VOLUME 7

DISEASE CONTROL PRIORITIES • THIRD EDITION

Injury Prevention and Environmental Health

DISEASE CONTROL PRIORITIES • THIRD EDITION

Series Editors

Dean T. Jamison
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DISEASE CONTROL PRIORITIES

Budgets constrain choices. Policy analysis helps decision makers achieve the greatest value from limited available resources. In 1993, the World Bank published *Disease Control Priorities in Developing Countries* (*DCP1*), an attempt to systematically assess the cost-effectiveness (value for money) of interventions that would address the major sources of disease burden in low- and middle-income countries. The World Bank's 1993 *World Development Report* on health drew heavily on *DCP1*'s findings to conclude that specific interventions against noncommunicable diseases were cost-effective, even in environments in which substantial burdens of infection and undernutrition persisted.

DCP2, published in 2006, updated and extended *DCP1* in several aspects, including explicit consideration of the implications for health systems of expanded intervention coverage. One way that health systems expand intervention coverage is through selected platforms that deliver interventions that require similar logistics but deliver interventions from different packages of conceptually related interventions, for example, against cardiovascular disease. Platforms often provide a more natural unit for investment than do individual interventions. Analysis of the costs of packages and platforms—and of the health improvements they can generate in given epidemiological environments—can help to guide health system investments and development.

DCP3 differs importantly from *DCP1* and *DCP2* by extending and consolidating the concepts of platforms and packages and by offering explicit consideration of the financial risk protection objective of health systems. In populations lacking access to health insurance or prepaid care, medical expenses that are high relative to income can be impoverishing. Where incomes are low, seemingly inexpensive medical procedures can have catastrophic financial effects. *DCP3* offers an approach to explicitly include financial protection as well as the distribution across income groups of financial and health outcomes resulting from policies (for example, public finance) to increase intervention uptake. The task in all of the *DCP* volumes has been to combine the available science about interventions implemented in very specific locales and under very specific conditions with informed judgment to reach reasonable conclusions about the impact of intervention mixes in diverse environments. *DCP3*'s broad aim is to delineate essential intervention packages and their related delivery platforms to assist decision makers in allocating often tightly constrained budgets so that health system objectives are maximally achieved.

DCP3's nine volumes are being published in 2015, 2016, 2017, and 2018 in an environment in which serious discussion continues about quantifying the sustainable development goal (SDG) for health. *DCP3*'s analyses are well-placed to assist in choosing the means to attain the health SDG and assessing the related costs. Only when these volumes, and the analytic efforts on which they are based, are completed will we be able to explore SDG-related and other broad policy conclusions and generalizations. The final *DCP3* volume will report those conclusions. Each individual volume will provide valuable, specific policy analyses on the full range of interventions, packages, and policies relevant to its health topic.

More than 500 individuals and multiple institutions have contributed to *DCP3*. We convey our acknowledgments elsewhere in this volume. Here we express our particular

gratitude to the Bill & Melinda Gates Foundation for its sustained financial support, to the InterAcademy Medical Panel (and its U.S. affiliate, the Institute of Medicine of the National Academy of Sciences), and to World Bank Publications. Each played a critical role in this effort.

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1 2 3 4 20 19 18 17

ISBNs and DOIs:

Softcover:	**Hardcover:**
ISBN: 978-1-4648-0522-6	ISBN: 978-1-4648-0521-9
ISBN (electronic): 978-1-4648- 0523-3	
DOI:10.1596/978-1-4648-0522-6	DOI:10.1596/978-1-4648-0521-9

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Cover and interior design: Debra Naylor, Naylor Design, Washington, DC

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Library of Congress Cataloging-in-Publication Data has been requested.

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Foreword

The world continues to suffer from an enormous burden of morbidity, disability, and premature mortality from injuries and environmental health conditions. Much of this burden is unnecessary and can be prevented by evidence-based, high-impact interventions that can be implemented in all countries, irrespective of income.

Injuries are leading causes of death, responsible for an estimated 5 million deaths and around 9 percent of global mortality. Most of the deaths are in low- and middle-income countries (LMICs). More than 1.2 million people die too young each year because of road traffic injuries. According to the World Health Organization's (WHO) *Global Status Report 2015*, death rates in low-income countries are more than double those in high-income countries. The African region has the highest death rates.

The current situation presents a major challenge to socioeconomic development and has rightly been the focus of attention globally and within all countries. In 2010, a decade for action on road safety was established by the United Nations General Assembly; more recently, in 2015, as part of the Sustainable Development Goals, countries of the world made an ambitious commitment to halving the number of global deaths and injuries due to road traffic crashes by 2020.

There is, therefore, a pressing need for action. This volume of *Disease Control Priorities*, third edition provides an excellent evidence-based guide to policy makers on the approaches and rational choice of interventions to address this challenge. Many of the interventions included in the volume are among the most cost-effective interventions in public health and can make a substantial impact on reducing the health and socioeconomic burden due to injuries, particularly in LMICs. Yet, current progress is too slow. As highlighted in this volume and documented in the *Global Status Report*, implementation of the key public health measures is disappointingly low. Countries, particularly LMICs, need to do more. Policy makers should seriously consider the recommendations of this volume when they develop their own essential package of interventions, which is one of the three key pathways to achieve universal health coverage. International organizations and development agencies should increase their support to low-income countries to make this possible.

This volume focuses on another key challenge to public health across the globe. Environmental causes lead to more than 8 million deaths per year; outdoor and indoor air pollution accounts for more than 5 million of these deaths per year. Climate change, which results from unsustainable policies in many sectors, exacerbates air pollution threats and causes additional morbidity and mortality. Unsafe sanitation and lack of safe water and hygiene cause an estimated 1.4 million deaths, almost all in LMICs.

Although the enormous burden and serious health challenges caused by environmental risk factors are evident, surveillance and systematic monitoring of the magnitude of the risks and their health impacts are severely limited in many countries. The data gaps are particularly serious for air quality and air pollution levels. Increasing awareness among high-level government officials and policy makers on the seriousness of environmental risks and the pressing need to take effective multisectoral action should be a key priority for all countries. This volume makes a strong case for advocacy and for strengthening commitment, and it provides clear policy advice on strategic directions to consider.

Despite the fact that there are limited economic analysis studies on some environmental health conditions, there is clear evidence for a range of interventions recommended in the volume that are cost-effective or supported by favorable cost-benefit ratios. Implementing them will have a considerable impact on reducing environmental

health risks and preventing a broad range of common communicable and noncommunicable conditions responsible for a major proportion of global disease burden and premature mortality. In addition to their desirable health effects, many of these interventions will also have important non-health outcomes that may be part of the priorities of the non-health sectors involved.

An important challenge to health and development is climate change. Although the importance of climate change challenges is increasingly recognized, and tackling them is becoming a global priority, addressing the health consequences is not receiving adequate attention. Policy makers at the highest levels of government and in different sectors need to be made fully aware of the seriousness of the health dimensions and the effective approaches to mitigate them.

Finally, making a difference in addressing injuries and environmental health risks will require solid commitments from all parts of governments, particularly sectors such as transport, energy, industry, agriculture, housing, and waste management. The health sector will have to demonstrate leadership in evidence-based advocacy, governance, technical support, and surveillance. The need to act is highlighted by a range of goals and targets included in the sustainable development agenda. Countries that initiate effective action now will benefit from improved health and realize considerable health care savings.

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Preface

The fields of injury prevention and environmental health address diverse health problems that arise from exposure to outside forces, such as chemicals and other toxins, infectious agents, kinetic energy, and thermal energy. The health problems addressed by these fields include the following:

- Unintentional injuries, such as road traffic accidents, falls, burns, and drowning
- Intentional injuries, such as interpersonal violence
- Diseases, such as those caused or aggravated by exposure to airborne and waterborne pollutants
- Occupational hazards, such as injuries and diseases caused or aggravated by workplace toxins,
- Effects of climate change due to human greenhouse emissions, such as enhancement of waterborne infectious diseases.

The conditions and risks encompassed in these fields account for more than 12 million deaths per year—21 percent—of the annual global total of 56 million deaths.

Most of these conditions and risks have not been effectively addressed globally; in recent years, however, some have received increased attention. This *Injury Prevention and Environmental Health* volume of *Disease Control Priorities*, third edition (*DCP3*), contributes to the understanding of how to address these health problems in the following ways:

- Elucidating the health burden of these conditions
- Documenting trends in the health burden at different phases of national development
- Identifying the most cost-effective and cost-beneficial interventions
- Describing policies and platforms that can widely and effectively deliver these interventions.

This volume looks at several types of policy approaches to reduce the burden of ill health from environmental and occupational risks and injuries. Unlike the other *DCP3* volumes, most of the actions proposed in this volume speak directly to non-health sectors, where a substantial portion of disease and injury prevention policies and programs needs to occur. These actions include fiscal and intersectoral policies, such as taxes and subsidies; regulations; and policies that affect infrastructure, the built environment, and product design. Also included are information, education, and communication initiatives to promote behavioral changes; these initiatives leverage a range of vehicles, from mass media campaigns to one-on-one counseling. A second major difference from other *DCP3* volumes is that the economic evidence supporting the actions described in this volume is primarily benefit-cost analyses—the benefits and costs may occur outside of the health sector and must be accounted for in common monetized units. We include two extended cost-effectiveness analyses (ECEAs) that indicate policies that provide strong financial risk protection for individuals and households.

Most of the policies and interventions discussed in this volume have not been fully implemented in high-income countries (HICs); their implementation in low- and middle-income countries (LMICs) is substantially more incomplete. More complete implementation would help to reduce the disproportionately high rates of death and disability from these conditions in LMICs. Doing so could avert over seven million premature deaths annually from environmental and occupational exposures and injuries in LMICs.

The goal of the editors and authors of *Injury Prevention and Environmental Health* is to provide the requisite evidence-based rationale and guidance to increase implementation of effective strategies to prevent injuries and lower environmental risks in countries at all

economic levels. We hope to stimulate increased implementation of proven effective strategies that have not yet been applied widely, let alone universally. We also seek to focus attention on the need to identify new strategies that would be particularly effective in LMICs. Finally, we wish to highlight the potentially substantial health hazards of climate change. This particular environmental issue will likely become increasingly preeminent in the 21st century. The resultant health problems, including food and water insecurity, may rival those of other major risk factors. The toll could be especially tragic among the world's poorest people. Enhancing the understanding of climate change and identifying effective interventions are likely to become major challenges in the next generation.

We thank the following individuals who provided valuable comments and assistance to this effort: Elizabeth Brouwer, Kristen Danforth, Mary Fisk, Rumit Pancholi, Jinyuan Qi, Shamelle Richards, and Carlos Rossel. The authors also thank the reviewers organized by the National Academy of Medicine and the InterAcademy Medical Panel listed separately in this volume. We especially thank Brianne Adderley for her hard work in keeping this large endeavor well organized.

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Abbreviations

ALRI	acute lower respiratory infection
BCA	benefit-cost analysis
BCR	benefit-cost ratio
BPL	below poverty line
CAMx	Comprehensive Air Quality Model with Extensions (Eulerian photochemical dispersion model)
CATS	Community Approach to Total Sanitation
CCT	conditional cash transfer
CDD	community-driven development
CEA	cost-effectiveness analysis
CERC	Central Electricity Regulatory Authority
CI	confidence interval
CIRCLE	Climate Impact Research and Response Coordination for a Larger Europe
CLTS	community-led total sanitation
CO	carbon monoxide
COPD	chronic obstructive pulmonary disease
CPLS	cost per life saved
CRA	comparative risk assessment
CTC	Communities that Care
CVD	cardiovascular disease
DALY	disability-adjusted life year
DHS	Demographic and Health Survey
ECEA	extended cost-effectiveness analysis
ESI	Economics of Sanitation Initiative
EU	European Union
FGD	flue-gas desulfurization
GACC	Global Alliance for Clean Cookstoves
GBD	Global Burden of Disease
GDP	gross domestic product
GIU	Give It Up
GNI	gross national income
GNP	gross national product

GPOBA	Global Program for Output-Based-Aid
GRP	gross regional product
GW	gigawatt
HAP	household air pollution
HAPIT	Household Air Pollution Intervention Tool
HICs	high-income countries
HLY	healthy life-year
HRTWS	Human Right to Safe Drinking Water and Sanitation
HWTS	household water treatment and storage
IAQG	Indoor Air Quality Guidelines
ICER	incremental cost-effectiveness ratio
IER	integrated-exposure response
IHD	ischemic heart disease
IHDS	Indian Human Development Survey
IHME	Institute for Health Metrics and Evaluation
IMAGE	Intervention with Microfinance for AIDS and Gender Equity
IOM	Institute of Medicine
IPV	intimate partner violence
ISBI	International Society for Burn Injuries
JMP	Joint Monitoring Programme
kWh	kilowatt-hour
LC	lung cancer
LICs	low-income countries
LMICs	low- and middle-income countries
LPG	liquefied petroleum gas
MDGs	Millennium Development Goals
mg/m^3	milligrams per cubic meter
MHM	menstrual hygiene management
MICS	Multiple Indicator Cluster Survey
MICs	middle-income countries
MW	megawatt
NCAP	New Car Assessment Program
NCDs	noncommunicable diseases
NGO	nongovernmental organization
NISP	National Improved Stove Program
NOx	oxides of nitrogen
OBA	output-based aid
OECD	Organisation for Economic Co-operation and Development
OOP	out of pocket
OR	odds ratio
OSH	occupational safety and health
PFD	personal flotation device
PIC	products of incomplete combustion
PM	particulate matter
PPPHW	Global Public-Private Partnerships for Handwashing
PRB	Powder River Basin
QALY	quality-adjusted life year

RCT	randomized controlled trial
RHS	Reproductive Health Survey
RTI	road traffic injury
SDGs	Sustainable Development Goals
SERC	State Electricity Regulatory Commission
SFU	solid fuel use
SLTS	School-Led Total Sanitation
SO_2	sulfur dioxide
SPA	Service Provision Assessment
STHs	soil-transmitted helminths
STIs	sexually transmitted infections
SV	Smokeless Village
swFGD	seawater flue-gas desulfurization
TSSM	Total Sanitation and Sanitation Marketing
UMICs	upper-middle-income countries
UN	United Nations
UNICEF	United Nations Children's Fund
UNRSC	United Nations Road Safety Collaboration
VSL	value per statistical life
WASH	water, sanitation, and hygiene
WASH-BAT	Water, Sanitation, and Hygiene-Bottleneck Analysis Tool
wFGD	wet limestone flue-gas desulfurization
WHO	World Health Organization
WTP	willingness to pay
YLDs	years lived with disability
YLLs	years of life lost