Cancer
DISEASE CONTROL PRIORITIES • THIRD EDITION

Series Editors
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Disease Control Priorities: Improving Health and Reducing Poverty
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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Cancer

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

**Abbreviations**