmental concerns in Chennai has shown that health and economic risks from PM 10 may rank higher than microbial/chemical contaminants in water and solid waste concerns. Jing-Shiang Hwang In 2004 stated that among all air pollutants, particulate matter is the type of air pollution that causes the most numerous and serious effects on human health, because of the broad range of diverse toxic substances it contains. For this reason, when assessing human health risk, PM10 may be considered to be a reliable indicator of the impact of global air pollution. Despite improvements in air quality achieved by many industrialized countries the negative effects of air pollution remains today an important public health problem. A person's relative risk due to air pollution is small compared with the impact of established cardiovascular risk factors such as smoking, obesity, or high blood pressure. However, this is a serious public health problem because an enormous number of people are exposed over

an entire lifetime¹⁰. J.N. Pande, *et al.* In 2002. They noted that cardiac ERV is higher in males than females. The maximum number of cardiac ERV was observed in the age group of 45-65 years which is consistent with other studies. Age, cultural practices, life style and socio-economic status may influence the exposure to air pollutants¹¹. As the individual sensitivity to pollutants increases, the severity of the response will increase for a given pollutant. Therefore, the effects of air pollutants and the severity of health outcomes in a given population depend on the population sensitivities.

During the last decade, epidemiological studies conducted worldwide have shown a consistent, increased risk for cardiovascular events, including heart and stroke deaths, in relation to short- and long-term exposure to present-day concentrations of pollution, especially particulate matter (AHA, 2004). As a preliminary effort, this study was carried out to evaluate PM10 and its association with cardio respiratory ERV in Chennai using time series analysis¹². Our study shows that there is an increasing trend in the number of emergency room visits due to cardiac cause from 2006 to 2008. Besides, PM10 level has also shown a 50% increase from 2006 to 2008. Comparison of the ERV due to cardiac reasons with that of the PM10 levels during the time period January 2006 to December 2008 shows an association between the cardiovascular ERV and the corresponding PM10 level suggesting that air pollution plays a role in increasing the morbidity due to cardiovascular illness. But no significant association between ERV due to respiratory causes and the PM10 level could be made out from the data obtained. Such increase in ERV associated with an increase in PM10 levels could be probably because PM10 has been known to exert its effects on the cardiovascular and respiratory systems via changes in blood coagulation. In our study, a 60% increase in ERV visits due to cardiovascular diseases is observed suggesting an increase in the number of emergency room visits from 2006 to 2008. A recent study by the state pollution control board has found that the level of pollution in Chennai is much higher than the WHO permissible limits and has been increasing over years (www.tn.gov.in, Chennai pollution policy note 2005-2006). The study results also indicate that the maximum number of cardiac ERV was observed between January to March. It was also observed that the particulate matter levels were highest during January to March. Similar results were obtained in Shanghai (Cao J, 2009), where the association between outdoor air pollutants and emergency room visits is more evident in the cool season than in the warm season. A study report from Chennai strongly suggests that the average concentration of PM10 is high in winter followed by monsoon (Jayanthi V *et al*, 2006). It is also noted that cardiac ERV is higher in males than females. The maximum number of cardiac ERV was observed in the age group of 45-65 years which is consistent with other studies (Braga AL, 2007). Age, cultural practices, life style and socio-economic status may influence the exposure to air pollutants (HEI, 2004)¹³. As the individual sensitivity to pollutants increases, the severity of the response will increase for a given pollutant. Therefore, the effects of air pollutants and the severity of health outcomes in a given population depend on the population sensitivities (American Thoracic Society, 2000)¹⁵. There is new evidence that even current ambient levels of PM10 (30 to 150 micrograms/m³) are associated with increases in daily cardio respiratory mortality and in total mortality, excluding accidental and suicide deaths. Short term effects of air pollution in relation to cardio respiratory diseases on specific age groups show significant increase with the excess relative risk (ERR) of a medical home visit under age 15 years and people aged 65 years. Moreover, vast majority of deaths related to higher concentrations of air pollution reduces life-years by less than 35 years on average expectancy.

Males reported for cardiac ERV was higher than females in our study. It is consistent with other study which shows a significant increase of cardiovascular mortality in males due to increased levels of air pollutants¹⁵. The increased incidence observed in males could be due to the lack of cardio protective effect of oestrogen, increased exposure to outdoor air pollution, comparatively more stressful and sedentary life style.

CONCLUSION

A 60% increase in Emergency room visits due to cardiovascular disease from 2006 to 2008 was observed. The number of males reported for emergency room visits was higher than females. The maximum number

of visits among the adults was in the age group of 45-65. The PM10 level has shown a 50% increase from 2006 to 2008. It was also observed that the particulate matter levels were highest during January to March. Emergency room visits for cardiovascular diseases is more than the respiratory illnesses on account of greater exposure to PM10. All the above findings suggest that air pollution plays a role in increasing the morbidity due to cardiovascular illness.

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