

# Building capacity for air pollution epidemiology in India

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Air pollution represents a major public health threat in India affecting 19% of the world's population at extreme levels. Despite this, research in India lags behind in large part due to a lack of comprehensive air pollution exposure assessment that can be used in conjunction with health data to investigate health effects. Our vision is to provide a consortium to rapidly expand the evidence base of the multiple effects of ambient air pollution. We intend to leapfrog current limitations of exposure assessment by developing a machine-learned satellite-informed spatiotemporal model to estimate daily levels of ambient fine particulate matter measuring less than 2.5 µm (PM<sub>2.5</sub>) at a fine spatial scale across all of India. To catalyze health effects research on an unprecedented scale, we will make the output from this model publicly available. In addition, we will also apply these PM<sub>2.5</sub> estimates to study the health outcomes of greatest public health importance in India, including cardiovascular diseases, chronic obstructive pulmonary disease, pregnancy (and birth) outcomes, and cognitive development and/or decline. Thus, our efforts will directly generate actionable new evidence on the myriad effects of air pollution on health that can inform policy decisions, while providing a comprehensive and publicly available resource for future studies on both exposure and health effects. In this commentary, we discuss the motivation, rationale, and vision for our consortium and a path forward for reducing the enormous burden of disease from air pollution in India.

**Key Words:** Air pollution health impact; Environmental epidemiology; Environmental health policy; Exposure modeling; Public health; Capacity building

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of the article.

G.A.W. has received consulting income from the Health Effects Institute (HEI), Boston, MA) and is currently a paid visiting scientist at Google Research (Mountain View, CA). P.L.S.L. has received consulting income from AFA Insurance (Stockholm, Sweden). P. Prabhakaran, J. Schwartz, and K. S. Reddy received The India GEOHealth (Global Environmental and Occupational Health) Hub funded by the National Institute of Health Fogarty International Center (R01 RW010007, LRR RW010108). The other authors have no conflicts to report.

The Consortium for Health Effects of Air Pollution Research in India (CHAPRI) meeting was funded by Karolinska Institutet through a donation from Carl Berner AB and Centre for Environmental Health, Public Health Foundation of India.

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Environmental Epidemiology (2020) 4:e117

Received: 25 June 2020; Accepted: 28 August 2020

Published online 1 October 2020

DOI: 10.1097/EPE.0000000000000117

## Background

Environmental risk factors contribute to nearly a quarter of the global burden of diseases. In 2012, an estimated 23% of deaths and 22% of disability-adjusted life years (DALYs) were attributable to modifiable environmental risk factors, thus pointing to the potential for prevention, intervention, and remedial action to promote health and prevent disease.<sup>1,2</sup> Estimates from the Global Burden of Disease (GBD) attribute 16% mortality and 12% DALYs to environmental risks, reflecting differences in definition and measurement yet nevertheless indicating a substantial potential for prevention.

Air pollution has become the most studied and discussed environmental risk factor worldwide. Ambient air pollution contributes globally to around 4.2 million premature deaths mainly due to heart disease, stroke, chronic obstructive pulmonary diseases, and lung cancer in adults and acute respiratory infections in children.<sup>1,3</sup> The evidence to support this has mostly emerged from research in high-income countries. However, according to the GBD study, the largest burden of disease—based on population size and air pollution levels—is in low- and middle-income countries.<sup>4</sup> Asian cities dominated the list of the top 100 places most affected by PM<sub>2.5</sub> in 2018, with cities in India, China, Pakistan, and Bangladesh occupying the top 50 most polluted cities.<sup>5</sup> The World Health Organization (WHO) notes that 13 of the 20 most polluted cities are in India.<sup>6</sup> Delhi is ranked as the most polluted capital city in the world superseded by 5 other Indian cities making it the sixth most polluted city in the world with an annual average concentration of PM<sub>2.5</sub> of 113.54 µg/m<sup>3</sup> in 2018 within a population of approximately 26 million residents.<sup>7</sup> Ambient PM<sub>2.5</sub> was estimated to account for 670,000 deaths in India in 2017 and a majority of these people <70 years of age. However, these GBD estimates are derived from on a low-resolution chemical transport model and global exposure response functions.<sup>8</sup> Despite these indications, efforts to address

# Epidemiology And Air Pollution

**Daniel F McAuley**



## **Epidemiology And Air Pollution:**

Epidemiology of Air Pollution P. J. Lawther, 1990      **Epidemiology and Air Pollution** ,1985-01-01      Epidemiology of Air Pollution ,1962      **Epidemiology of Air Pollution** P. J. Lawther, 1962      *Epidemiology of Air Pollution* P. J. Lawther, 1962      **Epidemiology and Air Pollution** National Research Council, Division on Earth and Life Studies, Commission on Life Sciences, Board on Toxicology and Environmental Health Hazards, Committee on the Epidemiology of Air Pollutants, 1985-02-01      Epidemiology and Air Pollution National Research Council (Estats Units d'Amèrica). Comittee on the Epidemiology of Air Pollutants, 1985      **Environmental Epidemiology** MEGAN, LONDON, 2006-03-01 The impact of the environment on human health is of growing concern to the public politicians and public health practitioners Epidemiology offers a way of investigating and measuring potential hazards from local sources of pollution to global climate changes It allows real effects to be distinguished from chance associations This book describes the methods available for public health practitioners to enable investigations to be carried out and how findings should be interpreted to ensure that the most appropriate policies are adopted The book examines Air pollution Clusters of cases of ill health Radiation and hazardous waste Water and health Climate change Contributors Mike Ahern Ben Armstrong Araceli Busby Pat Doyle Shakoor Hajat Sari Kovats Paul Wilkinson      Environmental Epidemiology John R. Goldsmith, 2019-06-12 Published in 1986 This book tells the story of how various persons and groups have successfully dealt with a type of problem which may threaten the lives and health of every group of humans every community The problem is that of a polluted environment      **Statistical Methods for Environmental Epidemiology with R** Roger D. Peng, Francesca Dominici, 2008-12-15 As an area of statistical application environmental epidemiology and more speci cally the estimation of health risk associated with the exposure to vironmental agents has led to the development of several statistical methods and software that can then be applied to other scienti c areas The stat tical analyses aimed at addressing questions in environmental epidemiology have the following characteristics Often the signal to noise ratio in the data is low and the targets of inference are inherently small risks These constraints typically lead to the development and use of more sophisticated and pot tially less transparent statistical models and the integration of large hi dimensional databases New technologies and the widespread availability of powerful computing are also adding to the complexities of scienti c inves gation by allowing researchers to t large numbers of models and search over many sets of variables As the number of variables measured increases so do the degrees of freedom for in uencing the association between a risk factor and an outcome of interest We have written this book in part to describe our experiences developing and applying statistical methods for the estimation for air pollution health e cts Our experience has convinced us that the application of modern s tistical methodology in a reproducible manner can bring to bear subst tial bene ts to policy makers and scientists in this area We believe that the methods described in this book are applicable to other areas of environmental epidemiology particularly

those areas involving spatial temporal exposures      **Air Pollution and Health in Rapidly Developing Countries** Gordon McGranahan, Frank Murray, 2012-05-23 In developing countries the price of rapid growth is all too often noxious airborne pollution which annually contributes to a disturbing number of avoidable deaths In recent decades however there has been considerable progress in the epidemiology of air pollution significant changes in international air pollution guidelines and the emergence of more systematic approaches to air pollution control While many of these advances have originated in affluent countries there have been major developments in other parts of the world In this book a distinguished cast of leading researchers in both the scientific and policy dimensions of air pollution and health have synthesized the recent developments in the field and their relevance for public health in developing countries The authors review studies from a wide range of Asian African and Latin American countries and contrast the findings with those from Europe and North America They also describe various tools and systems for air pollution management and emphasize approaches that can be used when data is scarce With a clear focus on the scientific and technical aspects of air pollution and health this book is essential reading for pollution and health policy makers researchers and others concerned with air pollution and health in developing countries

Epidemiology and Air Pollution National Research Council (U.S.). Committee on the Epidemiology of Air Pollutants, 1985

*Air Pollution and Health Effects* Srikanth S. Nadadur, John W. Hollingsworth, 2015-05-06 Exposure to ambient air pollutants both indoors and outdoors has been associated with the exacerbation and also in the etiology of diverse human diseases This book offers an overview of our current understanding of air pollution health risks and how this knowledge is being used in the regulatory therapeutic intervention measures to protect the public health and reduce the disease burden caused by acute and long term exposure to air pollutants Air Pollution and Health Effects provides readers with a comprehensive understanding of air pollution health risks morbidity and the global disease burden whilst also delivering critical review on state of the art research so as to gain a fundamental understanding of the biological mechanisms involved in the etiology of air pollution induced diseases Chapters range from pregnancy outcomes and pre term birth carcinogens in the ambient aerosol and the health consequences of indoor biomass burning Special emphasis is placed on regional and local air pollution and its impact on global health along with suitable preventive and interventional measures With contributions from international experts in the field this volume is a valuable guide for researchers and clinicians in toxicology medicine and public health as well as industry and government regulatory scientists involved in health protection      **Environmental Epidemiology, Volume 2** National Research Council, Committee on Environmental Epidemiology, 1997-07-26 Determining the health risks to humans of exposure to toxic substances in the environment is made difficult by problems such as measuring the degree to which people have been exposed and determining causation whether observed health effects are due to exposure to a suspected toxicant Building on the well received first volume Environmental Epidemiology Hazardous Wastes and Public Health this second volume continues the examination of ways to address these difficulties It describes

effective epidemiological methods for analyzing data and focuses on errors that may occur in the course of analyses The book also investigates the utility of the gray literature in helping to identify the often elusive causative agent behind reported health effects Although gray literature studies are often based on a study group that is quite small use inadequate measures of exposure and are not published many of the reports from about 20 states that were examined by the committee were judged to be publishable with some additional work The committee makes recommendations to improve the utility of the gray literature by enhancing quality and availability *Air Pollution in Donora, Pa* Helmuth Herman Schrenk,1949 **UCI - Planning Colloquium on Epidemiology and Air Pollution** James L. Whittenberger,1990 **Epidemiology of air pollution** P. J. Lawther,A. E. Martin,E. T. Wilkins,1962 *Air Pollution in Donora, Pa* United States. Public Health Service. Division of Occupational Health,Helmuth Herman Schrenk,1949 *Coronary Heart Disease Epidemiology* Michael Marmot,M. G. Marmot,Paul Elliott,2005 Coronary heart disease is the leading cause of death worldwide affecting millions of people in both developed and developing countries The dual aims of this book are to review the well established and emerging risk factors in coronary heart disease and to apply this knowledge to public health approaches to disease prevention The book includes authoritative accounts of studies within a single population and international studies important areas of methodological development trials to test preventive strategies and the application of epidemiological and other knowledge to the development of public health policy for the prevention of widespread disease It is an all encompassing work containing contributions from the world authorities in the field The book is divided into four sections The introduction reviews advances in the understanding of and the current status of risk factors for CHD Section 2 looks at recent global trends and emerging patterns of CHD morbidity and mortality in several countries and includes chapters on work done under the auspices of WHO on the global burden of disease in relation to smoking and blood pressure Section 3 focuses on advances in understanding the aetiology of CHD with each chapter focused on a particular risk factor Section 4 explores measures of prevention and intervention in terms of public health policy with specific examples from around the world *Epidemiology of Air Pollution* World Health Organization,1962

## Reviewing **Epidemiology And Air Pollution**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is really astonishing. Within the pages of "**Epidemiology And Air Pollution**," an enthralling opus penned by a very acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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