Environmental Burden of Disease Due to Urban Air Pollution with Special Reference to Bangalore City

ABSTRACT

The environmental burden of disease (EBD) is increasingly attributed to urban air pollution. The EBD imposes economic burden or welfare loss in terms of additional social cost to the society such as direct treatment cost and efficiency losses in the form of high number of sick leaves and reduced labour productivity. It is estimated that 1.1 billion people breathe unhealthy air globally. Urban air pollution is responsible for 800,000 deaths and 4.6 million losses of life years each year around the globe. It is responsible for 3 percent adult cardiopulmonary disease mortality; 5 percent trachea, bronchus and lung cancer mortality; and 1 percent mortality in children from acute respiratory infection worldwide. It is found that 23 Indian cities are critically polluted by urban air pollution. The World Bank study (2002) estimates that approximately 20 per cent of India’s health burden is attributable to urban air pollution.

There have been no studies conducted for Bangalore city linking environmental burden of disease attributed to urban air pollution particularly SPM and RSPM with the dramatic increase in the levels of pollutants.

In this backdrop, a study has been undertaken to measure the EBD associated with urban air pollution in the city and to estimate the economic cost of health damage. The contingent valuation method (CVM) is employed to estimate the willingness to pay (WTP) to avoid health damage caused by urban air pollution.

The EBD analysis and economic valuation of health impact is carried out through the concept of “Attributable Fraction”. The attributable fraction is, if two groups are similar in all respects, except that, one group is exposed to pollution, then any difference in disease rate between the two groups is said to be attributable (caused by) to the exposure.
The economic cost of urban air pollution is measured by considering household health production function model which consists of health production function, demand function for mitigating activities and demand function for averting activities. To supplement the analysis of cost of illness approach, the WTP based on the contingent valuation survey is also employed. The ordered logistic regression model is used to analyze the factors affecting willingness to pay for reducing urban air pollution.

The total suspended particulate matter (TSPM or PM\(_{10}\)) and the respirable suspended particulate matter (RSPM or PM\(_{2.5}\)) are considered as criteria pollutants. It is found that PM\(_{10}\) and PM\(_{2.5}\) concentration has exceeded the NAAQS in all the monitoring stations of study area. It is two to three times higher than the average annual standard.

The results have shown that cough, dust allergy and asthma are more prevalent in the study area, viz., Dairy circle, Majestic and Amco batteries, positively associated with high concentration of pollution unless in the control area. It is also found that increased frequency of hospital admissions is seen among the respondents from Peenya industrial area, Yeshwantpur, Majestic and Amco Batteries, where pollutant concentration is beyond NAAQ standard. It is clearly shows that higher concentration level of air pollution is directly linked to higher levels of morbidity (respiratory disease) and high rates of hospitalization.

The analysis on EBD estimates revealed that for every 100,000 population, the mortality rate per annum is 560 (for all cause mortality for all ages), 230 for cardiopulmonary disease and 305 for acute respiratory infections. On an average, 334 children aged less than 6 years would die due to high air pollutant concentration of PM 10 and PM2.5. In contrary to the above findings, it is found that if the PM\(_{10}\) concentration from the current level of 211.6 µg/m\(^3\) is reduced to the standard 60 µg/m\(^3\), on an average, 366 number of mortality due to acute respiratory infection, 125 due to cardiopulmonary disease and 10 due to lung cancer could be avoided annually. Similarly, if the PM\(_{2.5}\) concentration is reduced from the current level of 80.7 µg/m\(^3\) to ambient standard of 40 µg/m\(^3\), on an average, 48 number of mortality due to lung cancer and 923 due to cardiopulmonary diseases could be prevented.
The analysis on economic estimation i.e. the out-of-pocket expenditure per annum (for outpatient) incurred by respondents due to increase in illness is Rs 990 in the study area and Rs 278 in control area. Further, the annual expenditure on medicine in the study area (for all types of disease) is Rs 5,503 and Rs 1,982 in the control area. The average outpatient expenditure is Rs 2,845 for asthma in the study area, as compared to Rs 449 in the control area. There is an additional expenditure of Rs 3,845 per household per year in the study area as compared to control area.

The analysis of ordered logistic regression results reveals that the income of a household has significant impact on the WTP for reducing air pollution in their locality. The results clearly indicate that as one moves higher in the income level, willingness to pay for pollution control also increases. It is found that the educational qualification, total cost incurred towards health, distance traveled by the respondents, presence of illness among respondents and household members have positive influence on WTP values.

These results call for policy suggestion in improving ambient air quality standards by mandating the pollution under control certification. This is also possible by imposing pollution tax and fees to shape the behavior of commuters and industrialists. Subsidies and compensation may be considered for green technology and victims of air pollution respectively. Further, policy on mandating the hospitals to create health status data on EBD attributable to urban air pollution and to conduct regular studies on health impacts of air pollution in the city is feasible for ensuring sustainable city.