

Adverse Health Effects of Air Pollution in India

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Adverse Health Effects of Air Pollution

- Well documented in developed countries using several epidemiological study designs. Time series analysis convenient for short term effects
- NNMAPS: Average increase of 0.21% (revised estimate) in overall non-accidental mortality for every 10 $\mu\text{g}/\text{M}^3$ in PM_{10} in 90 largest US cities
- 1% increase in admissions for cardiovascular disease, and 1.2% and 1.6% increase in admissions for pneumonia and COPD for each 10 $\mu\text{g}/\text{M}^3$ increase in PM_{10}

Adverse Health Effects of Air Pollution

- Minimal influence of other gaseous pollutants in multi-pollutant model, except ozone in summer months
- Essentially similar results in APHEA and many other large studies from several countries using the time-series approach
- Estimates of increase in mortality and hospital admissions recalculated in recent years with more refined approach

Adverse Health Effects of Air Pollution

- In general, the health impact of short term air pollution assessed in time series is smaller than the long term effects noted in cohort studies
- Long term studies of variably exposed cohorts necessary to assess chronic effects on human health, such as prevalence and incidence of cardiopulmonary diseases including lung cancer
- These studies are time consuming, expensive, and subject to confounding by a large number of variables

Adverse Health Effects of Air Pollution

- It is estimated that air pollution in urban areas contributes to 800,000 deaths annually, and almost two thirds of these occur in developing countries of Asia
- The magnitude of air pollution in large cities of India is considerable by any standard. Delhi is amongst the most polluted cities of the world in terms of its ambient air quality

Adverse Health Effects of Air Pollution

- Population exposed to urban air pollution is rapidly expanding with high rate of rural to urban migration
- Unprecedented increase in the number of motor vehicles with inferior technology, poor maintenance, and inferior quality of fuel is aggravating the problem of ambient air pollution
- Industrial activity in residential areas in several towns and cities of India

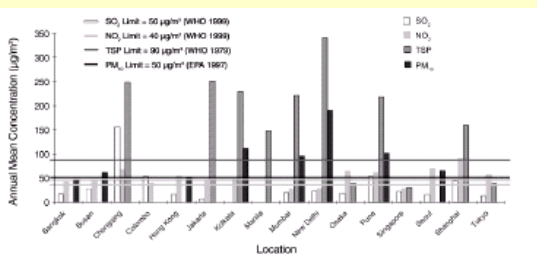


Figure 10. Annual mean concentrations of pollutants compared with their guidelines and standards in Asian cities, 2000 and 2001. Data from: Air Pollution in Migration of July 2004.

Indoor Air Pollution

- Indoor air pollution caused by combustion of solid fuels for cooking and domestic heating in India continues to adversely affect the health of women and children in rural India. Contribution from ETS is relatively smaller
- Extremely high levels of PM₁₀ recorded in rural households; high personal exposures of women and children
- It has been estimated that 400-550 thousand premature deaths could be attributed annually to the use of biomass fuels (Smith, 2000)

Adverse health effects of indoor air pollution in India

- Acute lower respiratory tract infection in children under 5 years of age
- COPD in women chronically exposed
- Aggravation of asthma and COPD
- Ischemic heart disease
- Tuberculosis
- Adverse pregnancy outcome
- Cataract
- Lung cancer

Importance of Studying Health Effects of Outdoor Air Pollution in Developing Countries

- Ambient levels of PM several fold higher than in the cities of developed world.
- Shape of the dose response curve uncertain
- Particle mix and composition different from other parts of the world
- Population characteristics different
- Residential characteristics different

Adverse Health Effects of Outdoor Air Pollution in India

- 0.23% increase in daily non-accidental deaths per 10 $\mu\text{g}/\text{M}^3$ increase in TSP, also significant increase in deaths from respiratory and cardiovascular causes for selected age groups (Cropper et al, 1997).
- A large number of deaths occurred below the age of 65 years from causes not associated with air pollution

Emergency room visits

- Increased emergency room visits for asthma, COPD and acute coronary events noted in a Delhi hospital with increasing levels of TSP in a time series analysis using standard approach (Pande, 2002)
- TSP levels exceeded NAAQ standards on most days. This led to a projected average increase in ER visits by 21.3%, 24.9% and 24.3% for patients with asthma, COPD and heart disease

Cross section Study from Delhi

- Respiratory symptoms and lung functional abnormalities more frequent in persons residing in more polluted zones in Delhi, after controlling for several confounders (Chhabra, 2001)
- No difference in prevalence of asthma and chronic bronchitis
- Higher prevalence of asthma symptoms in children studying in schools located near traffic intersections (Paramesh 2002). Similar reports by others (Lahiri, 2000)

Other health effects

- Vitamin D deficiency in children
- Dry eyes
- Lung function abnormalities amongst drivers and conductors of public transport in Calcutta
- No studies on pregnancy outcomes

Limitations of reported studies

- Lack of time series studies because of intermittent monitoring of air quality in most cities, incomplete and inaccessible hospital based health records and incomplete death records available with municipal authorities
- Only cross sectional studies. No large cohorts for longitudinal follow up. Inadequate information on potential confounders. Small numbers. Not published in peer-reviewed journals
- Neglected subject. Limited capacity

Meeting the Challenge: **PAPA Program**

- **Partnership with CAI-ASIA to understand the health effects of air pollution in Asia, now and in the future**
 - Supported by US AID, Foundations, industry, ADB, others
- **Four - year program to:**
 - Assess the state of air pollution and health across Asian cities
 - Initial review of what is known today about health effects in Asian cities published April 2004
 - A second *comprehensive assessment* in four years
 - Initiate a *series of epidemiological studies* in representative Asian cities to estimate local impacts, inform extrapolation throughout the region
 - *Build capacity* of local scientists
- **Overall Goal:**
 - Inform key Asian regulatory & policy decisions

PAPA Scientific Review
Health Effects of Outdoor Air Pollution in Developing Countries of Asia: A Literature Review



- Systematic identification of peer-reviewed Asian studies 1980-2003
- Focus on studies of daily changes in air pollution and health
- Conduct first regional "meta analysis" to quantify risks
- Identify knowledge gaps/research needs
- Put results in context of broader air pollution & health science
- Available at www.healtheffects.org

PAPA: Scientific Review

- Systematic identification of all peer-reviewed Asian studies on effects of air pollution on health
- Daily time series, cohort and panel studies collected from across Asia
- Focus on key subset: studies of daily changes in air pollution and health ("time series")
 - Conduct first regional "meta analysis" to quantify risks
 - Assess what is currently known, identify gaps in understanding
- Report Asian results in context of broader air pollution & health science

