



Socio-economic factors and air pollution health effects Symposium

Background

The health effects of air pollution is a subject of public concern, since numerous studies have shown a significant association between short and long-term exposure to air pollution and health indicators such as mortality and morbidity. Risk groups were clearly identified among the exposed population: children, elderly, and those with pre-existing cardiopulmonary diseases. However, in addition to age and disease status, socio-economic conditions may modify the effect of air pollution. Epidemiology studies have shown gradients in a variety of health outcomes associated with gradients in socio-economic position, measured at the individual as well as societal (e.g., neighborhood/community) levels.

Several studies have been published on the impact of socio-economic condition on the association between air pollution and diseases, as well as investigating whether exposure to air pollution differs by socioeconomic level. (E.g. Gouveia and Fletcher 2000, Wojtyniak et al 2001, Pope et al 2002) This topic has great significance to developing countries, which are presently struggling to increase their economies often at the expense of environmental deterioration. The proper evaluation of the interaction between air pollution and socio-economic circumstances is of paramount importance to establish the real costs of air pollution to such countries and the distribution of those costs among different segments of society. Moreover, in a global context, the impact of the environmental deterioration due to green house gases emissions and global warming could affect, mainly, populations of developing countries.

The organization of the workshop was coordinated through the U.S. Environmental Protection Agency (EPA)-initiated Integrated Environmental Strategies (IES) program. IES was begun in 1998 with the goal of supporting and promoting the evaluation of public health and environmental benefits of integrated air pollution and green house gas (GHG) mitigation efforts in developing countries. The program is continuing to pursue other activities that address the link between public health and air pollution such as this one day symposium on the effect of socioeconomic status on health impacts of air pollution, that will foster dialogue and cooperation among groups involved in similar research and policy endeavors.

The symposium was a forum for experts from different countries, with different skills, facing different realities, and involved with this topic to present results of the studies already carried out, their limitations, and proposals for future studies. Report of the workshop is currently under preparation and will be released in due time.

Organizers

Alfesio Braga, University of Sao Paulo/University of Santo Amaro, Brazil
(abraca@unisa.br)
Luis Cifuentes, Catholic University of Chile (lac@ing.puc.cl)
Marie O'Neill, Harvard University (moneill@hsph.harvard.edu)
Collin Green, National Renewable Energy Laboratory (collin_green@nrel.gov)
Arize Nweke, National Renewable Energy Laboratory (arize_nweke@nrel.gov)
Jorge Rogat, UNEP UNEP Risoe Centre (URC) Energy, Climate and Sustainable
Development (jorge.rogat@risoe.dk)
Katherine Sibold, U S Environmental Protection Agency
(Sibold.Katherine@epa.epa.gov)

Sponsors/Co-Sponsors

United State Environmental protection Agency, USA
National Renewable Energy Lab, USA
Health Effects Institute, USA
UNEP Energy Programme Secretaria, France
United States Geological Survey, USA

Other Supporting Institutions

Australian National University,
Clean Air Initiative -Asia Secretariat
London University of Hygiene and Tropical Medicine
Monash University, Australia
Organisation for Economic Co-operation and Development
University of Western Australia
World Bank
World Health Organization

Participants

Approximately 80 participants from across the globe attended.

Speaker's Abstracts

Modeling contextually and heterogeneity in health: a multilevel modeling approach

Presenter: S V Subramanian, Harvard School of Public Health

Abstract: This presentation considers two inter-related issues that are critical to research on social and environmental determinants to health. The first relates to the importance of modeling the context within which individual health outcomes and behaviors are experienced and observed. The second relates to modeling the heterogeneity underlying the typically observed relationships. The aim of the presentation will be to outline the extent to which multilevel statistical methods offer a framework to understand the complex role of contexts in shaping health achievements and health inequalities. Three models will be outlined and discussed. The first will highlight the notion of disentangling the "compositional" and "contextual" sources of variation in individual health outcomes. The second will discuss the idea of "contextual heterogeneity" and the third will discuss the importance of "cross-level" interactions between individual and contextual characteristics. These models will be applied to understanding the impact of state income inequality on individual health in the US. In conclusion, the potential and challenges for combining social and environmental perspectives, within a multilevel modeling framework, will be raised.

Biosketch:

S V Subramanian, Ph.D. is Assistant Professor at the Department of Society, Human Development and Health, School of Public Health, Harvard University. He has a PhD in geography with specialization in multilevel statistical methods and a Masters in development studies. The main focus of his research is how different contextual settings influence individual health outcomes and the population disparities in health achievements. Among others, he has specifically investigated the impact of macro contextual factors, such as income inequality and social capital on individual health outcomes. His work has demonstrated the need to explicitly consider a multilevel methodological framework while conceptualizing and estimating contextual effects on public health issues. While the empirical focus of much of this work has been on the U.S, he is conducting original collaborative research on the different ways in which health gets spatially and socially stratified in different societies, including Argentina, Australia, Chile, Europe, France, India, Japan, New Zealand and UK. Besides his substantive interest in understanding place-effects on health, Dr. Subramanian is additionally conducting independent research on the methodological challenges to estimating contextual and neighborhood effects on health. He has published and refereed on the above issues in a wide range of national and international social science and public health journals. He is co-developing a training manual to assist researchers in the applications of multilevel models using the MLwiN program.

Email: svsubram@hsph.harvard.edu

Reporting of doctors' diagnoses of respiratory diseases: influence of socioeconomic level and methodological implications for air pollution studies

Presenter: Tony Fletcher, London School of Hygiene and Tropical Medicine

ABSTRACT

This paper is prompted by an apparently anomalous observation noticed in analyses of the CESAR (Central European Study of Air Pollution and Respiratory Health) data set, with respect to socio-economic status. This study assessed risk factors for respiratory ill-health among nearly 20,000 children in 6 countries (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia). Data were collected by questionnaire from the parents (usually the mother), and indicators of SES included education and occupation of the mother and father. Outcomes included questions on symptoms such as wheeze and cough and reported diagnosis such as asthma and bronchitis. Mother's education in particular showed clear monotonic trends in risk for most outcomes. What was striking was that for most symptoms and for reported asthma, the trend was as expected, a strong relationship with the lowest SES group (e.g. least education) exhibiting the highest risk, but that for doctors' diagnoses, divergent results emerged. Asthma (with an overall prevalence of 2.5%) showed this typical relationship with the OR rising to 1.5 for low SES, but for the much more frequently diagnosed bronchitis (prevalence of 58%) we found the opposite relationship with the OR falling to 0.54 in the lowest SES group.

It was possible to identify a group consisting largely of those with more severe bronchitis by taking the subset with reported bronchitis who had also been hospitalised for respiratory disease. For them the relationship with SES followed the same pattern as for symptoms, risk increasing with low SES. While the same pattern was not evident in all 6 countries, from these results we infer that the pattern with bronchitis reflects access to physicians or diagnostic behaviour between physicians, being differentially distributed by SES: Less educated parents appear less likely to have their children diagnosed with bronchitis. Or possibly they are less likely to recall the given diagnosis, though this seems unlikely given the other patterns. This suggests potential problems for investigating the relationship between pollution and doctors' diagnoses of respiratory disease. In particular there is a concern that residual confounding may be present even after including a term for SES: a) it may be an inadequate indicator for this rather strong diagnostic bias; b) doctors' patients fall into catchment areas and it is plausible that the "between-doctor" effect (which may be associated with area-based measures of outdoor pollution) may be more important than the "within-doctor" effect of differential patient responses correlated with SES. outcomes, there ew's

Bio Sketch: Tony Fletcher PhD

Environmental Epidemiologist and coordinator of two EU funded multicountry studies: PATY Pollution and the Young, focussing on childhood respiratory illness and air pollution and ASHRAM a case control study of bladder, skin and kidney cancer in relation to Arsenic in drinking water. This year he is working from Lyon where he has a visiting scientist award to IARC. He is president-elect of ISEE assuming the presidency January 2004.

Email: Tony.Fletcher@lshtm.ac.uk

Indoor air pollution in India and its link with socio economic conditions

R Uma and Dhenuka Srinivasan, TERI, New Delhi, India

Introduction

It has been recognized that indoor air pollution due to solid fuel usage is one of the major health concern in developing countries. According to the World Health Organization, indoor air pollution due to biomass smoke is one of the largest environmental risk factors for ill health of any kind. As per the latest census data, 90% of the rural households and 72.3 % of the total households in India still rely on solid biofuels for domestic cooking needs. (Census of India, 2001). Combustion of these fuels in traditional, low efficiency devices emits considerable quantities of pollutants such as particulates, carbon monoxide (CO), polycyclic organic matter and formaldehyde. In poorly ventilated households, concentrations of some of these pollutants are ten to hundred times of health related standards/guidelines. The resulting health implications are reported to be high among women and children.

Links with socio-economic factors

Levels of indoor air pollution vary significantly according to type of fuel, fuel quantity, burning device and ventilation condition. These drivers vary considerably from region to region depending on various parameters such as climatic condition, cultural practices and socio economic condition. Income levels and literacy rate especially among women have been proved to be the important drivers for household fuel choices, which in turn influence the health status of the family.

Exposure assessment to indoor air pollution in rural Haryana: A case study

In addition to the overview of indoor air pollution problem in India, the current study presents results of a case study on exposure assessment carried out in rural villages of northern India. The study entailed selection of a total of eleven village clusters in the state of Haryana. A base line survey was conducted among all households in the selected villages to obtain information pertaining to socio economic status, fuel usage pattern and cooking practices.

A subset of 110 households was selected from these villages to carry out micro-environmental monitoring and exposure assessment. Respirable suspended particulate (RSP) levels in three microenvironments namely cooking, living, and outdoor were monitored during winter season. Time budget surveys were carried out among all members excluding infants in each household to determine the time spent by the individuals in each of the three microenvironments. Based on the time activity records and the concentration of RSP monitored in three microenvironments, exposure levels to RSP by various population sub groups were determined.

The results of the study reveals that the mean RSP level in the cooking micro-environment during cooking was more than 10 times the mean RSP levels observed in the other two micro-environments namely living and outdoor. It was found that the levels of RSP in the cooking area vary significantly ($p < 0.05$) across the household depending upon the type of fuel used for cooking. Though the levels of RSP measured in this study were comparable to indoor particulate levels reported in few studies conducted in the northern region (urban slum and Hilly area) of India, the

values were much higher than the levels reported in indoor air pollution studies conducted in the southern region of the country (Saksena et.al. 1992, Saksena et.al.2003, Balakrishnan K, et.al. 2002, The World Bank 2002). This also reinforces the fact that indoor air pollution is highly influenced by factors such as socio economic condition, fuel choice and by climatic and cultural variations. Similar to the findings of other studies, results of the present study also point out that the exposure levels are highest among women, who become victims of drudgery and health implications of indoor air pollution.

References

Census of India. 2001

India: Summary – Distribution of Households by availability of separate kitchen and type of fuel used for cooking

<http://www.censusindia.net/results/S00-018.html> (accessed on 4/21/2003).

Saksena S, Prasad R, Pal RC, Joshi V. 1992

Patterns of daily exposure to TSP and CO in the Garhwal Himalaya

Atmospheric Environment **26A** (11): 2125–2134.

Balakrishnan K, Sankar S et.al. 2002

Daily average exposures to respirable particulate matter from combustion of biomass fuels in rural households of southern India

Environmental Health Perspectives **110**(11): 1069–75

Saksena S, Singh P B et.al. 2003

Exposure of Infants to Outdoor and Indoor Air Pollution in Low-Income Urban Areas-A Case Study of Delhi

Journal of Exposure Analysis and Environmental Epidemiology **13**(3):219–230

The World Bank. 2002

ESMAP newsletter on Indoor Air Pollution - Energy And Health For the Poor Issue No. 7 (July, 2002), New Delhi : The World Bank, 8 pp.

Bio Sketch:

Ms Uma is a Fellow in TERI. She has more than a decade in the area of Air pollution, specifically indoor air pollution issues related to fuel usage for cooking in developing countries. She also worked on Green House Gas inventorying projects. She is currently working on exposure assessment to Indoor Air Pollution and Integrated Environmental Strategies Programme. She handles and coordinates activities of the Center for Environmental Studies of the Policy Analysis Division at TERI. This center handles wide range of projects related environmental issues.

Email: ruma@teri.res.in

The impact of socio-economic status on air pollution: Challenges for South Africa

Presenter: Kuku Voyi, School of Health Systems and Public Health

Abstract: South Africa is a developing country with pockets of first world technology and industries. Poverty, unemployment and housing shortage as a result of rapid urbanisation is still an unmet challenge. Nationally air pollution monitoring network is poor. Some major cities have taken the lead in air pollution management by developing air quality management plans.

The National department of Environmental Affairs and Tourism is in a process of reviewing the law, proposing to replace the ambient air quality guidelines with enforceable standards. The National department of health has gazetted a new Health Bill. This bill proposes that the management of Environmental health services be devolved to the local authorities. This will add another dimension to the current socio-economic indicators related to service delivery.

The objective of this paper is to highlight the challenges that are complex and demand creative investigation, taking into account that socio-economic status is a proxy of health behaviour.

Bio Sketch

Dr. K. Voyi is an Associate professor of Environmental Health at the School of Health Systems and Public Health at the University of Pretoria and head of the Environmental and Occupational Health Division. She was previously an air pollution health risk scientist employed by the CSIR since 1999. She joined the CSIR Environmentek division in October 1999 to lead the Human Health risk assessment group. She later managed the Environmental health and Human health risk assessment in the air quality group, which is concerned with the impacts of air pollutants on human health. The activities of this group included health risk and environmental risk assessment of bio/chemical processes in the research department. In July 2000 her responsibilities were extended to include the following groups:

Air quality – dispersion modeling; Air monitoring and analysis; Vegetation impacts – ecology; Environmental studies integration section.

The above groups now comprise the Air Quality Assessment and Risk (AQAR) business area. The Climate change section has been added to the group in December 2000.

The research carried out in the business area is on impacts of Air pollution to the environment. She previously worked for AECI Research and Development Department since 1988, this department was taken over by CSIR in 1999.

She has trained under Prof. Graham Jackson at the University of Cape Town and obtained her PhD in 1988 in the field of bioinorganic chemistry. She has been working in the field of chemical computing until June 1995. In the beginning of July 1995 she established a Health Safety and Environment group in the R&D department that she looked after until September 1999.