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Research Article

Emergency Room Visits Due To Respiratory Illness from Major Hospitals of Chennai: A Preliminary Study

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Abstract: Health status is determined by both host and environmental factors. 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 countries. Aim of the study was 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. Hospital data of emergency room visits (ERV) for the years 2006, 2007 & 2008 due to respiratory 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. The incidence of respiratory related health hazards were analyzed 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. The study reveals an alarming increase in ERV due to repiratory causes in the urban population of Chennai which could be due to increased levels of ambient air pollution (PM 10) due to rapid urbanisation. ERV can be used as a health indicator in the ongoing air pollution study and has potential applications in future in assessing the trend of health status in urban population.
Keywords: Emergency room visits, Ambient air pollution,Urban population, Respiratory disease

INTRODUCTION

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.

Metropolitan cities of India head the list of the most polluted cities of the world [1]. India has 23 major cities of over 1 million people and in many of the cities ambient air pollution levels exceed the WHO standards [2, 3]. Every year more than 40,000 people die prematurely as a result of air pollution and Delhi has the highest share of 19% [3]. According to WHO, every year that premature death of around 800,000 happens worldwide every year due to urban air pollution [4]. Almost two thirds of these deaths occur in the developing countries of Asia. Approximately 150,000 of these deaths are estimated to occur in South Asia alone [5].

Every year more than 180,000 deaths occur worldwide due to asthma. India has an estimated 15–20 million asthmatics [5]. It is due to the long-term

exposure to high levels of air pollution with particulate matter. Air pollution causes increased exacerbation of chronic pulmonary disease that results in increased emergency room visits (ERV). ERV can be a direct result of short-term exposure to air pollution. It is more experienced by urban populations in both developed and developing countries and respiratory illness is among the leading causes of hospitalization [6].

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 [7]. In Bangkok, Thailand and China effects of short term exposure to air pollution on daily mortality tended to be equal or greater than Western industrial nations [8].

Studies conducted in India have also shown significant association between major air pollutant levels in big cities and acute morbidity and mortality [14]. Studies show that there is a strong association between particulate pollution & asthma and respiratory illnesses [9] are more common in high pollution areas when compared to low pollution areas. The association of outdoor air pollution with chronic respiratory morbidity has been reported in an industrial town of Northern India [10]. 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 population [11]. 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 [12, 13]. Hence, the present study has been done to evaluate the ERV from two major hospitals in Chennai, India and to understand the association between respiratory health outcomes and air pollution in this city.

MATERIALS AND METHODS

Study design is Time series analysis study and the study centers are tertiary care hospitals, Govt. General Hospital & Govt. Kalpak 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 respiratory & respitatoryvascular 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 analyzed 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: Details of emergency room visits in Chennai due to various respiratory causes for the years 2006 to 2008

	Year	N	Median	Min	Max
Overall	2006	365	7	0	49
	2007	365	5	0	32
	2008	366	6	0	57

Form the above table it is clear according to our survey among the Chennai hospitals shows a slight decrease in the respiratory ERV across the three years has been noted.

Table 2: The gender variation in the number of emergency room visits due to respiratory cause from 2006 to 2008. ERV due the respiratory causes is observed more in males when compared with that of females each year

	Year	N	Median	Min	Max
Female	2006	365	3	0	15
	2007	365	1	0	12
	2008	366	2	0	17
	Year	**N**	**Median**	**Min**	**Max**
Male	2006	365	5	0	39
	2007	365	4	0	27
	2008	366	4	0	45

From the above table the gender variations have a role in prevalence of disease among the population. When compare to females, males are more frequently affected by respiratory oriented distress than females.

Table 3: Respiratory ERV for different age groups across years of both the genders

	Year	N	Median	Min	Max
Age<45	2006	365	3	0	22
	2007	365	2	0	19
	2008	366	3	0	25
	Year	**N**	**Median**	**Min**	**Max**
Age (45-65)	2006	365	3	0	25
	2007	365	2	0	15
	2008	366	2	0	24
	Year	**N**	**Median**	**Min**	**Max**
Age > 65	2006	365	1	0	9
	2007	365	1	0	7
	2008	366	1	0	12

Table 4: The General trend in the ERV in various months of a year. Similar trend is observed in all the three years. ERV due to respiratory causes is more in the months of January, February and March.

	Months	N	Median	Min	Max
Overall	Jan	93	15	0	49
	Feb	85	13	0	34
	Mar	93	12	1	57
	Apr	90	6.5	0	31
	May	93	7	0	20
	June	90	6	0	20
	July	93	5	0	18
	Aug	93	4	0	31
	Sept	90	4	0	16
	Oct	93	8	0	32
	Nov	90	3	0	25
	Dec	93	3	0	18

Secondary data on PM10 levels were obtained from Tamilnadu Pollution Control Board for the period 2006 to 2008. The PM10 levels show an increasing trend over a period of three years among both the genders.

DISCUSSION

Particulate air pollution is an important environmental risk factor for causing adverse health effects [14]**.** 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 [15].

Among all air pollutants, particulate matter causes the most numerous and serious effects on human health, because it contains diverse toxic substances. So, when human health risk is assessed, 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 [16].

A person's relative risk due to air pollution is small compared with the impact of established respiratory vascular risk factors such as smoking, obesity, or high blood pressure [17]. Epidemiological studies conducted worldwide in last decade had shown a consistent, increased risk for respiratory vascular events, including heart and stroke deaths, in relation to short and long-term exposure to present-day concentrations of pollution, especially particulate matter [18]. As a preliminary effort, this study was carried out to evaluate PM_{10} and its association with respiratory respiratory ERV in Chennai using time series analysis. 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, PM_{10} level has also shown a 50% increase from 2006 to 2008. Comparison of the ERV due to respiratory reasons with that of the PM_{10} levels during the time period January 2006 to December 2008 shows an association between the respiratory ERV and the corresponding PM_{10} level suggesting that air

pollution plays a role in increasing the morbidity due to respiratory illness. But no significant association between ERV due to respiratory causes and the PM_{10} level could be made out from the data obtained. Such increase in ERV associated with an increase in PM_{10} levels could be probably because PM has been known to exert its effects on respiratory systems via changes in blood coagulation. This is in concurrence with other studies which reported that air pollution has a role in respiratory morbidity and that increased level of PM_{10} is associated with increased hospitalization and mortality due to respiratory disease.

Jyoti Nautiyal *et al*. [19] from there study they showed that Higher prevalence of respiratory symptoms with increased levels of different pollutants in Mandi-Gobindgarh Industrial town India has been reported. Moreover, in a study conducted in Delhi, by J.N.Pande *et al*., ambient levels of pollutants exceeded the national air quality standards on most of the days, and the acute coronary events increased by 21.30% on account of higher than acceptable levels of pollutants [14].

Various studies conducted in the last 10 years have shown that current ambient concentrations of PM_{10} may lead to increased mortality and morbidity [16]. In our study, a 60% increase in ERV due to respiratory diseases is observed suggesting an increase in the number of emergency room visits from 2006 to 2008.

It was observed in our study that the particulate matter levels were highest during January to March. The study results also indicate that the maximum number of respiratory ERV was observed between Januarys to March. A plausible explanation for these results may be found by examining meteorological conditions. During these months, average mixing height could have been lower as compared to other days causing minimum atmospheric dispersion and therefore the pollutants would not have been as widely dispersed. Lower average mixing height and calm conditions during these days could have resulted in less volume of troposphere available for mixing and hence higher concentrations V. jayanthi et al, .conducted a study report from Chennai strongly suggests that the average concentration of PM_{10} is high in winter followed by monsoon The concentrations are higher in winter season and are lower during monsoon months. Similar results were obtained in Shanghai where the association between outdoor air pollutants and emergency room visits is more evident in the cool season than in the warm season [20].

The maximum number of respiratory 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 pollutants 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 [21].

Short term effects of air pollution in relation to respiratory 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 65years. Moreover, vast majority of deaths related to higher concentrations of air pollution reduces life-years by less than 35 years on average expectancy [22].

Males reported for respiratory ERV was higher than females in our study. It is consistent with other study which shows a significant increase of respiratory vascular mortality in males due to increased levels of air pollutants. The increased incidence observed in males could be due to the lack of respiratory protective effect of estrogen, increased exposure to outdoor air pollution and a comparatively more stressful & sedentary life style [17].

In our study we found no consistent associations between PM_{10} and respiratory emergency room visits. A report published in 1994 in the Annual Reviews of Public Health, noted a 1% increase in total mortality for each 10 mg/m^3 increase in particulate matter. Respiratory mortality increased by 3.4% and cardiovascular mortality increased by 1.4%. percent. Increase in $10mg/m^3$ in PM_{10} were found to be associated with increases in respiratory emergency room visits [23].

Studies by Jyoti Nautical *et al*. on air pollution and ERV for respiratory respiratory diseases showed that PM_{10} has weaker effects on daily ERV for respiratory diseases [19]. There is new evidence that even current ambient levels of PM_{10} (30 to 150 micrograms/m^3) are associated with increases in daily respiratory mortality and total mortality, excluding accidental and suicide deaths; air pollution does play a role in increasing the morbidity due to respiratory respiratory illness and emergency room visits is an indirect outcome parameter which reflects the health impact of air pollution [24].

CONCLUSION

The study reveals an alarming increase in ERV due to respiratory causes in the urban population of Chennai which could be due to increased levels of ambient air pollution (PM 10) due to rapid urbanisation. ERV can be used as a health indicator in the ongoing air pollution study and has potential applications in future in assessing the trend of health status in urban population such as in evaluating the temporality of causal association in examining the exposure response relationship, in predicting the cumulative effects of air pollution.The results of these studies could be used as a

base to design larger epidemiologic investigations to address the problems of measurement error, reduce uncertainties in risk estimates and identify the determinants of exposures. In addition, this will pave way to implement intervention strategies. Strategies that target the known risks such as air pollution should be adopted which include simple measures to limit exertion and time spent outdoors when levels are highest, and to reduce the infiltration of outdoor air pollutants into indoor spaces which can provide substantial public-health gains.

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REFERENCES

1. Gupta U; Valuation of urban air pollution: A case study of Kanpur City in India. Eniron Resource Econ., 2008; 41(3): 315-326.
2. Gupta HK, Gupta VB, Ra CVC, Gajghate DG, Hasan MZ; Urban air quality and its management strategy for a metropolitan city of India. Bull Environ Contam Toxicol., 2002; 68(3): 347-354.
3. World Health Organization; Air quality guidelines, Global Update 2005, particulate matter, ozone, nitrogen dioxide and sulphur dioxide. Copenhagen: WHO Regional Office for Europe, 2006.
4. UNEP; Cleaning up Urban Bus Fleets: With a focus on developing and transition countries. Available from http://www.unep.org/transport/pcfv/PDF/Retrofit.pdf
5. Honaganahalli PS; Bangalore's ambient air quality is under threat. Available from http://www.deccanherald.com/content/56221/content/219337/F
6. WHO; Bronchial asthma. Available From http://www.who.int/mediacentre/factsheets/fs206/en/
7. Dockery DW; Epidemiologic evidence of cardiovascular effects of particulate air pollution. Environmental Health Perspectives, 2001; 109(Suppl 4): 483-486.
8. Wong CM, Vichit-Vadakan N, Kan H, Qian Z; Public Health and Air Pollution in Asia (PAPA): a multicity study of short-term effects of air pollution on mortality. Environ Health Perspect., 2008;116(9):1195-1202.
9. WHO; effects of air pollution on children's health and development: a review of the evidence. European centre for environment and health bonn office, 2005. Available from http://www.euro.who.int/__data/assets/pdf_file/0010/74728/ E86575.pdf
10. Kumar R, Sharma M, Srivastva A, Thakur JS, Jindal SK, Parwana HK; Association of outdoor air pollution with chronic respiratory morbidity in an industrial town in northern India. Archives of Environmental Health, 2004; 59(9): 471-477.
11. Ren C, Tong S; Health effects of ambient air pollution – recent research development and contemporary methodological challenges. Environ Health., 2008; 7: 56.
12. Hansen C, Neller A, Williams G, Simpson R; Maternal exposure to low levels of ambient air pollution and preterm birth in Brisbane, Australia. BJOG, 2006; 113(8): 935–941.
13. Hedley A, Wong C, Thach T, Ma S, Lam TH, Anderson HR; Cardiovascular and all-cause mortality after restrictions on sulphur content of fuel in Hong Kong: an intervention study. Lancet, 2002; 360:1646–1652.
14. Pande JN, Bhatta N, Biswasl D, Pandey RM, Ahluwalia G, Siddaramaiah NH *et al*.; Outdoor air pollution and emergency room visits at a hospital in Delhi. Indian J Chest Dis Allied Sci., 2002; 44(1): 13-19.
15. Balakrishnan K; Economic valuation of health damage in north chennai using a comparative risk assessment framework. EERC Working Paper Series: EHE-2, Available from http://coe.mse.ac.in/eercrep/fullrep/ehe/EHE_FR_Kalpana_Balakrishnan.pdf
16. Colucci ME, Veronesi L, Roveda AM, Marangio E, Sansebastiano G; [Particulate matter (PM10) air pollution, daily mortality, and hospital admissions: recent findings. Ig Sanita Pubbl., 2006; 62(3): 289-304.
17. Exposure to air pollution contributes to the development of cardiovascular diseases (Heart Disease and Stroke). Available from http://www.rabbitair.com/air-pollution-contributes-to-the-development-of-cardiovascular-diseases.aspx
18. Studies and Reports on Indoor Air Quality and Health. Available from http://www.dylosproducts.com/ stabinairqu.html
19. Nautiyal J, Garg ML, Sharma MK, Khan, Thakur JS, Kumar R; Air pollution and cardiovascular health in Mandi-Gobindgarh, Punjab, India - A Pilot study. Int J Environ Res Public Health, 2007; 4(4): 268-282.
20. Cao J, Li W, Tan J, Song W, Xu X, Jiang C *et al*.; Association of ambient air pollution with hospital outpatient and emergency room visits in Shanghai, China. Science of the Total Environment, 2009; 407(21): 5531-5536.
21. American Thoracic Society; What Constitutes an Adverse Health Effect of Air Pollution? American Journal of Respiratory Critical Care Medicine, 2000; 161: 665-673.
22. Lvovsky K; economic costs of air pollution with special reference to India. Prepared for the National

Conference on Health and Environment Delhi, India, July 7-9, 1998. Available from http://siteresources.worldbank. org/PAKISTANEXTN/Resources/UrbanAir/ Economic+costs+of+air+pollution+KL.pdf

23. Kumar R, Saini K, Dewal ML; Deployment of electrical system by the integration of solar, wind and Electrical power. International Journal of Advanced Engineering & Application, 2010: 67-70
24. Health effects of outdoor air pollution. Committee of the environmental and occupational health assembly of the American Thoracic Society. Am J Respir Crit Care Med., 1996; 153(1): 3-50.