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Title of Thesis: Economic Valuation of Air Pollution Related Health Effects - A Case Analysis of Khrew-Khonmoh Cement Manufacturing Belt in J&K
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Abstract

Findings:

The air pollution in Khrew-Khonmoh cement manufacturing belt in Jammu and Kashmir is above the national ambient air quality standards. We aimed to measure the health related benefits that accrue from reducing the cement plant specific air pollution to the national standards in Khrew and Khonmoh. Two health endpoints - Acute Respiratory Illness (ARI) and Chronic Bronchitis (CB) were selected for the economic valuation. As per the specified objectives of the study, we estimated the association between Acute Respiratory Illness based Numbers of Sick Days (NSD) and Air Pollution (PM_{10}) using Poisson Regression Model. To overcome the overdispersion of the count data Negative Binomial Regression and Two-Part Models were estimated to justify the robustness of results. The Mitigating expenditure (an approximation of demand for Mitigating activities which includes: the cost on medicine, doctor's fee, cost on diagnostic test and travel cost for seeking medical care, associated with the acute respiratory illness episode) was estimated using Tobit Model. Based upon estimated Dose-Response and Mitigating Expenditure Functions, annual health benefits that accrue from air pollution reductions were evaluated for individual person and then extrapolated for the total population of Khrew and Khonmoh. The health benefits consist of: reductions of acute respiratory illness related Sick Days (NSD) and Mitigating Expenditure reductions. The effect of personal socio-economic, and other general health related characteristics were used as control variables in Dose-Response and Mitigating Demand Functions.

For valuing Chronic Bronchitis risk reduction a Contingent Valuation Survey was used to elicit directly peoples WTP for reducing the risk of chronic bronchitis. Two scenarios were created which differ in terms of magnitude/size of the risk. Using Split Sampling Technique the effect of risk magnitude/size on the WTP responses was enquired. A Binary Logistic Model was used to analyze CV survey data. From the estimated parameters the mean WTP and Value of Statistical Case of Chronic Bronchitis was estimated.

The major findings from the data analysis are:

- The association between acute respiratory illnesses based sick days (NSD) and air pollution worked out to be positive and significant. Higher levels of air pollution increases the days of sickness. Reducing the ambient air pollution (PM_{10}) in Khrew and Khonmoh from current average of two seasons ($109\mu\text{g}/\text{m}^3$) to the level of national standards ($60\mu\text{g}/\text{m}^3$) will reduce the 3.25 days [lower limit] of illness per person per year. The estimated sick days reductions ranged from 3.25 to 12.7 days. The estimates based on

Dose-Response coefficient transfer of acute respiratory symptom days ranged from 4.36 to 13.15 days;

- The Mitigating expenditure on acute respiratory illness episodes is significantly and positively associated to air pollution. The reduction of air pollution to national standards will reduce the respiratory illness related Mitigating Expenditure by Rs. 170 per year for an individual. Extrapolating the benefits for the total population of Khrew and Khonmoh [15473 persons (2001 Census)] is estimated to be Rs. 2.63 million per annum [lower limit]. The annual estimated benefits range from Rs. 2.63 to Rs.12.68 million. Based on the Dose-Response coefficient transfer estimates and Cost per symptom day from survey (Rs.70) the estimated benefits would range from Rs. 4.71 million to Rs. 14.24 million;
- Both the number of acute respiratory illness based sick days and Mitigating expenditures are high among the elderly people;
- Males and females do not differ statistically in terms of prevalence of respiratory illness-based sick days but generally males tend to have higher Mitigating expenditure than females;
- Increased years of schooling is negatively associated with the number of sick days and Mitigating expenditure but the impact of education is significant on Mitigating expenditure only;
- Household monthly income does not have significant association with NSD but is negatively and significantly related with the Mitigating expenditure. The low income people are spending more on acute respiratory illness and as income level increases the Mitigating expenditure decreases;
- High frequency of smoking cigarettes and tobacco increases the number of sick days and Mitigating expenditure associated with the acute respiratory illness episodes;
- Persons with poor health stock or chronic health conditions like heart problems, high blood pressure, chronic bronchitis and asthmatics tend to have more number of sick days and higher mitigating expenditure related with the acute respiratory illness episode;
- The indoor air pollution has statistically no impact on the NSD and Mitigating expenditure;
- The mean WTP for reducing the risk of Chronic Bronchitis is Rs.360 and the value of statistical case of chronic bronchitis was estimated to be Rs. 18,040;
- The WTP increases with the increase in the magnitude/size of risk but the association was not significant. Hence, the WTP was found to be insensitive to the risk magnitude;
- The WTP decreases with the bid price and increases with education, income and poor health status.