Country-Level Decision Making for Control of Chronic Diseases: Workshop Summary

ISBN
978-0-309-25272-0

122 pages
6 x 9
PAPERBACK (2012)

Alexandra Beatty, Rapporteur; Board on Global Health; Institute of Medicine

COUNTRY-LEVEL DECISION MAKING FOR CONTROL OF CHRONIC DISEASES

Workshop Summary

Alexandra Beatty, *Rapporteur*

Board on Global Health

INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

THE NATIONAL ACADEMIES PRESS
Washington, D.C.
www.nap.edu

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, NW Washington, DC 20001

This project was supported by funds from private donors. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the individuals or organizations that provided support for this project.

International Standard Book Number-13: 978-0-309-25272-0
International Standard Book Number-10: 0-309-25272-5

Additional copies of this report are available from the National Academies Press, 500 Fifth Street, NW, Keck 360, Washington, DC 20001; (800) 624-6242 or (202) 334-3313; http://www.nap.edu.

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Printed in the United States of America

The serpent has been a symbol of long life, healing, and knowledge among almost all cultures and religions since the beginning of recorded history. The serpent adopted as a logotype by the Institute of Medicine is a relief carving from ancient Greece, now held by the Staatliche Museen in Berlin.

Suggested citation: IOM (Institute of Medicine). 2012. *Country-Level Decision Making for Control of Chronic Diseases: Workshop Summary.* Washington, DC: The National Academies Press.

"Knowing is not enough; we must apply.
Willing is not enough; we must do."
—Goethe

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PLANNING COMMITTEE FOR A WORKSHOP ON DEFINING COUNTRY-LEVEL RESOURCE NEEDS FOR CARDIOVASCULAR DISEASE AND RELATED CHRONIC DISEASES[1]

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[1] Institute of Medicine planning committees are solely responsible for organizing the workshop, identifying topics, and choosing speakers. The responsibility for the published workshop summary rests with the workshop rapporteur and the institution.

Reviewers

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the process. We wish to thank the following individuals for their review of this report:

Amanda Glassman, Center for Global Development
Paul Holmes, USAID
J. Jaime Miranda, Universidad Peruana Cayetano Heredia, Peru
Rachel Nugent, University of Washington
Theo Vos, University of Queensland, Australia

Although the reviewers listed above have provided many constructive comments and suggestions, they did not see the final draft of the report before its release. The review of this report was overseen by **David R. Challoner,** Emeritus, University of Florida. Appointed by the Institute of Medicine, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the rapporteur and the institution.

Acknowledgments

The planning committee and project staff are deeply appreciative of the many valuable contributions from those who assisted us with this project. We offer our profound thanks to the presenters and discussants at the workshop, who gave so generously of their time and expertise. These individuals are listed in full in Appendix A. We are also grateful to the many participants who attended the workshop both in person and via the live webcast. The robust engagement of everyone in attendance was vital to the success of the event.

During the planning of the workshop, we benefited enormously from input from Dan Chisholm, Tom Gaziano, Amanda Glassman, Louis Niessen, and Theo Vos, as well as from representatives of the UnitedHealth/National Heart, Lung, and Blood Institute Centers of Excellence, who provided valuable perspectives, feedback, and suggestions when they very graciously included us in their April 2011 meeting.

A number of individuals contributed to the administrative and logistical success of this project. For their patience and assistance facilitating scheduling and communication with the planning committee, we are grateful to Julia Addae-Mintah, Derek Cutler, Josie Kummer, and Jennifer Tsai. In addition, we extend many thanks to Anthony Mavrogiannis and the staff at Kentlands Travel for supporting the travel needs and requirements of this project. We thank Cornelia Lluberes for her help with logistics at the workshop during her summer internship. We also convey our gratitude for the hard work of the many other staff of the Institute of Medicine and the National Academies who supported the project at every stage. In particular, we greatly appreciate the work of Kathleen C. Ostapkovich, who assisted

with various aspects of the workshop during her time as a summer Research Associate.

Finally, we are grateful for the tremendous generosity of the individual donors who made this workshop possible through their contributions to a fund that supports dissemination and follow-up activities for the 2010 Institute of Medicine report, *Promoting Cardiovascular Health in the Developing World*.

Contents

Acronyms

BMI	body mass index
CDC	U.S. Centers for Disease Control and Prevention
DALY	disability-adjusted life year
EVIDEM	Evidence and Value: Impact on Decision Making
GDP	gross domestic product
HIV/AIDS	human immunodeficiency virus/acquired immune deficiency syndrome
INDEPTH	International Network for the Demographic Evaluation of Populations and Their Health in Developing Countries
LiST	Lives Saved Tool
MCDA	multi-criteria decision analysis
NCD	noncommunicable disease
NGO	nongovernmental organization
NHLBI	National Heart, Lung, and Blood Institute

UN	United Nations
UNFPA	United Nations Population Fund
USAID	U.S. Agency for International Development
WHO	World Health Organization
WHO-CHOICE	CHOosing Interventions that are Cost Effective (WHO)
WHO-STEPS	STEPwise approach to Surveillance (WHO)

1

Introduction[1]

There is growing recognition that chronic diseases represent a major health threat in low- and middle-income countries, accompanied by significant economic consequences. Yet most governments, global health institutions, and development agencies have largely overlooked chronic diseases when investing in health in developing countries (IOM, 2010). These countries have limited resources and many competing demands, from basic development priorities to a range of important health needs. However, despite these challenges, a recent Institute of Medicine report, *Promoting Cardiovascular Health in the Developing World* (2010), concluded that not only is it possible to reduce the burden of cardiovascular and related chronic diseases in developing countries but such a reduction will be critical to achieving global health and development goals. To reduce the burden of chronic diseases in these countries, the report concluded that it will be necessary to

- improve local data and mechanisms for monitoring and evaluation;
- build knowledge of effective, affordable, and feasible interventions and programs as well as how to implement these interventions and programs in the settings where they are needed;

[1]This report has been prepared by the workshop rapporteur, with the assistance of the project staff, as a factual summary of what occurred at the workshop. The planning committee's role was limited to planning and convening the workshop. The views contained in the report are those of individual workshop participants and do not necessarily represent the views of all workshop participants, the planning committee, or the Institute of Medicine.

- align the effort with local characteristics and needs, such as disease burden, priorities, capacity, and resources;
- recognize the realities of resource constraints and competing priorities that require difficult choices;
- set clear, measurable goals;
- build successful collaborations within and beyond the health sector;
- integrate efforts across chronic diseases with common risk factors; and
- integrate efforts with existing health and development priorities.

The authoring committee for that report recognized that a key next step would be to identify practical ways to assist low- and middle-income countries in taking the most appropriate actions for improved control of chronic diseases through approaches that are driven by a country's circumstances and led by a country's key decision makers and stakeholders.

As part of a series of follow-up activities related to the 2010 report, the Institute of Medicine convened a committee of experts who were charged with advising the planning of a workshop exploring the recommendation to establish a framework to assess "the future financial and other resource needs . . . to prevent and reduce the burden of CVD [cardiovascular disease] and related chronic diseases" (IOM, 2010, p. 336). The workshop planning committee chose to explore the process of assessing resource needs and planning resource allocation as part of a broader process of planning, priority setting, and decision making to support chronic disease control through locally-driven approaches that are aligned with local realities. Thus, the workshop built on two key messages from the 2010 report. First, it is critical for countries to use evidence and ongoing monitoring to inform decision making and to plan for implementation of chronic disease programs. Second, to achieve this, countries need evidence that is relevant to local circumstances, including the ability to define resource requirements that reflect real costs at the country level.

The resulting workshop on decision making and planning for control of chronic diseases at the country level was held in July 2011. The workshop's primary goal, planning committee chair Rachel Nugent explained in her introductory remarks, was to identify what tools could serve to support country-led planning for effective, efficient, and equitable chronic disease control programs.

As Nugent noted, the 2010 report offered a model of the decision-making and planning process (Figure 1-1). The model is idealized, she said, but it does reflect a complex process that already takes place. "Policymakers and the public are constantly asking these kinds of questions."

The planning committee intended the workshop to help identify ways in which tools can be most useful to countries as they build on what they

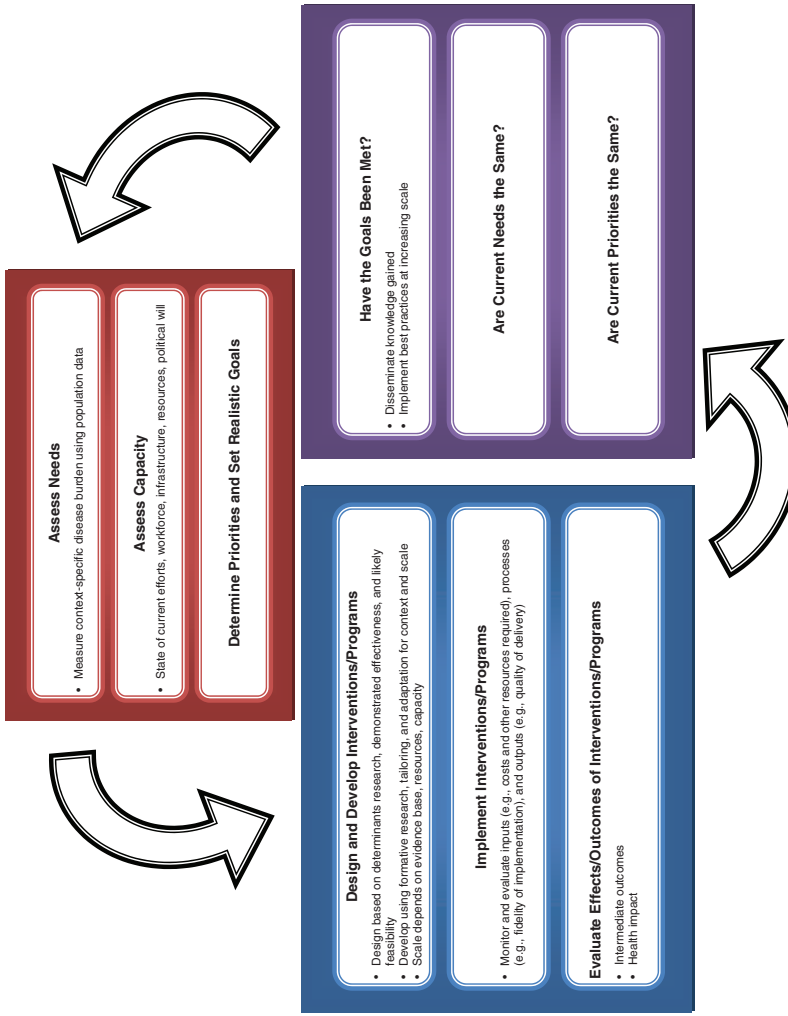

FIGURE 1-1 Measurement-based decision making cycle.
SOURCE: IOM (2010).

are already doing. Many countries are already taking steps, Nugent said, "but there is much more to do in many places." She added that the planning committee also hoped that the discussions would reflect the fact that priority setting is "not simply a technical matter . . . but also a political matter." While the workshop was not intended to produce a finished product, Nugent noted, the committee hoped that it would help advance the conversation about key components that need to be incorporated in a process of decision making, planning, and resource prioritization, including

- assessment of baseline status and progress over time related to chronic disease control;
- a priority-setting process to incorporate country-specific objectives and values;
- the synthesis and analysis of the best available global and country-specific evidence to guide priorities and choices for resource investment; and
- communications strategies aimed at policy makers and other key stakeholders.

The workshop included two main groups of presentations. In the first, representatives from six economically, demographically, and geographically diverse countries described their experiences, progress, and lessons learned in planning and implementing chronic disease control efforts at the country level, including the availability and gaps in useful, country-level data. The second consisted of examples of tools, models, and methods to inform possible components of a toolkit that could support countries in their decision making related to chronic diseases. The full workshop agenda can be found in Appendix A.

The workshop was attended by policy makers; clinical, public health, and policy experts; economists; and public- and private-sector leaders from a range of countries and institutions. Time for discussion was a focus of the workshop, and those in attendance participated in a robust series of conversations along with the workshop presenters and panelists. This report describes the presentations from the workshop and the main themes that emerged from the discussions that took place. Unfortunately, it is not feasible in this report to capture all views and comments contributed by the discussants and participants nor the full depth of the discourse over the 3 days of the workshop.

Chapter 2 provides an overview of perspectives from six countries on progress they have already made, how decisions for health have been made, lessons learned, and the needs going forward. Chapter 3 provides a closer look at available data and gaps in four countries. Chapter 4 discusses approaches to costing, economic modeling, and setting priorities in

a climate of limited resources. Chapter 5 discusses promising ways that international partners can support low- and middle-income countries and how the experiences and efforts of select stakeholders relate to the goals of a toolkit for country-level planning. The final chapter draws together themes from the presentations and discussions throughout the workshop, focusing on the considerations that could be most useful in the development and implementation of a toolkit to support country-level planning for control of chronic diseases.

2

Progress, Needs, and Lessons Learned: Perspectives from Six Countries

In setting the context for the workshop discussions, Peter Lamptey noted that of the 57 million deaths that occurred worldwide in 2008, 63 percent, or roughly 36 million, were caused by noncommunicable diseases. Of the 63 percent of deaths caused by noncommunicable diseases, 48 percent (or 30 percent of all deaths) were caused by cardiovascular disease, 21 percent (13 percent of all deaths) by cancer, and 12 percent (7 percent of all deaths) by chronic respiratory disease and diabetes (Alwan et al., 2011). These are the "big four," he said, and several common risk factors are principally responsible for the disease burden from these four. Tobacco use is by far the most devastating contributor. The World Health Organization (WHO) estimates that approximately 6 million people die from tobacco- or second-hand smoke–related diseases each year. Smoking is estimated to cause 71 percent of lung cancer cases, 42 percent of chronic respiratory disease, and 10 percent of cardiovascular disease (Alwan et al., 2011). Insufficient physical activity, unhealthy diets, and alcohol overconsumption are other prominent risk factors that contribute to a large portion of the global chronic disease burden globally (Alwan et al., 2011). The WHO has set targets for reducing tobacco use and alcohol consumption and improving diets as well as lowering blood pressure and slowing the increase in obesity, which by itself contributes to at least 2.8 million deaths per year (Alwan et al., 2011).

In addition to these major categories of chronic disease and major risk factors, Lamptey said that many countries also have a high burden of other chronic conditions, including mental health problems, the effects of injuries, sickle cell disease, and renal disease, as well as infections such as

human papillomavirus, hepatitis, and helicobacter pylori that contribute to chronic disease.

Global statistics provide a window into the magnitude of the chronic disease burden worldwide, but do not reflect variations that exist across countries—especially low- and middle-income counties. Therefore, the opening session of the workshop provided an opportunity to explore the distinct conditions and capacities of six countries—Grenada, Kenya, Bangladesh, Rwanda, India (from the subnational perspective of the state of Kerala), and Chile. These economically, geographically, and demographically diverse countries illustrated the significant variations that can exist regarding the contributions of particular diseases to national chronic disease burdens, how chronic diseases fit in with other health issues, the challenges that countries face when attempting to address chronic diseases, and the degree to which countries have or are able to address these challenges. The exploration of the progress and challenges in these countries' chronic disease efforts provided a jumping-off point to discuss the importance of local context when considering tools that might be useful to inform country-level decision making to address chronic diseases.

Dr. Lamptey explained that presenters from each of the countries were asked to describe the current national disease burden along with such relevant factors as policies, the health infrastructure, and information management systems. They were also asked to describe existing chronic disease control programs, the role of civil society, and public–private partnerships, with the goal of helping to highlight gaps in disease control efforts and opportunities for improvement.

Lamptey identified a number of specific questions for discussion:

- Why has the public health community taken so long to move past the myth that chronic diseases are primarily problems in the industrialized world and how can the community make sure the myth no longer impedes policy or funding for combating these diseases in developing nations?
- Why has the demand for action on chronic diseases—from donors, international institutions, national governments, and communities—been so muted?
- How can the public health community better combat the myth that chronic diseases are difficult to prevent and expensive to treat?
- What has prompted some countries to take significant action on these diseases and what lessons do these countries offer?
- The WHO has proposed that the state of a country's health services be used as a gauge of its ability to respond to chronic diseases. In some countries, HIV funding has helped to strengthen health systems in many ways, but it has neglected other elements of it. For

example, in one HIV clinic in Zambia, the staff do not routinely measure blood pressure. In one regional hospital in Ghana, the laboratory is state of the art, while the emergency room is "18th century." How can this be rectified so that health systems can adequately address chronic diseases?

GRENADA

The government of Grenada views health as a basic human right as well as a vehicle for economic growth and social development, as Dr. Francis Martin, director of primary health care for the Ministry of Health in Granada, explained. The health care system in Grenada emphasizes primary prevention, health education, and promotion, he said, and it strives to provide health care that is appropriate, accessible, and sustainable, since Grenada is a small island with a fragile ecosystem. In answer to a question, he said that, "by and large, Grenada practices socialized health care," in the sense that any individual can receive basic treatment at no cost. There is also private health insurance available, and individuals with resources may elect to pay for additional care in the private sector.

Hospital data are the primary source of information about disease in Grenada, Martin said, because the nation does not currently have the capacity to collect other sorts of health data. According to patient discharge data, from 2001 to 2010 there was a steady increase in the total number of hospital stays in Grenada while the percentage of hospital stays attributable to chronic diseases has increased from 18 percent to almost a third. Data on hospital deaths from 2006 to 2010 also indicate that chronic diseases had an increasing toll (Figure 2-1). By 2010, 65 percent of hospital deaths had complications from chronic diseases. Cardiovascular disease accounted for 37 percent of all chronic disease hospital deaths for the period from 2006-2010, while hypertension accounted for 26 percent, diabetes for 21 percent, and other chronic diseases for 16 percent. Cardiovascular-related deaths have increased since 2006, and diabetes deaths have increased even more sharply in that period of time. These data demonstrate a disturbing trend, Martin said.

The primary reason for the trend in Grenada, as elsewhere, Martin explained, has been an increase in tobacco use. Other factors include reduced physical activity, changes in diet, and increases in alcohol use, all of which are associated, he noted, with the rising socioeconomic conditions of many Grenadians. In Grenada, he said, health status and outcomes are actually worse for middle- and upper-income people than for those with the lowest incomes—which is the opposite of the pattern in many developed nations.

Grenada has a number of efforts in place to control chronic diseases:

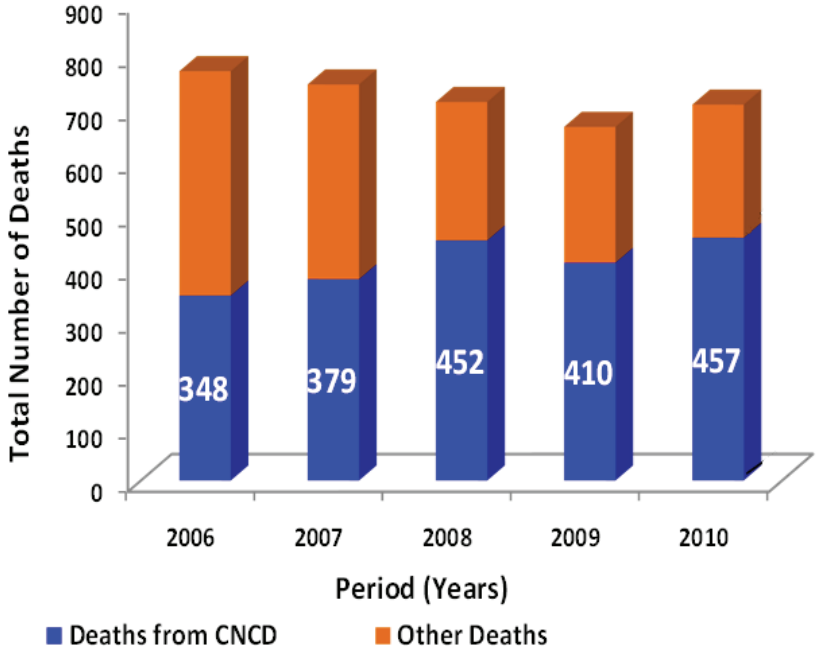

FIGURE 2-1 Deaths in Grenada, 2006-2010 (population just over 100,000).
NOTE: CNCD = chronic noncommunicable diseases.
SOURCE: Martin (2011).

- The National Chronic Disease Non-Communicable Disease Commission, established in 2010, brings together multiple sectors, including agriculture, education, and trade, along with experts from a range of disciplines, to advise the health ministry regarding chronic disease policies.
- The newly launched Primary Health Care Renewal program is designed to support integrative primary health care and to decentralize decision making. District health care teams provide technical support for disease prevention programs developed at the local level. These multidisciplinary teams will not only include doctors and nurses, but will also "involve people like dentists, environmental officers, social workers, mental health workers, psychologists, educators, and nutritionists."
- A National Tobacco Committee is developing legislation and other efforts to reduce tobacco use.

Other public health efforts include social marketing, such as television advertisements reminding viewers to have their blood pressure checked; public–private partnerships, such as a program to allow Grenadians to use exercise facilities belonging to the military; and health fairs and exercise programs sponsored by churches, private companies, and other organizations. Grenadians now also have Chronic Care Passports, which were designed to help to coordinate the care they receive at all levels of the system. These booklets contain demographic data, and patients are asked to carry them to every visit with a health care professional. The health care professional then can enter a record of the care delivered on the patient's passport.

There are barriers to care and prevention of chronic diseases in Grenada, however, Martin said. There are gaps in surveillance and data analysis, and few of the data that are collected are used to develop policies, he observed. The health ministry has no health economist on staff, and the ministry has not been able to use economic tools to identify the costs of disease burdens and support planning and decision making. Indeed, the health care system actually lacks sufficient computers for such analysis, Martin said, noting that he often receives data in hard copy. Grenada also lacks a disease registry, which would provide a mechanism for sustaining social participation in health issues and public information. The nation lacks a tradition of public health research, and it lacks both human and financial resources for improved integration of health services.

At the same time, Martin added, Grenada has certain strengths and opportunities. The country has an excellent network of health care facilities, despite challenges with infrastructure. The progress these facilities have made in integrating primary health care leaves them well set up to move forward, Martin emphasized. Immunization coverage is 90 percent and the maternal mortality rate is almost 0. The country is politically stable and has the political will to improve in the area of health. The minister of health is "more excited about integrated primary health care than any minister had ever been in the history of Grenada," Martin said, and "we have very strong affiliations with international agencies."

Looking forward, Martin concluded that the key players who can help guide progress in Grenada—the government, the general public, the National Chronic Non-Communicable Disease Commission, the Diabetic Association, nongovernmental organizations and regional and international donors—are in place and have begun to focus on Grenada's needs. Guidelines from the Pan American Health Organization and the WHO shape regional policy, and Grenadian officials tweak and give final approval to policies and program implementation, he said, pointing to that process as a place to look for improvement. "We have the determination to move forward with chronic disease control," he added. "What we need is just good collaboration, integration, and help from wherever we can get it."

KENYA

As in Grenada, health is viewed as a basic human right in Kenya, said Dr. Gerald Yonga, chair and associate professor of medicine and cardiology at Aga Khan University, who presented on behalf of Kenya's director of medical services, Francis Kimani. The right to health is explicitly established in the new Kenyan constitution adopted in 2010. The Kenyan parliament is now working to implement the constitution and put in place policies that will make health care more accessible, and chronic disease control advocates are struggling to get attention during the process.

The new constitution divides the country into states that each have considerable autonomy. Kenya's population of 42 million people is made up of approximately 42 different communities, or tribes, who speak different languages and have "slightly different cultures, interests, diets, and exercise habits," Yonga explained. Kenya is a very capitalistic society with quite liberal markets. The country has "enormous" gaps between rich and poor, Yonga added, and it is home to both some of the richest people in the world and some of the poorest. The Kenyan gross domestic product (GDP) is $20.6 billion in U.S. dollars, Yonga said, and Kenya is the world's 17th poorest country with an average annual per capita income of $780 (U.S.). Of the 42 million members of the Kenyan population, 78 percent live in rural areas, and 47 percent live below the national poverty line. The average life expectancy is 59.5 years. Annual per capita spending on health care is $27, and just 5.2 percent of government spending is on health.

The health care infrastructure, which is made up of public (44 percent), private, and religious facilities, is stretched thin, Yonga said. For every 1,000 people, there are 1.4 hospital beds, 0.14 physicians, and 1.18 nurses. Most of the health care resources are devoted to outpatient (39.6 percent) and inpatient (29.8 percent) care and health administrators (14.5 percent), and only 11.8 percent is spent on preventive care and public health programs. Only about 8 percent of Kenyans have health insurance, so the majority of the 39.3 percent of health care costs that come from the private sector are paid by individuals. Donors pay for 31 percent—a figure that has increased from 18 percent in the last 10 years, primarily due to funding for HIV programs. Of the remaining health costs, 29.3 percent are publicly funded, with 0.4 percent paid for by other sources.

Kenya has a "double burden" of disease, Yonga noted. Communicable diseases, such as malaria, HIV, and tuberculosis, are not completely under control, but the rates of noncommunicable diseases, including diabetes, heart disease, cancer, chronic injury, and neurological and psychiatric disease, have been increasing for the past two decades. As can be seen in Figure 2-2, which shows deaths caused by different sorts of diseases in 2004 for males and females, the noncommunicable chronic diseases accounted for

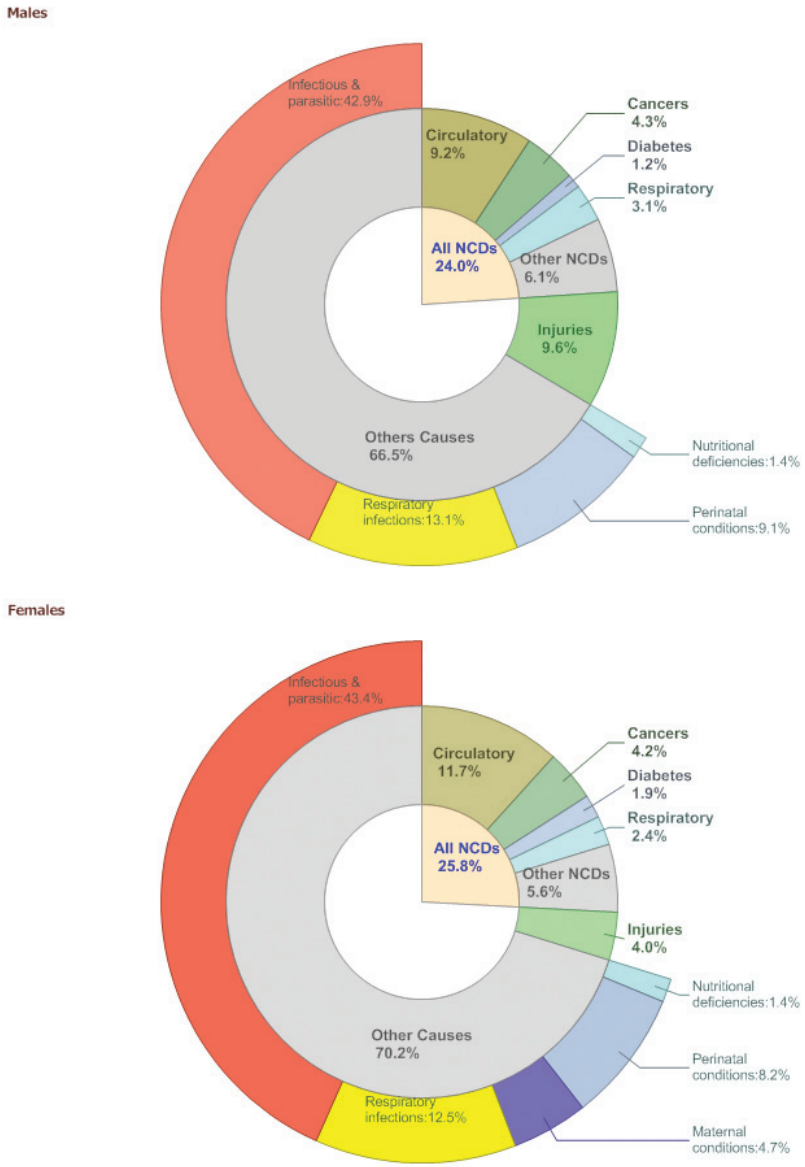

FIGURE 2-2 Estimated proportional mortality, Kenya, 2004.
SOURCE: WHO (2008b).

approximately 22 percent of deaths for both sexes. The primary cause of chronic morbidity, Yonga said, is accidents, particularly automobile accidents; but chronic diseases such as cardiovascular disease, cancer, and asthma also account for significant amounts of chronic morbidity as measured in terms of disability-adjusted life years (DALYs). The toll of these different factors is shown in Table 2-1.

These data are suggestive of the significant burden of chronic diseases in Kenya, Yonga indicated, but they do not come from national surveys with good sampling methods. Regional health data are collected, but sampling and collection methods vary. Nevertheless, one overall trend is clear: early in the 20th century, health officials noted that Kenya had virtually no cardiovascular disease, and as late as the 1960s some communities in the country were called "low-pressure communities," Yonga explained, because people's blood pressure did not rise with age, regardless of what they ate. Researchers have shown that, over time, people have migrated from rural areas to urban areas and changed both their dietary habits and levels of physical activity, with predictable effects on body mass index (BMI), blood pressure, and other health indicators and outcomes. In general, the common risk factors that contribute to chronic diseases in Kenya are the familiar ones: tobacco use (which is rising among schoolchildren), alcohol consumption (which is much higher among males than females), inactivity (particularly in urban areas), and diet and obesity (there are disparities between urban and rural areas in both).

Numerous stakeholders play a role in the Kenyan health system, Yonga said, including the government, nongovernmental organizations, universities and research institutions, civil society, religious organizations, and the private sector. The government has taken a number of actions in response to noncommunicable chronic diseases, including the formation of a division to address them in 2001 (although Yonga said the division is grossly under-

TABLE 2-1 Chronic Disease Morbidity in Kenya, 2009

Chronic Disease	DALYs[a]/1,000 capita/year	World Range
Other Unintentional Injuries	6.8	0.6-30
Traffic Accidents	3.6	0.3-15
Cardiovascular	1.9	1.4-14
Cancer	1.9	0.3-4.1
Asthma	1.7	0.3-2.8
Neuropsychiatric	1.7	1.4-3.0
Musculoskeletal	0.6	0.5-1.5
Chronic Obstructive Pulmonary Disease	0.6	0.0-4.6

[a] Disability-adjusted life year.
SOURCE: WHO (2009).

staffed and underfunded); bills to control tobacco and alcohol use in 2008 and 2010, respectively; the development of new plans and frameworks, which is currently under way; and the definition of health as a basic human right in the 2010 constitution. Several agencies collect data regularly: the Kenya Demographic and Health Survey, which, because of funding limitations, provides only limited health information;[1] the Kenya National Health Accounts, which tracks expenditures; and the Kenya Central Bureau of Statistics, which collects vital statistics.

There is currently an effort under way to broaden understanding of the significance of the chronic disease burden and to help the various stakeholders work together to develop an integrated policy on these diseases, Yonga said. A number of related efforts are already playing a role, he added, including a National Cancer Prevention program, strategic plans to combat diabetes and hypertension, and the national health policy framework, which is in development. Some research is ongoing, and some programs have been designed to raise awareness of risk factors and also to provide screening for several conditions. These and other programs have done well, Yonga observed, but they are, "unfortunately, uncoordinated. They need to be brought together in one framework," he said.

The lack of coordination, and the lack of a national policy, are perhaps the most significant gaps in Kenya's approach to chronic diseases, Yonga said. Funding is very limited. Furthermore, he said, "We are currently operating in lots of silos. We have many organizations within the ministry of health—especially donor-funded organizations—with completely different funding and infrastructure, and, often, a total refusal by particular departments to collaborate with others." Recently, more attention has been paid to coordination and collaboration, but there are many obstacles, he said. One is the lack of primary care throughout Kenya. "Health care is free, yes, but, you pay nothing, you get nothing." For example, he said such basic care standards as taking a patient's blood pressure, height, and weight are not uniformly adhered to. A workshop participant added that many facilities lack sufficient operable equipment, such as calibrated instruments, and do not offer adequate training for staff in how and when to use these tools. In addition, there are no cost-effective models for screening and intervention, Yonga said. He added that the health information and surveillance system is "nonexistent," although funding was recently secured for an attempt to develop an electronic health system as part of a government-wide effort to adopt electronic data collection.

In short, Yonga said, Kenya's principal barriers to a more robust response to chronic diseases are

[1]For example, Yonga explained in answer to a question, this system does not track rates of diabetes.

- lack of national data on the economics of these diseases and the costs of specific interventions;
- competing priorities, especially the control of noncommunicable diseases being seen as competing with the control of communicable diseases;
- lack of political will to focus on chronic diseases;
- lack of policies and legislation that would facilitate disease mitigation; and
- insufficient resources and infrastructure for chronic disease reduction efforts.

Government action in Kenya usually begins with a body of data sufficiently persuasive to motivate the relevant ministry to draft policies for the cabinet, and then parliament, to consider. Persuading officials at each level to act requires hard data, Yonga emphasized, and the budget-allocation process depends not only on economic and other data but also on historical precedents for funding. "If historically you have been underfunded, you shall continue to be underfunded until you are able to prove that you really exist—and that is really the problem at the moment," he said.

Yonga closed with his vision for chronic disease reduction in Kenya. The nation, he hopes, will develop an integrated and coordinated national policy that provides support of public education and promotion of healthy behavior and implements cost-effective screening and intervention programs at the community level and at health institutions. A strengthened primary care system will provide preventive, curative, rehabilitative, and palliative care at all levels. And a strengthened health information and surveillance system will build the basic understanding of the disease burden and promote research on prevention and treatment. A sustainable funding mechanism, Yonga emphasized, will ensure the stability of this approach.

BANGLADESH

Bangladesh faces many challenges, said Shah Monir Hossain, a consultant to the Ministry of Health and Family Welfare and former director general for health services. In 2009, the country had a population of 162 million, and its population density is the highest in the world. Natural disasters in this low-lying nation frequently cause loss of life, assets, and infrastructure on a sweeping scale. Life expectancy at birth is 67 years (UNICEF, 2010). Nevertheless, the country has made steady improvements in many areas, Hossain said. For example, the 2010 poverty rate of 31.5 percent was down from 40 percent in 2005 (Bangladesh Bureau of Statistics, 2011). Between 1990 and 2010, the country reduced rates of measles,

mumps, and rubella, and 75 percent of children in Bangladesh are now fully immunized (Bangladesh Ministry of Health and Family Welfare, 2007).

Bangladesh faces a double burden of the infectious diseases common in developing nations plus a growing rate of chronic noncommunicable diseases attributable to social transitions that have brought rapid urbanization, unhealthy diets, and other risk factors. A 2010 national survey showed that 99 percent of the population had at least one risk factor for a chronic disease, and 29 percent had three or more risk factors. Chronic diseases now account for 61 percent of the total disease burden, and underprivileged rural and urban communities bear the heaviest burden of diabetes, cardiovascular disease, hypertension, stroke, chronic respiratory diseases, and cancer. Cardiovascular disease (heart attack, stroke, and other) accounts for 12.5 percent of all deaths. Cancer claims 150,000 lives annually in Bangladesh, and more than 200,000 new cases are detected each year.

Bangladesh has a number of assets in the fight against these diseases, Hossain said. Health care facilities are widely available at the community level as well as for secondary and tertiary care; these facilities are overseen by a variety of agencies under the Ministry of Health and Family Welfare. There are specialized and teaching hospitals at the tertiary level as well as district hospitals (and a few district-level teaching hospitals). For primary health care there is a sub-district system (the Upazila Health Complex) with each subdistrict covering approximately 200,000 people; a health and welfare program and dispensary that covers approximately 20,000 people in each center; and community clinics that each typically serve approximately 6,000 people.

There are, however, a number of gaps in Bangladesh's capacity to control chronic diseases. The primary care system focuses primarily on communicable diseases and maternal and child health, and adequate care for chronic diseases is not generally available, Hossain said. These diseases are not given high priority in United Nations (UN) programs or by development partners, and medical personnel lack the skills and training to address them. There is a need for more complete surveillance and information related to the economic burden of these diseases, and coordination is lacking between the public and private services that are available. Hossain would like to see a greater policy emphasis on chronic diseases in Bangladesh, such as a strategy for improving nutrition. He suggested that if the health sector placed greater emphasis on chronic diseases, budget allocations for combating them would increase, which would make it possible to increase the skill level of medical workers in these areas.

The ministries of Health and Family Welfare, Local Government, Planning, and Finance all have a stake in health issues and a role in the decision-making process for health sector planning, Hossain said. Private and civil

society groups, such as the Diabetic Association of Bangladesh and the National Heart Foundation, also play a role, as do development partners including the World Bank, WHO, the U.S. Agency for International Development (USAID), and the UN Population Fund (UNFPA). While noncommunicable diseases were not a priority area in previous health sector programs, he noted, Bangladesh's latest health sector program (2011-2016) includes an operational plan for the prevention, management, and control of non-communicable chronic diseases among its objectives, which should bring greater attention and support to the problem in Bangladesh. Specifically, the plan is designed to

- develop and implement effective, integrated, sustainable, and evidence-based public policies on chronic diseases;
- strengthen surveillance capacity for chronic diseases, their consequences, risk factors, and the impact of interventions;
- promote social and economic conditions that empower people to adopt healthier behaviors; and
- strengthen the health system's capacity to manage chronic diseases and their risk factors.

The plan addresses not only conventional chronic diseases (e.g., cardiovascular disease and diabetes) but also road safety, injury prevention, and violence against women. It also addresses occupational safety and health; climate change, water, sanitation, and other environmental health issues; emergency preparedness and response; and mental health and substance abuse.

This effort will be supplemented by the Non-communicable Diseases Forum, an organization that works to reduce the burden of chronic diseases in Bangladesh by coordinating the efforts and resources of public and private health care providers and other partners such as nongovernmental organizations.[2] The organization, which began its work in 2009, hopes to build awareness of these diseases, establish a database to coordinate information, and advocate for stronger policies related to chronic diseases. Hossain believes that with better information about the chronic disease burden, policy makers will put a higher priority on them and will provide more resources for fighting them.

[2]For more information about this organization, see http://ncdf.eminence-bd.org/ (accessed October 2011).

RWANDA

In Rwanda, as in other very-low-income countries, communicable diseases, high rates of maternal death in childbirth, deaths of children under age 5, and other conditions still take a heavy toll. Nonetheless, chronic diseases account for approximately 25 percent of the disease burden, said Gene Bukhman, senior technical advisor on noncommunicable disease at the Rwandan Ministry of Health.

Rwanda, Bukhman said, has made "absolutely extraordinary" progress in improving its health system since 1994, when the country was, in effect, "starting from scratch." The mortality rate for children under 5 has decreased dramatically from 200 deaths per 1,000 people annually to fewer than 80. There has been a large increase in the percentage of women who deliver their babies in a health facility, rates of malnutrition have decreased, and there is universal coverage for HIV, Bukhman added. Rwanda provides an excellent demonstration of how leadership in the health sector can yield measurable improvements, he said, noting in particular the efforts of the current minister of health, Agnes Binagwaho, who oversaw the increase in HIV coverage.

For Rwanda, Bukhman suggested, chronic diseases are an obvious next target for those involved in health planning. These diseases are very visible and in many cases preventable, and the rescue principle—the duty to alleviate suffering where it is possible to do so—makes them an important priority. The challenge, however, is that no single chronic disease is dominant in terms of prevalence, as Figure 2-3 illustrates. Hospital data indicate that in Rwanda these diseases account, in total, for only about 10 to 15 percent of hospital admissions and 20 to 26 percent of deaths, he added. On the other hand, Bukhman noted, they require much longer hospitalization times so their burden on the health system is high.

Another challenge, Bukhman observed, is that in Rwanda the major causes of these diseases are probably not the four major risk factors that are at work elsewhere: tobacco, lack of physical activity, obesity, and alcohol. For example, he said, virtually none of the cancers seen in Rwanda are caused by tobacco. Instead, viral infections, streptococcal disease, and household air pollution are the primary risk factors for heart and renal disease and other conditions. Collecting data on individual conditions in Rwanda is challenging, Bukhman said, because if considered each by itself, the conditions are often rare. Rheumatic heart disease, for example, has a prevalence of just 0.2 or 0.3 percent. While it is important to seek data on such traditional risk factors as smoking and BMI rates, Bukhman said, it is also important to recognize that in Rwanda the noncommunicable diseases are affecting children and young adults and that they are not caused by the risk factors of affluence but rather by many of the same factors that are

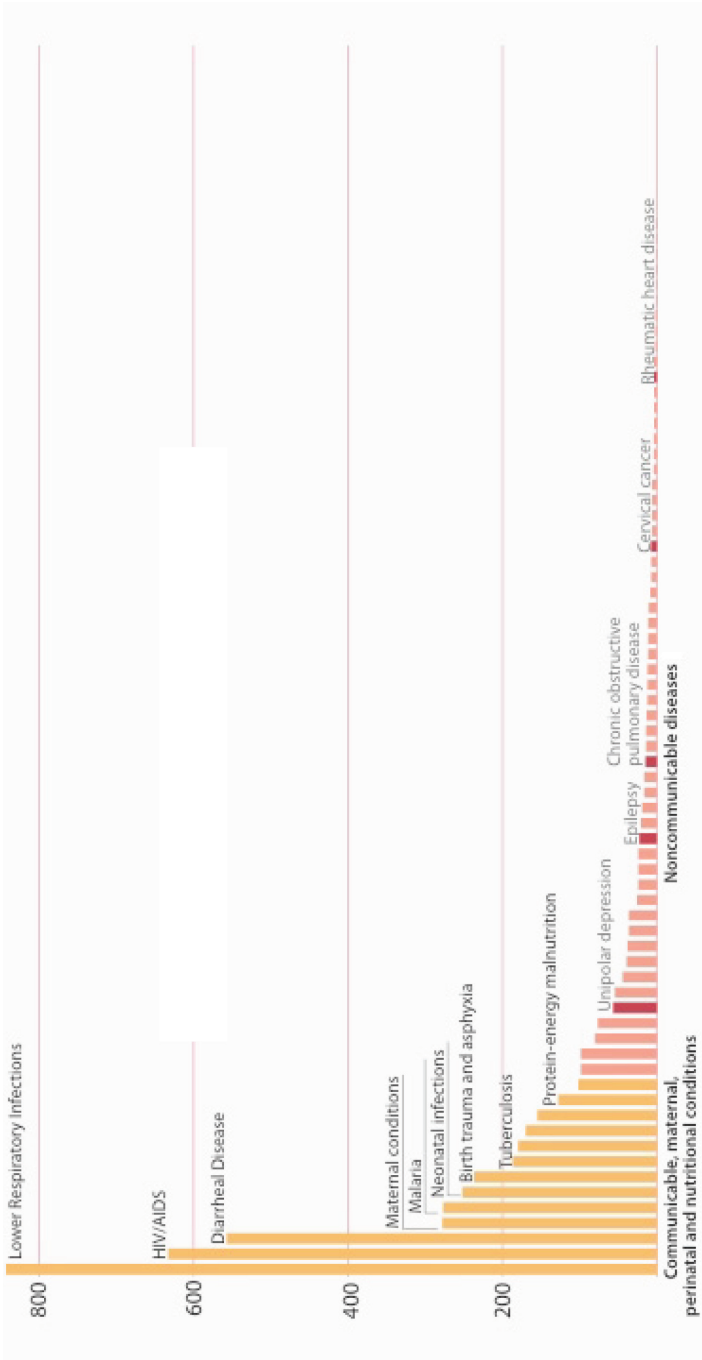

FIGURE 2-3 The long tail of endemic noncommunicable diseases in Rwanda.
SOURCE: Bukhman (2011).

associated with the "major killers," the communicable diseases. Table 2-2 shows a number of factors linked to poverty that influence noncommunicable diseases in Rwanda.

Rwanda is known for its centralized, coordinated planning on health issues, Bukhman said, and health leaders held a summit in January 2010, with the goal of building partnerships to tackle noncommunicable diseases. A wide range of groups worked to identify national priorities based on experience in particular districts—participants included Rwandan facilities and associations focused on particular diseases; Rwandan government; regional and international universities; and such international partners as WHO, the U.S. Centers for Disease Control and Prevention, and the Clinton Health Access Initiative. The group recognized that new strategies were needed to address the gaps in Rwanda's health services for noncommunicable diseases. An obvious first goal, Bukhman said, was to decentralize services for chronic diseases and incorporate more care related to chronic diseases at the community and district levels. The group also determined that there was a shortage of qualified personnel to provide acute care at the district level, and they agreed that a consortium of medical centers in the United States should support residency programs for district-level and family-practice physicians. Other needs identified included pathology services, cardiac surgery, and cancer services, all of which will require additional funding.

Yet another need, Bukhman said, is the planning and training required to enable Rwanda's medical system to absorb the enormous amounts of money needed to improve services—assuming that money can be made available. Absorbing new funds at a rate of $1 or $2 per capita would probably be manageable, he said, but more than that would be beyond the system's capacity. Furthermore, it will take time for new guidelines and protocols to go through the process of development and field testing so that they can be properly implemented to meet local needs.

In conclusion, Bukhman observed that "these are not emerging diseases; they have been endemic in [low-income] countries since the 1950s." What is happening now, he said, is a return to higher expectations for the health system, and "an opportunity for the current generation to deliver on that."

KERALA, INDIA

India is the largest democracy in the world in terms of population, noted Meenu Hariharan, director and chief executive officer of the Indian Institute of Diabetes and state nodal officer of the National Program for the Prevention and Control of Diabetes, Cardiovascular Diseases and Stroke. It

TABLE 2-2 Burden of Noncommunicable Diseases in Rwanda Linked to Conditions of Poverty

	Condition	Risk Factors Related to Poverty
Hematology and oncology	Cervical cancer, gastric cancer, lymphomas, Kaposi sarcoma, hepatocellular carcinoma	HPV, H. pylori, EBV, HIV, hepatitis B
	Breast cancer, CML	Idiopathic, treatment gap
	Hyperreactive malarial splenomegaly, hemoglobinopathies	Malaria
Psychiatric	Depression, psychosis, somatoform disorders	War, untreated chronic diseases, undernutrition
	Schizophrenia, bipolar disorder	Idiopathic, treatment gap
Neurological	Epilepsy	Meningitis, malaria
	Stroke	Rheumatic mitral stenosis, endocarditis, malaria, HIV
Cardiovascular	Hypertension	Idiopathic, treatment gap
	Pericardial disease	Tuberculosis
	Rheumatic valvular disease	Streptococcal diseases
	Cardiomyopathies	HIV, other viruses, pregnancy
	Congenital heart disease	Maternal rubella, micronutrient deficiency, idiopathic, treatment gap
Respiratory	Chronic pulmonary disease	Indoor air pollution, tuberculosis, schistosomiasis, treatment gap
Renal	Chronic kidney disease	Streptococcal disease
Endocrine	Diabetes	Undernutrition
	Hyperthyroidism and hypothyroidism	Iodine deficiency
Musculoskeletal	Chronic osteomyelitis	Bacterial infection, tuberculosis
	Musculoskeletal injury	Trauma
Vision	Cataracts	Idiopathic, treatment gap
	Refractory error	Idiopathic, treatment gap
Dental	Caries	Hygiene, treatment gap

NOTE: CML = chronic myeloid leukemia; EBV = Epstein-Barr virus; HIV = human immunodeficiency virus; HPV = human papillomavirus.
SOURCE: Kidder et al. (2011).

is a complex country, with 28 states and 7 union territories.[3] As one workshop participant emphasized, the country has many cultural and linguistic traditions, and it is necessary to factor those into any kind of national planning. The union governments have considerable health-related responsibilities, including policy making and controlling drug standards. Health care services are delivered through a multi-level structure, which includes

- sub–health centers that offer trained health care workers (not doctors) to cover populations of 3,000 to 5,000;
- primary health centers, headed by medical officers, which each supervise six to eight sub–health centers and thus serve 20,000 to 30,000 people;
- community health centers, which are the first layer that provides inpatient services. These each have 30 to 50 beds and provide basic specialties for populations of 80,000 to 120,000;
- district hospitals that provide multiple specialties; and
- medical colleges that offer tertiary-level hospitals.

Hariharan focused on the small, very densely populated state of Kerala, which is known for high literacy rates, social activism and reform, and a high-quality health care system. The backbone of Kerala's health care system, she explained, is the care provided at the local levels—most often by paramedics rather than doctors. Table 2-3 provides some basic indicators for contrasting Kerala with the whole of India and, for comparative purposes, with Sweden.

As India has become more prosperous, Hariharan said, it has experienced the same changes that have affected other countries and contributed to increases in chronic diseases: unhealthy diets, smoking, physical inactivity, and alcohol abuse. Kerala is no exception—India has been described as the diabetes capital of the world and Kerala, with a diabetes rate of 19.5 percent, as the diabetes capital of India. Other noncommunicable diseases have similarly high rates of prevalence: 36.1 percent for hypertension, 85.6 percent for central obesity, 24 percent for adolescent obesity, and 20 percent for coronary heart disease. Kerala also has a very high suicide rate, particularly for males (44.7 per 100,000 people, as compared to 26.8 for females), which Hariharan attributed to economic struggles. Rates of smoking are also high among men (28 percent compared to 0.4 percent for women) and college students (11.7 percent), and the lung cancer rate is 8.1 percent.[4]

[3]Each state has an elected government. The union territories are governed by presidentially-appointed administrators.

[4]Hariharan noted that some of these data are old and that smoking rates may have been declining somewhat, though tobacco chewing and oral cancers have been increasing.

TABLE 2-3 Basic Indicators for Kerala, India, and Sweden

Indicator	Kerala	India	Sweden
Population	33 million	1030 million	9 million
Death rate (per 1,000 people)	6.8 (SRS 2007[a])	7.4 (SRS 2007)	10
Infant mortality rate (per 1,000 people)	13 (SRS 2007)	55 (SRS 2007)	6
Institutional delivery	99% (NFHS3[b])	39% (NFHS3)	100%
Birth rate (per 1,000 people)	14.7 (SRS 2007)	23.1 (SRS 2007)	11.7
Female literacy	87.9%	45.16%	100%
Maternal mortality rate (per 1,000)	81	212	8
Sex ratio	1058	933	980
Immunization coverage	87.9% (CES 06[c])	42% (NFHS3)	100%
Human Development Index (out of 1)	0.62	0.47	0.94 (1st in world)

[a]Sample Registration System Bulletins, Office of the Registrar General & Census commissioner, India.

[b]National Family Health Survey, India.

[c]Coverage Evaluation Survey, All India Report 2006, UNICEF.

SOURCE: Hariharan (2011).

In 2008, India launched a national program to combat diabetes, cardiovascular disease, and stroke, called Health in Your Hands. The program focuses on community-based detection and awareness camps, workplace interventions, and school programs designed to build awareness of lifestyle diseases, as well as on subspecialty clinics for the treatment of patients. Hariharan offered several lessons from the implementation of this program in Kerala. As is the case with other low-income countries, India has the double burden of infectious disease and noncommunicable ones. Leprosy, malaria, and other diseases are largely under control, but newer ones such as hepatitis, hemolytic fevers, H1N1, and leptospirosis have brought a new burden—and perhaps taken some attention away from chronic diseases. Moreover, many communicable diseases leave behind lasting health problems, such as arthritis and musculoskeletal deformities, that may have long-term economic consequences for families. Malnutrition is also still a problem in many places, and it causes many Indians, particularly children, to be more vulnerable to disease. These problems are very present in Kerala.

In addition to competing with these various issues for attention, the Health in Your Hands program was also hampered by limited capacity for screening and surveillance of chronic diseases, Hariharan said. The private sector plays little role in surveillance in India and, at the district level in particular, there is limited capacity to analyze data and respond to data

findings. Other national programs provided some assistance that strengthened Health in Your Hands. For example, the National Rural Health Mission provided both money and trained medical workers; and the integrated Child Development Services Scheme provided support for children, including health education and nutritional supplements. Public–private partnerships are also very important in Kerala, Hariharan added, because there are many private facilities in the state.

Looking forward, Hariharan indicated that bridging gaps and inequities in care will be a primary goal in Kerala. "We boast of a good health infrastructure but it is at times absolutely unequally distributed," she said. She believes that the key strategies for addressing this problem will be reducing costs and improving efficiency, decentralizing regulation, improving information sharing, improving basic facilities such as laboratories, and building the skills of health workers at the community level. At present there is not a robust health insurance system in India, and private facilities are often of higher quality than public ones. There are few regulations on providers, premiums are unaffordable for many people, and exclusions and administrative procedures complicate the process, she noted.

In response to a question, Hariharan said that as a national program is implemented it is very important that regional services be coordinated through the main health services department. "You identify the centers to which you want to coordinate—smaller units of local self government. You have to educate them, to make them understand why you are doing this. The main network goes down through the community health centers."

For Hariharan, the primary conclusion from a regional perspective is "You cannot depend only on the government, only on society, or only on a single community." A multipronged approach to preventing chronic diseases is needed, one that involves a strong public health policy at the national level (to focus on changing personal behavior and improving the environment for healthy life choices); strong community-based programs; and clinical preventive services.

CHILE

Chile began a major reform of its health care system in 2006. The experience of this reform serves as an example and offers a number of lessons learned from a health decision-making and priority-setting process, which was inclusive of, although not limited to, chronic disease services. The reform was in response to a broad set of problems, said Antonio Infante, Chile's former undersecretary for health. There had been serious inequities in the delivery of care, he explained. Epidemiological changes had altered the disease burden, and there was a need to greatly increase the efficiency with which resources were used. Perhaps most important, he added, was the dissatisfaction of Chile's citizens with their health care.

Chronic, noncommunicable diseases, including hypertension, diabetes, and cardiovascular disease, are the majority of the disease burden in Chile, accounting for 76 percent in 2007. For most of these conditions, it is the lower-income, less-educated people who are most likely to have problems, he said. For example, those in the lowest educational category have three times more cardiovascular disease than those in the highest education group, and they are roughly twice as likely to be obese or have diabetes.

Chile has a national health service that was modeled after the one in the United Kingdom. It is used primarily by lower-income Chileans, Infante said, while affluent Chileans use private insurance. While 73.5 percent of all Chileans use the public system, fewer than 40 percent of the wealthiest quintile do so. The 2006 reform was designed to address this imbalance by providing a plan that bridged the two systems.

At an annual cost of $130 per capita, the plan was designed to cover 60 percent of the burden of disease, Infante said. Its goal was to focus on the highest-priority medical problems, to offer guaranteed limitations on out-of-pocket expenses, and to provide high-quality care by certified medical professionals. The plan developers used surveys to identify Chileans' views of their highest-priority (most frequent, severe, and expensive) medical concerns. They then assessed the epidemiological impact of these concerns, the cost effectiveness of available treatments, and the system's capacity to provide the requisite care throughout the country. Despite controversy, the developers settled on 56 conditions for which the plan would guarantee care (the number is now 69) and developed clinical guides with explicit protocols for physicians to follow.[5]

The guides were voluntary, Infante said, but the College of Physicians still objected to this limitation on their autonomy. Others objected that the plan did not provide universal coverage and was difficult for ordinary people to understand. Ads were posted in opposition to the reform, some going so far as to state that the new plan put citizens' jobs at risk. Nevertheless, the plan has been implemented, and initial impacts are now evident. Perhaps most important, in Infante's view, is the financial protection the plan provides. "People are so afraid of being ill," he said, "that having the guarantee [of care] is a very important thing for families." Overall, the guaranteed care made people feel more confident. The program has also led to a reduction in high blood pressure, mostly due to wider coverage for primary care, Infante said.

In Infante's view, the system still needs to address a number of problems. Inherent in the process of prioritization is the pressure put on the

[5]In answer to a question, Infante explained that for care that is very expensive, such as transplants, there is a commission that reviews the evidence base, the patient's prognosis, and other factors, and makes a recommendation.

decision makers by different industries, societies, and advocacy groups. In order to resist these pressures, the government will need to become more confident in the decision-making process. The program will also have to address the large inequities that still do exist even after its implementation. In addition, progress is not yet evident in such lifestyle changes as reducing consumption of salt, tobacco, and alcohol or increasing physical activity, and the program has not yet helped to control diabetes. The new system also needs to address long wait times for care and medical problems not on the list of 69 conditions for which care is guaranteed. "We need a stronger primary health care [system]," Infante said, and for success in that area, "we need the support of physicians and the physician union."

SUMMATION

The six presentations illustrated the variation in the challenges related to chronic diseases across low- and middle-income countries. The presentations showed how economic, political, cultural, and health systems factors can affect a country's progress toward addressing chronic diseases at the national and subnational level. There were, however, a number of common threads that emerged across these diverse presentations. Insufficient national-level data and surveillance capacity was a common theme. Countries had developed different strategies to fill these gaps in their national-level data, such as the use of hospital data, small-scale surveys, research studies, and regional data from similar countries. Another common theme was the lack of economic data and economic analyses, which are important for informing policy decisions and making compelling arguments for resource allocation. The lack of resources and capacity across all aspects of the systems and areas of expertise required to manage chronic disease also complicate efforts to advocate for policies and programs. This lack of resources and capacity is especially challenging when countries face the double burden of communicable and chronic diseases.

Several countries also faced difficulties garnering political will for action on chronic disease. Where there had been recognition of the need to address chronic diseases, several speakers described the challenge of a lack of coordination among existing efforts and the challenge of making the transition from idea to sustained action. For example, speakers discussed national plans for non-communicable disease control that have not been fully implemented and external projects that left behind little support for sustaining their efforts after their research was completed or programs were initiated.

Chapter 6 provides a more complete summary of the considerations raised in this session along with the presentations and discussions throughout the workshop.

3

Data Availability and Gaps in Four Countries

The country discussions summarized in Chapter 2 emphasized the importance of accurate data and noted limitations in current data collection. An additional session on the second day of the workshop, with representatives from Bangladesh, Kenya, Grenada, and Rwanda, was designed to further explore the sorts of data that are most needed to support a decision-making process, the currently available data sources in their countries, and the specific challenges their countries face with respect to data. Reliable and accurate information is a critical resource for decision makers, session moderator Stephen Jan of the George Institute for Global Health observed. A useful toolkit would need to provide data to guide decision makers in "institutionalizing a process of rational resource allocation," Jan commented, meaning not just a process of exploring cost effectiveness but a process for using evidence to identify the optimal ways to meet the objectives for a particular country's health system.

Jan noted that certain types of data are particularly likely to be useful: health care expenditures; cost offsets (savings that might accrue as a result of particular expenditures); social costs and benefits, such as gains or losses in productivity resulting from health problems or health interventions; the cost effectiveness of interventions and resources; costs that are relevant to health outcomes but that are borne by other sectors, such as education, housing, or labor; and resource capacity, including infrastructure and human resources. It will also be important, he added, to identify needs and the ways they may vary across population groups, regions, classes, and disease group, as well as to understand community preferences for the allocation of resources. There are many potential sources for such data, Jan said, in-

cluding research studies, health ministry data, hospital data, insurance data, and international resources, but such data may not all be of equal quality. "We need to identify gaps and data needs," he said, "but also to identify the tradeoffs between quality and pragmatism."

BANGLADESH

Bangladesh is fortunate in having a number of sources of data on chronic diseases, said Tracy Pérez Koehlmoos, of the ICDDR,B, although she added that they are "perhaps not collected with the rigor we would like to see." Sources include reporting data from public hospitals; specialty hospital reports; a survey of risk factors and burdens in six cities (Angeles et al., 2008); standardized data collected using the World Health Organization's (WHO's) Stepwise Approach to Surveillance (WHO-STEPS)[1] and published research literature.

These data are valuable but do not provide a complete picture, Koehlmoos said. There are no national registries for cancer, for example, although cancer specialty hospitals and medical schools do report some data, which are included in a biennial health report. The specialty hospitals, she added, are "quite strong" but have mostly "worked in isolation rather than thinking about [chronic diseases] as a common issue that needs to be addressed by the whole health system." The Urban Health Survey data, although they do not cover the whole country, are quite useful because Bangladesh's population is heavily concentrated in urban areas. Koelhmoos expressed the hope that the next round of the Demographic and Health Survey will provide more data on chronic diseases and risk factors. Also, there has also been a recent "explosion" of primary and secondary studies related to noncommunicable diseases in Bangladesh, she added.

Bangladesh also has health and demographic surveillance sites run by the ICDDR,B.[2] For 40 years, ICDDR,B has followed the lives of more than a quarter of a million people, collecting data about their health, employment, marriages and divorces, and other indicators, Koehlmoos said, which has helped to document the rapid growth in Bangladesh's mortality rates for noncommunicable diseases. In 1986, these diseases accounted for approximately 10 percent of all deaths in Bangladesh, but by 2006, they accounted for approximately 70 percent of deaths (Karar et al., 2009).

Bangladesh has many programs of various types to combat chronic

[1]For more information about WHO STEPS, see http://www.who.int/chp/steps/en/ (accessed October 2011). Koehlmoos and presenters also cited the value of the INDEPTH network of surveillance sites; see http://www.indepth-network.org/ (accessed October 2011). A participant noted that the WHO STEPS program in Bangladesh was particularly easy to set up, in part because of the presence of the INDEPTH network.

[2]See http://www.icddrb.org/ (accessed October 2011).

diseases, including programs operated by specialty hospitals and national associations as well as camps for groups who have these diseases. However, Koehlmoos said, these programs have not been rigorously evaluated, so there is little to say about their effectiveness. It is similarly difficult to be precise about the economic burden of chronic diseases, she added, because few studies have been done in this area.

Koehlmoos also noted that although the country has national strategic plans for both cancer control and the control of noncommunicable diseases, these plans have not been fully implemented. "What we are seeing is long delays between thinking about how to address an issue and actually getting to the point where action is taken to deliver services and create awareness," she said.

Another problem is a lack of consistency between the private and the public sector; furthermore, private-sector providers have no requirement to report their data. Even within the public sector there is a lack of continuity. For example, urban areas fall under the Ministry of Local Governance rather than the Ministry of Health and Family Welfare, and there is not yet unified reporting across these units of government. However, the Ministry of Health and Family Welfare has recently created a directorate devoted to noncommunicable diseases, which Koehlmoos believes will improve coordination of resources, although funding is still an issue. Of the directorate's total 2008-2009 budget of $10.2 million, nearly $9 million was channeled to a program dealing with arsenic poisoning (a problem that currently affects approximately 20 million people in Bangladesh) and to strengthen the Institute of Public Health (for example, by purchasing equipment for public hospitals). Moreover, even where data are collected there are gaps. For example, Koehlmoos noted that the Urban Health Survey collects data on tobacco use among males but not among females. The reason is that smoking is viewed as extremely inappropriate for women in Bangladesh, so few of them are thought to smoke; nonetheless, the precise numbers cannot be known if the data are not collected.

Several research efforts now under way are expected to yield data on chronic diseases soon, including a national survey of risk factors for noncommunicable diseases; the WHO-STEPS research; and a study of salt intake, public beliefs about salt, and policy related to salt usage that was funded by United Health Group. Several studies funded by the U.S. National Heart, Lung, and Blood Institute are also under way, focusing on health-seeking behavior and health systems, prevalence and determinants of chronic obstructive pulmonary diseases, prevalence of hypertension and risk factors, and chronic disease and poverty. Research on healthy aging in Bangladesh and the cost of prevention of noncommunicable diseases is also forthcoming (El Saharty et al., 2011; Mirelman et al., 2012).

Koehlmoos closed by offering her sense of the most urgent needs for

targeting chronic diseases in Bangladesh. One such need is to perform a rapid assessment of barriers to moving from the "pre-action phase to action." It will also be very important to evaluate existing programs, at least to assess how many people are being reached, and to assess the availability of drugs and services for treating these conditions. Koehlmoos also suggested that the Ministry of Local Health and the Ministry of Health and Family Welfare devise a unified reporting system and that noncommunicable disease risk factors be included in future Health and Demography Surveys.

There are models that have been shown to work well in Bangladesh that can be emulated as the country moves forward in a campaign against chronic diseases, Koehlmoos said. One such model is offered by the Expanded Programme of Immunization, in which the ministries of defense, education, and health collaborate to make sure that young people have necessary vaccinations. Public–private partnerships have also been successful, such as in the way in which nongovernmental agencies worked with the government in efforts to reduce tuberculosis. Koehlmoos suggested that a first step toward dealing with chronic diseases would be to convene a national platform that would engage all potential partners in conducting an inventory of existing data, performing a comparative analysis of risk factors, and carrying out an economic burden analysis. It will also be important to carry out a qualitative analysis of implementation issues, she said, and together such information could support effective planning and programs.

KENYA

As Gerald Yonga suggested in his presentation summarized in Chapter 2, there are a number of problems with data collection in Kenya. In his later presentation on data availability and gaps, Yonga reviewed a range of materials developed by the Kenyan government, professional societies, researchers, and international organizations in order to develop a picture of publications and data related to chronic diseases. Looking across this material, he found that it supplies a good amount of epidemiological information, such as data about disease prevalence and incidence, but very little information or analysis of costs and few economic burden analyses. Even less information is available about interventions for chronic disease in Kenya, and there is virtually nothing known about the costs of interventions. "Regional data predominates," Yonga said. Primary national data are almost nonexistent; policy makers must instead rely on "estimates accumulated from various sources."

As discussed in Chapter 2, the cost and prevalence data that are available indicate that chronic diseases are an increasing problem in Kenya. For

example, although there is no national cancer registry, hospital registries and studies collectively provide a reasonable picture of the significant cancer burden and the rates of particular cancers. "There is room for strengthening" the available data on risk factors and screening for these diseases, Yonga noted, in order to obtain a more representative national picture, but the existing information does provide a useful basis for action.

Both the direct costs of treating and managing patients and the loss of productive years of work from chronic diseases are significant, Yonga noted, but there are few economic studies of either. Much of the available information comes from studies that included Kenya as one of a number of countries, such as the WHO Choice study and the Intersalt study of the cost savings that can occur when a population reduces its salt intake (Murray et al., 2003; Rose et al., 1988). Furthermore, there are few studies of the cost effectiveness of interventions, either those targeting individuals or those targeting populations. Such studies could provide useful information for determining health care policies in Kenya, but their lack of country-specific information is often very apparent. For example, one study using regional data recommended certain guidelines for risk modeling of cardiovascular disease that relied heavily on the results of laboratory tests, such as for blood sugar and cholesterol. However, it was impossible for Kenya to use this type of modeling and to use blood sugar and cholesterol tests as mass screening tools because the country does not have the laboratory resources and testing policies needed to collect this data (Lemogoum et al., 2003). A study that had focused only on Kenya might have produced more helpful guidelines for screening programs and risk detection that were less laboratory-based and that instead took advantage of the resources that Kenyan health centers can access.

To summarize, Yonga identified some of the principal gaps in Kenya's chronic disease data:

- National data on the prevalence and incidence of noncommunicable diseases and risk factors
- National surveillance of diseases and risk factors
- Data on the economic burden of these diseases and their costs at the community and household level
- Evidence on feasible and cost-effective risk modeling, screening methods, and intervention programs for cardiovascular and other chronic diseases
- Collection of health information from private-sector hospitals and other health activities
- Access to unpublished data (e.g., from nongovernmental projects or university theses)
- Connection between evidence needs and research activities

Yonga suggested several steps that Kenya could take to fill in some of these gaps. Primarily, it could implement the WHO-STEPS survey and simultaneously work on enhancing existing data and health information systems, including e-health systems, in a way that would allow the country to capture data on noncommunicable diseases. For example, Yonga suggested that the Kenya Demographic Health Survey, as a regular instrument with an existing logistical structure, has the potential to be used to collect national representative data, but it does not currently include a lot of noncommunicable disease indicators. In addition, noncommunicable disease screening and intervention programs should be integrated into existing HIV and maternal and child health systems, and these programs could then be equipped with mechanisms that would make it possible to do costing and economic analysis.

GRENADA

While total deaths in Grenada have declined in the last 5 years, the number and percentage of deaths caused by chronic diseases has increased during that time, said Emma Herry-Thompson, Chief Medical Officer of Grenada's Ministry of Health. Unfortunately, she added, the data available on interventions are "minimal." As Francis Martin noted in the presentation summarized in Chapter 2, surveillance data in Grenada consist primarily of weekly tallies from community health nurses. Hospitals supply medical records (of births, diagnoses of discharged patients, and deaths), and emergency rooms supply records of accidents and violence. The government's infectious disease control department also collects weekly data on those diseases. This is a paper-based system, and, as Herry-Thompson explained, the individuals responsible for collecting and reporting the data are not always committed to the importance of the task and thus data are frequently lost.

A number of other sources of data are being developed, Herry-Thompson said, including the WHO-STEPS survey, WHO's Global Youth Tobacco Survey,[3] the Global School-Based Health Survey of the U.S. Centers for Disease Control and Prevention (CDC), the Grenada Heart Project, and research by the Retina Resources Foundation of New York. However, she expressed concern that inefficiency and gaps in data collection may limit the value of some of these results. She also noted that project sustainability is often a problem. The Retina Resources Foundation did a great deal of surveillance and screening and even treated some patients with diabetic retinopathy, but the program was not sustained. Herry-Thompson

[3]See http://www.who.int/tobacco/surveillance/gyts/en/ and http://www.cdc.gov/gshs/ (accessed October 2011).

expressed the greatest optimism about the Grenada Heart Project.[4] In this case, researchers from the World Heart Federation conducted a survey to profile risk factors in Grenada using the WHO STEPwise approach for the surveillance of risk factors. This work demonstrated a pressing need for interventions, some of which are in now in progress.

Finally, Herry-Thompson noted that much of the data in Grenada is regionally driven, submitted as a requirement to regional surveillance organizations like the Pan American Health Organization (PAHO) and then used to generate regional reports that are fed back to the Ministry of Health. Herry-Thompson is hopeful that improvement in country-driven generation and use of data is under way.

Herry-Thompson described the primary source of health care financing in Grenada as general taxation, though support from other nations and international organizations such as PAHO, WHO, the United Nations Children's Fund, and the Caribbean Development Bank are also important sources. However, the external funds are generally specifically targeted in ways that may not perfectly match the needs the ministry perceives. One result of the limited funding has been to prompt Grenada's health officials to shift their focus to prevention, she said.

Grenada's biggest need, in Herry-Thompson's view, is for a monitoring and evaluation system that could help ensure that limited resources are spent in optimal ways. The country also needs technical support to assess costs and cost-effectiveness, she said. Grenada has insufficient trained personnel for data collection and analysis, and it also needs both software and hardware for the collection and analysis of data. Public–private partnerships need to be strengthened to facilitate data collection and sharing, she added, and the country needs a chronic disease registry. On the positive side, Herry-Thompson concluded, there is a growing awareness of the importance of data among health officials and workers. Grenada has some challenges with its health infrastructure, but there is a good supply of well-distributed facilities.

RWANDA

It is not essential to have complete population-based data about noncommunicable diseases in order to act, noted Gene Bukhman of the Harvard Medical School and Partners in Health. In many countries with very low levels of current health spending, he said, "there is probably sufficient data to know we should be doing more for problems we are already aware

[4]See http://www.world-heart-federation.org/press/news-old/demonstration-projects/grenada-heart-project/print.html (accessed October 2011).

of." Bukhman described the primary sources of health data for Rwanda as well as some concerns related to that data.

The Demographic and Health Survey is one key source, he said. It provides various data relevant to chronic diseases, such as the fact that 93 percent of rural Rwandans live in housing with a dirt floor, versus 52 percent of urban Rwandans, and that 19 percent of urban woman have a BMI over 25, versus 10 percent of rural women (Institute National de la Statistique du Rwanda and ORC Macro, 2005). However, Bukhman said, it is important to place data on the prevalence of risk factors and diseases in context. For example, any response to data on tobacco use should take into account that Rwandans who smoke typically have only a few cigarettes per day, and that studies show that the number of cigarettes smoked per day has a major effect on disease outcomes. Similarly, although obesity is a significant health concern, undernutrition, malnutrition, and starvation are more serious conditions, and should lead to greater concern in a country such as Rwanda. This prompted a discussion among participants at the workshop about whether obesity and malnutrition are competing health issues. Gerald Yonga pointed out that undernourished and obese populations exist side by side in many places. "With increasing urbanization, you see very underprivileged conditions where the problem is not complete lack of food but lack of choice." One participant suggested that "unless we are able to show that the two need to be discussed at the same time, we have the risk of the entire noncommunicable disease agenda just being dropped lower on the priority list."

Another source of information is the estimates of the global burden of diseases that have been produced by WHO[5] (Mathers et al., 2008), which indicate that noncommunicable diseases make up 25 percent of the disease burden in Rwanda. Such data do provide a general sense of the magnitude of the relative burden, but Bukhman described a few concerns pertaining to these data. For instance, the estimates were not based on data for particular conditions from Rwandan populations because such data are not available. Rather, the data are extrapolated from other sources, and thus may not be representative of what is happening in Rwanda. There may, for example, have been a "major overestimation of the burden of ischemic heart disease in Africa and for rural African sites," Bukhman said. One participant commented that many countries face a similar problem, with burden of disease statistics being presented that sound serious but that are not based on any data from the country itself.

Population surveys are also useful sources of information, Bukhman said, but the low prevalence in Rwanda of some of the chronic diseases has limited the collection of such data. The only nationally representative

[5] See http://www.who.int/topics/global_burden_of_disease/en/ (accessed October 2011).

population surveys conducted in Rwanda have been for epilepsy, severe musculoskeletal impairment, and severe visual impairment (Atijosan et al., 2008; Mathenge et al., 2007; Simms, 2008). Thus, those studying chronic disease in Rwanda look to data from similar populations and settings for an indication of what is probable in Rwanda. Bukhman described an example of how data from rural communities in Gambia could be used to draw conclusions about the situation in Rwanda. Data from Gambia show that, while rates of mild hypertension are significant, only 1 to 2 percent of the population has severe hypertension (blood pressure over 180). The data from Gambia also indicated that most cases of hypertension are not accompanied by such other risk factors as obesity, diabetes, or high cholesterol (van der Sande et al., 1997). If one assumes that the risk factor profile would be similar in Rwanda, Bukhman suggested, this information could influence decisions about priorities in services and the development of care protocols.

One source of information is data from facilities, which indicate the relative importance of particular diseases as a cause of hospitalization. "It's very important to have the correct denominator" when considering such data, Bukhman said. For example, if one included obstetric admissions in the data, "it will make the burden of [chronic] diseases in terms of admissions and deaths seem very small." Another complication is if the coding used to record diseases is not standardized, which increases error. Recordkeeping such as health facility registers was interrupted during the 1990s by the Rwandan genocide, Bukhman said, but gaps are now being filled in retrospectively. An increasing number of districts now have electronic medical recordkeeping systems. Electronic medical records and monitoring of indicators will be key "in better documenting the risk factors and disease patterns that affect Rwandans, which will make it possible to improve intervention effectiveness," Bukhman said.

Some data concerning the cost of interventions are available, he said, but most of the data concern actual procurement costs—the actual outlays for drugs, for example. The resulting figures are rough, he added, but they do provide a general picture, as Table 3-1 shows. These figures reflect spending on transport costs, community health worker and nurse salaries, hospitalization, and the like, which were used to calculate a per capita increase in spending, as well as a total. Bukhman noted that interventions for conditions that are very expensive to treat may be cost-effective if the treatments are effective, in part because very few cases of some of them are diagnosed. Another information source is the joint annual work plan. All of the parties that contribute to health care in Rwanda report exactly what they contribute and for what purposes, Bukhman said. It may not be completely accurate, but it provides a useful general picture.

Looking forward, Bukhman identified several promising opportunities

TABLE 3-1 Rough Cost Data for Selected Chronic Diseases in Rwanda

Condition	Case-Finding Rate	Population Prevalence	Cases Found	Average Annual Cost		
				Total	Per Patient	Per Capita
Cardiomyopathy	30%	0.2%	6,000	$2,009,506	$334	$0.20
Cardiac surgical follow-up	3%	0.1%	300	$3,709	$412	$0.012
Screening and follow-up for HIV nephropathy	100%	0.1%	9,000	$46,873	$5	$0.005
Diabetes	50%	0.44%	22,000	$3,806,655	$173	$0.38
Hypertension (160/90 threshold)	100%	4%	400,000	$7,632,542	$9	$0.76
Chronic respiratory disease	15%	2%	24,900	$1,453,695	$57	$0.14
Chronic care integration subtotal				**$3,655,917**		**$1.50**
Cardiac surgery (initial surgery)	3%	0.1%	300	$1,164,000	$3,880	$0.12
TOTAL				**$819,917**		**$1.62**

SOURCE: Kidder et al. (2011).

for improving the data situation in Rwanda. One is a forthcoming study of rheumatic fever prevalence, which will influence the decision on whether or not to treat sore throats at community clinics. Another is the possibility of taking greater advantage of the mobile clinical experiences many young doctors have by using them to collect clinical population data. The development of a national cancer registry would also be very valuable. Finally, Bukhman mentioned other opportunities, such as the WHO-STEPS surveys, the use of sentinel surveillance sites, and the International Network for the Demographic Evaluation of Populations and Their Health in Developing Countries (INDEPTH), although there are challenges to implementing these methods. Overall, he said, it is clear that there is a need for collecting population-level clinical data.

SUMMATION

From the presentations across all four countries, there emerged a clear need for strategies to collect and analyze data to assist an evidence-driven process for allocation of resources for chronic disease control. As Stephen Jan mentioned, a process for decision making regarding resource allocation can be aided by data that exposes the disease situation on multiple levels, including the basic disease epidemiology; whether there is a need or preference for more intervention; the social and economic disease burden; the available resources that can be used for disease control and the capacity to absorb new investment; the short- and long-term costs, benefits, and effectiveness; and the potential for sharing some of the cost burden with other sectors outside of health. Collecting an abundance of data to address each of these areas is a challenge; however, some data sources are available and do provide evidence that can serve as a basis for action.

According to the reports from Bangladesh, Kenya, Grenada, and Rwanda, the majority of available data addresses disease epidemiology and comes from regional surveys and studies run by multilateral organizations such as WHO, public and private hospital data, and various academic research studies. Some countries also conduct local surveys, some have surveillance sites that provide data, and some have national health management information systems that aggregate data from many facilities. There are, however, many gaps in the epidemiological data—several countries have no national registries for certain chronic diseases, others lack continuous and systematic reporting methods, some are dealing with weak communication between the government and private hospitals or companies that could provide health data, and others lack data on disease risk factors. A common theme across countries is the lack of country-specific data—many countries are using what they can from regional studies, but the recommen-

dations from these studies are not always aligned with a country's available resources and community preferences.

The representatives of Bangladesh, Kenya, Grenada, and Rwanda described less availability of information regarding the social and economic burden of disease or the costs and benefits of using various resources. The speakers mentioned that there are few country-specific studies on the effectiveness of programs targeting chronic diseases, the cost effectiveness of interventions, or the economic burden of disease. This is in large part due to the fact that there are few people in the health sector with the technical skills to do these assessments. Several speakers mentioned that there is limited availability of services and interventions in their countries, and it is difficult to evaluate the effectiveness of something that is not present in the first place.

Overall, the speakers suggested that the data that are available provide a general, even if not completely comprehensive, picture of the chronic disease situation in the countries that they represent. It is clear that action for chronic disease control is needed, and the current data sources already provide some guidance for decision making on what measures should be taken. As many of the participants mentioned, data gaps should not be an excuse for inaction; however, better data will ideally lead to smarter spending and more effective programs that effectively address the chronic disease burden.

Chapter 6 provides a further summary of the considerations raised in this session along with the presentations and discussions throughout the workshop.

4

Examples of Tools for Costing, Economic Modeling, and Priority Setting

A toolkit that could support countries in their decision making related to chronic diseases must address a complex set of tasks, including budgeting, planning, decision making, and priority setting, said session moderator Rachel Nugent of the University of Washington. The first session summarized in this chapter presented several models for costing and other economic analyses that might represent useful components of a toolkit, recognizing that financing is a fundamental aspect of decision making in every country. Therefore, any tool or process to support decision making for chronic disease control needs to provide information about costs to support budgeting as well as, ideally, information on cost effectiveness and potential return on investment to help convince policy makers of the benefits of allocating resources to support intervention. Even more ambitiously, Nugent added, the toolkit might also be used to address more "big picture" types of economic questions that may also play a role in priority setting—for example, the relationship between the prevalence of chronic diseases and economic development.

In addition to economic analyses, decision making is also influenced by a range of other types of information and influences. The second session summarized in this chapter explored two examples of tools to inform priority setting that incorporate data beyond costing and economic analysis. One is a model that focuses on estimates of impact based on the anticipated life-saving effects of interventions, which can be a powerful policy tool. The other is a tool that can incorporate multiple criteria that influence decision making, including empirical data (such as effectiveness and economic data) as well as information that reflects values and preferences. The aim of the

tool is to provide a way to systematically and transparently establish rankings or comparisons among different intervention options across a broad range of criteria.

The following sections summarize the content of each of the presentations in this session. Chapter 6 provides a summary of the considerations raised in this session along with the presentations and discussions throughout the workshop.

TOOLS FOR COSTING AND ECONOMIC MODELING

Developing a Country-Validated Price Tag for Chronic Disease Prevention

Knowing how much it would cost to prevent or reduce noncommunicable diseases can be important for advocacy and to promote spending from international donors, Andrew Mirelman of Johns Hopkins University commented, as well as to establish priority setting at the national and subnational levels. He noted that efforts to calculate the costs of disease burdens and preventive interventions—for HIV/AIDS, vaccines, and child survival, for example—have become valuable tools for advocacy and for priority setting.

Mirelman described an effort to develop a disease prevention price tag using a cross-validation study in which international estimates of the costs of preventing specific diseases and reducing specific risk factors are compared with country-level data on costs for specific population- and individual-based interventions. The study explored prevention costs for noncommunicable diseases in 19 resource-poor countries and was carried out primarily by a number of Centers of Excellence set up through the UnitedHealth Chronic Disease Initiative and the U.S. National Heart, Lung, and Blood Institute (NHLBI).[1] The Centers of Excellence are research institutions in low- and middle-income countries that collaborate with academic institutions in high-income countries in order to address chronic diseases. (See Box 4-1 for a list of the centers and their university partners at the time of Mirelman's data collection.) The goal of the Centers of Excellence program is to build research capacity within local institutions, and for the past year these centers have participated in developing a country validation approach to calculating the costs of prevention.

For this project, the teams used values from international databases (including the World Health Organization [WHO] Comparative Risk Assessment for Burden of Disease, WHO-CHOICE reference pricing, the Management Sciences for Health *International Drug Price Indicator Guide*,

[1]For more information see http://www.nhlbi.nih.gov/about/globalhealth/centers/ (accessed October 2011).

BOX 4-1
UnitedHealth and NHLBI Collaborating Centers of Excellence[a]

Argentina (Instituto de Effectividad Clinica y Sanitaria)	Tulane University
Bangladesh (ICDDR,B)	Johns Hopkins University
China (George Institute)	Duke University
Guatemala (The Institute of Nutrition of Central America and Panama)	Johns Hopkins University
India (Bangalore) (Population Health Research Institute)	McMaster University
India (New Delhi) (Public Health Foundation India)	Emory University
Kenya (Moi University)	Duke University
Peru (Universidad Peruana Cayetano Heredia)	Johns Hopkins University
South Africa (University of Cape Town)	Harvard University
Tunisia (University Hospital Farhat Hached)	National Public Health Institute, Helsinki, Finland
U.S.–Mexico Border (Pan American Health Organization)	University of Texas El Paso; University of Arizona; Whittier Institute of Diabetes San Diego, CA

[a]This list includes those centers that were in existence at the time of Mirelman's data collection.
SOURCE: NHLBI (2011).

and the WHO Global InfoBase). They then validated the data at the country level using a questionnaire and interviews with technical personnel. The key variables were risk factor prevalence, intervention coverage, and unit prices for drugs and health staff salaries. The researchers used demographic projections based on United Nations (UN) data to estimate, for example, growth in the elderly populations most likely to be affected by the diseases being studied.

The approach used in this project had several important strengths, Mirelman explained. Tailoring the analysis of risk reduction approaches to the individual countries was important. The teams confirmed which medical approaches were used in each country (such as which tool was typically the first choice for targeting hypertension), the guidelines for treatment, and other information. They used an iterative approach to investigate confusing information and to fill in gaps, and they found that doing so influenced

their results. Many of the countries became interested in the benefits of the analysis, so the validation is ongoing. The researchers used multi-variate sensitivity analysis to address uncertainties in measurement and in the data, such as data concerning drug prices, epidemiological information, and compliance. They were also able to integrate their findings with other estimates of the burden of diseases and with cost-effectiveness analysis.

The approach also had a number of limitations, Mirelman said. The team needed to make assumptions that were in some cases quite optimistic. For example, the team assumed that prevalence data could be translated into ideal professional protocols—that patients would be identified and an intervention of some kind would be initiated—but "that's supremely idealistic," Mirelman said. Thus, the price tag essentially answers the question "If we could do everything right now, how much would it cost?" The model used in this work also required assumptions about data that were not fully available, such as the availability of medical personnel, and it could not fully account for barriers to implementation. In general, there was "never enough data at the country level," Mirelman said. The model also did not take into account the cost offsets likely to come from the health and societal benefits of reducing disease prevalence. Furthermore, Mirelman said, the findings are a yearly estimate of the cost of prevention—not a projection into the future.

The researchers hope to build on the work that has already been done, Mirelman said, by developing more comprehensive data calculating the burden of diseases used to support cost-effectiveness analysis. The researchers hope to develop a league table to rank potential interventions based on cost effectiveness as well as decision weights for such criteria as disease severity and equity (multiple criteria decision analysis, an approach described in a subsequent presentation summarized in this chapter, is one way to develop such weights, he noted). The researchers also hope to expand the program to more countries.

The research done through these collaborations, Mirelman concluded, can provide valuable support for decision makers. As an example, he cited an analysis of future projections from data from China that showed that even though the assumption has been that population-based approaches are the most cost-effective, in that setting "you can get an equally good buy with individual-based approaches, even though they are expensive, because you are targeting high-risk individuals, so you realize very high-level effects." Furthermore, participants noted that the value of such rigorous research goes beyond advocacy. It can reveal significant differences across countries, which could yield insights about variation in treatment guidelines, prices, and other issues.

Two Types of Economic Modeling

Tom Gaziano, of Harvard University's Brigham and Women's Hospital, started by explaining that his work focuses not so much on a research ideal of the best possible thing to do, but rather on "what we are able to do" with what is available. It is unlikely that there are perfect data for any country, he commented, and the countries with the greatest need have the greatest data challenges. Thus, real-world modeling requires the flexibility to adapt questions to the available data—for example, addressing a less specific aspect of cardiovascular disease.

Gaziano described a project conducted through the UnitedHealth/NHLBI Centers of Excellence[2] that was designed to determine the potential cost to low- and middle-income countries of adhering to current international blood pressure guidelines, which have set a goal of bringing people with hypertension to a target blood pressure of 140 over 90 or lower. The researchers also examined the potential savings that might come from three different lifestyle changes that could lessen the need for medications: a reduction in salt intake, an increase in physical activity, and improvements in diet. The researchers hoped the results would be useful for determining policy recommendations for both individual countries and regions.

High blood pressure is a significant risk factor, Gaziano noted. It contributes to at least 50 percent of cardiovascular disease, particularly stroke and ischemic heart disease. Elevated blood pressure leads to a major financial burden from both the efforts to manage the high blood pressure and the treatment of the health problems it causes. A variety of data regarding the economic impact of treating heart attacks and stroke are available, but much less information is available concerning treatment of individual risk factors at a country level. Data on the global financial burden of hypertension are also scarce, Gaziano added, but full compliance with drug treatment is clearly expensive. Estimates of the cost of hypertension as a percentage of total health care costs range from 7 or 8 percent to 20 percent, depending on the region, with heart attacks and strokes being the largest drivers of cost (Gaziano et al., 2009).

In the study carried out through the Centers of Excellence, Gaziano said, the basic protocol was to determine the total number of people eligible for blood pressure treatment by country, assess the cost of treating this population, and determine the effect of lifestyle interventions on the distribution of elevated blood pressure. Estimating the number of people who would not need treatment if the lifestyle interventions were available would make it possible to calculate the net costs and savings associated

[2]For more information, see http://www.nhlbi.nih.gov/about/globalhealth/centers/ (accessed October 2011).

with each lifestyle intervention. The researchers studied the 19 countries represented by the 10 Centers of Excellence and 14 additional countries, and these 33 countries contained approximately 80 percent of the population of low- and middle-income countries worldwide.[3]

The researchers sought new or confirming epidemiological data on prevalence, awareness, treatment, and control of blood pressure, using the WHO database as well as individual country and regional data. Data on treatment costs came from the Centers of Excellence or, when this was not available, from WHO and other global sources. It included the costs of antihypertensive medicines if prescribed according to standard of care as well as the costs for physicians and nurses, clinic time, treatment, and laboratory work. The associated costs of a strategy to increase physical activity were based on a mass media campaign in Australia, and those of population-based strategies to reduce salt intake were based on existing published estimates (Asaria et al., 2007). The centers provided data they collected on costs for fruit and vegetables; this was supplemented by U.S. Department of Agriculture data. To estimate the anticipated reduction in mean blood pressure through treatment and the three lifestyle strategies, the team used a variety of sources, including WHO and the available published literature.

The data on estimates of prevalence, awareness, and treatment were "somewhat shocking," Gaziano noted. Among the population covered in the study (as noted, roughly 80 percent of the population of low- and middle-income countries) it was estimated that approximately 600 million people, or about 25 to 26 percent of adults, had hypertension. Only about 40 percent of them were aware that they were hypertensive, and of that group, only 40 percent—approximately 120 million people—were being treated. Furthermore, of that small percentage, only about 20 percent had their hypertension adequately controlled.

Based on the combined results across countries, the cost to treat the people whose blood pressure is currently not being controlled and to bring them to the point specified by the international guideline would be about $43 billion, with human resources representing a significant portion of the cost. The calculated net savings from the physical activity intervention were about $1 per person. For salt reduction, the net savings were $2 per person. By contrast, the fruit and vegetable intervention would have a net cost of about $80 per person rather than a net savings, although Gaziano

[3]The 19 countries represented by the Centers of Excellence were Argentina, Bangladesh, Belize, Chile, China, Costa Rica, El Salvador, Guatemala, Honduras, India, Kenya, Mexico, Nicaragua, Pakistan, Panama, Peru, South Africa, Tunisia, and Uruguay. The 14 additional countries included in the study were Brazil, Czech Republic, Democratic Republic of the Congo, Egypt, Ethiopia, Indonesia, Iran, Myanmar, Nigeria, Russia, Thailand, Turkey, Ukraine, and Vietnam.

noted that the intervention could have other benefits as well, for example in reducing cancer rates.

When looking at individual countries, the costs varied significantly by country, and thus the per capita net savings that would result from the different interventions varied as well. Based on the data provided by the countries, the variability was quite high for the cost of medications, even those that are generically available, and there was a big range compared to the estimates from the Management Sciences for Health *International Drug Price Indicator Guide*. "This is one of the striking findings," said Gaziano. There was also a wide range in laboratory costs, and outpatient visits ranged anywhere from $20 up to about $120. Similarly, the estimated per capita costs for the lifestyle interventions considered in the study ranged, for example, from 4 cents to 30 cents for salt reduction and from $35 to $300 per capita to increase fruit and vegetable consumption.

Indeed, one overall finding from this work was the significant variation in results from country to country. "It's quite a broad range," Gaziano explained, "depending on what they were already doing and the level of control they had, as well as how much they were spending on health care."

Gaziano also described a second model which was used in a study conducted for the World Economic Forum on the global economic burden of noncommunicable diseases, with a particular focus on cardiovascular disease (Bloom, 2011). In this study the researchers began with a model of the life course of cardiovascular disease. This life course approach is important because such lifestyle factors as excessive salt intake, consumption of trans fats, and insufficient physical activity may start to have effects early in life, and these and other factors become risk factors in individuals, which in turn increase the probability of disease. Primary prevention strategies at either the population or individual level may help control these risk factors, and secondary prevention or acute medical treatment—both of which are more expensive than primary prevention—come into play if primary prevention strategies are not effective.

The researchers developed a "decisional analytic model," Gaziano said, which involves assessing a population in terms of age and gender distribution, blood pressure status, smoking, diabetes, and cholesterol. The model identifies those with differing levels of risk for cardiovascular disease, and it indicates the proportions of each in the population, which provides the opportunity to consider different intervention options for each subpopulation.

This type of modeling can be used to predict cardiovascular disease events, Gaziano explained, and costs can then be attached to the various possible interventions. The result makes it possible to predict, given a population with a particular distribution of risk factors, the number of events likely in a particular period of time as well as the potential treatments and costs. Using this approach, the researchers estimated a global cost of about

$860 billion annually due to various aspects of cardiovascular disease, including the management of blood pressure and cholesterol levels and the treatment of ischemic heart disease, stroke, heart failure, and hypertensive heart disease. Approximately 50 percent of the cost was due to health care costs and the rest to lost productivity. The costs differ by country and region, he added, ranging from a low of $20 or $30 per capita in developing countries to a high of $400 to $650 per capita in North America, Western Europe, and developed Asian countries. In high-income countries, a considerable portion of the costs are accounted for by acute, advanced hospital care. Although $20 to $30 per capita in developing countries may seem low, it could be the entire health care budget in many low-income countries, so covering all costs of cardiovascular disease would be difficult despite the fact that the cost would be relatively low compared to high-income countries.

Gaziano added that the global cost of cardiovascular disease is likely to rise to as much as $20 trillion over the next 20 years, given the projected population growth and assuming no change in risk factor estimates. "These are probably underestimates," he added, "because we use mostly public-sector pricing." A number of other factors could indicate that the estimate is low, he said. The analysis did not include rheumatic heart disease and other cardiovascular conditions, for example, nor did it include devices such as pacemakers and defibrillators or some other procedures that can be quite expensive. The researchers assumed a low level of hospital access in low- and middle-income countries, but that hospital access could improve, which would "vastly affect the costs over time."

During the discussions following his presentation, Gaziano and other participants commented on how, from the perspective of a potential toolkit, these models could be applied at the country level by using country-specific estimates of the costs of interventions and by adjusting the anticipated effects of treatment and lifestyle interventions based on how they would actually be implemented in a country and the evidence for effectiveness in a similar population or context. There is also the potential to expand the models to use them to explore different scenarios in a country, such as setting different treatment targets or shifting treatment costs by changes in the system's current guidelines or standards, such as using lower-cost personnel or changing the frequency of clinic visits for managing treatment. "When you do these models you are forced to look at all the individual components and say, hmm, why are we spending so much on this part?" Gaziano said. Thus, the models can generate data that could be used to consider options for how to make optimal use of available resources.

The World Health Organization's Costing Methods

In the presentation following Gaziano's, Karin Stenberg of the World Health Organization (WHO) began by agreeing that many assumptions go into any model. In many cases the data are somewhat shaky, she said, so it is important to "look at the different pieces of evidence that come together." This means, as the previous presentations indicated, that one should both recognize the size of the problem and explore potential solutions and priorities for investment. Once priorities are established, however, it is also important to determine the costs of implementing the chosen interventions at the intended scale.

To illustrate such costing, Stenberg described a WHO study led by Dan Chisholm which examined the costs of scaling up interventions aimed at noncommunicable disease control (Chisholm and Mendis, 2011). The goal of the study was to develop a financial planning tool to aid countries in the scale-up of these health care interventions, and the cost estimates from individual countries were then combined to produce a global "price tag" that illustrated the total cost of scaling up noncommunicable disease interventions worldwide. The study included analysis of data from 42 low- and middle-income countries;[4] these countries account for 90 percent of the noncommunicable disease burden in developing countries. The scope of the costing study was limited to the diseases and risk factors highlighted in WHO's *Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases*, specifically cardiovascular disease, diabetes, cancers, and respiratory disorders (asthma and chronic obstructive pulmonary disease) (WHO, 2008a). To determine which interventions to analyze, the researchers used previous work from WHO that had identified cost effective, feasible, low-cost interventions that were also appropriate to implement within the constraints of the local health system where they would be used (Alwan et al., 2011). They defined the "best buys," or very-cost-effective interventions, as those that could add an additional year of healthy life for less than the country's annual per capita income. (Table 4-1 summarizes the 14 "best buys.") Interventions that did not meet all of these criteria but that still offered good value for the money and had other attributes that recommended their use were considered as "good buys" and were also included in the costing study.

[4]Included in the study were 14 low-income countries (Afghanistan, Bangladesh, Côte d'Ivoire, DPR Korea, DR Congo, Ethiopia, Ghana, Kenya, Myanmar, Nepal, Nigeria, Sudan, Uganda, Tanzania), 13 lower-middle-income countries (China, Egypt, India, Indonesia, Iraq, Morocco, Pakistan, Philippines, Sri Lanka, Ukraine, Uzbekistan, Vietnam, Yemen) and 15 upper-middle-income countries (Algeria, Argentina, Brazil, Colombia, Iran, Kazakhstan, Malaysia, Mexico, Peru, Romania, Russian Federation, South Africa, Thailand, Turkey, Venezuela).

TABLE 4-1 "Best Buy" Interventions

Condition	Interventions
Tobacco use	Tax increases; smoke-free indoor workplaces and public spaces; health information/ warnings; advertising/promotion bans
Harmful alcohol use	Tax increases; restrict retail access; advertising bans
Unhealthy diet and physical inactivity	Reduced salt intake; replacement of trans fat with polyunsaturated fat; public awareness about diet and physical activity
Cardiovascular disease and diabetes	Counseling and multi-drug therapy (including glycemic control for diabetes) for people with > 30 percent cardiovascular risk (including those with cardiovascular disease); treatment of heart attacks with aspirin
Cancer	Hepatitis B immunization to prevent liver cancer; screening and treatment of pre-cancerous lesions to prevent cervical cancer

SOURCES: Alwan et al. (2011), Chisholm and Mendis (2011).

The WHO costing study also took into account the readiness issues discussed earlier, by including an assessment of the current strength of the health system in a given country as part of the scaling-up process. For example, the researchers assumed that low-resource countries would need more lag time than others to put infrastructure and personnel for individual interventions into place. For population interventions, they included an assessment of current policies and how these policies are enforced. The model then included activities needed to strengthen policy, planning, and implementation. Table 4-2 shows the phases of policy development and the sorts of resources needed in each phase. The researchers developed cost estimates for each of these elements.

The costing method was straightforward, Stenberg said, and it was similar to those described in other previous presentations. The researchers calculated the relevant variables: population; prevalence (percent of population with disease or risk factor, by age and sex); current and target coverage (percent of population in need of intervention); resource use (resources needed to implement an intervention); and cost per unit of resource use. For example, in a country with a population of 1 million and a 20 percent prevalence rate for smoking, the population in need of intervention would be 200,000 individuals. An intervention that costs $1 per patient per year

TABLE 4-2 Resource Needs Matrix for NCD Policy Instruments

Stage of Policy Development	Human Resources	Training	Meetings	Mass Media	Supplies and Equipment	Other
Planning (year 1)	Program management; administration	Strategy/policy analysis	Stakeholders		Office equipment	Baseline survey
Development (year 2)	Advocacy; law	Legislation	Intersectoral collaboration	Awareness campaigns		Opinion poll
Partial implementation (years 3-5)	Inspection	Regulation	Monitoring	Counter-advertising	Vehicles, fuel	
Full implementation (year 6 onward)	Enforcement	Evaluation				Follow-up survey

NOTE: NCD = noncommunicable disease.
SOURCE: Stenberg (2011a).

would cost $200,000. If the country were to begin with a 50 percent scale-up, the cost would then be $100,000. The researchers produced estimates for each of the 42 countries, using country data as well as standard assumptions, and then totaled these numbers to come up with the global price tag of noncommunicable disease interventions.

This particular study concentrated on the worldwide totals of certain interventions; however, perhaps its most useful product when it comes to actual health care planning is the tool that was developed to analyze country-specific costs of noncommunicable disease interventions. The global estimates of the noncommunicable disease burden that the WHO study produced are useful for advocacy, to demonstrate need and garner additional resources, Stenberg noted, but the average costs are not very relevant to individual countries. Similar to the experience with the other models presented, the WHO study showed that the cost of implementation of a given intervention varies widely among countries and thus the study highlighted the need to tailor planning to individual countries rather than to make assumptions based on global estimates. During the course of the study, templates were developed that each country could use for more detailed costing by plugging in more information and changing the assumptions as needed. These templates could be a valuable asset for country-level planning, particularly because of the care the researchers took in providing ways to tailor the analysis to specific circumstances.

One of the main strengths of the model, Stenberg said, is its capacity to provide a comprehensive assessment of a broad range of both public health and primary care interventions, considering both the "best buys" and "good buys." The researchers used the most current country policies and health care systems in their analyses, which, Stenberg noted, is an approach that could be useful in the further development of country-level tools for the planning of noncommunicable disease control. The model also uses a standard methodology that has been used in other WHO programs, which makes it very easy to compare findings across diseases and interventions.

On the other hand, Stenberg said, the results will not reflect assessment of health gains because the researchers were not able to model impact in the available time. The model also does not include changes in epidemiology over time, so it does not reflect the decrease in prevalence that could be expected once interventions are implemented or the cost savings related to such decreases. It also does not include medical personnel training costs. In addition, as was the case with the other models, the WHO work was based on sometimes idealized assumptions and used data inputs that could be better validated by the countries. Stenberg also noted that countries might wish to model other interventions that fit their needs better than those selected.

In the future, Stenberg said, it is likely that the templates will be made available to countries, and that this noncommunicable disease work will be

integrated with another project, the OneHealth model, which is a costing tool designed to assess public health needs in low- and middle-income countries.[5] Developed by a UN interagency working group, this model is part of an effort to standardize approaches to costing within the network of UN agencies so that results can be compared and planning can be integrated. The OneHealth model is also intended to address the growing awareness of the importance of considering the health sector in national planning and of using national health plans as a mechanism for coordination and for ensuring that donors' efforts are harmonized with local agendas.

Analysis has shown, Stenberg said, that a significant majority of the new resources that will be needed in low- and middle-income countries between 2009 and 2015 will be required for strengthening health systems (McCoy, 2009). However, the disease programs in many countries operate independently and develop their plans without considering the timing of other health programs, the national health plan, or the overall development plan for the country. This lack of synchronicity among various health plans in different countries can be seen clearly in the WHO planning cycle database, Stenberg said, which tracks the development of different health plans across the world.[6] For example, in Afghanistan, the National Health Plan covers the years 2007-2013, the immunization plan covers 2011-2015, the TB plan covers 2009-2013, and so on.

The OneHealth model is a tool intended to support medium-term planning and promote integration. Its focus is on the public sector, but it also allows for private-sector activities to be incorporated. The intended audience is health-sector planners, disease-specific program planners, nongovernmental agencies, and donors. Six UN agencies are engaged in the development of the tool, along with experts for each key area, who provide technical assistance. Representatives from several countries have also been involved in the development process to ensure that it will be useful for individual countries.

Figure 4-1 shows the basic framework covered by OneHealth. Six health system components form the building blocks; the bars in the center represent the levels at which action can be taken. The model is modular, so it can be adapted for different purposes. An additional benefit of its flexibility is that it encourages the involvement of experts in particular areas to conduct the planning for their domains, even while the model's structure keeps the whole system integrated.

Stenberg acknowledged that there are already many tools and models

[5]For more information, see http://www.who.int/pmnch/topics/economics/costing_tools/en/index4.html (accessed November 2011).

[6]For more information, see http://www.internationalhealthpartnership.net/en/home (accessed November 2011).

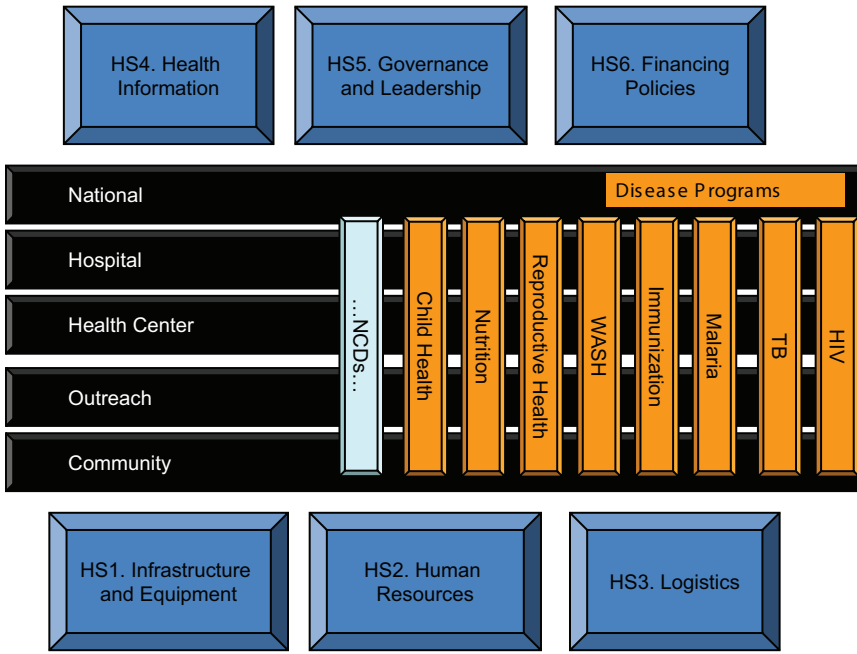

FIGURE 4-1 OneHealth framework.
NOTE: HIV = human immunodeficiency virus; NCDs = noncommunicable diseases; TB = tuberculosis; WASH = water, sanitation, and hygiene.
SOURCE: Stenberg (2011b).

available for health planning. She believes, however, that this particular one is important not only because it offers the possibility of coordination across agencies, countries, and other units, but also because it is the first to "bring together disease-specific planning with health systems in a unified way." OneHealth allows a person "to do a situation analysis, look at the capacity of the health system, look at different strategies, do priority setting, and look at financial implications." OneHealth also incorporates some of the UN's epidemiology impact models, such as the Lives Saved Tool (LiST) and the AIDS Impact Model (AIM), which can be used to demonstrate achievable health gains and to predict reductions in disease prevalence resulting from specific health care models.

The software is also very user-friendly, Stenberg added. The user can adapt the model to local circumstances and chose the level of detail that is most useful for a given purpose. For example, the model might be used to answer such questions as "What set of interventions will have a desired impact in my setting? What constraints in my system need to be addressed

before I can scale up a promising intervention? How feasible would a given intervention be if I have to adapt in certain ways in order to implement it in a given setting? What funding will I need to accomplish X?" A user might want to cost and budget a plan that has been already developed, or perhaps compare alternative scenarios. "It helps to make the planning more realistic, as opposed to setting very ambitious targets that you may not be able to achieve," Stenberg said. For example, a user with a target of scaling up an intervention to 90 percent coverage for a given disease or risk factor can click on the human resources module to determine whether the health system has a sufficient number of nurses or community health workers to deliver the intervention. If not, the user can adjust the target and explore other pathways for scaling up the intervention.

The OneHealth model faces the same data challenges that affect the other models discussed, Stenberg said. Another challenge is ensuring that each country has the capacity to take full advantage of the tool's possibilities. Despite the challenges, Stenberg concluded, the OneHealth model provides a common platform and consistent methods for countries to use and a way to ensure that their health systems' capacity is what drives planning and priority setting. As funding permits, the development team will continue to add new elements to the model, such as a health information systems module and models for health gains for noncommunicable diseases.

Stenberg closed with her recommendations for designing and applying a costing model as part of a toolkit:

- Be very clear about the specific policy questions to be answered, how the tools will be used and by whom.
- Focus on broad health sector planning processes and ways to integrate across programs.
- Don't overlook the need to invest in capacity building, advocacy, communication, and training in how to use the tools.

PRIORITY SETTING TOOLS

The Lives Saved Tool for Maternal and Child Health

The purpose of the Lives Saved Tool (LiST)[7] is straightforward, explained Neff Walker of Johns Hopkins University. It is intended to estimate the impact that increasing health coverage has on maternal and neonatal health, child mortality, and stillbirths. It is a computer-based tool that countries or program developers can use to estimate the relative impact of a wide range of possible interventions and levels of coverage for purposes

[7]For more information, see http://www.jhsph.edu/dept/ih/IIP/list/ (accessed November 2011).

of strategic planning. It is incorporated in the OneHealth model discussed above.

To use LiST, users begin by plugging in data for a particular country or region, such as neonatal and maternal mortality rates, current health coverage and interventions, and background information (e.g., vitamin A or zinc deficiencies or exposure to *P. falciparum*). Data on the effectiveness of many interventions, in terms of reducing either a cause or a risk factor of maternal or child death, are already programmed into the model, which currently includes more than 20 causes of death and risk factors (e.g., stunting, wasting, and intrauterine growth restriction).

The program has data for 85 low- and middle-income countries as well as for individual states in large countries. The demographic data are from the UN Population Division, the cause of death data are from WHO estimates, and the mortality rates come from the Inter-Agency Group for Mortality Estimation. The effectiveness values are from WHO's Child Health Epidemiology Reference Group, and the data on coverage are from several sources: the Department of Homeland Security, the Multiple Indicator Cluster Survey, the Malaria Indicator Survey, the United Nations, and WHO/UNICEF estimates of vaccine coverage. The data also cover countries' actions regarding HIV/AIDS and family planning, which influence maternal and child outcomes.

As an example of how the tool can be used, Walker said that a user focused on vaccines could assess the impact on mortality of increasing pneumococcal and rotavirus vaccination. Such vaccines would likely have little impact on maternal mortality but could have a significant impact in some countries on infant mortality. The model is structured to make it possible to compare multiple scenarios—for example, comparing the impact of 80 percent coverage of pneumococcal vaccine with 80 percent coverage with antibiotics. The model also allows users to consider the outcome if two or more interventions were scaled up at the same time and to generate a variety of counter-factual scenarios—that is, asking what would happen if an alternate course were followed. The scenarios also help users anticipate unexpected outcomes, Walker noted. For example, an effective intervention that reduces neonatal mortality might indirectly increase malaria rates because if more infants survive, more may be exposed to malaria, unless there is an increase in anti-malaria efforts as well.

The model is fairly simple, Walker said, but once all the factors are combined, the result is still rather complex. As an illustration of this complexity, Figure 4-2 depicts all of the factors that have an effect on pneumonia mortality, some of which are indirect. For example, the actions in the upper left related to hygiene reduce the incidence of diarrhea, which in turn lowers rates of stunting, which is beneficial because children whose growth is stunted have a significantly increased risk of dying of pneumonia.

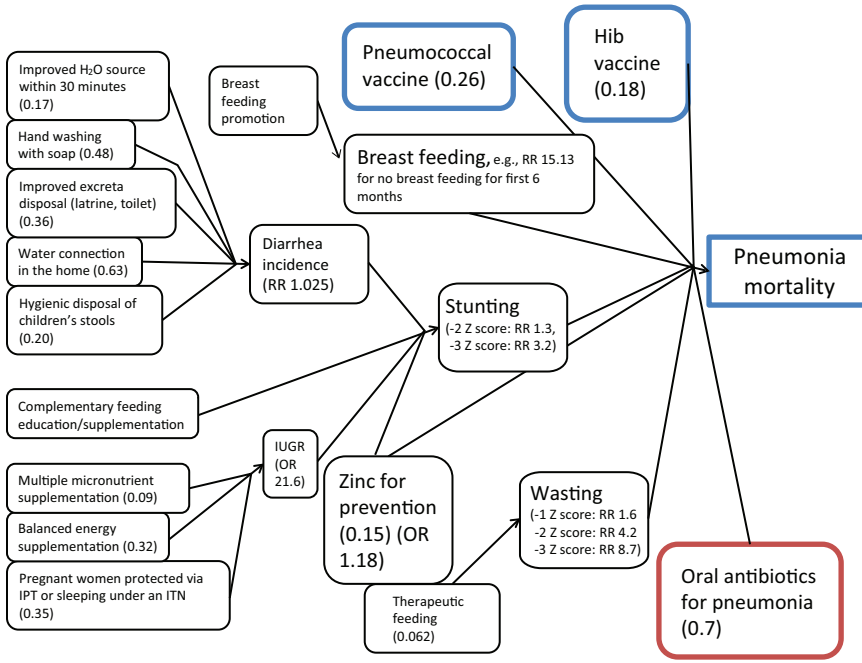

FIGURE 4-2 Factors and weights used in the LiST model that effect pneumonia mortality.
NOTE: Hib = haemophilus influenza type B; IPT = intermittent preventive treatment; ITN = insecticide-treated mosquito net; OR = odds ratio; RR = relative risk.
SOURCE: Walker (2011).

Similarly, interventions that affect intrauterine growth (lower left corner) also reduce stunting. The current model is not complete, however, and a participant pointed out a few elements that are missing from the current model, such as tobacco use, indoor air pollution, and gestational diabetes, all of which influence birth weight and infant death.

LiST has been used by many large organizations, such as WHO, UNICEF, the U.S. Agency for International Development, the Global Fund, and Save the Children, for priority setting and to support their advocacy, Walker said. More than 40 developing countries have used it to support their strategic planning, though only six or seven have used it as part of their national planning processes. LiST has also been used for the evaluation of programs, for example by the Global Fund and Roll Back Malaria.

There are several keys to success for LiST and other such models, Walker said. First, it is critical to have an ongoing system for developing and updating the assumptions that are part of the model. It is also impor-

tant that the model be easy for users to learn. It should require not more than about 2 days of training for the users to be able to easily change the default values as they modify the model for the circumstances they are assessing, and it should be available in multiple languages. LiST is strong in those areas, Walker noted—it is now available in four languages, for example—but it is also important to have some sort of organizational backing for the model to work with individual countries, and LiST is just now being adopted by UNICEF and WHO. Another important factor is to have published evidence of a model's effectiveness, Walker said, and LiST satisfies that criterion as well.[8] The most difficult key to success, Walker said, may be to ensure that the model harmonizes with other models and approaches. Because of the involvement of WHO and UNICEF, LiST has been integrated with several models with broader scopes, but there are many other disease-specific models as well, so the harmonization of LiST with other models remains a challenge. Walker's last word of advice was that it is very important to "define your primary task and try to stick to it—don't let mission creep take over."

A Multi-Criteria Decision Analysis Framework

The key question in setting health system priorities, said Mireille Goetghebeur of BioMedCom and the EVIDEM collaboration, is which interventions will contribute most to an equitable, efficient, and sustainable health care system. To answer this question, she said, it is necessary to consider both what should be done and what can be done. To tackle those two questions, it is useful to have a mechanism to rank or compare a range of possible interventions across a broad range of criteria. Multi-criteria decision analysis (MCDA) provides a tool for doing precisely this by assigning weights to a range of relevant and possibly conflicting criteria. Goetghebeur described a particular Web-based framework for applying this approach to decision making and priority setting for health care developed by the EVIDEM Collaboration.[9] The EVIDEM Collaboration of researchers and decision makers from a variety of countries has developed a decision-making framework that is available on the Internet and is supported by a Web registry of research on health care interventions and a discussion forum. EVIDEM is intended to develop a community of MCDA practice,

[8]For more information, see http://www.jhsph.edu/dept/ih/IIP/list/applications.html (accessed February 2012).

[9]EVIDEM was founded by researchers at BioMedCom, a consulting firm that specializes in economic analysis and its application in the health sector, and its board of directors includes policy makers, health care professionals, patients, researchers, members of the health care industry, and other specialists. For more information, see https://www.evidem.org/ (accessed November 2011).

Goetghebeur said, in which researchers and users develop, apply, and adapt the tools in a continuous, open, and nonproprietary fashion.

EVIDEM began with a generic framework for assessing and ranking interventions, based on an adaptable set of criteria. There are two modules, the MCDA core model, which is a universal template, and the contextual tool, which allows users to adapt it to specific circumstances. The core model is based on four principles: that the criteria should be complete, should have minimum overlap among them, should be mutually independent, and should be operational (National Economic Research Associated, 2005). Those principles yielded a set of 15 universal normative criteria in the core model, based on the assumptions that the highest value or priority should be assigned to interventions that

- address severe diseases;
- address common diseases;
- address diseases with many unmet needs;
- are recommended by expert consensus;
- confer major improvements in efficacy/effectiveness over current standard care;
- confer major improvement in patients' perceived health over current standard care;
- either confer major risk reduction or major alleviation of suffering;
- result in savings in health care intervention, medical, or nonmedical expenditures; and
- are supported by sufficient data that are fully reported, valid, and relevant.

To address the question of what *can* be done in a given context, there is a contextual tool with six criteria to help users define objectives and priorities of the population as well as feasibility. According to this tool, the decision-making process must address the following issues:

- Scope and mission of the health care system or plan
- Priorities for populations and access
- Opportunity costs (interventions foregone) and affordability
- System capacity (e.g., infrastructure, skills) and appropriate use of intervention
- Political/historical context (e.g., cultural acceptance, precedents)
- Pressures/barriers from health care stakeholders

To use the framework, a user would first assign weights to the criteria, and then, based on these weights, score and rank the potential interventions. The contextual module can then be used to factor in the other

elements (discussed above), and a financial tool is used to consider affordability and related issues. To demonstrate the process, Goetghebeur showed the workshop audience a prototype that is available to demonstrate the process,[10] and provided a link to additional prototypes that serve as examples of the application of the framework.[11]

One workshop participant noted that certain assumptions about shared ethical preferences seem to underlie the framework and wondered how weights are assigned to ethical or value-based criteria. The weights are defined by the users, Goetghebeur replied, and the overall weighting would reflect the preferences expressed by each of the stakeholders involved in the process (who might be asked to systematically rank possible considerations in order of priority). For each of the broad criteria, she added, there is a set of sub-criteria designed to help users tailor their responses. The tools are also evolving in response to user feedback.

Another participant noted that the framework appears to value interventions individually and wondered how the framework addresses interactions among different approaches—that is, considering whether or how the implementation of one worthwhile intervention might affect assessments of how reasonable another might be. Goetghebeur responded that the assessment of current interventions and what they are contributing is part of the framework.

There are a number of applications for the framework and for the information on the Web site, Goetghebeur said. Policy makers, physicians, patients, researchers, and developers of new health care programs and interventions all might use the framework to find information and make decisions. In New Zealand and Italy, the MCDA tool is being used to assess the reimbursement or implementation of health technology and drugs. At the level of health care professionals, the tool has been used to develop clinical practice guidelines, with the goal of making a link between the guidelines and the decision making at the regulatory and reimbursement level. The tool can also be used for identifying priority research questions and data needs. The MCDA framework can also be used to inform the development stage for new health care interventions or new health care programs. Finally, the framework can be used as a tool to communicate validated information to a range of stakeholders in a digestible format.

Goetghebeur identified some of the program's key strengths and limitations, organized into four main areas:

[10]The interactive demonstration prototype is available at http://www.evidem.org/tiki/?page=DEMO-main.

[11]Additional example prototypes are available at http://www.evidem.org/evidem-collaborative.php.

Utility to Policy Makers

- Adaptable to local context
- Systematizes decision-making process
- Combines quantitative and qualitative inputs
- Identifies applicable criteria and perspectives
- Based on a wide set of criteria
- Transparent

But

- Perceived as very complex
- May be difficult to integrate with existing processes
- There is a risk that MCDA may be used in a formulaic way rather than as a support to priority setting.

Methodology

- Pragmatic, user-friendly and modular
- Instructions are detailed
- Open-source—so users benefit from others' work

But

- Criteria selection and weighting process may be challenging.

Data Requirements

- Comprehensive but modular
- Open web registry—so users benefit from others' work

But

- The Web registry is just in a beginning phase.
- Data synthesis by criteria may be challenging.

Capacity and Training Requirements

- A testing package is available in toolkit.
- There is a growing community of developers and users.

But

- Expertise with MCDA is limited in the health care sector.

The EVIDEM framework, Goetghebeur concluded, provides a mechanism for priority setting that is transparent and consistent and that can help users identify the interventions that will contribute most to sustainable and efficient disease control and that will reflect the priorities and preferences of decision makers across a wide range of criteria.

5

Approaches to Supporting Country-Led Action

There are many different ways in which global organizations provide support to low- and middle-income countries. The NCD Alliance and World Bank are two examples of organizations using global mechanisms and infrastructure to address chronic diseases in ways that contribute to country-led processes. These two organizations have been particularly inspiring, said moderator Derek Yach. The NCD Alliance has been a leader in organizing the civil society sector both globally and within countries in the lead-up to the September United Nations meeting, and the World Bank has had a fundamental role in raising the visibility of global chronic disease for at least 20 years.

The current approaches of these two organizations were highlighted on the final day of the workshop as a complement to the country-level approaches and discussions from the preceding two days of the workshop. As described below, their work has allowed them to bring a large base of evidence related to chronic diseases together with country-specific data to support programs, planning, and priority setting at the national level. Both Johanna Ralston of the NCD Alliance and Montserrat Meiro-Lorenzo of the World Bank emphasized that planning for chronic disease control will require an approach that is multisectoral, ensuring that all policies and strategies are aligned to promote a healthy nation. A decision-making toolkit could supplement the work of international organizations by facilitating the sharing of expertise and ideas between countries as well as assisting leaders as they work in their unique country contexts to coordinate multiple sectors for chronic disease control.

The following sections summarize the content of each of their presenta-

tions. Chapter 6 incorporates the key considerations raised in this session with the presentations and discussions from throughout the workshop.

THE NCD ALLIANCE

The NCD Alliance was founded in 2009 to identify and pursue the goals that are shared by stakeholders concerned with four noncommunicable diseases: cardiovascular disease (in particular heart disease and stroke), diabetes, cancer, and chronic lung disease, explained Johanna Ralston of the World Heart Federation and the NCD Alliance. The World Health Organization identified these four diseases as responsible for the greatest portion of the global disease burden, and it also identified tobacco use, unhealthy diets, insufficient physical activity, and harmful use of alcohol as the most significant modifiable risk factors for those diseases.[1]

The NCD Alliance was founded to help increase recognition of the significance of the burden of these diseases as part of the global health and development agendas. To illustrate the problem, she quoted an opinion expressed in *The Economist* in 2006: "The World Health Organization needs to help sick people, not be a nanny. Dr. Chen must cure the agency's addiction to noisy campaigns against obesity, smoking and other non-infectious ailments. Many of these afflictions arise from personal choice and are not contagious." This mindset has been difficult to combat, Ralston said, citing a leader in the field, Sir George Alleyne, who observed that the problem is not a lack of data or knowledge but rather the need to "raise the issue to a high-enough level in the political agenda and maintain it there, as without that, there will be no material progress."

The NCD Alliance came together through collaboration among the International Union Against Cancer, the Union for TB and Lung Disease, the International Diabetes Federation, and the World Heart Federation, Ralston said, and it now has 900 member associations in 170 countries as well as a Common Interest Group of 350 additional member organizations. There are also now 24 country-based and two regional noncommunicable disease alliances. The NCD Alliance's key objectives are to identify shared messages across these diseases, coordinate advocacy and other efforts, and push noncommunicable disease "high on the development agenda," Ralston said.

The NCD Alliance's most important accomplishments to date include its efforts related to the United Nations High-Level Meeting on noncommunicable diseases. In particular, the alliance has been active in coordinating civil society input to the modalities resolution and the outcomes document

[1]Ralston noted the importance of mental health as another contributor to the noncommunicable disease burden, and also commented that the Alliance is currently considering ways to involve neurological health, particularly dementia and Alzheimer's disease, in its work.

for the United Nations meeting. Part of the alliance's goal in this process was to widen the circle of involved stakeholders. "It's not just a health issue," Ralston said. "You need to have agriculture at the table, urban planning at the table, employers, the private sector, education. The solutions lie not just with the whole of government, but the whole of society." As part of this process, the alliance engaged with regional and country-level leaders to generate tailored input, and NCD Alliance members in countries around the world were also able to initiate activities in their home countries. The NCD Alliance also worked with the Lancet NCD Action Group to prepare a list of priority actions in the categories of leadership, international cooperation, accountability, monitoring and reporting, and investment in prevention and treatment (Beaglehole et al., 2011). In its efforts to contribute to the draft outcomes document for the United Nations meeting, the alliance highlighted these priorities along with other key points such as the necessity and urgency of a multisectoral approach, the possibility of finding "new and adequate financial resources without jeopardizing current and future funding of the prevention and control of communicable diseases," integrating chronic disease control efforts into existing health systems strengthening, and accelerated implementation of the Framework Convention on Tobacco Control.

Looking beyond the United Nations High-Level Meeting, future priorities of the NCD Alliance include monitoring and advocacy to ensure commitments made at the meeting are kept and continuing to build the evidence base, particularly regarding operations research focused on affordable, feasible integrated approaches to delivery of care and prevention. The alliance also hopes to build capacity and strengthen programs at the country level, including supporting the growing NCD alliance movements in countries so that strong coordination and connections will exist and in turn foster international communication and support for the NCD control movement. Ralston highlighted recent successes applying the models that the alliance has developed in both Nigeria and India; in both countries policy makers have become more engaged, and innovative ways to find needed resources are being explored.

An NCD Alliance was initiated in Nigeria with support from World Heart Federation and the International Diabetes Federation. The organization grew quickly and was able to attend an interactive United Nations (UN) hearing on noncommunicable diseases that preceded the September 2011 High-Level Meeting on NCDs. Members of the NCD Alliance reported back to the Minister of Health in Nigeria and then published a paper online calling for their head of State, Goodluck Jonathan, to attend the UN high-level meeting.

India is another country that has the enthusiasm and willingness to focus on noncommunicable disease efforts, Ralston said. She mentioned

the work of Srinath Reddy of the Public Health Foundation of India, who believes that India will need to address its shortage of human resources, and focus on task-shifting, technical assistance, and a general restructuring of health systems to better address noncommunicable diseases. Ralston also said that India has plans for taxes that will support noncommunicable disease control efforts and reduce the country's reliance on external donor funding.

In the future, she concluded, the key to success against NCDs will be to find ways to be responsive to opportunities as they arise. There is no one algorithm will that work for every country, she said, but "there is a lot we can do without significant additional resources." If people continue to be flexible and adaptable, integrating and preparing systems where possible and assessing their country's readiness for certain tools, then they will be able to effectively use the resources when they do become available.

THE WORLD BANK

Derek Yach noted that it was a 1993 report from the World Bank that first used disability-adjusted life years (DALYs) as a metric and gave greater visibility to noncommunicable diseases. The World Bank played a fundamental role in the prioritization of noncommunicable diseases, he added, by supporting the study of the economics of tobacco use, which reduced the resistance of government leadership around the world to anti-tobacco measures. The World Bank also provided a "SWAT team" of economists who worked with countries to guide them in developing tobacco control policies, Yach said. This history offers an important context for thinking about the bank's current efforts related to chronic diseases. These current World Bank efforts were described by Montserrat Meiro-Lorenzo.

The role of the World Bank, Meiro-Lorenzo explained, is not to dictate the policies that countries should have, but rather to support their planning—particularly priority setting—and their programs. The bank works with other institutions to develop decision-making tools that are based on evidence. The bank's starting principle is that where there are resources, there are tradeoffs to be made, and it is important to be explicit about the potential results of possible choices so that countries "make their decisions understanding what the potential results of their actions are." Politically, when leaders have a short political view it's difficult to sell something like chronic disease programs that are going to have an effect in 10 or 20 years. Understanding the actual tradeoffs, in the short, medium, and long term, is work that needs to be done to support a more constructive dialogue in countries, a dialog that includes ministers of finance.

The two elements the bank has found most useful in supporting prior-

ity setting, Meiro-Lorenzo said, are country characteristics and global evidence. Meiro-Lorenzo emphasized that for countries to adopt general tools for prioritization, it is crucial to take into consideration country-specific underlying determinants and socioeconomic characteristics to understand what interventions to undertake and what policies may work better than others. For individual countries the World Bank supports systems analysis of such issues as access to care; equity in the distribution of care; financial flows, such as national health account reviews, public health expenditure reviews, and public and private expenditure reviews; information systems; and system capacity. These microeconomic tools are placed in a macroeconomic framework to aid countries in making sure that they structure their systems in ways that best move them toward their development goals. Using these country-specific analyses while also building on what is known from global evidence on determinants, costs, and economic and fiscal impact provides the basis for planning and adaptation. Having such a basis—which, she observed, is also the goal for the toolkit under discussion at the workshop—would be "an enormous contribution to the technical and policy dialogue." There are many ways for countries to prioritize and make health-related policy decisions, but these tools can help countries make their priorities explicit.

In term of specific noncommunicable disease efforts, Meiro-Lorenzo said, the World Bank has long been investing in this issue, and has spent approximately $4.2 billion on NCDs since the mid-1990s. About half of the money is spent through the health sector and the other half through other sectors, including efforts related to indoor air pollution and road traffic safety. Despite significant investment in NCDs, the bank has missed some opportunities, and Meiro-Lorenzo identified areas where the bank could increase or strengthen its involvement. The bank is working to build on lessons learned from past programs, especially revisiting and strengthening efforts using the economics of tobacco control to influence the policy process in countries. The bank also supports impact evaluations and results-based financing efforts, Meiro-Lorenzo explained, and both of these mechanisms could be applied more in the context of chronic disease control. The World Bank also hopes to improve its own capacity to assess multisectoral constraints as part of systems analysis and multisectoral expenditures as part of financial reviews. She views effort in this area as an important foundation for building a multisectoral approach. At the policy level, for example, the bank should be focusing more effort on exploring countries' existing policies in such areas as urban planning, tobacco taxes, and agricultural subsidies, including studying the impact of these policies. "Let's make [the multisectoral ideal] very palpable," she said, "by identifying which policies within a country are contradictory" when it comes to contributing to

versus reducing the chronic disease burden. The World Bank and others working in chronic diseases need to be opportunistic, Meiro-Lorenzo said, to not only identify opportunities in the health sector but also to put efforts together in ways that are a win-win for our environmental colleagues, our energy colleagues, and colleagues in other sectors, and then to make sure that we measure and showcase each other's successes.

6

Summary of Considerations for Developing a Toolkit for Country-Led Decision Making

This chapter summarizes the main themes and key messages from the presentations and discussions during the 3 days of the workshop, with a particular focus on considerations for developing a toolkit to support decision making at the country level. Throughout the workshop, planning committee members Rachel Nugent, Peter Lamptey, Kalipso Chalkidou, Stephen Jan, and Derek Yach moderated an ongoing conversation by offering provocative questions and observations that engendered extensive discussions among the presenters, panelists, and those attending the workshop. On the final day the Institute of Medicine project director, Bridget Kelly, summarized the preceding workshop sessions. Then, to start the final discussion session of the workshop, four discussants—Arun Chockalingam of the National Heart, Lung, and Blood Institute of the U.S. National Institutes of Health; Sonia Angell of the U.S. Centers for Disease Control and Prevention; Scott Ratzan of Johnson & Johnson; and Amanda Glassman of the Center for Global Development—offered their thoughts, after which the conversation was opened up to include all of the workshop participants.

SCOPE AND GOALS FOR THE TOOLKIT

"Health is emerging as something that countries identify as both a human right and a development goal," one discussant said, "and if those two things are really to be taken seriously, chronic diseases can't be ignored." However, the range of possibilities for addressing chronic diseases can seem overwhelming, another participant observed. Health systems in low- and

middle-income countries are already overburdened in many cases, yet much can be done even with very limited resources. One view is that the primary purpose of developing a toolkit would be to dispel the myth that the problem is overwhelming and to support countries in navigating the choices.

There are many questions that countries may want to answer as they plan for chronic disease control, a discussant said, and the participants at the workshop offered a number of examples: What are the health aims, or the diseases, or the risk factors that need to be targeted? Which programs should be implemented? Which programs will be effective, feasible, and affordable? What should be the timeframe for developing priorities and planning?

One discussant commented that it is "useful to take a step back and ask ourselves, what is the key factor that is impeding the implementation of NCD programs at the country level that the toolkit should address?" The discussant suggested several possible impediments: the difficulty of getting a line item for specific chronic disease activities in the budget, the need for assistance with how to estimate costs for interventions, or the need for cost-effectiveness evidence for chronic disease interventions that can be used in national dialogue.

Amanda Glassman was particularly interested in the idea of a toolkit that could lead to a costed national plan for chronic disease prevention and control that also includes estimates of impact. Having estimates of the number of lives that could be saved and what it would cost would provide a very powerful policy tool, she said. She noted that it is also important to be able to approach ministers of finance in particular not just with costs but with estimates of economic impacts and potential savings.

Several participants suggested that a focus on a specific disease—or even a focus on a category of diseases, such as communicable diseases or noncommunicable diseases—is too narrow. Many of the actions needed to address one disease or category of diseases are also important for other diseases, one observer noted: strengthening health services, improving health insurance and primary care, and providing more well-trained and motivated health care workers. Another offered a similar comment: "If what goes into the [chronic disease] toolkit is different from what goes into a communicable disease toolkit, we are potentially misallocating resources." In fact, one goal of a toolkit may be to help countries plan how to coordinate the programs and care they can offer—across population-based programs and individual health services as well as with efforts such as policy changes that need to be implemented outside the health system. However, this is a challenge in part because programs and funding are often organized in "silos." Sectors that could be working together are often in competition, which undermines the goal of coordination or integration.

One discussant noted that an important goal for the toolkit might be to

assist countries in institutionalizing a process for rational, evidence-based decision making. "What we are really trying to achieve is a process rather than just a list of things that will or won't get funded," he said. Several participants agreed on the importance of this goal, and a number of models for accomplishing it were noted. For example, some countries have regular national surveys that support decisions about costing health care options; others have national advisory councils in which researchers and policy makers take part. Another participant suggested that public health professionals within government ministries need to "become a lot more proactive—they have the capacity to do research and to speak to politicians." However, as another noted, "It won't occur naturally because policy makers are very busy; unless it is part of their daily critical path, it won't happen." Other possibilities for institutionalizing evidence-based decision making are academies that are apolitical and independent and can convene experts and decision makers to facilitate shared understanding, and "parliamentary twinning schemes" that link policy makers with science advisors.

Adaptability emerged as another key consideration if the toolkit is to be useful for country-level planning and relevant for the different environments in which it will be used. The countries discussed at the workshop represented a range of economic circumstances, disease burdens, health systems infrastructure, and funding and administrative structures. One discussant wondered whether it would even be feasible to develop one toolkit that could meet the needs of diverse countries. "Should there be a list of key interventions that address 80 percent of the disease burden," a discussant asked, "or should we try to be everything to everybody?" Several participants suggested that the toolkit should present a menu of options so that countries can tailor the toolkit to their needs and priorities, rather than prescribing solutions based on global estimations of what would contribute most to reducing the global burden. Another suggestion was that a toolkit could include model plans for addressing noncommunicable diseases that could be adapted to local needs, but still allow countries to move forward "without starting from scratch." There was even a suggestion that the ability to adapt the tool for regional planning could be useful. For example, one participant noted, among Caribbean countries the greatest need is for regional high-tech centers because individual countries in that region are too small to sustain such expertise. One participant envisioned the toolkit as a technical instrument that would offer a universally applicable process in guiding priority setting through the use of local information and mechanisms. Each country would use the toolkit to assess evidence and to develop priorities that are reasonable in a given context; this is "something that each country will have to determine through its own indigenous institutions and preferences."

Other questions were also raised: Who will use the tool and shape it

to a particular country's needs? Who will use the output of the tool? How will those choices affect the tool's influence? Arun Chockalingam suggested that a successful toolkit should be applicable to the country in question and simple enough to understand and use, and it should be validated and pilot tested. Several participants reinforced the idea that the toolkit should be simple, and that it should also be easy to integrate with existing tools. If we keep introducing new tools, one observed, "we undermine people's confidence and their willingness to invest the time in learning how to use new ones." As Sonia Angell noted, if a tool is difficult to use it may even create the need for increased capacity. The tool cannot be effective if the infrastructure to apply it is insufficient, she added.

In summary, over the course of the workshop the participants discussed the many questions that countries might seek to answer and the many different uses of information that could comprise the scope and goals for a toolkit—setting priorities, decision making, advocacy and mobilizing resources, deriving or shaping questions, elucidating the options to meet a specific implementation goal, promoting dialogue about alternatives, stimulating a thought process about innovation, generating a report card or score card for accountability. While these different uses are not mutually exclusive, each implies somewhat different content and strategies, and several participants advocated care in identifying a principal purpose.

Ultimately, it was clear that no single tool can address all the different questions a country may have and all the country's goals for the use of evidence and information. "A model that deals with everything in life, period—that means every decision made—it's impossible. And it would be 6,000 pages long, and nobody would look at it," one discussant commented. "Nor do we want 6 million models to deal with the 6 million different decisions that potentially make up a health care or a life system. And so trying to find the balance between the two is a struggle, but it doesn't mean we shouldn't be looking for that." To maximize adaptability and utility, therefore, the goal that emerged was not to attempt to create a single modeling tool that could comprehensively address everything, but rather to develop a way of gathering together different tools that would be available to policymakers and other stakeholders in countries to serve multiple needs. Arun Chockalingam noted that a suitable goal for the toolkit would be that "the whole is better than the sum of its parts."

KEY ELEMENTS TO INCORPORATE IN THE TOOLKIT

Assessment of Current Status and Progress

An important first step in designing strategies for chronic disease control is to assess, at the country level, the current profile of disease and risk

factor burden, the existing policies and programs to address that burden, and the key impeding factors that are specific to the country. Understanding the realities of the current status in a country is critical to inform what the priority targets for intervention should be, what the most appropriate and feasible interventions are, and what intermediate steps may be necessary to achieve implementation of control efforts.

The level of awareness and recognition of the growing burden of chronic diseases is variable across countries—in some countries this may still be a key first step in any control effort, while in others there may be a high level of awareness already among policy makers to serve as a starting point for the planning process. Similarly, in some countries there is currently little technical expertise for chronic diseases, with very few health or policy professionals working in this area. In others, by contrast, specialty institutions and expertise for chronic diseases have been part of the national fabric for some time and the next step is to translate this into making chronic disease control a public health and policy priority and scaling up capacity and implementation of policies and programs.

Several workshop participants emphasized that a valuable part of a toolkit would be a way to assess a country's readiness for particular interventions. One participant noted, "Some of the interventions are relatively simple and don't depend on a strong heath system, but others will only be successful if there is some degree of maturity in the health system, [e.g.,] an adequate number of health workers, an adequate logistical system, medical records system." The need to assess and build capacity may apply not just to infrastructure and technical staff but to managerial, administrative, and other kinds of staff as well. In addition, capacity building may be needed at the national, regional, and local levels and in both government and nongovernmental sectors. For chronic diseases, which are widely recognized as requiring a multisectoral response, there is also a need to assess and plan for capacity building not just in the health services and public health arena, but also in other related fields such as transportation and urban planning, agriculture, sustainable development, and education.

Finally, the advantage of a baseline assessment is that once a method or framework has been established for assessing the key components of the response to chronic disease, this can also be used as an ongoing tool to assess progress over time and inform future iterations of the planning process.

Data and Information Needs

The goal of evidence-based decision making and planning is to assess the evidence to help determine which interventions are likely to be not only effective but also feasible and affordable in a given country context. However, the quality of the output for any information-driven process depends

on the quality of the data and the assumptions that underlie the inputs. The country representatives and other presenters and discussants highlighted issues related to data, noting limitations in most low and middle income countries in "current basic epidemiology, basic vital statistics, data on program monitoring and evaluation, data on costs and the economic burden, and also data about the other criteria, such as values and preferences." Indeed, no country has all of the data that would ideally be needed to inform the decision-making process, whether as formal input into a model or as information and analysis to be communicated to decision makers. The barriers to data collection that emerged in the discussions spanned a range of issues, including the lack of attention and resources applied to data collection for chronic diseases; the limited number of experts in chronic disease surveillance, research, and evaluation; a lack of capacity in other aspects of data collection such as field workers with the skills to assess factors related to chronic disease; and limitations on data collection design and approach, such as one example of a household survey in which women were not asked about tobacco use.

On the other hand, a theme that arose from the country experiences presented at the workshop is that, while the ideal data might be lacking, there are data that, if interpreted appropriately, can be reasonably used to inform decision making in lieu of the ideal. One discussant noted that he was "a bit surprised by the extent of data that are available," despite the gaps that people identified. He was expecting the situation to be worse. For example, some countries have some chronic disease data from employing WHO-STEPS, from large-scale international research studies, or from the addition of chronic disease information to demographic and health surveillance, as is being done in Bangladesh. Other examples of usable data sources from the country presentations include hospital admission, discharge, and mortality data; small-scale surveys; research studies; and regional data from countries with similar demographics, epidemiological profiles and current status in terms of control efforts as well as capacity, infrastructure, and resources. In fact, one discussant asked, "Why are we collecting more data when we are unable to use the simple data that we already have?" He suggested that countries do not at this stage have the capacity to use sophisticated models and absorb additional data.

Therefore, an important message that emerged was to not wait until there are better data but rather to make use of the best available data now—and then to simultaneously plan for improvements in data collection as a part of disease control efforts, so that future iterations of planning and decision making will have ever better information as inputs.

Costs and Economic Analysis

Although many countries would like to treat health care as a basic human right, they all face the challenge that cost plays a fundamental role in decision making. Improved health care costs money, and in their presentations the country representatives all highlighted areas where additional funding is needed. "We should not be shy in emphasizing that financing is an absolutely critical part of this," one participant said. As moderator in a discussion session on key factors that influence decision making for health, Kalipso Chalkidou raised some key questions: "What does it mean to have the right to health? How does it get implemented? How does it link to funds?" She added that this is not just an issue in low-income countries. Her home country, the United Kingdom, "is running out of money," and waiting lists for health care have been growing by as much as 200 or 300 percent. One participant commented, "The one inescapable fact that we are dealing with . . . whether it is Sweden, the United States, Uganda, or Bangladesh, is that we are all going broke in one way or another." Therefore, any tool or process to support decision making for chronic disease control would need to capture information that can help convince government and other stakeholders to increase the level of resources dedicated to health and to chronic disease control. To achieve this, policy makers need evidence from economic analyses. Increased resources for chronic disease may include adding funding—however, total government and other expenditures are unlikely to increase greatly. As a result, alternatives discussed by the workshop participants included reallocating resources or finding ways in which current expenditures can be applied to include chronic disease control, such as opportunities for services to be added on to existing programs and infrastructure with minimal additional marginal costs. A related theme that emerged across the country representatives at the workshop was the urgent need for health economists who understand the country context and the issues around chronic disease planning and implementation and who have the skills to use these kinds of costing and economic analysis tools.

When funds are limited, cost effectiveness becomes a critical concern. If data as specific as possible to a country are used, a toolkit that includes tools for economic analysis could guide countries in reviewing services and actual costs and identifying inefficiencies specific to their systems that could be corrected. A toolkit could also guide countries in identifying what the most cost-effective policies will be in the context of their political and economic environment, and then to develop incentives and advocacy to promote those policies. One participant cautioned, however, that the toolkit should not be too prescriptive because "the confidence intervals around cost effectiveness are in truth fairly broad."

For credible and realistic budgeting, it is also important to consider the true total cost of implementing chronic disease control efforts. This means the costs of necessary intermediate steps, such as training new workforce or adding new infrastructure or equipment or the costs associated with the effort required to successfully pass new legislation. In addition, costs based on the current known burden of disease or risk factors may be an underestimate of true costs. One discussant emphasized this aspect of the problem, noting that once a health system begins new screening the result will be an enormous demand for additional care for patients identified as having such conditions as hypertension and diabetes. The same thing happened with HIV, she noted: "Once I know who [is] HIV positive I have an ethical imperative to treat those people with the full armament of interventions." It is important to anticipate this expansion of identified need as part of the planning process and the estimation of costs.

A related issue in resource allocation is opportunity costs. Prioritizing investment to address one disease may divert money from other disease control efforts, and prioritizing investment in health may take money away from other development efforts. "It could be that in managing hypertension to prevent strokes, we might need to take money away from HIV," a participant said, but "these decisions are made anyway implicitly every day. Can we take the heat when we make the decision making explicit?" Where the toolkit might help is insulating policy makers, one discussant noted. If the toolkit provides an explicit, rational process for priority setting, they may take less "heat" when making a rationing decision in allocating resources. On the other hand, making the tradeoffs explicit may also open the door to even greater political and societal pressures on decision makers.

Opportunity costs are one way that decisions about health expenditures and investments in one area can have an impact in other areas. The converse of this is opportunities for synergistic investments that benefit multiple health issues, such as strengthening health services including primary care, improving health insurance and other financing mechanisms, and providing more well-trained and motivated health care workers. A similar consideration is opportunities for services to be added on to existing programs and infrastructure with minimal additional marginal costs. On this topic, Derek Yach suggested that one of the most important areas for the future will be the integration of noncommunicable diseases into general health services. He said that investments in HIV/AIDS and tuberculosis create a financial opportunity that could be seized if measures related to chronic disease could be folded into those existing programs. He added that it would be valuable to examine current "missed opportunities," as in a study conducted by UNICEF to find ways to ensure that no child in a target age group would leave a facility without receiving measles immunization services. The rationale was that with millions of children going through these

facilities, the major investment has already been made, and the marginal extra cost of adding in a vaccine would be trivial. Similar logic could apply with chronic disease, where it would make sense to begin with simple, inexpensive approaches to add chronic disease services onto existing programs, such as using patient visits to clinics for other programs, for example HIV services, as an opportunity to check blood pressure. Information and analysis that identifies synergistic or minimal-cost opportunities will help focus the planning process on ways to maximize existing investments, which is especially important when total resources are limited.

Planning for Implementation and Adaptation

An important part of gathering, analyzing, and applying information to decision making is the need to take into account the feasibility of not just initiating but also sustaining planned efforts. This needs to be factored into what interventions are selected as well as into realistically determining costs. Ideally, support for the planning process would take into account a long-term timeframe in order to incorporate developing capacity in human resources and infrastructure, anticipating an evolving disease burden, and allowing for sufficient time to see a return on investment in the form of health and economic benefits. One participant commented, "It's not simply choosing a menu of programs and implementing them; it's thinking about how that's going to play out over time, how capacity will be built, how expectations for results may evolve over the long term." Therefore, tools for prioritizing interventions need to include a way to highlight choices that will build on current strengths in the existing system to develop chronic disease control efforts and that while being implemented will also increase capacity. Thus, short-term efforts can also serve as a basis for successfully scaling up or expanding the scope of interventions in the future.

Another important feature of supporting a long-term time horizon is to plan for the flexibility to adapt priorities and strategies based on the realities of implementation, changes in the resource environment, and adoption of emerging innovations. Sonia Angell noted the danger of "decoupling initiatives and implementation from planning. . . . You can plan for one thing, and then within 6 months you realize you have to scrap that and move somewhere else."

Preferences and Values

In addition to demographic, epidemiological, intervention effectiveness, and economic data, participants emphasized that there are other inputs that may also be incorporated in the policy decision-making process, either implicitly or explicitly. There are a wide range of factors that can contrib-

ute to one health issue being prioritized over others, and it is important to acknowledge that the resulting preferences and values are a key part of priority setting, and therefore to incorporate them in the process. As one discussant noted, "Many things will cause one health issue or one population to be privileged over others and that's part of priority setting too. There's advocacy, there are donors, there's the prime minister's cancer—lots of factors that will cause some things to be privileged and other things to be penalized." These preferences and values do not just come from government leadership but also other sectors of society with a stake in the priorities for health care and for government investment, including nongovernment sectors, professional societies, academic communities, advocacy groups, civil society organizations and even external donors, discussants noted. Many of the country representatives said that decisions about investments in health must also be responsive to the concerns of the public and the community at large, as was done explicitly in the examples from Grenada and Chile. Participants at the workshop agreed, stressing that communal action is needed to support real progress in many areas.

The biomedical community places the highest value on empirical evidence, one discussant noted, so "when you formalize such evidence into a model, then it privileges that kind of information." If a model is seen not just as a research tool but as a policy-making aid, things look a bit different. "I don't think there is any controversy about the value of these models as important research tools," another discussant commented. "The controversy lies in using these models as a way to make decisions about the allocation of resources." Successful support for those decisions cannot be done solely with models that privilege empirical evidence. The risk is that "as these models get more and more complex, what you are potentially asking decision makers to do is perhaps cede responsibility for decision making to the models." This could potentially reduce the transparency of decision making by "essentially relegating it to a black box–type process."

"A model is a tool that should not be a substitute for other processes," another participant noted. Another added the view that such models are very useful for "logistical questions," in the way that a business model helps users make sure a product gets where it's needed at the right time. They are less useful, in this discussant's view, for "actually trying to change the very business model that underpins it." Models are not necessarily used to question the assumptions underlying them, but he suggested that if models are used to "lay bare the assumptions and remodel," that would be a good thing. Without that element, he continued, "the complexity of the decision-making process is ignored, the deep ethical issues are ignored, the complexity of the [relationships] among programs is ignored. This is not a mechanical process, but a very political one. I fear that putting it into a model can dumb down what is by necessity a very complex process."

Therefore, empirical models need to be part of tools that support a broader process that promotes transparency and that takes into account other factors such as ethical issues, public interest, political will, and negotiation of the interests of competing priorities.

Communication

Several participants emphasized that part of a successful decision making process lies in establishing a stronger link between evidence and policy. As one participant commented, "We have research going on but I am afraid in some countries it is not well packaged and given to the politicians and policy makers in language that they can understand." One of the toolkit goals could be to facilitate access to information and resources through communication tools that streamline and organize information in a way that is targeted to specific audiences and purposes. Scott Ratzen in particular focused on the importance of the way a toolkit packages and communicates the evidence and outcomes so that it is accessible and easy to interpret for potential users like politicians and policy makers. He noted that he had seen some communications that "looked like the Yellow Pages." Instead, he said, the "at-a-glance publications, or the one-pagers, or the one-card, or the electronic pieces, are the pieces that make a difference." He cited his experience with the Institute of Medicine's Roundtable on Health Literacy in recommending a simple scorecard approach that would highlight the "the 5 to 10 things that we all need to do, or know, that on an individual, community, and systemwide basis can help make a difference for noncommunicable disease." There might be debate about what those 5 or 10 things are, he commented, but if those are in place, "we can measure and build on those indicators and really make a difference." In this way, communication tools can also serve as mechanisms to allow for basic information to be tracked over time as an indication of progress in the implementation of chronic disease control efforts.

Another area of discussion that emerged at the workshop was that to truly support evidence-based decision making, this communication needs to work in both directions—as one discussant put it, there needs to be not only evidence-based policy making, but also "policy-based evidence making." In other words, policy makers need to use evidence and therefore there is a need to find ways of effectively communicating that evidence to them. In the other direction, to ensure that appropriately useful information will be available, those who generate the evidence also need to consider the needs of policy makers in designing data collection and evaluation and in setting their research priorities. Related to this issue, several participants commented that in many countries there is limited demand from policy makers for data and empirical evidence as part of their decision-making process,

and that there is limited support for investment in data collection activities. A potentially important aspect of supporting policy planning would be to build a feedback cycle into the data collection process and to work with policy makers to create greater demand and to incorporate support for gathering this information into planning, priority setting, and resource allocation.

Final Reflections

This workshop took place in the lead-up to the September 2011 United Nations High Level Meeting on Noncommunicable Diseases, a milestone event in the increasing recognition that chronic diseases represent a major health and economic burden in low- and middle-income countries. These countries face many competing demands on their available resources, from basic development priorities to a range of important health needs. Low- and middle-income countries currently have limited internal resources devoted to chronic diseases, and also receive little external funding to address this issue. Nonetheless, it is increasingly clear that reducing the burden of chronic diseases is critical to meeting global health and development goals.

The workshop was convened to advance the global conversation about how to support countries in planning for chronic disease control. There was agreement among the participants that the overarching aim should be to assist countries in navigating the many, sometimes overwhelming, options for chronic disease interventions and programs, rather than prescribing externally determined priorities and solutions. In this way, real progress will come through approaches that are driven by a country's particular disease burden, priorities, capacity, and resource availability and that are led by a country's key decision makers and stakeholders. The challenge is that the process of selecting, planning, and implementing chronic disease control programs will by necessity be quite complex.

The participants in the workshop considered the experiences of several low- and middle-income countries and contemplated different examples of tools, models, and methods that could support countries in their decision making. From the resulting discussions about the appropriateness of tools for different purposes and different contexts, the theme emerged that to effectively support the decision making process, a toolkit would need to include but not be limited to tools for a technical assessment of disease burden, intervention effectiveness, and costs. It would need to be designed to support a broader process of priority setting and decision making that reflects not only empirical evidence but also the preferences and priorities of those in the country with a stake in how resources are allocated. This would need to be a process that uses and strengthens a country's existing institutions and mechanisms for information gathering and for decision making.

When it comes to chronic disease control in low- and middle-income countries, there are currently opportunities and challenges in providing services and programs, in implementing health-promoting policies across sectors, and in the institutionalization and accountability of government decision making and resource allocation. The workshop ultimately challenged participants to think about several key questions: What can country-level stakeholders do next to overcome the challenges and take advantage of the opportunities? What can the global community do to support them? What mechanisms and tools can be developed to guide and strengthen the process of setting priorities for investment and planning for implementation? The workshop initiated a conversation about these questions, and in their final reflections the participants expressed the hope that this dialog will be taken up and expanded at the global and country level to help advance chronic disease control worldwide.

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Appendix A

Workshop Agenda

DAY ONE: COUNTRY PERSPECTIVES ON DECISION MAKING FOR CONTROL OF CHRONIC DISEASES

Tuesday, July 19, 2011
8:30 a.m.–6:00 p.m.

8:00 a.m.	**Arrival and Registration**
8:30 a.m.–9:00 a.m.	**Overview of Workshop Objectives and Toolkit Concept** Rachel Nugent, University of Washington, Workshop Planning Committee Chair
9:00 a.m.–9:15 a.m.	**Q&A**
9:15 a.m.–12:00 p.m.	Session 1, Part 1: Decision Making for Chronic Disease Control in Low- and Middle-Income Countries: Perspectives on Progress, Needs, and Lessons Learned **Opening comments from the moderator** Peter Lamptey, Family Health International, Workshop Planning Committee Member

Grenada
E. Francis Martin, Director of Primary Health Care, Ministry of Health

Kenya
Gerald Yonga, Kenya Cardiac Society

10:10 a.m.–10:30 a.m. **BREAK**

Bangladesh
Shah Monir Hossain, Former Director General for Health Services

Rwanda
Gene Bukhman, Senior Technical Advisor on Non-Communicable Disease, Ministry of Health

11:10 a.m.–12:00 p.m. **Moderated Q&A**

12:00 p.m.–1:15 p.m. LUNCH

1:15 p.m.–3:10 p.m. Session 1, Part 2: Decision Making for Chronic Disease Control in Low- and Middle-Income Countries: Perspectives on Progress, Needs, and Lessons Learned

Opening comments from the moderator
Peter Lamptey, Family Health International, Workshop Planning Committee Member

India: Decision Making and Implementation for Chronic Disease Control at the Subnational Level
Meenu Hariharan, Indian Institute of Diabetes, Kerala, India

Chile: Financing as Part of Decision Making and Implementation for Chronic Disease Control
Antonio Infante, Former Undersecretary of Health, Chile

2:35 p.m.–3:10 p.m.	**Moderated Q&A**
3:10 p.m.–3:30 p.m.	**BREAK**
3:30 p.m.–5:45 p.m.	**Session 1, Part 3: Roundtable Discussion on Key Factors for Decision Making and Implementation of Health Promotion and Disease Control Programs** **Opening comments from the moderator** Kalipso Chalkidou, National Institute for Health and Clinical Excellence (NICE), UK, Workshop Planning Committee Member
3:40 p.m.–5:00 p.m.	**Facilitated discussion** *Discussants:* Amanda Glassman, Center for Global Development *Speakers from Session 1, Parts 1 and 2*
5:00 p.m.–5:45 p.m.	**Moderated Q&A**
5:45 p.m.–6:00 p.m.	**Day One Closing Remarks and Adjournment** Rachel Nugent, University of Washington, Workshop Planning Committee Chair
6:00 p.m.–7:30 p.m.	**Reception**

DAY TWO: DESIGN AND CONTENT OF THE TOOLKIT

Wednesday, July 20, 2011
8:30 a.m.–6:00 p.m.

8:00 a.m.–8:30 a.m.	**Arrival and Registration**
8:30 a.m.–8:50 a.m.	**Welcoming Remarks and Recap of Workshop and Toolkit Objectives** Rachel Nugent, University of Washington, Workshop Planning Committee Chair

8:50 a.m.–11:30 a.m.	**Session 2: Country Studies–Data Availability and Gaps**
	Opening comments from the moderator Stephen Jan, The George Institute of International Health, Workshop Planning Committee Member
	Bangladesh Tracey Pérez Koehlmoos, ICDDR,B
	Kenya Gerald Yonga, Kenya Cardiac Society
9:40 a.m.–10:00 a.m.	**BREAK**
	Grenada Emma Herry-Thompson, Chief Medical Officer, Ministry of Health, Grenada
	Rwanda Gene Bukhman, Harvard Medical School and Partners in Health
10:40 a.m.–11:30 a.m.	**Moderated Q&A**
11:30 a.m.–12:30 p.m.	**LUNCH**
12:30 p.m.–2:40 p.m.	**Session 3: Costing and Economic Modeling**
	Opening comments from the moderator Rachel Nugent, University of Washington, Workshop Planning Committee Chair
	NCD Costing with NHLBI Centers of Excellence Andrew Mirelman, Johns Hopkins University
	Economic Modeling of CVD Risk Factor/Disease Interventions Using Country-Specific Data to Cost Treatment of Hypertension with NHLBI Centers of Excellence Tom Gaziano, Brigham and Women's Hospital

	Methods for WHO NCD Costing **The OneHealth Model, Developed by the UN Interagency Working Group on Costing** Karin Stenberg, World Health Organization
2:00 p.m.–2:40 p.m.	**Moderated Q&A**
2:40 p.m.–3:00 p.m.	**BREAK**
3:00 p.m.–4:30 p.m.	**Session 4: Assessment and Priority Setting**
	Opening comments from the moderator Derek Yach, Pepsico, Workshop Planning Committee Member
	Lessons from a Multi Criteria Decision Analysis Framework Mireille M. Goetghebeur, BioMedCom and EVIDEM Collaboration *(via videoconference)*
	Lessons from the Lives Saved Tool (LiST) for Maternal and Child Health Neff Walker, Johns Hopkins University
4:00 p.m.–4:30 p.m.	**Moderated Q&A**
4:30 p.m.–5:45 p.m.	**Day Two Concluding Discussion of Data and Methods with Country Case Studies**
	Opening comments from the moderator Stephen Jan, The George Institute of International Health, Workshop Planning Committee Member
	Facilitated discussion *Discussants*: *Session 2, 3, and 4 Panelists*
5:45 p.m.–6:00 p.m.	**Day Two Closing Remarks and Adjournment** Rachel Nugent, University of Washington, Workshop Planning Committee Chair

DAY THREE: IMPLEMENTATION AND DISSEMINATION OF THE TOOLKIT

Thursday, July 21, 2011
8:30 a.m.–12:30 p.m.

8:00 a.m.–8:30 a.m.	**Arrival and Registration**
8:30 a.m.–8:35 a.m.	**Welcoming Remarks** Rachel Nugent, University of Washington, Workshop Planning Committee Chair
8:35 a.m.–9:00 a.m.	**Summary of Days One and Two** Bridget Kelly, Institute of Medicine, Workshop Project Director
9:00 a.m.–10:20 a.m.	**Session 5: Global Support for Country-Level Planning in Low and Middle Income Countries** **Opening comments from the moderator** Derek Yach, Pepsico, Workshop Planning Committee Member **NCD Alliance** Johanna Ralston, World Heart Federation/NCD Alliance **World Bank** Montserrat Meiro-Lorenzo, World Bank
9:50 a.m.–10:20 a.m.	**Moderated Q&A**
10:20 a.m.–10:40 a.m.	**BREAK**
10:40 a.m.–12:20 p.m.	**Session 6: Roundtable Discussion on Next Steps for Developing, Implementing, and Building Demand for the Toolkit** **Opening comments from the moderator** Rachel Nugent, University of Washington, Workshop Planning Committee Chair

10:50 a.m.–12:00 p.m. **Facilitated discussion**

Discussants:
Amanda Glassman, Center for Global Development
Scott Ratzan, Johnson & Johnson
Sonia Angell, Centers for Disease Control and Prevention
Arun Chockalingam, National Heart, Lung, and Blood Institute
Workshop Speakers and Discussants

12:00 p.m.–12:20 p.m. **Moderated Q&A**

12:20 p.m.–12:30 p.m. Closing Remarks
Rachel Nugent, University of Washington, Workshop Planning Committee Chair

12:30 p.m.–1:00 p.m. Adjourn

Appendix B

Biographies

SPEAKER AND DISCUSSANT BIOGRAPHIES

Sonia Angell, MD, MPH, provides leadership for global noncommunicable disease strategy, policy, and program development at the U.S. Centers for Disease Control and Prevention (CDC). She has particular expertise in environmental and clinical care systems policy, programming, and evaluation designed to reduce chronic disease risk. Dr. Angell recently joined the CDC, coming from the New York City Department of Health and Mental Hygiene where she directed the Cardiovascular Disease Prevention and Control Program. Some of her program's key accomplishments included regulating the use of trans fat in New York City restaurants, the National Salt Reduction Initiative, establishing nutrition standards for food procured by New York City government agencies, and clinical quality improvement initiatives for blood pressure and cholesterol control. She received her medical degree from the University of California, San Francisco, and completed internal medicine residency training at Brigham and Women's Hospital in Boston. She has a diploma in tropical medicine and hygiene from the London School of Hygiene and Tropical Medicine, and a master's in public health from the University of Michigan. She is a fellow of the American College of Physicians. She is a former Robert Wood Johnson clinical scholar.

Gene Bukhman, MD, PhD, is an assistant professor of medicine and an assistant professor of global health and social medicine at Harvard Medical School. He is a cardiologist in the Division of Global Health Equity at

Brigham and Women's Hospital and in the Boston VA Healthcare System. By training, Dr. Bukhman is a medical anthropologist and a cardiologist with special competence in echocardiography. He is the cardiology director for Partners In Health. Dr. Bukhman is an expert on strategic planning for non-communicable disease control and serves as the senior technical advisor on noncommunicable disease to the Rwandan Ministry of Health. His research has focused on the political and historical context of intervention in this area, as well as the evaluation of programmatic outcomes. He has worked in Rwanda since 2006. In 2010 Dr. Bukhman was appointed as the director of the Program in Global Non-Communicable Disease and Social Change at Harvard Medical School.

Arun Chockalingam, MS, PhD, FACC, FAHA, leads the Office of Global Health at the U.S. National Heart, Lung, and Blood Institute. Prior to this appointment, Dr. Chockalingam was the founding director of the Global Health Program and subsequently served in an enhanced role as the director of continuing public health education at the Faculty of Health Sciences at the Simon Fraser University, Vancouver, Canada. He received his PhD in cardiac cell physiology and pharmacology from Memorial University of Newfoundland. In addition, he has an extensive and varied career in cardiovascular epidemiology, prevention, government research administration, and global health. Dr. Chockalingam served as senior policy advisor, Centre for Chronic Disease Prevention and Control, Health Canada, and associate director of the Institute of Circulatory and Respiratory Health in the Canadian Institutes of Health Research, and he currently serves as secretary general of the World Hypertension League. He has published more than 150 papers and 11 book chapters, served as an editorial board member and reviewer for numerous journals. He has been a reviewer for a number of national and international research granting agencies. He was a member of the authoring committee of the Institute of Medicine's 2010 report *Promoting Cardiovascular Health in the Developing World*. He is passionate about promoting healthy lifestyles and preventing chronic noncommunicable diseases throughout the world.

Thomas A. Gaziano, MD, MSc, is an assistant professor of medicine at Harvard Medical School and the Harvard School of Public Health. His research interests are in the treatment of cardiovascular disease in developing countries, including the epidemiology and management of its risk factors and the development of decision analytic models to assess the cost-effectiveness of various screening, prevention, and management decisions. He has served as a consultant and author for the Disease Control Priorities Project of the World Bank, World Health Organization, and the Fogarty In-

ternational Center. He is the co-principal investigator of the United Health and U.S. National Heart, Lung, and Blood Institute collaborating center of excellence at the University of Cape Town, where he holds an honorary senior lectureship. He is co-leader of the Chronic and Cardiovascular Disease Working Group at the Harvard Institute for Global Health. He is certified as a diplomat in internal medicine and cardiovascular diseases.

Amanda Glassman, MSc, is the director of the Global Health Policy Program at the Center for Global Development. She has 20 years of experience working on health and social protection policy and programs in Latin America and elsewhere in the developing world. Prior to her current position, Glassman was principal technical lead for health at the Inter-American Development Bank, where she led health economics and financing knowledge products and policy dialogue with member countries, and was team leader of the Oportunidades conditional cash transfer program. She was also a nonresident fellow at the Brookings Institution. From 2005 to 2007, Glassman was deputy director of the Global Health Financing Initiative at Brookings and carried out policy research on aid effectiveness and domestic financing issues in the health sector in low-income countries. Before joining the Brookings Institution, Glassman designed, supervised, and evaluated health and social protection loans at the Inter-American Development Bank and worked as a Population Reference Bureau fellow at the U.S. Agency for International Development. Glassman holds an MSc from the Harvard School of Public Health and a BA from Brown University, has published on a wide range of health and social protection finance and policy topics, and is editor and co-author of the books *From Few to Many: A Decade of Health Insurance Expansion in Colombia* (IDB and Brookings, 2010) and *The Health of Women in Latin America and the Caribbean* (World Bank, 2001).

Mireille Goetghebeur, PhD, received an engineering diploma and a PhD in biochemistry from the University of Montpellier in France. Co-founder of BioMedCom, a consulting group specializing in applied research based in Montreal, Canada, she has worked since the mid-1990s at generating and synthesizing data to support evidence-based decision making for health care interventions in numerous therapeutic contexts. Her current research interests focus on developing multi-criteria decision analysis–based tools, processes, and databases to advance health care decision making and priority setting internationally. Principal investigator in the development of the EVIDEM framework, she currently serves as president for the EVIDEM Collaboration. Mireille is also an associate member of the research center of Ste. Justine University Hospital Center in Montreal.

Meenu Hariharan, MD, DM, presently the director and chief executive officer of the Indian Institute of Diabetes (a joint venture of the government of Kerala and World-India Diabetes Foundation) and state nodal officer of the National Program for the Prevention and Control of Diabetes, Cardiovascular Diseases and Stroke, possesses an illustrious career and academic accomplishments. Formerly the director of medical education, Kerala state, India, she is now professor emeritus at the Government Medical College, Trivandrum, and consultant gastroenterologist. A gold medalist in MBBS, her postgraduate qualifications include an MD in internal medicine and doctorate (DM) in gastroenterology. Her major attainments during her career in government include the certificate of appreciation from the government of Kerala for disaster management after the 2004 tsunami, and the Best Doctor Award 2007, Kerala State, by the government of Kerala. The major thrust of her field of research interest lies in pancreatic diabetes (tropical pancreatitis), a disease almost endemic to Kerala, for which she has had international collaboration with INSERM in France and the Naro Cancer Center in Japan. She has since broadened her perspectives in research to include the awareness, prevention, and control of diabetes, cardiovascular diseases, and stroke under the aegis of the national control program for the same, stoking many ongoing research projects, and has conducted 245 detection and awareness camps so far, screening 24,540 members of the populace.

Emma Herry-Thompson, MD, has been in the health care arena for the past 40 years. Thirteen of those years were spent as a registered nurse. She received her nursing diploma in London, England. Her BSc degree was obtained from the University of Tennessee. She was a 1984 graduate of James H. Quillen College of Medicine, East Tennessee State University. She completed post-graduate training in internal medicine and practiced in four U.S. states and Washington, DC, before returning to Grenada after a 32-year absence in January 1998. Dr. Herry-Thompson currently holds the position of chief medical officer, a position she has held for the past 32 months. She also continues to keep a limited internal medicine practice. Prior to joining the public system, she was director of medical education for St. George's University's clinical teaching unit for 5 years.

Shah Monir Hossain, MBBS, MPhil, MPH, FCPS, is now working as consultant to Program Preparatory Cell (PPC) of the Ministry of Health and Family Welfare of Bangladesh. He worked with the government of Bangladesh for 33 years in different academic and executive position. His last assignment was director general of health services of Bangladesh, and he was responsible for policy making, strategy development, and supervising the national health program as chief executive for implementing health

sector program. He provided results-oriented guidance to effectively plan, organize, implement, manage and coordinate public health activities and human resources in the public sector. At present he is providing technical assistance to prepare a program implementation plan (PIP) for the health sector program for the next 5 years. One of the major components of the PIP is noncommunicable diseases where a strategy and interventions with targeted indicators have been designed to improve the quality of services in both rural and urban setting. Prof. Hossain is also involved in teaching health service management in the Department of Public Health of North South University, Dhaka, Bangladesh.

Antonio Infante, MD, MPH, spent the majority of his career in the Chilean National Health Service. He began as a general practitioner, and then as a public health specialist he directed primary health care (PHC) clinics; the PHC in a health district; the department of health in Santiago, Chile's capital; and the North District of Health in Santiago. He also worked in the Ministry of Health in the nutrition area (food programs), in the health reform project, and in the management of health care. Finally, he was undersecretary of health. He also has had experience in the educational sector as advisor in the school feeding program and then as chief of the National Students Welfare Agency. He was consultant to the United Nations and to multilateral agencies in Latin America, Africa, and East Europe.

Tracey Pérez Koehlmoos, PhD, MHA, is the head of the Health & Family Planning Systems Programme, at ICDDR,B. Dr. Koehlmoos is a health systems scientist who specializes in managing complex tasks, program development, and capacity building across the spectrum of health systems building blocks. She has lived and worked in Pakistan, Nepal, Bangladesh, and Indonesia for more than 15 years. Her research areas of interest include the very upstream area of developing health service delivery for the homeless in urban Bangladesh to the downstream translation of evidence to policy with the Ministry of Health and Family Welfare. She heads the national scale-up of zinc (SUZY Project) and is the team leader of the Centre for Systematic Review at ICDDR,B, which focuses on health systems and policy reviews of non-state sector issues in low- and middle-income countries. She founded the Centre for Control of Chronic Diseases in Bangladesh, which features a unique health-systems approach to the issue of noncommunicable disease in resource-poor settings. She is an adjunct professor at the James P. Grant School of Public Health at BRAC University and in the College of Health and Human Services at George Mason University. Her publications appear in the *Lancet*, *PLoS Medicine*, the Cochrane Library, and *Health Policy* among others. She blogs for the *British Medical Journal*. At ICDDR,B she is co-founder of the Women Scientists and Researchers' Forum and serves

on the scientific council. Her consultancies include the World Food Programme, the World Bank, and the World Health Organization.

E. Francis Martin, MD, MPH, is a graduate of St. George's University and works in the emergency room at the General Hospital. Dr. Martin has a profound interest in primary health care, advocating for health promotion as pivotal to disease prevention. He has committed himself to the cause of healthy living by recommending lifestyle changes, helping people to connect the dots that link behavior to diseases. Dr. Martin also conducted research on the effects of Sahara dust on asthma visits to the emergency room in Grenada, the abstract of which was accepted by the American Thoracic Society for its May 2011 international conference. Dr. Martin published the article "A community approach and involvement in primary health care" in the *Grenada Medical Journal*. Presently Dr. Martin is spearheading the primary health care revitalization program in Grenada.

Montserrat Meiro-Lorenzo, MD, MPH, MPP, is a senior public health specialist. She is responsible for the dialogue on noncommunicable diseases at the World Bank's Health Nutrition and Population group. She has more than 20 years' experience in international health and development in Africa, Latin America, and East Asia, ranging from clinical care to health services management and public policy dialogue. She has designed and managed programs and projects in areas that include hospital care, tuberculosis control, health information systems, primary health care, nutrition, HIV/AIDS, results-based financing, and public health insurance. She holds a medical degree and master's degrees in both public health and public policy.

Andrew Mirelman, MPH, is a current PhD candidate in the International Health Department at the Johns Hopkins Bloomberg School of Public Health (JHSPH). His research interests are in applied demographic and economic techniques for public health, specifically, economic evaluation of noncommunicable disease prevention, rational decision-making, and methods for assessing economic impacts. Mr. Mirelman graduated in 2009 with an MPH from JHSPH, conducting a thesis project in Lima, Peru on national-level decision making for immunization introductions. He has continued his work with the International Vaccine Access Center group at JHSPH, working on their economics team. Current dissertation-level work is being conducted on the economic impact of chronic diseases and associated risk factors in Bangladesh, partnering with the International Center for Diarrheal Disease Research Bangladesh (ICDDR,B) as part of the U.S. National Heart, Lung, and Blood Institute collaborating centers of excellence for chronic diseases. He has been a teaching assistant for several classes at JHSPH, including Managing Health Services Organizations, Health Systems

in Lower and Middle Income Countries, and Understanding Cost-Effective Analysis for Healthcare Professionals. Before coming to JHSPH, he worked for a think tank on health and security and for a consulting firm in Washington, DC, in the field of occupational health. He received a BS in biomedical engineering from the University of Virginia in 2006.

Johanna Ralston has been chief executive officer of World Heart Federation since February 1, 2011. The World Heart Federation, headquartered in Geneva, comprises more than 200 member organizations in 120 countries and leads the global fight against heart disease and stroke, with a focus on low- and middle-income countries. The World Heart Federation is one of the founding members of the NCD Alliance, the lead civil society organization focusing on noncommunicable diseases (NCDs) leading up the United Nations high-level meeting on NCDs and beyond. Ms. Ralston's work in global chronic disease has spanned several organizations, and she has a particular interest in strengthening local capacity and advocating for integrated approaches. Prior to joining the World Heart Federation, Ms. Ralston was vice president, global strategies at the American Cancer Society (ACS). She joined the ACS in 1999 as its first-ever director of international programs and development and went on to build a department with training programs and partnerships in over 80 countries in capacity building, tobacco control, cancer control advocacy, and, more recently, in global advocacy with key partners including the World Health Organization and the World Economic Fund as well as the NCD Alliance. Ms. Ralston's work in global health has also included positions as a program development adviser at the International Planned Parenthood Federation of Latin America and in advocacy with AIDS organizations in Boston and New York. A dual citizen of the United States and Sweden, Ms. Ralston has lived and worked in Europe, Asia, and the United States. She is an alumna of the Harvard Business School Advanced Management Program, and she has studied public health at Harvard and Johns Hopkins Bloomberg School of Public Health.

Scott Ratzan, MD, MPA, is vice president of global health at Johnson & Johnson and editor-in-chief of the *Journal of Health Communication: International Perspectives*. Dr. Ratzan is co-chair of the United Nations Secretary General's Joint Action Plan on Women and Children's Health Innovation Working Group. He presented the pharmaceutical industry framework on noncommunicable diseases as the International Federation of Pharmaceutical Manufacturers and Associations representative at the United Nations interactive hearing in June 2011. He has testified before the U.S. Congressional Committee on the Millennium Development Goals concerning opportunities for success with the private sector engagement in health diplomacy. His books include *Mad Cow Crisis: Health and the*

Public Good, *Attaining Global Health: Challenges and Opportunities*, and *AIDS: Effective Health Communication for the 90s*. He received his MD from the University of Southern California, his MPA from the John F. Kennedy School of Government at Harvard University, and his MA in communications from Emerson College.

Karin Stenberg has worked as a health economist at the World Health Organization (WHO) headquarters in Geneva, Switzerland, since 2004. As a staff member of the department of child and adolescent health and development from 2004 to 2008, she supported models for estimating the cost of scaling up child health interventions at the global and country levels and provided support to ministries of health in low-income countries for estimating costs associated with implementing national child health strategies. Based with the WHO Department of Health Systems Financing since 2008, she is responsible for the development and application of tools for costing, cost-effectiveness, and expenditure tracking, with a primary focus on health systems and WHO's millennium development goals. She is a member of the inter-agency working group that is developing the OneHealth model for supporting country strategic health planning, and she has supported multiple global cost and impact assessment analyses with advocacy implications, including the International Health Partnership high-level task force on innovative international financing for health systems and the global strategy for women's and children's health.

Neff Walker, PhD, is currently a senior scientist in the Department of International Health of the Bloomberg School of Public Health at Johns Hopkins University. At Johns Hopkins, Neff's work has focused on the development of the Lives Saved Tool (LiST) a program that is used to estimate the impact of scaling up interventions on maternal, neonatal, and child mortality. Before coming to Johns Hopkins he spent three years at UNICEF as the senior advisor for estimation and modeling related to the impact of HIV/AIDS as well as serving as UNICEF's focal point for the Child Health Epidemiology Reference Group. From 1998 through 2003 Neff worked as the senior advisor for statistics and modeling at United Nations Programme on HIV/AIDS. In both positions a primary focus of his work was the development and implementation of standard methods for estimation and modeling related to disease burden. Prior to working at the United Nations, Neff spent 15 years working as a faculty member in the areas of computer science and human factors.

Gerald Yonga, MBChB, MMed, MBA, FESC, FACC, is the chair and associate professor of medicine and cardiology at Aga Khan University Hospital in Nairobi, Kenya. He is also the national chair of the Kenya Cardiac So-

ciety and the interim national chair of the Kenya Non-Communicable Disease Alliance. Dr. Yonga has over 20 years of experience running internal medicine and cardiology diagnostic and treatment clinics in both the public and the private sector. His professional mission is to help develop high-quality accessible health care services, health care workers, institutions, and health care systems in the East African region. He has lectured extensively and taught courses on best practices and capacity building in cardiology to nurses and doctors in the Kenya Ministry of Health, medical students, and experienced health professionals. Dr. Yonga's research interests include the epidemiology, primary and secondary prevention, and primary care of noncommunicable diseases, and he has published more than 30 articles in peer-reviewed journals. Dr. Yonga received his MBChB and MMed from the University of Nairobi and his MBA in health care management from Regent Business School in Durban, South Africa.

WORKSHOP PLANNING COMMITTEE BIOGRAPHIES[1]

Rachel A. Nugent, PhD (*Chair*), is director of the Disease Control Priorities Network and senior research scientist at the Department of Global Health, University of Washington. She has 25 years of experience as a development economist, managing and carrying out research and policy analysis in the fields of health, agriculture, and the environment. Prior to joining the University of Washington, Dr. Nugent was deputy director for global health at the Center for Global Development. She previously worked at the Population Reference Bureau, the Fogarty International Center of the U.S. National Institutes of Health, and the United Nations Food and Agriculture Organization. She also served as associate professor and chair of the economics department at Pacific Lutheran University in Tacoma, Washington. Dr. Nugent's recent publications address the cost-effectiveness of noncommunicable disease interventions, the economic impacts of chronic disease, and the health impacts of fiscal policies. Dr. Nugent was a committee member for the Institute of Medicine study *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*.

Kalipso Chalkidou, MD, PhD, is the founding director of the UK National Institute for Health and Clinical Excellence's international program, helping governments build technical and institutional capacity for using evidence to inform health policy. She is interested in how local information, local expertise and local institutions can drive scientific and legitimate health care

[1]Institute of Medicine planning committees are solely responsible for organizing the workshop, identifying topics, and choosing speakers. The responsibility for the published workshop summary rests with the workshop rapporteur and the institution.

resource allocation decisions. She has been involved in Chinese rural health reform and also in national health reform projects in Colombia, Turkey, and the Middle East, working with the World Bank, the Pan American Health Organization, the UK Department for International Development, and the Inter-American Development Bank as well as with national governments. She holds a doctorate in molecular biology from the University of Newcastle and an MD (Hon.) from the University of Athens and is an honorary senior lecturer at the London School of Hygiene and Tropical Medicine, a senior advisor on international policy at the U.S. Center for Medical Technology Policy and visiting faculty at the Johns Hopkins Berman Institute for Bioethics.

Valentin Fuster, MD, PhD, serves the Mount Sinai Medical Center as director of Mount Sinai Heart, the Zena and Michael A. Wiener Cardiovascular Institute, and the Marie-Josée and Henry R. Kravis Center for Cardiovascular Health. He is the Richard Gorlin, MD/Heart Research Foundation Professor at the Mount Sinai School of Medicine. Dr. Fuster is the general director of the Centro Nacional de Investigaciones Cardiovasculares Carlos III in Madrid, Spain. After receiving his medical degree from Barcelona University and completing an internship at Hospital Clinic in Barcelona, Dr. Fuster spent several years at the Mayo Clinic, first as a resident and later as professor of medicine and consultant in cardiology. In 1981 he came to Mount Sinai School of Medicine as head of cardiology. From 1991 to 1994 he was Mallinckrodt Professor of Medicine at Harvard Medical School and chief of cardiology at Massachusetts General Hospital. He returned to Mount Sinai in 1994 as director of the Zena and Michael A. Wiener Cardiovascular Institute and, most recently, he has been named the director of Mount Sinai Heart. Dr. Fuster is a past president of the American Heart Association, immediate past president of the World Heart Federation, a member of the Institute of Medicine of the National Academy of Sciences, a former member of the National Heart, Lung, and Blood Institute Advisory Council, and former chairman of the fellowship training directors program of the American College of Cardiology. Twenty-seven distinguished universities throughout the world have granted Dr. Fuster Honoris Causa. He has published more than 800 articles on the subjects of coronary artery disease, atherosclerosis, and thrombosis, and he has become the lead editor of two major textbooks on cardiology and of three books related to health for the public in Spain (best sellers, presently being translated into English). Dr. Fuster has been appointed editor-in-chief of the *Nature* journal that focuses on cardiovascular medicine. Dr. Fuster is the only cardiologist to receive all four major research awards from the four major cardiovascular organizations: the Distinguished Researcher Award (Interamerican Society of Cardiol-

ogy, 2005), the Andreas Gruntzig Scientific Award (European Society of Cardiology, 1992), Distinguished Scientist (American Heart Association, 2003), and the Distinguished Scientist Award (American College of Cardiology, 1993). In addition, he has received the Principe de Asturias Award of Science and Technology (the highest award given to Spanish-speaking scientists), the Distinguished Service Award from the American College of Cardiology, the Gold Heart Award (American Heart Association's highest award), and the Gold Medal of the European Society of Cardiology (the highest award, Vienna, September 2007). Dr. Fuster has four ongoing projects as part of the World Heart Federation: "Promoting health as a priority" in children of Bogotá with Sesame Street, "Promoting health as a priority" in adults in the island of Grenada, a cardiovascular disease polypill developed in Spain for middle- and low-income countries, and a project with Jeffrey and Sonia Sachs focused on chronic diseases (as an addition to the Millennium Project) in the African villages (Rwanda). Dr. Fuster was the committee chair for the IOM study *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*.

Stephen Jan, PhD, is a senior health economist at the George Institute for Global Health. He also holds an associate professorship in the Sydney Medical School at the University of Sydney and is an associate at the Menzies Centre for Health Policy. Dr. Jan's areas of research interest are economic evaluation alongside clinical and public health studies, indigenous health, health systems research, the analysis of the household economic impact of chronic illness, institutionalist economics, and health policy. He has published widely in the medical, public health, health policy and health economics literature and has co-authored two textbooks in health economics and financing. His current projects are set in China, various countries in Southeast Asia, and Australia. He is the lead chief investigator on an Australian National Health and Medical Research Council-funded capacity-building grant in health services research that provides traineeships for a number of health economics researchers at the George Institute and the University of Sydney. Over the course of his career he has acted as an advisor for numerous local and international agencies, including agencies within state and national governments in Australia, the World Health Organization, and the Institute of Medicine (IOM). He was an invited speaker and was commissioned to author a paper as part of the initial IOM study *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*.

Peter R Lamptey, MD, DrPH, is based in Accra, Ghana, and is the president of public health programs at Family Health International (FHI360).

Dr. Lamptey is an internationally recognized public health physician and expert in developing countries, with particular emphasis on communicable and noncommunicable diseases. With a career at FHI spanning more than 25 years, Dr. Lamptey has been instrumental in establishing FHI as one of the world's leading international nongovernmental organizations in implementing HIV/AIDS prevention, care, treatment, and support programs. His experience in HIV/AIDS efforts internationally includes collaboration with the World Bank to design and monitor the China Health IX HIV/AIDS Project. From 1997 to 2007 Dr. Lamptey directed the 10-year Implementing AIDS Prevention and Care (IMPACT) project. The IMPACT project encompassed HIV/AIDS programs in Africa, Asia, Latin America, the Caribbean, Eastern Europe, and the Middle East. He is the former chair of the Monitoring the AIDS Pandemic (MAP) Network, a global network of more than 150 HIV/AIDS experts in 50 countries that was formed in 1996 by the AIDS Control and Prevention (AIDSCAP) project, the François-Xavier Bagnoud Center for Health and Human Rights of the Harvard School of Public Health, and the Joint United Nations Programme on HIV/AIDS. Dr. Lamptey delivered the HIV prevention plenary speeches at the world AIDS conferences held in Berlin, Germany, in 1993 and in Durban, South Africa, in 2000. From 1991 to 1997 Dr. Lamptey directed AIDSCAP, funded by the U.S. Agency for International Development (USAID) and implemented by FHI. The largest international HIV/AIDS prevention program undertaken to date, AIDSCAP consisted of more than 800 projects in 50 countries in Africa, Asia, Latin America, and the Caribbean. Prior to his work with AIDSCAP, he directed AIDSTECH, also funded by USAID as a global HIV/AIDS project and implemented by FHI from 1987 to 1992. Born in Ghana, Dr. Lamptey began his career as a district medical officer there, first in the Salaga district, where he was responsible for preventive and clinical health services for 200,000 individuals, and then for the USAID-funded Danfa Comprehensive Rural Health Family Planning Project. He received his medical degree from the University of Ghana, a master's degree in public health from the University of California, Los Angeles, and a doctorate in public health from the Harvard School of Public Health. Dr. Lamptey was a committee member for the IOM study *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*.

Derek Yach, MBChB, DSc, MPH, has played a leading global role in many aspects of noncommunicable diseases (NCDs) within the private, public, and foundation world for the past two decades. He is senior vice president of global health and agricultural policy at PepsiCo. He has headed global health at the Rockefeller Foundation, been professor of global health at Yale University, and is a former executive director of the World Health Organization (WHO). At the WHO he served as cabinet director for non-communicable diseases and mental health under Director-General Gro Harlem

Brundtland, during which time he led development of WHO's Framework Convention on Tobacco Control, the Global Strategy on Diet and Physical Activity, and WHO's World Health Report on Mental Health. Dr. Yach established the Centre for Epidemiological Research at the South African Medical Research Council. He has authored or co-authored more than 200 articles covering the breadth of global health. These include leading thought pieces within NCDs over the last 20 years. He serves on advisory boards of the Clinton Global Initiative, the Chicago Council on International Affairs' Agricultural Development Initiative, the World Economic Forum's New Vision for Agriculture, the Fogarty International Centre of the U.S. National Institutes of Health, and the World Food Program USA. He is regular plenary speaker and moderator of global and national meetings related to health and development. Dr. Yach has degrees in medicine (Cape Town) and public health (Johns Hopkins) and an honorary D.Sc. from Georgetown University. Dr. Yach was a committee member for the IOM study *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*.

INSTITUTE OF MEDICINE STAFF BIOGRAPHIES

Bridget B. Kelly, MD, PhD (*IOM Project Director*), is a senior program officer with the Institute of Medicine's Board on Global Health. She was the study director for the recent report *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*, and continues to direct dissemination efforts for the report. She is also the study co-director for the congressionally mandated Institute of Medicine evaluation of U.S. global HIV/AIDS programs. She first came to the National Academies in September 2007 as a Christine Mirzayan Science and Technology Policy Graduate Fellow. Prior to joining the Board on Global Health in September 2008, she worked on the Board on Children, Youth, and Families for projects on prevention of mental, emotional, and behavioral disorders among children, youth, and young adults; on depression, parenting practices, and child development; and on strengthening benefit-cost methodology for the evaluation of early childhood interventions. She holds both an MD and a PhD in neurobiology, which she completed as part of the Medical Scientist Training Program at Duke University. She received her BA in biology and neuroscience from Williams College, where she was also the recipient of the Hubbard Hutchinson Fellowship in fine arts. In addition to her work in science and health, she has more than 10 years of experience in grassroots nonprofit arts administration.

Collin Weinberger is a research associate at the Institute of Medicine's Board on Global Health where he serves as a member of the research staff for the ongoing dissemination efforts around the 2010 report *Promoting*

Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health as well as for the PEPFAR outcomes and impact evaluation. He has also served as research staff for the IOM's Forum on Microbial Threats. Prior to joining the IOM, he was a communications associate at Global Health Strategies, a communications and advocacy consultancy specializing in diseases of the developing world. He also spent a year as a volunteer with Partners in Health/Socios en Salud in Lima, Peru, where he worked with the organization's children's health, multi-drug-resistant tuberculosis, and HIV/AIDS programs. He received his bachelor's degree in health and societies from the University of Pennsylvania.

Leigh Carroll is a senior program assistant with the Institute of Medicine's Board on Global Health. She is involved in dissemination activities for the 2010 report *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health,* as well as in the evaluation of PEPFAR-supported global HIV/AIDS programs. Before coming to the IOM, she spent two years in rural Tanzania teaching high school science through the Peace Corps. She received her BS in neuroscience from the University of Rochester in 2008.

Patrick Kelley, MD, DrPH, joined the Institute of Medicine (IOM) in July 2003 as the director of the Board on Global Health. He has subsequently also been appointed the director of the Board on African Science Academy Development. Dr. Kelley has overseen a portfolio of IOM expert consensus studies and convening activities on subjects as wide ranging as the evaluation of the U.S. emergency plan for international AIDS relief, the role of border quarantine programs for migrants in the 21st century, sustainable surveillance for zoonotic infections, and the programmatic approach to cancer in low- and middle-income countries. He also directs a unique capacity-building effort, the African Science Academy Development Initiative, which over 10 years aims to strengthen the capacity of African academies to advise their governments on scientific matters. Prior to coming to the National Academies Dr. Kelley served in the U.S. Army for more than 23 years as a physician, residency director, epidemiologist, and program manager. In his last Department of Defense (DoD) position, Dr. Kelley founded and directed the DoD Global Emerging Infections Surveillance and Response System. This responsibility entailed managing surveillance and capacity building partnerships with numerous elements of the federal government and with health ministries in more than 45 developing countries. Dr. Kelley is an experienced communicator, having lectured in English or Spanish in more than 20 countries and published more than 64 scholarly papers, book chapters, and monographs. Dr. Kelley obtained his MD from the University of Virginia and his DrPH in epidemiology from the Johns Hopkins School of Hygiene and Public Health.