EPH - International Journal of Medical and Health Science

ISSN (Online): 2456-6063
Volume 04 Issue 02 June 2018

DOI: https://doi.org/10.53555/eijmhs.v4i4.55

AIR POLLUTION: A CASE STUDY OF ASTHMA CHILDREN AND ADULTS IN THE URBAN ZONES

Iyyanki V. Murali Krishna[1*] , Prisilla[2], Aruna M [3]
[*1]*Former Professor and Director R&D JNTUH, Hyderabad, India.*
[2] *Research Scholar, Secunderabad, India. prisillaj28@gmail.com*
[3]*Associate Professor, IBS, the ICFAI Foundation for Higher Education, Hyderabad, India. arunam@ibsindia.org*

Corresponding Author:-
Email:-iyyanki@gmail.com

Abstract:-

The traffic pollution causes the risk of inhaling fresh air to be increased when the homes are exposed to the roadways or industries. The transportation vehicles emit CO, NO_2, SO_2 and PM2.5 which are closely related for the key cause of asthma or other chronic respiratory diseases in children and adults. The ultimate rise of nitrogen dioxide above 35 µg/m3 in the areas of Tarnaka, Abids, Nacharam and Zoo Park in Andhra Pradesh and peak rise of above 80 µg/m3 in nitrogen dioxide in the areas such as Pritampura, Townhall and Mayapuri industrial areas in the Delhi in the year 2012 showed more children and adults suffer from asthma, chronic illness. The Karnataka state showed the results of NO_2 with 31µg/m3 in four places whereas in Uttar Pradesh, the highest reading of NO_2 is found to be 34µg/m3 in Renusagar colony and DIC Nunhai in the year 2012.

Keywords: - *Air pollution, diseases, nitrogen dioxide, vehicles*

INTRODUCTION:-

The association of respiratory diseases and air pollution are found from a long period and proved with the increase of the nitrogen dioxide and sulfur dioxide and PM2.5 in the air. The risk of childhood asthma was greater in children who played sports or other activities outdoors with high ozone concentrations. The CO, NO_2, SO_2 and PM2.5 are released by the vehicles and great numbers of measures have been taken by the traffic authorities for controlling the traffic pollution, but it would not be reduced. In certain areas the pollution is found to be dreadful and these areas come under red alert where the asthma person finds very difficult to inhale.

Previous Study

C. Pe´nard-Morand et al. evaluated the impact of urban air pollution, assessed through reliable indicators of exposure, on asthma and allergies in schoolchildren and adults. In the study, the role of urban air pollution in the influencing respiratory and allergic outcomes in a representative population-based sample of living in six communities in French. The three features of the study includes 1) the use of long-term exposure on major traffic pollutants within communities. 2) The repeated sensitivity analysis among children residing at their current address since birth to reduce exposure misclassification. 3) The number of potential modifiers that were taken into account. The study has reported associations between allergic health and air pollution indicators, specifically long-term concentrations from fixed locations, which were used to assess long-term exposure to background air pollution and short-term exposure to urban air pollution. These indicators are easy to obtain but are less reliable at assessing exposure to urban air pollution than the more accurate indicators built through a dispersion model. The use of more reliable exposure indicators will reduce exposure misclassifications, which may have led to an attenuation of air pollution effect estimates. With the help of epidemiological studies, the associations between asthma and urban pollution are reliable with the results. The increased frequency of wheezing symptoms, diagnosis and incidence of asthma showed analyzed associations of traffic exposure with allergic rhinitis. The result showed consistent for sensitization to pollens with previous reports of associations between outdoor particles with a 50% cut-off aerodynamic diameter of 2.5 mm and sensitization to pollens. The concentrations of SO_2 and coarse particles, emitted from industry, while concentrations of traffic-related air pollutants (TAP), nitrogen oxides (NOx), small particles and organic compounds have increased steadily due to the growing number of motor vehicles, especially in urban areas where road traffic has become the main source of air pollutant emissions [1]. Be´ne´dicte Jacquemin et al. analyzed the association between an individual exposure to home outdoor NO_2, and from traffic-related pollution and onset of asthma in adults. The studies based on the measurements of air pollution with no characterization of exposure to local traffic-related pollution in Europe, play a role in the onset of childhood asthma. NO_2 has been used in epidemiologic studies as a marker for traffic-related air pollution. The NOx emission map was used for modeling NO_2 concentrations, in a Global Information System. The model provides estimates of concentrations by adjusting the distance-weighted sum of the emissions (tons/km/y), in concentric rings around each monitoring site, to the monitored concentrations (g/m3). Performing the statistical analysis, Be´ne´dicte Jacquemin et al. found the association between onset of asthma and NO_2 by odds ratios (ORs) and 95% confidence intervals (CIs) from logistic regression models. In the initial step, center effect was adjusted. In second step, a set of predefined covariates like sex, age, socio-economic status, family history of asthma or smoking was included. Age and smoking were considered into the model. The other variables were tested but not considered in the final model such as cooking done with gas or other means, any job exposure, and exposure to tobacco smoke. The study suggested a positive association between NO_2 and asthma incidence in adulthood, with similar inferences across Europe. The exposure valuation had certain strengths and limitations. The investigation of acute effects of pollution or the symptoms integration to assess frequency and decrease of asthma is beyond the work scope. The occurrence of asthma using NO_2 is measured a marker of traffic-related air pollution and moreover, NO_2 plays an interrelating role in combination with other pollutants prevalent in the urban air [2]. George T. O'Connor et al., proposed data validation in associations with the levels of air pollution for lung functioning and NO_2 for asthma symptoms. A 3-pollutant model estimates that an increase in NO_2 of 20.4 ppb was associated with a relative risk of wheezing or cough of 1.24- a 24% increase in the frequency of symptom days. The increase in NO_2 was associated in a 3-pollutant model with an average reduction in FEV1 (forced expiratory capacity in 1 second) of 1.09% of the predicted level. But the study lacked to recognize additional hospitalizations or emergency visits in association to air pollution, many asthma-related school absences that were reported in emergency. In the study it suggested that the rise in NO_2 of 20.4-ppb was associated with a 67% increase in the risk of asthma-related school absence in a single-pollutant model. Higher concentrations of NO_2, (PM with aerodynamic diameter less than 2.5m) PM2.5, and sulfur dioxide- SO_2 were associated with decrements in pulmonary function, and higher NO_2 concentrations were associated with more frequent asthma symptoms and asthma-related problems. In single pollutant models, higher 5-day average concentrations of NO_2, sulfur dioxide, and particles smaller than 2.5 mm were related with significantly lower pulmonary function. Higher pollutant levels were independently associated with reduced lung function in a 3-pollutant model and higher NO_2 concentrations were associated with asthma symptoms [3].

Statistical Discussions and Results

In this study, four states namely Andhra Pradesh, Delhi, Karnataka and Uttar Pradesh were considered for high nitrogen dioxide pollutant in air as a case study in comparison to the other states in India and the data was analyzed using Stata IC 12.1. The figures 1 and 2 show the amount of nitrogen dioxide in the air as a pollutant. Each solid line and dash line with different colors indicates the levels of the nitrogen dioxide from the year 2007 to 2012 of the various places in the states shown in the graphs respectively.

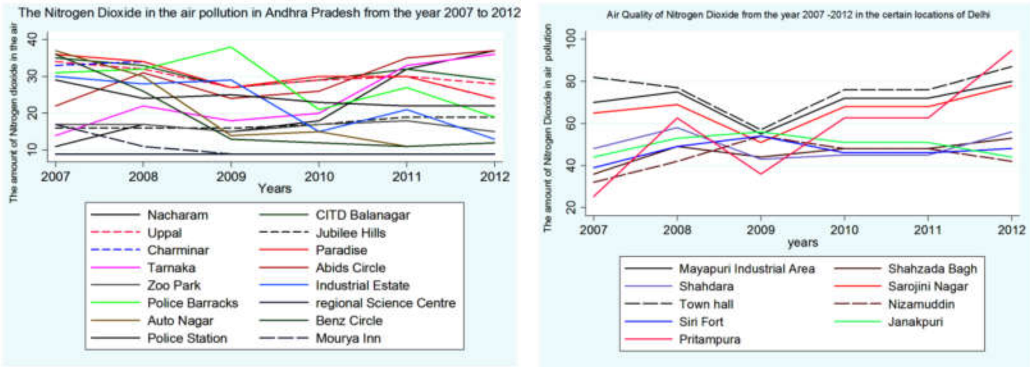

Figure 1: The Nitrogen dioxide in Air in few areas of Andhra Pradesh (left) and Delhi (right)

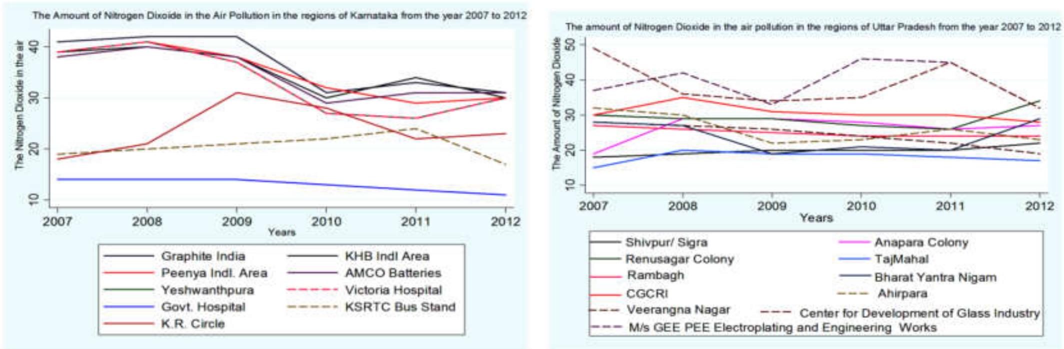

Figure 2: The Nitrogen dioxide in Air in certain regions of Karnataka (left) and Uttar Pradesh (right)

A time-series analysis has revealed increased nitrogen dioxide in the air as one of the key factor causing more cases of asthma among the children and adults. The time-series graph in figure 1 clearly indicates the peak rise of nitrogen dioxide above 80 µg/m3 in Pritampura, Townhall and Mayapuri industrial areas in Delhi in the year 2012. Similarly, the peak rise of nitrogen dioxide above 35µg/m3 in the graph (figure 1) can be studied in the areas of Tarnaka, Abids, Nacharam and Zoo Park in Andhra Pradesh in the year 2012. The results of NO_2 in Karnataka state showed 31µg/m3 in four places whereas the highest reading of NO_2 in Uttar Pradesh is 34µg/m3 in Renusagar colony and DIC Nunhai. The data analysis was carried out using region-wise linear regression shown in the table 1. From the table 1, R-squared value is found to less than 1 hence it is a good model. With a single independent variable in regression, the coefficient helps to understand the possibility of the dependent variable to increase (if the coefficient is positive) or decrease (if the coefficient is negative) as independent variable increases by one. The t- statistic is the coefficient divided by its standard error. The standard error is an estimate of the standard deviation of the coefficient, the amount it varies across the cases. It is a measure of the precision with which the regression coefficient is measured. A larger coefficient when compared to its standard error, then it is probably different from 0. The larger the absolute value of the t-value, the smaller the p-value, and the greater the evidence against the null hypothesis and with high significant result.The probability value of the nitrogen dioxide is found to less than 0.05 in few cases in the table 1, it implies that null hypothesis is rejected and significant difference does exists. It is agreed that if p-value is below 0.05, then the model is significant and p-value is over 0.05, then the model is not significant.

Table 1. Regression analysis result for the amount of Nitrogen dioxide in the air pollution

Year/State/observations	Coefficient	Std. error	t-value	P>|t|	R-squared	Prob >f
2007/AP/15	0.352878	0.5293051	0.67	0.515	0.1084	0.4229
2008/AP/15	0.072010	0.224864	0.32	0.75	0.0256	0.8232
2009/AP/15	0.259963	0.431334	0.60	0.556	0.0633	0.6122
2010/AP/15	-0.70923	0.522175	-1.36	0.194	0.1170	0.3934
2011/AP/15	1.19541	0.840528	1.42	0.175	0.1847	0.2162
2012/AP/15	-0.94238	0.299854	-3.14	0.07	0.5317	0.0034
2007/Delhi/5	0.56910	0.066755	8.53	0	0.9507	0.0005
2008/Delhi/5	0.76931	0.13194	5.83	0.002	0.9213	0.0017
2009/Delhi/5	0.85422	0.67883	1.26	0.264	0.2938	0.4191
2010/Delhi/5	0.13829	0.10386	1.33	0.24	0.9594	0.0003
2011/Delhi/5	-0.2169	0.09722	-2.23	0.076	0.9932	0
2012/Delhi/5	0.2683	0.25783	1.04	0.346	0.9131	0.0022
2007/Karnataka/6	0.1848	0.32589	0.57	0.591	0.1564	0.6003
2008/Karnataka/6	-0.01929	0.3556	-0.05	0.959	0.2714	0.3868
2009/Karnataka/6	-0.58557	0.8295	-0.71	0.507	0.0852	0.7654
2010/Karnataka/6	-2.72496	1.4931	-1.82	0.118	0.6667	0.0370
2011/Karnataka/6	-0.735	1.3168	-0.56	0.597	0.0526	0.8502
2012/Karnataka/6	1.7299	1.5086	1.15	0.295	0.222	0.4706
2007/UP/16	-2.41038	1.592	-1.51	0.156	0.1691	0.3290
2008/UP/16	-2.040	1.282	-1.59	0.138	0.4263	0.035
2009/UP/16	-6.2096	2.5479	-2.44	0.031	0.3328	0.088
2010/UP/16	-6.0915	3.029	-2.01	0.067	0.2524	0.1746
2011/UP/16	-6.881	2.244	-3.07	0.010	0.4824	0.0192
2012/UP/16	-6.0377	2.4161	-2.50	0.028	0.3461	0.0782

Table 2. The percentage of diseases of respiratory and TB found in the certain areas in AP and Karnataka

Districts of AP and Karnataka	Disease of respiratory system (%)	Disease of cardiovascular system	Persons suffering from tuberculosis
Hyderabad	5.9	15.9	NA
Nellore	8.8	19.8	0.8
Vizianagaram	3.2	8.9	0.4
Visakhapatnam	3.4	6.3	0.8
Cuddapah	9.2	7.8	0.9
Bijapur	6.5	6.1	2.2
Belgaum	9.7	21.4	NA
Dharwad	21.1	5.6	0.3
Yadgir	23.9	6.7	2

The table 2 shows certain areas of Andhra Pradesh and Karnataka state where the respiratory diseases, cardiovascular and tuberculosis were analyzed and found to have more in number due to the air pollution with NO_2.

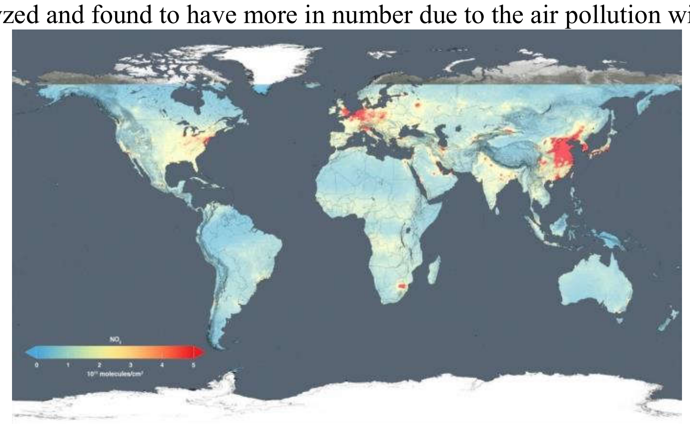

Figure 3. The nitrogen dioxide concentration in the troposphere detected by the Ozone Monitoring Instrument by the Aura satellite in the year 2014 (NASA) [4].

In the figure 3 the world map shows the red color where the high levels of nitrogen dioxide is measured to be in high levels in the air. Nitrogen dioxide is the key factor of the asthma, wheezing and respiratory disease. The nitrogen dioxide is increased due to the rise in the private vehicles and the smoke and dust which is emitted by the engine of the vehicle. Despite of several measures taken by the traffic authorities to control the traffic air pollution, the nitrogen dioxide levels have not reached to minimum. The nitrogen dioxide can be controlled by an individual person with the awareness of self-health measures by using pollution free vehicles.

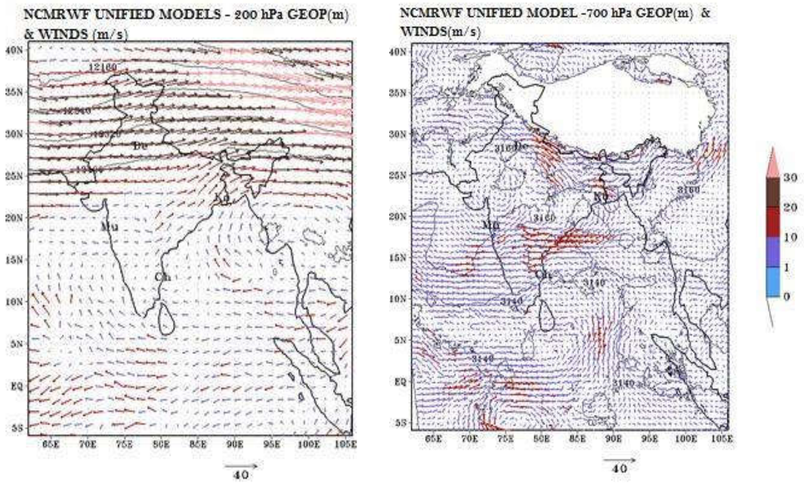

Figure 4: NCMRWF model of India weather reports with 200 hPa and 700 hPa

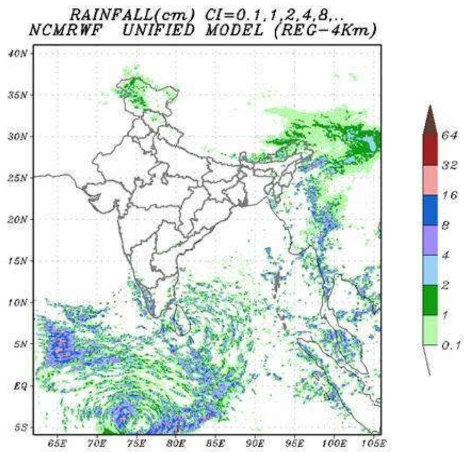

Figure 5: NCMRWF Model of rainfall in India

The maps in figure 4 and 5 suggest that the wind and rain influences the nitrogen dioxide to increase in the atmosphere; the survey reveals that one can find more asthma people suffering on a rainy day than on a sunny day. The nitrogen pollution in coastal waters is partially responsible for declining fish. Both industrial and agricultural waste, have strongly increased the amount of biologically active nitrogen compounds and thereby alarmed the natural nitrogen cycle. The several forms of nitrogen pollute the air, largely nitric oxide (NO), NO_2 and NH_3 as dry deposition, and NO_3 and NH_4 as wet deposition. The environmental effects of acid rain can be seen in aquatic environments, such as streams, lakes, and marshes where it can be harmful to fish and other wildlife. The pollutants that cause acid rains with SO2 and NOX, the sulfate and nitrate particle are in the air are harmful to human life. In the atmosphere, SO_2 and NO_X react to form fine sulfate and nitrate particles that people inhale into their lungs. Many research including scientific studies have proved a relationship between these particles and effects on heart function, such as heart attacks resulting in death and effects on lung function, such as breathing difficulties for people with asthma [6].

Conclusions

The respiratory diseases in the India such as bronchial asthma, chronic obstructive pulmonary disease (COPD), chronic bronchitis and emphysema are found to be increasing. The occurrence of such diseases is greatest in industrialized areas, especially in urban areas where vehicle emits the pollution to the maximum. The occurrence of asthma in children is associated with trafficrelated air pollutants such as NO2 and PM2.5. NO_2 was found to be related twice more on the risk of new-onset asthma. The asthma children and adults' long term health benefits can be improved by effective control of vehicular emissions.

REFERENCES

[1] C. Pe´nard-Morand et al., "Long-term exposure to close-proximity air pollution and asthma and allergies in urban children", EUROPEAN RESPIRATORY JOURNAL J 2010; 36: 33–40, DOI: 10.1183/09031936.00116109.

[2] Be´ne´dicte Jacquemin et al., "Home Outdoor NO2 and New Onset of Self-Reported Asthma in Adults", Epidemiology Volume 20, Number 1, January 2009, 10.1097/EDE.0b013e3181886e76.

[3] George T. O'Connor et al., "Acute respiratory health effects of air pollution on children with asthma in US inner cities", J ALLERGY CLIN IMMUNOL MAY 2008 doi:10.1016/j.jaci.2008.02.020.

[4] https://www.nasa.gov.in

[5] http://www.ncmrwf.gov.in

[6] Effects of nitrogen containing air pollutants: critical levels, WHO Regional Office for Europe, Copenhagen, Denmark, 2000.