

VOLUME **6**

DISEASE CONTROL PRIORITIES • THIRD EDITION

# Major Infectious Diseases



# **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 throughout 2015–18 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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# Major Infectious Diseases

EDITORS

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## Foreword

Since the publication of the second edition of *Disease Control Priorities* in 2006, we have experienced some of the most substantial progress in infectious disease–caused mortality and morbidity. The number of annual deaths attributable to human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) declined 50 percent between 2004 and 2015, thanks to an unprecedented expansion of life-saving antiretroviral therapy to over 18 million people (UNAIDS 2016); since 2006, mother-to-child transmission of HIV has been reduced to low levels, even in generalized epidemic settings (AVERT 2017). Similarly, fewer children and adults die from malaria, diarrheal diseases, and lower respiratory infections. Two infectious diseases are close to eradication: polio and dracunculiasis (Guinea worm disease).

This third edition of the *Disease Control Priorities (DCP3)* comes at a pivotal moment for infectious disease control and research. Its chapters clearly demonstrate that, despite the remarkable progress, infectious diseases remain a major threat to health worldwide—particularly in South Asia and Sub-Saharan Africa—but that an increasing range of highly cost-effective interventions is available.

As this volume amply illustrates, innovations in the prevention, diagnosis, and treatment of infectious diseases have been impressive. They include preexposure prophylaxis (PrEP) to prevent HIV infection, new forms of computer-based education for clinicians to manage sexually transmitted infections, HPV vaccines to prevent cervical cancer, and a cure for hepatitis C. The new attention to viral hepatitis in this volume is most welcome, as greatly improved control is now technically feasible—although the history of tuberculosis illustrates that a cure alone is insufficient to bring a disease under control. Much of the progress is due to political and technical leadership, greatly increased funding,

and improved delivery of interventions through health systems and other sectors. Community engagement is the key to success in many cases; a community buy-in to very simple, non-technological prevention mechanisms was instrumental in the sharp decline in dracunculiasis cases, from 130,000 in 2000 to only 22 in 2015 and 0 cases at the time of writing in 2017. However, dogs, which act as alternative hosts for the worm, present a threat to total eradication and remind us of the importance of a “One Health” approach.

At the same time, several epidemics and new pathogens have emerged, including the swine flu (H1N1) pandemic; the Middle East Respiratory Syndrome (MERS); the largest Ebola outbreak ever known in the West African region where it had never caused an outbreak; and an epidemic of Zika and associated neurological disorders. In particular, the collective failure to respond to the Ebola outbreak in a timely and coordinated fashion before it spiraled out of control—infected over 28,000 people and causing over 11,000 deaths—was a wake-up call for the world. The disastrous impact of the Ebola epidemic prompted an urgent rethinking of how governments, nongovernmental organizations, and international organizations can better work to contain emerging disease threats in an increasingly interconnected world.

It is, however, noteworthy that almost as many people in the three Ebola-affected West African countries died from the disease’s disruption on increasing mortality from HIV/AIDS, tuberculosis, and malaria as from Ebola itself (Parpia and others 2016). These three diseases, as well as diarrheal diseases and lower respiratory infections, continue to exact a heavy burden, particularly in Sub-Saharan Africa, where infectious diseases remain the leading cause of death. In 2015, over 1.8 million people worldwide died from tuberculosis (including

0.4 million among people with HIV) (WHO 2017); 1.1 million people from AIDS (UNAIDS 2016); and an estimated 429,000 people died from malaria (WHO 2016). In spite of real achievements in improved access to HIV treatment, over 2 million new infections occur each year, with hardly any decline in new infections over the past five years, and several subpopulations continue to be heavily affected. A critical review of current HIV strategies may be needed to achieve the United Nations goals of ending the AIDS epidemic. Lower respiratory infections remain a major persistent cause of death in children.

Many of these infectious diseases have sophisticated vaccines, diagnostics, and therapeutics available, but political, economic, and social factors limit the extent to which populations can benefit. Furthermore, in a world of growing resistance to antimicrobials and drug-resistant infections, we need to continue to develop innovations in biomedicine. We also need to improve incentives for rational antibiotic use, antimicrobial stewardship, and increased acceptance of the importance of prevention to avoid infection.

The global health agenda is an increasingly crowded space, and the cost-effectiveness of interventions is under growing scrutiny. While there is more information than ever regarding the cost-effectiveness of different interventions in a growing spectrum of contexts, hard choices remain in terms of allocating scarce funding to infectious diseases, especially in light of the complexities of fragile health systems, comorbidities with other infections and NCDs, structural factors that can undermine disease prevention, and treatment programs. One particularly valuable facet of *DCP3* is that it demonstrates that some of the most effective steps we can take to reduce the burden of infections are not necessarily expensive, as exemplified by the low cost per disability-adjusted life year averted of condoms for female sex workers or insecticide-treated bednets. Often, the key is not just more, but smarter, investment, for example, better integration of services, strong community engagement, and targeted interventions based on the population most in need in specific locations. In addition to cost-effectiveness, key questions are

whether people will accept and use the interventions, whether the interventions are affordable and work in various parts of the real world, and what the best way is to deliver them.

If we are to reach the ambitious targets under the Sustainable Development Goals, we must focus not only on delivery of innovation but also on “innovation of delivery.” One example might be new systems of community-based treatment for tuberculosis to minimize transmission in health care settings. *DCP3* helps us to think about improving health care delivery models through its unique focus on packages of interventions, and on the interrelationships among different kinds of interventions, at both the policy level and in terms of the outcomes across populations.

*DCP3* is to be lauded for its focus on equity, recognizing that cost-effective intervention is not cost-effective if the financial burden falls on the poor. With this *DCP3* volume on major infectious diseases, we have a highly pragmatic addition to the literature that will help policy makers across the world make smarter decisions to improve health sustainably and equitably in the ongoing fight against infectious disease threats, old and new.

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## Abbreviations

ACTs	artemisinin-combination therapies
ADCs	AIDS-defining cancers
AEM	AIDS Epidemic Model
AIDS	acquired immune deficiency syndrome
AIM	AIDS Impact Model
ANC	antenatal clinic
ART	antiretroviral treatment
BCC	behavior change communication
CBT	community-based testing
CDC	Centers for Disease Control and Prevention (U.S.)
CHMI	controlled human malaria infection
CHW	community health worker
CI	confidence interval
CQ	chloroquine
CRP	C-reactive protein
CSF	cerebrospinal fluid
CVD	cardiovascular disease
DAA	direct-acting antiviral
DALYs	disability-adjusted life years
DBS	dried blood spots
<i>DCP2</i>	<i>Disease Control Priorities in Developing Countries</i> , second edition
<i>DCP3</i>	<i>Disease Control Priorities</i> (third edition)
DDT	dichloro-diphenyl-trichloroethane
DMPPT	Decision Makers' Program Planning Tool
EID	early infant diagnostic
ELISA	enzyme-linked immunosorbent assay
EMOD	Epidemiological Modeling
EMTCT	elimination of mother-to-child transmission
EPP	Epidemic Projection Package
FBC	facility-based care
FI	febrile illness
FSW	female sex worker

G6PD	glucose-6-phosphate dehydrogenase
GBD	Global Burden of Disease
GDP	gross domestic product
GHD	Global Health Decisions
GMAP	Global Malaria Action Plan
GMEP	Global Malaria Eradication Program
GRADE	Grading of Recommendations, Assessment, Development and Evaluation
GRNE	Global Resource Needs Estimates
GTS	Global Technical Strategy
HAI	health care-associated infections
HAT	Human African trypanosomiasis
HBC	home-based care
HBV	hepatitis B virus
HCC	hepatocellular carcinoma
HCV	hepatitis C virus
HDL	high-density lipoprotein cholesterol
HHV-8	human herpes virus 8
HICs	high-income countries
HIV/AIDS	human immunodeficiency virus/acquired immune deficiency syndrome
HIVAM	HIV-associated malignancies
HIV	human immunodeficiency virus
HPV	human papillomavirus
HRQL	health and health-related quality of life
HSV	herpes simplex virus
HTC	HIV testing and counseling
HTS	HIV/AIDS testing service
ICER	incremental cost-effectiveness ratio
IDU	injecting drug user
IMAI	Integrated Management of Adolescent and Adult Illness
IMCI	Integrated Management of Childhood Illness
IRS	indoor residual spraying
ITN	insecticide-treated net
IVM	integrated vector management
JEV	Japanese encephalitis virus
KS	Kaposi sarcoma
LDL	low-density lipoprotein cholesterol
LGBT	lesbian, gay, bisexual, and transgender
LICs	low-income countries
LLIN	long-lasting insecticide-treated nets
LMICs	low- and middle-income countries
LTFU	loss to follow-up
MCH	maternal and child health
MDA	mass drug administration
MDG	Millennium Development Goal
MDR-TB	multidrug-resistant tuberculosis
MMC	medical male circumcision
MERS	Middle East respiratory syndrome
MCC	mobile clinic care

MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
MSM	men who have sex with men
MTCT	mother-to-child transmission
NADCs	non–AIDS-defining cancer
NBS	National Bureau of Statistics
NCC	noncommunicable chronic comorbidities
NCDs	noncommunicable diseases
NECT	nifurtimox-eflornithine combination therapy
NHL	non-Hodgkin lymphoma
NNRTI	non-nucleoside reverse transcriptase inhibitors
NRTI	nucleoside reverse transcriptase inhibitors
NSP	needle and syringe program
NTDs	neglected tropical diseases
NT-NMFI	nontreatable nonmalaria febrile illness
OOP	out of pocket
PCR	polymerase chain reaction
PEPFAR	President’s Emergency Plan for AIDS Relief (United States)
PMI	President’s Malaria Initiative
PMTCT	prevention of mother-to-child transmission
POC	point-of-care
POCT	point-of-care test
PPT	periodic presumptive treatment
PrEP	preexposure prophylaxis
PROMISE	Promoting Maternal-Infant Survival Everywhere
QALY	quality-adjusted life year
RNM	Resource Needs Model
RBM	Roll Back Malaria (Partnership)
RPR	rapid plasma reagin
RCT	randomized controlled trial
RDTs	rapid diagnostic tests
SAC	school-age children
SARS	severe acute respiratory syndrome
SDG	Sustainable Development Goal
SMART	Strategies for Management of Antiretroviral Therapy
STDs	sexually transmitted diseases
SP	sulfadoxine/pyrimethamine
STIs	sexually transmitted infections
STH	soil-transmitted helminthiases
SW	sex workers
TasP	treatment as prevention
TB	tuberculosis
TCPs	target candidate profiles
T-NMFI	treatable nonmalaria febrile illness
UI	uncertainty interval
UNAIDS	Joint United Nations Programme on HIV/AIDS
UN	United Nations

VCT	voluntary counseling and testing
VIMT	vaccines that interrupt malaria transmission
VMMC	voluntary male medical circumcision
WHO	World Health Organization
WWR	What Works Reviews
YLDs	years lived with disability
YLLs	years of life lost