

## Child and Adolescent Health and Development



EDITORS

Donald A. P. Bundy Nilanthi de Silva Susan Horton Dean T. Jamison George C. Patton

WITH A FOREWORD BY Gordon Brown



# Child and Adolescent Health and Development

#### **Series Editors**

Dean T. Jamison Rachel Nugent Hellen Gelband Susan Horton Prabhat Jha Ramanan Laxminarayan Charles N. Mock

#### **Volumes in the Series**

Essential Surgery Reproductive, Maternal, Newborn, and Child Health Cancer Mental, Neurological, and Substance Use Disorders Cardiovascular, Respiratory, and Related Disorders Major Infectious Diseases Injury Prevention and Environmental Health Child and Adolescent Health and Development 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 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 National Academies of Science, Engineering, and Medicine), and to the External and Corporate Relations Publishing and Knowledge division of the World Bank. Each played a critical role in this effort.

Dean T. Jamison Rachel Nugent Hellen Gelband Susan Horton Prabhat Jha Ramanan Laxminarayan Charles N. Mock



## Child and Adolescent Health and Development

#### EDITORS

Donald A. P. Bundy Nilanthi de Silva Susan Horton Dean T. Jamison George C. Patton



© 2017 International Bank for Reconstruction and Development / The World Bank 1818 H Street NW, Washington, DC 20433 Telephone: 202-473-1000; Internet: www.worldbank.org

Some rights reserved 1 2 3 4 20 19 18 17

This work is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Nothing herein shall constitute or be considered to be a limitation upon or waiver of the privileges and immunities of The World Bank, all of which are specifically reserved.

#### **Rights and Permissions**



This work is available under the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO) http://creativecommons.org/licenses/by/3.0/igo. Under the Creative Commons Attribution license, you are free to copy, distribute, transmit, and adapt this work, including for commercial purposes, under the following conditions:

Attribution—Please cite the work as follows: Bundy, D. A. P., N. de Silva, S. Horton, D. T. Jamison, and G. C. Patton, editors. 2017. *Child and Adolescent Health and Development. Disease Control Priorities* (third edition), Volume 8. Washington, DC: World Bank. doi:10.1596/978-1-4648-0423-6 License: Creative Commons Attribution CC BY 3.0 IGO

Translations—If you create a translation of this work, please add the following disclaimer along with the attribution: This translation was not created by The World Bank and should not be considered an official World Bank translation. The World Bank shall not be liable for any content or error in this translation.

Adaptations—If you create an adaptation of this work, please add the following disclaimer along with the attribution: This is an adaptation of an original work by The World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by The World Bank.

Third-party content—The World Bank does not necessarily own each component of the content contained within the work. The World Bank therefore does not warrant that the use of any third-party-owned individual component or part contained in the work will not infringe on the rights of those third parties. The risk of claims resulting from such infringement rests solely with you. If you wish to reuse a component of the work, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright owner. Examples of components can include, but are not limited to, tables, figures, or images.

All queries on rights and licenses should be addressed to World Bank Publications, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2625; e-mail: pubrights@worldbank.org.

 Softcover:
 Hardcover:

 ISBN: 978-1-4648-0423-6
 ISBN: 978-1-4648-0517-2

 ISBN (electronic): 978-1-4648-0439-7
 DOI: 10.1596/978-1-4648-0517-2

Cover photo: © John Hogg/World Bank. Used with the permission of John Hogg/World Bank. Further permission required for reuse. © Cover and interior design: Debra Naylor, Naylor Design, Washington, DC

#### Chapter opener photos:

Chapter 1: © Greatstock/Alamy Stock Photo. Used with permission. Further permission required for reuse; chapter 2: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 3: © Greatstock/Alamy Stock Photo. Used with permission. Further permission required for reuse; chapter 4: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 5: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 6: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 7: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 9: © Scott Wallace/World Bank. Further permission required for reuse; chapter 9: © Scott Wallace/World Bank. Further permission required for reuse; chapter 10: © Greatstock/Alamy Stock Photo. Used with permission. Further permission required for reuse; chapter 11: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 12: © Frank Spangler/Worldview Images, Used with the permission of Worldview Images, Further permission required for reuse; chapter 13: © Simone D. McCourtie/World Bank, Further permission required for reuse; chapter 14: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 15: © Greatstock/Alamy Stock Photo. Used with permission. Further permission required for reuse; chapter 16: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 17: © Simone D. McCourtie/World Bank. Further permission required for reuse; chapter 18: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 19: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 20: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 21: © Scott Wallace/World Bank. Further permission required for reuse; chapter 22: © Simone D. McCourtie/World Bank. Further permission required for reuse; chapter 23: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 24: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 25: © Simone D. McCourtie/World Bank. Further permission required for reuse; chapter 26: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 27: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 28: © Scott Wallace/World Bank. Further permission required for reuse; chapter 29: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse; chapter 30: © Frank Spangler/Worldview Images. Used with the permission of Worldview Images. Further permission required for reuse.

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

## **Contents**

Foreword xiii Preface xv Abbreviations xvii

 Image: Child and Adolescent Health and Development: Realizing Neglected Potential
 1

 Donald A. P. Bundy, Nilanthi de Silva, Susan Horton, George C. Patton, Linda Schultz, and Dean T. Jamison
 1

#### PART 1 ESTIMATES OF MORTALITY AND MORBIDITY IN CHILDREN (AGES 5-19 YEARS)

- 2. Mortality at Ages 5 to 19: Levels and Trends, 1990–2010
   25

   Kenneth Hill, Linnea Zimmerman, and Dean T. Jamison
   25
- **3. Global Nutrition Outcomes at Ages 5 to 19 37** *Rae Galloway*
- 4. Global Variation in Education Outcomes at Ages 5 to 19 47 Kin Bing Wu
- Global Measures of Health Risks and Disease Burden in Adolescents
   George C. Patton, Peter Azzopardi, Elissa Kennedy, Carolyn Coffey, and Ali Mokdad

#### PART 2 IMPACT OF INTERVENTIONS DURING THE LIFE COURSE (AGES 5–19 YEARS)

6. Impact of Interventions on Health and Development during Childhood and Adolescence: A Conceptual Framework 73

Donald A. P. Bundy and Susan Horton

7. Evidence of Impact of Interventions on Growth and Development during Early and Middle Childhood 79

Harold Alderman, Jere R. Behrman, Paul Glewwe, Lia Fernald, and Susan Walker

#### 8. Evidence of Impact of Interventions on Health and Development during Middle Childhood and School Age 99

Kristie L. Watkins, Donald A. P. Bundy, Dean T. Jamison, Günther Fink, and Andreas Georgiadis

- **9. Puberty, Developmental Processes, and Health Interventions 107** *Russell M. Viner, Nicholas B. Allen, and George C. Patton*
- **10.** Brain Development: The Effect of Interventions on Children and Adolescents
   119

   Elena L. Grigorenko
   119

#### PART 3 CONDITIONS AND INTERVENTIONS

- **11.** Nutrition in Middle Childhood and Adolescence
   133

   Zohra Lassi, Anoosh Moin, and Zulfiqar Bhutta
   133
- School Feeding Programs in Middle Childhood and Adolescence
   147

   Lesley Drake, Meena Fernandes, Elisabetta Aurino, Josephine Kiamba, Boitshepo Giyose, Carmen Burbano, Harold Alderman, Lu Mai, Arlene Mitchell, and Aulo Gelli
- 13. Mass Deworming Programs in Middle Childhood and Adolescence 165

Donald A. P. Bundy, Laura J. Appleby, Mark Bradley, Kevin Croke, T. Deirdre Hollingsworth, Rachel Pullan, Hugo C. Turner, and Nilanthi de Silva

#### 14. Malaria in Middle Childhood and Adolescence 183

Simon J. Brooker, Sian Clarke, Deepika Fernando, Caroline W. Gitonga, Joaniter Nankabirwa, David Schellenberg, and Brian Greenwood

 15. School-Based Delivery of Vaccines to 5- to 19-Year Olds
 199

D. Scott LaMontagne, Tania Cernuschi, Ahmadu Yakubu, Paul Bloem, Deborah Watson-Jones, and Jane J. Kim

- **16.** Promoting Oral Health through Programs in Middle Childhood and Adolescence
   211

   Habib Benzian, Renu Garg, Bella Monse, Nicole Stauf, and Benoit Varenne
   211
- **17.** Disability in Middle Childhood and Adolescence
   221

   Natasha Graham, Linda Schultz, Sophie Mitra, and Daniel Mont
- **18. Health and Disease in Adolescence 239** Nicola Reavley, George C. Patton, Susan M. Sawyer, Elissa Kennedy, and Peter Azzopardi
- PART 4 PACKAGES AND PLATFORMS TO PROMOTE CHILD AND ADOLESCENT DEVELOPMENT
- **19.** Platforms to Reach Children in Early Childhood
   253

   Maureen M. Black, Amber Gove, and Katherine A. Merseth

#### 20. The School as a Platform for Addressing Health in Middle Childhood and Adolescence 269

Donald A. P. Bundy, Linda Schultz, Bachir Sarr, Louise Banham, Peter Colenso, and Lesley Drake

#### 21. Platforms for Delivering Adolescent Health Actions 287

Susan M. Sawyer, Nicola Reavley, Chris Bonell, and George C. Patton

#### 22. Getting to Education Outcomes: Reviewing Evidence from Health and Education Interventions 307

Daniel Plaut, Milan Thomas, Tara Hill, Jordan Worthington, Meena Fernandes, and Nicholas Burnett

#### 23. Cash Transfers and Child and Adolescent Development 325

Damien de Walque, Lia Fernald, Paul Gertler, Melissa Hidrobo

#### PART 5 THE ECONOMICS OF CHILD DEVELOPMENT

24. Identifying an Essential Package for Early Child Development: Economic Analysis 343

Susan Horton and Maureen M. Black

#### 25. Identifying an Essential Package for School-Age Child Health: Economic Analysis 355

Meena Fernandes and Elisabetta Aurino

#### 26. Identifying an Essential Package for Adolescent Health: Economic Analysis 369

Susan Horton, Elia De la Cruz Toledo, Jacqueline Mahon, John Santelli, and Jane Waldfogel

#### 27. The Human Capital and Productivity Benefits of Early Childhood Nutritional Interventions 385

Arindam Nandi, Jere R. Behrman, Sonia Bhalotra, Anil B. Deolalikar, and Ramanan Laxminarayan

#### 28. Postponing Adolescent Parity in Developing Countries through Education: An Extended Cost-Effectiveness Analysis 403

*Stéphane Verguet, Arindam Nandi, Véronique Filippi, and Donald A. P. Bundy* 

#### 29. Economics of Mass Deworming Programs 413

Amrita Ahuja, Sarah Baird, Joan Hamory Hicks, Michael Kremer, and Edward Miguel