

Environmental Burden of Disease Assessment

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Jacqueline MacDonald Gibson • Angela S. Brammer
Christopher A. Davidson • Tiina Folley
Frederic J.P. Launay • Jens T.W. Thomsen

Environmental Burden of Disease Assessment

A case study in the United Arab Emirates

 Springer

Jacqueline MacDonald Gibson
Gillings School of Global Public Health
University of North Carolina–Chapel Hill
Chapel Hill, NC, USA

Angela S. Brammer
Gillings School of Global Public Health
University of North Carolina–Chapel Hill
Chapel Hill, NC, USA

Christopher A. Davidson
Gillings School of Global Public Health
University of North Carolina–Chapel Hill
Chapel Hill, NC, USA

Tiina Folley
Gillings School of Global Public Health
University of North Carolina–Chapel Hill
Chapel Hill, NC, USA

Frederic J.P. Launay
Environment Agency–Abu Dhabi
United Arab Emirates

Jens T.W. Thomsen
Health Authority–Abu Dhabi
United Arab Emirates

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Foreword

This remarkable book is the result of the first-ever effort by a nation to commission a comprehensive model to estimate the national burden of disease from environmental pollution in air, water, soil, and food—a project especially notable for its long-term perspective in a world too often focused on short-term thinking. When we collaborated with the Environment Agency–Abu Dhabi and Health Authority–Abu Dhabi to commission the research reported here, we envisioned that the result could serve as a model for other nations wishing to understand environmental pollution impacts on public health from a holistic perspective. We believe this book fulfills the role we originally envisioned: it provides a template for other nations to use to characterize their environmental burden of disease across multiple pollutants and exposure routes.

Systematic planning of environmental investments to protect health is more important than ever as much of the world continues to recover from economic difficulties. Such planning not only ensures governments will reap the greatest health benefits from steps they take to reduce environmental pollution but also will result in substantial long-term savings in healthcare costs. As observed in an editorial in *The Lancet* advocating for countries to undertake environmental burden of disease assessments, “If policymakers don’t plan for healthier environments now, many more lives will be lost unnecessarily.”¹

Using environmental monitoring data, health records, and epidemiologic information, the computer model described in this book, known as the *UAE Environmental Burden of Disease Model*, predicts how many excess deaths and visits to health-care facilities are caused by environmental contaminants each year in the United Arab Emirates. The model, created by scientists from the Gillings School of Global Public Health at the University of North Carolina–Chapel Hill, is designed to be updated and improved over time, allowing the accuracy of predictions to be continually refined as new environmental monitoring and health data become available.

¹ *The Lancet*. 2007. The environment’s impact on health. *The Lancet* 369(June 23), 2052.

Other nations can build directly on the *UAE Environmental Burden of Disease Model* and the detailed information this book contains to jump start their own environmental burden of disease assessments. The model can be adapted readily by replacing UAE population, environmental monitoring, and health outcome data with comparable data for other nations. The model's modular construction, as described in this book, is designed to facilitate future use by others. The full model is encoded using the software platform *Analytica*, available from Lumina Decision Systems (<http://www.lumina.com/>). A stripped-down version (with UAE-specific data removed) can be requested from Dr. Jacqueline MacDonald Gibson at the University of North Carolina–Chapel Hill (jackie.macdonald@unc.edu).

As evidenced by the commissioning of the environmental health project, the UAE already had the vision and desire to become a world leader in environmental health. But with the publication of this book, the UAE now has the necessary knowledge and tools to begin to assume that leadership role. The world is shrinking, and every action taken by a nation affects its neighbors. The actions taken in response to the facts presented in this book can set an example for others to follow, both in the Middle East and throughout the world.

Centre for Environmental Health Activities
Regional Office for the Eastern Mediterranean Region
World Health Organization

Amir Johri

Department of Civil Engineering
University of Lahore

Muhammad Zulfiqar Ali Khan

Preface

This book originated from a September 2007 visit to the University of North Carolina–Chapel Hill (UNC) by H.E. Majid Al Mansouri, then Secretary General of the Environment Agency–Abu Dhabi (EAD). Accompanied by Dr. M.Z. Ali Khan and Dr. Amir Johri from the World Health Organization (WHO), H.E. Al Mansouri sought guidance on organizing his agency’s fledgling environmental protection programs. At the time of his visit, the EAD was just 2 years old, having arisen from what was previously an agency focused almost exclusively on wildlife protection, the Environmental Research and Wildlife Development Agency.

H.E. Al Mansouri invited UNC’s Gillings School of Global Public Health to collaborate on a study to identify the environmental pollution risks posing the largest burden of disease among the human population of the United Arab Emirates (UAE). He planned to use the results to guide the organization of his newly expanded agency. Because Abu Dhabi is the political center and geographically largest of the UAE’s seven emirates, he also envisioned that the results could benefit the entire UAE. Hence, the scope of the project included not just Abu Dhabi emirate but all of the UAE.

H.E. Al Mansouri arrived at UNC with a list of 14 concerns, ranging from depletion of the stratospheric ozone layer to electromagnetic fields to carcinogens in water (see Chap. 2 for a complete list). Recognizing that his agency was understaffed to be able to manage all 14 concerns simultaneously and with equal effort, he aspired to discover ways the EAD could invest its limited resources in order to yield high benefits for public health. A key part of this process was to develop an accounting of the environmental burden of disease associated with each type of pollution on the list of concerns. This book presents the methods used to develop this accounting, along with the results for the UAE. The methods, and much of the epidemiologic evidence used to support the analysis, can be readily applied in other countries, and I hope that others will borrow freely from this book and use it as a model for their own, similar analyses.

For a U.S. scientist, the opportunity to view environmental impacts on health from a holistic perspective—rather than examining risks one at a time—was highly appealing. In the United States, environmental protection policies have arisen in

piecemeal fashion, driven by acts of Congress that generally consider only one environmental medium (such as surface water or outdoor air) at a time. The result is a fragmented regulatory system that has no mechanism by which to account for the relative public health importance of pollutants in different environmental media—and that, indeed, overlooks some very important exposure routes, such as indoor air. As the eminent U.S. environmental policy scholar Richard N.L. Andrews has observed, the U.S. Congress “passed a patchwork of extraordinarily prescriptive statutes, denying EPA [the U.S. Environmental Protection Agency] authority to address some sources and to set priorities among mandates as well as denying it use of more effective and efficient policy tools.”² Dr. Andrews (and many others) have concluded that without a new law from the U.S. Congress providing the EPA with “a coherent statutory mission and the flexibility to carry it out,” adopting a multi-media perspective to U.S. environmental policymaking probably will remain an elusive goal. Hence, the opportunity to assist a visionary leader in planning a system to protect human health from environmental risks with the “big picture” in mind was highly appealing to the U.S. scientists on our team.

I hope that this book will serve as inspiration to other nations (including my own) wishing to reassess their environmental protection paradigms by viewing the environment and its impacts on human health from a more holistic perspective, considering the multiple ways in which people can be exposed to pollutants instead of addressing just one pathway at a time. There is much more work to be done to improve on the foundation established in this book, including considering the potential cumulative risks of exposure to multiple contaminants in different media. Nonetheless, I hope the model this book can serve as a starting point.

Department of Environmental Sciences
and Engineering
Gillings School of Global Public Health
University of North Carolina–Chapel Hill
Chapel Hill, NC, USA

Jacqueline MacDonald Gibson

²Richard, N. L. Andrews. 1995. Reform or reaction: EPA at a crossroads. *Environmental Science & Technology* 29(11):505A–510A.

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Acronyms

ACS	American Cancer Society
ADFCA	Abu Dhabi Food Control Authority
ADFSC	Abu Dhabi Farmers Services Centre
ADI	acceptable daily intake
AF	attributable fraction
aPAD	acute population adjusted dose
BMI	body mass index
BPA	bisphenol A
CAREX	Carcinogen Exposure database
CCS	carbon capture and sequestration
CDC	Centers for Disease Control and Prevention (U.S.)
CMAQ	Community Multiscale Air Quality
cPAD	chronic population adjusted dose
CWM	Center of Waste Management–Abu Dhabi
DALY	disability-adjusted life year
EAD	Environment Agency–Abu Dhabi
EBD	environmental burden of disease
EC	European Commission
EFSA	European Food Safety Authority
EMF	electromagnetic field
EPA	Environmental Protection Agency (U.S.)
FDA	Food and Drug Administration (U.S.)
GBD	global burden of disease
GHG	greenhouse gases
HAAD	Health Authority–Abu Dhabi
IPCC	Intergovernmental Panel on Climate Change
LOAEL	lowest adverse effect level
MOEW	Ministry of Environment and Water (UAE)
MRLs	maximum allowable pesticide residue levels
NATO	North Atlantic Treaty Organization
NEHAP	national environmental health action plan

NOAEL	no observed adverse effect level
NO _x	nitrous oxides
PAHs	polyaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PDF	probability distribution function
PET	polyethylene terephthalate
ppb	parts per billion
PM	particulate matter
RfD	reference dose
RR	relative risk
SD	standard deviation
THMs	trihalomethanes
VOC	volatile organic compound
WHO	World Health Organization
WSH	water, sanitation, and hygiene