VOLUME 3

DISEASE CONTROL PRIORITIES • THIRD EDITION

Cancer

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Series Editors

Dean T. Jamison
Rachel Nugent
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Ramanan Laxminarayan

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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 and 2016 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 the External and Corporate Relations Publishing and Knowledge division of the World Bank. Each played a critical role in this effort.

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Contents

Foreword

When the biopsy results confirmed that I had oral cancer, I was 18 years old. If it sounded like a death sentence, there was reason for that thought. Survival rates from cancer were very low in those days, especially in the poorer countries in the world (I was then a student in Calcutta), and statistics offered very little reason for cheer. Now, at the age of 81, I can not only celebrate the fact that I made it, with help from heavy-dose radiation, but also that the battle against cancer in the world is increasingly being won.

However, the victory is not only partial, it is also deeply uneven. With early diagnosis and effective treatment, almost two-thirds of the people who get cancer in high-income countries now survive. In low- and middle-income countries, only half of that proportion—no more than one-third—make it.

This wonderfully illuminating book tells us about the state of the battle against cancer, but it also takes on the challenge of making lives better—and longer—particularly in the poorer countries of the world. As the chapters in this state-of-the-art book on cancer show, with extensive data and probing analyses, both mortality and suffering from cancer can be dramatically reduced, even in the less affluent countries, through a combination of *preventive measures* (of which tobacco control is the most well-known and frustratingly underused avenue), *early diagnosis* (distressingly low for cancers in which early detection is not difficult to achieve and would make a major difference, such as oral, cervical, and breast cancer as well as the cancers that afflict children), and of course *early treatment* (including well-established procedures as well as newly developed methods).

The lesson that emerges from the well-aimed empirical analyses presented in this volume is not only that a major difference can be made in the incidence, management, and elimination of cancer, even in the poorer countries of the world, but that this can be done in cost-effective and affordable ways. Understanding and determination are the deficiencies most in need of change.

This is, ultimately, a cheerful book on a very grim subject. It is also a hugely important invitation to action.

Amartya Sen
Thomas W. Lamont University Professor
Harvard University
Cambridge, Massachusetts
Nobel Laureate, Economic Sciences 1998

Preface

The burden of cancer in low- and middle-income countries (LMICs) is large and growing. By contrast, resources to control cancer in LMICs, either from domestic budgets or international aid, have not increased proportionately. Most populations in LMICs lack access to effective cancer prevention, treatment, and palliation. This volume, *Cancer*, part of the 3rd edition of *Disease Control Priorities*, provides an up-to-date review of the effectiveness, cost-effectiveness, cost, and feasibility of interventions for cancers that impose high disease burdens in LMICs.

We propose an "essential package" of feasible interventions that countries can use in cancer planning, knowing that some countries are well along in providing many of the elements. We recognize that the essential cancer package may not be immediately feasible in low-income countries and only partially so in many middle-income countries. The package is not intended to limit cancer control to these measures, but we are suggesting that these measures are likely to save large numbers of lives at an affordable cost and should be prioritized by the public sector before large investments are made in interventions that will have more limited effects. Local cancer patterns and resource availability may dictate somewhat different priorities, and these should also guide national cancer planning.

Smoking cessation reduces the risks of developing various cancers reasonably quickly, but other preventive measures, such as vaccinations against cervical or liver cancer, will take longer to manifest full effects. Many types of cancer, which are not currently preventable, will remain. Thus, the best approach to lowering the cancer burden is a system that promotes prevention as well as early detection and treatment. This volume provides evidence that policy makers at all levels can use to support the immediate ramp-up of cancer control interventions that will have near-term and long-range benefits.

Serious progress in cancer prevention and treatment began about half a century ago in high-income countries. The knowledge that has fueled progress is available immediately for LMICs. In some cases, newer and better technologies are now available: HPV testing can replace the more resource- and infrastructure-intensive Pap smear for cervical cancer screening. Newer screening tests for colon cancer have similar advantages. Increasing national incomes and broader national health coverage in middle-income countries, in particular, have already made a range of services available to a wider swath of the population. The pace needs to be accelerated and efforts can be broadened in low-income countries, where numbers of deaths from cancer are still relatively low, but increasing.

Regarding tobacco—still the single most important cancer-causing agent the world over—LMICs have the knowledge to avert the epidemic that has now begun to subside in high-income countries. At the same time, LMICs are underequipped to combat the tactics of multinational tobacco companies. In a few cases, national treasuries profit from state-owned tobacco companies.

Certain neglected areas are of special concern. Progress is all but nonexistent in providing adequate pain control and palliative care, even in middle-income countries. Limited progress has been made in cancer registration and cause of death reporting. Very little progress is evident in documenting the costs and cost-effectiveness of interventions in LMICs for even the highest-burden cancers. And very few clinical trials in cancer take place in LMICs. As a result, much of the evidence included in this volume is from high-income countries, which we and our many co-authors have reinterpreted as realistically as possible for LMICs.

We thank our dozens of co-authors for working tirelessly, responding to several reviews, and producing evidence that can be understood and acted on. We also give our thanks to the Cancer Surveillance Section of the International Agency for Research on Cancer for the custom maps and graphs in the volume and to the National Cancer Institute, particularly the Center for Global Health, for supporting the work in many ways. The Bill & Melinda Gates Foundation's core support for *DCP3*, through the University of Washington, has made the whole enterprise possible. Others in the process also deserve our thanks: the Institute of Medicine for coordinating critical reviews and the World Bank publishing staff for their wholehearted collaboration. Sir George Alleyne, Dr. Christopher Wild, and Sir Richard Peto acted as special advisors for the volume, providing guidance and wise counsel.

Cindy Gauvreau coordinated all aspects of the volume production, including chapter content and consistency. She vastly improved the quality of the volume that you see, and we are grateful for her many contributions. Many more individuals provided thoughtful comments, guidance, and encouragement; we thank them all.

The tide has been turned against cancer in high-income countries and can be in the rest of the world, armed with evidence and bolstered by political resolve. This volume is intended to spur that effort.

Hellen Gelband
Prabhat Jha
Rengaswamy Sankaranarayanan
Susan Horton

Abbreviations

ADA	American Dental Association
ADR	adenoma detection rate
ALDH	aldehyde dehydrogenase
AML	acute myeloid leukemia
APL	acute promyelocytic leukemia
ASIR	age-specific incidence rate
BCS	breast-conserving surgery
BHGI	Breast Health Global Initiative
BL	Burkitt lymphoma
BMI	body mass index
BSE	breast self-examination
CBC	complete blood count
CBE	clinical breast examination
CEA	cost-effectiveness analysis
CI	confidence interval
CIN	cervical intraepithelial neoplasia
CISNET	Cancer Intervention and Surveillance Modeling Network
CME	continuing medical education
CMF	cyclophosphamide, methotrexate, and 5-fluorouracil
CRC	colorectal cancer
CT	computed tomography
CTC	computed tomographic colonography
CVG	cost per vaccinated girl
DALY	disability-adjusted life year
DCIS	ductal carcinoma in situ
ECEA	extended cost-effectiveness analysis
EDP	early detection and prevention
EPI	Expanded Program for Immunization
ER	estrogen receptor
FAC	5-fluorouracil, doxorubicin (®Adriamycin), and cyclophosphamide
FAP	familial adenomatous polyposis
FCTC	Framework Convention on Tobacco Control
FIT	fecal immunochemical test
FS	flexible sigmoidoscopy
Gavi	Gavi, the Vaccine Alliance
GDP	gross domestic product

gFOBT	guaiac fecal occult blood test
GICR	Global Initiative for Cancer Registry Development
GNI	gross national income
GOPI	Global Opioid Policy Initiative
GTFRCC	Global Task Force on Radiotherapy for Cancer Control
HAU	Hospice Africa Uganda
HBsAg	hepatitis B surface antigen
HBV	hepatitis B virus
HCC	hepatocellular carcinoma
HCV	hepatitis C virus
HDI	Human Development Index
HDV	hepatitis D virus
Hib	*Haemophilus influenzae* type B
HICs	high-income countries
HIV	human immunodeficiency virus
HL	Hodgkin lymphoma
HPV	human papillomavirus
HR	high-risk
HSIL	high grade squamous intraepithelial lesion
IAEA	International Atomic Energy Agency
IAHPC	International Association for Hospice and Palliative Care
IARC	International Agency for Research on Cancer
ICD	International Classification of Diseases
ICER	incremental cost-effectiveness ratio
ICRCSN	International Colorectal Cancer Screening Network
IHC	immunohistochemistry
IMRT	intensity modulated radiation therapy
INCB	International Narcotics Control Board
IT	information technology
JCI	Joint Commission International
LEEP	loop electrosurgical excision procedure
LICs	low-income countries
LLETZ	large loop excision of the transformation zone
LMICs	low- and middle-income countries
LR	low-risk
LYS	life-years saved
MICs	middle-income countries
MISCAN	microsimulation screening analysis
MMG	mammography
MRI	magnetic resonance imaging
MRM	modified radical mastectomy
NAFD	non-alcoholic fatty liver disease
NCCN	National Comprehensive Cancer Network
NCD	noncommunicable disease
NCI	National Cancer Institute
NIAAA	National Institute of Alcohol Abuse and Alcoholism
NWTS	National Wilms Tumor Study
OECD	Organisation for Economic Co-operation and Development
OSMF	oral submucous fibrosis
PAF	population attributable fraction
PAHO	Pan American Health Organization
PBCR	population-based cancer registry
PET	positron emission tomography

PODC	Pediatric Oncology in Developing Countries
PPP	purchasing power parity
PSA	prostate-specific antigen
QALY	quality-adjusted life-year
RCC	regional cancer center
RCT	randomized controlled trial
RT	radiotherapy
SEER	Surveillance, Epidemiology, and End Results
SES	socioeconomic status
SIL	squamous intraepithelial lesion
SLN	sentinel lymph node
SPS	Seguro Popular de Salud
SSP	sessile serrated polyp
TLS	tumor lysis syndrome
TNM	tumor, nodes, metastasis
TRM	treatment-related mortality
UCI	Uganda Cancer Institute
UHC	universal health coverage
UICC	Union for International Cancer Control
UMIC	upper-middle-income country
UNOP	Unidad Nacional de Oncologia Pediátrica
US	ultrasound
USMSTF	U.S. Multi-Society Task Force on Colorectal Cancer/American Cancer Society
USPSTF	U.S. Preventive Services Task Force
VAD	vascular access device
VIA	visual inspection with acetic acid
VIAM	magnified visual inspection with acetic acid
VLP	virus-like particles
VSL	value of statistical life
WBC	white blood cell
WHO	World Health Organization
WTO	World Trade Organization
YLL	years of life lost