Including Health in Global Frameworks for Development, Wealth, and Climate Change: Workshop Summary

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Suzanne Landi, Rapporteur; Roundtable on Environmental Health Sciences, Research, and Medicine; Board on Population Health and Public Health Practice; Institute of Medicine

Including Health *in* Global Frameworks *for* Development, Wealth, *and* Climate Change

WORKSHOP SUMMARY

Suzanne Landi, *Rapporteur*

Roundtable on Environmental Health Sciences, Research, and Medicine

Board on Population Health and Public Health Practice

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

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This workshop summary has been reviewed in draft form by persons 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 workshop summary as sound as possible and to ensure that the summary 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 workshop summary:

Hilary French, United Nations Environment Programme
Canice Nolan, European Commission
David Simpson, U.S. Environmental Protection Agency
Kimberly Thigpen Tart, National Institute of Environmental Health Sciences

Although the reviewers listed above have provided many constructive comments and suggestions, they did not see the final draft of the workshop summary before its release. The review of this summary was overseen by **Johanna T. Dwyer,** Tufts Medical Center. Appointed by the Institute of Medicine, she was responsible for making certain that an independent examination of this workshop summary was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this summary rests entirely with the rapporteur and the institution.

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1

Introduction[1]

The Roundtable on Environmental Health Sciences, Research, and Medicine provides a structured opportunity for regular and open communication among experts interested in environmental health topics from a variety of government, academic, industry, and consumer groups. In September 2012, the Roundtable established the Global Environmental Health and Sustainable Development Innovation Collaborative as an ad hoc activity to provide an adaptable pathway for discussing issues related to sustainable development and for sharing scientific information across United Nations (UN) system entities, international and governmental organizations, academia, the private sector, and civil society. Through multidisciplinary collaboration, the Innovation Collaborative seeks to connect and leverage expertise across a variety of fields related to sustainable development, including economics, energy, environmental sciences, medicine, public health, and health communication.

In December 2012, members of the Innovation Collaborative met to develop the statement of task for the 2013 Global Environmental Health and Sustainable Development Spring Webinar Series (see Box 1-1). An independent planning committee, whose role was limited to planning the webinar series in accordance with the procedures of the National Research Council (NRC), invited experts within the fields of economics, environmental health, global health, and public policy to present their experiences and thoughts on the webinar topic areas. Participants in these webinars examined frameworks for global development goals and connections to

[1] The planning committee's role was limited to planning the workshop, and the workshop summary has been prepared by the workshop rapporteur as a factual summary of what occurred at the workshop. Statements, recommendations, and opinions expressed are those of individual presenters and participants, and are not necessarily endorsed or verified by the Institute of Medicine, and they should not be construed as reflecting any group consensus.

BOX 1-1
Statement of Task

An ad hoc committee will plan and conduct a public three-part webinar series (workshop) in spring 2013 on three themes identified from the 2012 fall meeting of the Roundtable on Environmental Health Sciences, Research, and Medicine and its collaborative on Global Environmental Health and Sustainable Development. The webinars will feature invited presentations and discussions to look at the role of health in measuring a country's wealth (going beyond gross domestic product), health scenario communication, and international health goals and indicators. The workshop will focus on fostering discussion across academic, government, business, and civil society sectors to make use of existing data and information that can be adapted to track progress of global sustainable development and human health. The committee will develop the webinar agendas, select invited speakers and discussants, and moderate the discussions. A workshop summary based on all three webinars will be prepared by a designated rapporteur in accordance with National Research Council policies and procedures.

health indicators, the role for health in the context of novel sustainable economic frameworks that go beyond gross domestic product, and scenarios to project climate change impacts.

OVERVIEW OF SUSTAINABILITY, MILLENIUM DEVELOPMENT GOALS, AND POST-2015 GOALS

Defined in the 1987 report by the World Commission on Environment and Development (WCED) (commonly known as the Brundtland Commission), the term "sustainability" comes from the concept of sustainable development defined as "development which meets the needs of current generations without compromising the ability of future generations to meet their own needs" (WCED, 1987). Sustainable development is supported by three pillars—the economic, social, and environmental dimensions—in which health is both an outcome of and precondition for all three pillars (UN, 2012). In 1992, sustainable development was formally endorsed by the international community at the historic Earth Summit held in Rio de Janeiro, Brazil. The Earth Summit resulted in the creation of Agenda 21, an ambitious action plan for global sustainable development (UN, 1993), and the Rio Declaration, which outlined 27 principles for global sustainability (UN, 1992).

At the Millennium Summit held in 2000, world leaders adopted the Millennium Declaration (UN General Assembly, 2000)—a document that sought to uphold human dignity especially for the most vulnerable people—which gave rise to eight global development goals known as the Millennium Development Goals (MDGs) (see Box 1-2). The global community set a 15-year implementation plan to achieve the specific targets established for each MDG in order to realize overarching objectives such as poverty eradication, improved human health, and protection and management of the natural resources base.

BOX 1-2
Millennium Development Goals (MDGs) and Targets

1. Eradicate extreme poverty and hunger
   - 1A. Halve, between 1990 and 2015, the proportion of people whose income is less than $1 per day
   - 1B. Achieve full and productive employment and decent work for all, including women and young people
   - 1C. Halve, between 1990 and 2015, the proportion of people who suffer from hunger
2. Achieve universal primary education
   - 2A. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
3. Promote gender equality and empower women
   - 3A. Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015
4. Reduce child mortality
   - 4A. Reduce by two-thirds, between 1990 and 2015, the under-5 mortality rate
5. Improve maternal health
   - 5A. Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio
   - 5B. Achieve, by 2015, universal access to reproductive health
6. Combat HIV/AIDS, malaria, and other diseases
   - 6A. Have halted by 2015 and begun to reverse the spread of HIV/AIDS
   - 6B. Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it
   - 6C. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases

7. Ensure environmental sustainability
   - 7A. Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources
   - 7B. Reduce biodiversity loss, achieving, by 2020, a significant reduction in the rate of loss
   - 7C. Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation
   - 7D. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers
8. Global partnership for development
   - 8A. Develop further an open, rule-based, predictable, nondiscriminatory trading and financial system
   - 8B. Address the special needs of the least developed countries
   - 8C. Address the special needs of landlocked developing countries and small-island developing states
   - 8D. Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term
   - 8E. In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries
   - 8F. In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

NOTE: Please see *The Millennium Development Goals Report 2013* for a detailed assessment of global and regional progress made toward the MDGs and targets: http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2013/English2013.pdf (accessed August 14, 2013).

SOURCE: UN, 2008.

As 2015 approaches, efforts are under way at the UN to develop a set of post-2015 goals that will provide a framework for global development efforts during the next 15 years. In July 2012, the UN High-Level Panel of Eminent Persons for the Post-2015 Development Agenda was convened and tasked to make recommendations for this development agenda that will extend beyond 2015.[2] Their report was released at the end of May 2013 and titled *A New Global Partnership: Eradicate Poverty and Transform*

[2] The UN High-Level Panel was convened by the UN Secretary General to advise on the global development framework beyond 2015, the target date for the MDGs. The panel comprises 27 eminent leaders from civil society, the private sector, and government (http://www.un.org/sg/management/hlppost2015.shtml [accessed August 26, 2013]).

Economies Through Sustainable Development.[3] The High-Level Panel highlighted the lack of collaboration between environmental and development group efforts to further the MDGs and noted that "the MDGs fell short by not integrating the economic, social, and environmental aspects of sustainable development as envisaged in the Millennium Declaration, and by not addressing the need to promote sustainable patterns of consumption and production" (UN, 2013). In considering new goals and targets for post-2015 that will promote sustainable development, the High-Level Panel considered tangible topics such as hunger, poverty, sanitation, and water, as well as projections related to cross-cutting topics such as population growth and climate change. Discussions about the post-2015 goals and targets will continue until to September 2015, when the UN General Assembly is expected to adopt a new global development agenda.

STRUCTURE OF THE SUMMARY

This summary was prepared by the workshop rapporteur as a factual summary of what occurred during the webinars. All views presented in the summary are those of the webinar participants. The summary does not contain any findings or recommendations by the planning committee or the Roundtable.

The presentations and discussions that occurred during the webinars are summarized in the subsequent chapters. Chapter 2 provides a summary of the featured presentations and discussion on existing efforts to develop goals and indicators for the post-2015 development agenda. Chapter 3 presents a summary of the remarks and presentations focused on sustainable economic frameworks and links to health. Chapter 4 summarizes the presentations on climate change scenarios and health outcomes. The webinar agendas can be found in Appendix A and the speaker biosketches are included in Appendix B.

[3] The report is available at http://www.post2015hlp.org/wp-content/uploads/2013/05/UN-Report.pdf (accessed August 26, 2013).

REFERENCES

UN (United Nations). 1992. *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, 3-14 June 1992*. A/CONF.151/26. New York: United Nations.

UN. 1993. *Earth Summit: Agenda 21. The United Nations programme of action from Rio*. New York: United Nations.

UN. 2012. *The future we want.* A/CONF.216/L.1. New York: United Nations.

UN. 2013. *A new global partnership: Eradicate poverty and transform economies through sustainable development. The report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda*. New York: United Nations.

UN General Assembly. 2000. *United Nations Millennium Declaration*. A/RES/55/2. New York: United Nations.

WCED (World Commission on Environment and Development). 1987. *Our common future*. Edited by G. H. Brundtland. Oxford: Oxford University Press.

2

Health in the Context of Processes to Develop Post-2015 Goals and Sustainable Development Goals

This chapter presents a summary of a webinar on Health in the Context of United Nations (UN) Processes to Develop Post-2015 Goals and Sustainable Development Goals (SDGs). The focus of the webinar was to review the key points and gaps in existing efforts to develop new goals and indicators for the post-2015 development agenda and discuss how best to incorporate environmental health indictors into the indicator development process. The first presentation, from Kumanan Rasanathan, United Nations Children's Fund (UNICEF), was an overview of the Global Thematic Consultation on Health, which assembled inputs from people and organizations around the world on how best to reflect health in the post-2015 development agenda. The second presentation, from John Norris, Center for American Progress, provided an overview of the UN report (2013), *A New Global Partnership: Eradicate Poverty and Transform Economies Through Sustainable Development*, developed by the UN High-Level Panel of Eminent Persons for the Post-2015 Development Agenda. The third presentation, from Andrew Haines, London School of Hygiene and Tropical Medicine, specifically addressed health linkages to the goals and indicators proposed by the UN High-Level Panel in the *New Global Partnership* report. The chapter concludes with highlights of the discussion that followed the presentations.

OPENING

John Balbus, senior advisor for public health at the National Institute of Environmental Health Sciences and co-chair of the Global Environmental Health and Sustainable Development Innovation Collaborative, provided an overview of the webinar topic. He began by noting that the

global burden of disease is related in part to environmental exposure, and the need to recognize this relationship in current global development projects is crucial, so that the health impact can be measured and any adverse effects prevented.

As noted above, the UN High-Level Panel of Eminent Persons released a report providing a framework for integrating new goals and measurable targets into the post-2015 development agenda. Balbus noted that previous Collaborative webinars addressed aspects of the post-2015 development agenda including UN processes and ways to provide input, reasonable goals and indicators for environmental health and sustainability, and health equity and social justice considerations.[1] He added that the webinar build on those themes in an effort to provide useful information to the global community as the post-2015 agenda and SDGs are developed.

THE GLOBAL THEMATIC CONSULTATION ON HEALTH AND INCORPORATING ENVIRONMENTAL HEALTH INTO THE POST-2015 DEVELOPMENT AGENDA

Kumanan Rasanathan, M.B.Ch.B., M.P.H., FAFPHM
Health Specialist,
UNICEF

Kumanan Rasanathan began with the context of health in the post-2015 agenda, which he identified as an entry point for developing potential targets and indicators for an environmental health agenda. He praised the UN High-Level Panel for performing well in the face of much concern about reconciling the many different and sometimes conflicting agendas. He explained that the process would now move to intergovernmental discussion, with the challenge of preserving the value of the targets under the Millennium Development Goals (MDGs) while allowing for broader issues to be addressed, including the role of institutions and the role of governance (see Box 1-2 for a detailed list of the MDGs and related targets). A schematic of the post-2015 Development Agenda process produced by the UN Foundation is shown in Figure 2-1.

[1] A summary of these webinars is available at http://www.iom.edu/Reports/2013/Global-Development-Goals-and-Linkages-to-Health-and-Sustainability.aspx (accessed September 30, 2013).

The criticism of the original MDGs as an enterprise too much under the control of a few people at the top, resulted in a participatory process for the post-2015 development agenda. There was a huge amount of consultation and work that fed into the UN High-Level Panel, including country consultations, thematic consultations, regional consultations, civil society interaction, and much more. For example, the Global Thematic Consultation on Health—conducted and managed by UNICEF, the World Health Organization (WHO), and the governments of Botswana and Sweden—established a process that was as open as possible and that eventually led to a final report. Drafts of the report were placed on the Web for comment, and a final meeting was convened that brought together members of the UN High-Level Panel, member state representatives, civil society representatives, leaders of the H8[2] international health agencies, and key academic leaders. The challenge with a participatory process is that in order to please everyone, the end result could have become a unwieldy compendium of everybody's wish list, with far too many indicators and targets. The final report, submitted to the UN High-Level Panel and the Secretary General, focused on five general areas:

1. Lessons learned from MDGs.
2. Health priorities in the post-2015 era.
3. The role of health in the broader post-2015 development agenda.
4. Potential goals and targets.
5. Lessons learned from the implementation science of goals and targets from the MDGs.

Health goals, Rasanathan said, need to be considered not just in terms of achievements in the health sector, but also in terms of sustainable development and well-being, in general. The health goals of the new agenda are a continuation of the MDGs, addressing child and maternal health, HIV, malaria, and other diseases, but adding noncommunicable diseases. He added that there is a need to consider the contributions of

[2] The Health Eight (H8) comprises leaders of the eight global international health agencies: the Bill & Melinda Gates Foundation; GAVI (formerly the Global Alliance for Vaccines and Immunization); the Global Fund to Fight AIDS, Tuberculosis and Malaria; the Joint United Nations Programme on HIV/AIDS; UNICEF; United Nations Population Fund; WHO; and the World Bank. The H8 meets to discuss challenges to scaling up health services and improving health-related MDG outcomes.

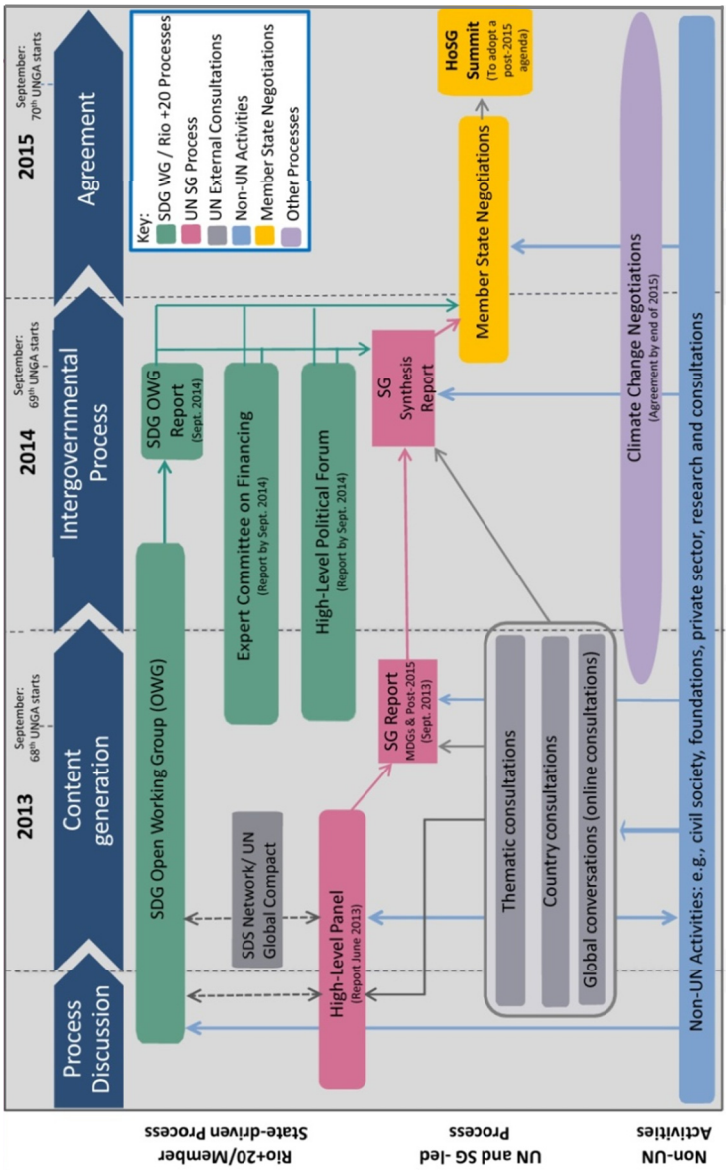

FIGURE 2-1 Schematic of the post-2015 development agenda process.
NOTES: HoSG = Heads of State Governments; MDGs = Millennium Development Goals; OWG = Open Working Group; SDG = Sustainable Development Goal; SDS Network = Sustainable Development Solutions Network; SG = Secretary General; UN = United Nations; UNGA = UN General Assembly; WG = Working Group.
SOURCE: UN Foundation and Dalberg Analysis, 2013. Reprinted with permission from the UN Foundation.

other sectors to health, such as social determinants and people's living conditions. He also indicated strong support for the idea of universal health coverage, which had been the subject of a UN General Assembly resolution in 2011. Affordability of service is a challenge, with coverage and quality of service as additional complicating factors.

Measuring achievement of goals is difficult, and Rasanathan cited the healthy life expectancy[3] measure as potentially useful, although the methodology may not yet be sufficiently developed. He added that there could have been more targets identified in the goals, and noted that the only target listed under universal health coverage was immunization, which distressed many proponents of that goal who had hoped for more. However, other important health-related issues were added or further highlighted, such as

- reducing death from national disasters,
- water and sanitation,
- birth registration,
- reducing violent deaths, and
- climate change.

Rasanathan stressed that this is an ongoing process that will continue to be dealt with at future General Assemblies. Developing indicators is a task that presents many challenges, and presents much opportunity for further clarification.

Rasanathan concluded by offering a view on how environmental health issues could be better linked to the current process. The environmental health community could consider targets and indicators that have already been put forward as well as links between different sectors and different goals and targets. The environmental health community could also consider different options in positioning environmental concerns, such as focusing their efforts in the health sector or in the environment or energy sectors. Rasanathan urged a policy of thinking strategically and being more aggressive in putting potential targets and indicators on the table for consideration and debate.

[3] Healthy life expectancy is based on mortality and morbidity data that is used to calculate the average number of years that a person can expect to live in full health (free from disability or disease) when taking into account years lived in less than full health due to disease and injury. Further information is available at http://www.who.int/healthinfo/statistics/indhale/en (accessed September 9, 2013).

OVERVIEW OF THE REPORT *A NEW GLOBAL PARTNERSHIP: ERADICATE POVERTY AND TRANSFORM ECONOMIES THROUGH SUSTAINABLE DEVELOPMENT*

John Norris, M.P.A.
Executive Director, Sustainable Security and Peace Building Initiative, Center for American Progress

John Norris began by describing efforts leading up to the release of the UN High-Level Panel report on *A New Global Partnership: Eradicate Poverty and Transform Economies Through Sustainable Development*. He characterized the recent UN Rio +20[4] Summit as "something of a train wreck," adding that there was a perception that the whole process of multilateralism had faltered. The UN High-Level Panel had to deal with the disappointment this perception caused. They wanted to build on the successes of the existing MDGs in the report and preserve parts of the agenda that had been effective, such as those concerning health and education—but, they also had to confront the failures of the agenda, such as initiatives on the environment.

The record of MDG implementation during the past 13 years has been uneven, Norris said, noting that although millions have moved from poverty into middle income status, traditionally marginalized populations have often been left behind. This issue brings to light the tension between the anti-poverty and environmental communities, which Norris described as a considerable source of tension in the UN High-Level Panel. Each community feared the other would divert funding from its issues, and trying to resolve this conflict was central to the High-Level Panel's work.

Another important issue was the difference between the procedures and funding landscape in 2000 compared with 2013. The original MDGs were produced behind closed doors, largely by a handful of representatives from the UN, some key member states, and international financial institutions. Creating the post-2015 agenda was envisioned as a much more transparent process, involving civil society, implementing partners, private philanthropy, and the business community. To achieve this, the UN held a series of consultations in more than 100 countries around the

[4] Rio +20 is the short name for the UN Conference on Sustainable Development which took place in Rio de Janeiro, Brazil, in June 2012, 20 years after the 1992 Earth Summit in Rio. More information is available at http://www.uncsd2012.org/about.html (accessed August 26, 2013).

globe, which Norris credits with changing the agenda in important ways that may help in subsequent intergovernmental negotiations. Norris also noted that the amount of official development assistance has diminished over time, with less going to environmental issues, health issues, and development in general. However, development funding from foreign direct investment, domestic resource mobilization, and private philanthropy is increasing. The High-Level Panel felt that this change in funding sources should be reflected in a constructive way in the post-2015 agenda.

The UN High-Level Panel's main achievement in the report on *A New Global Partnership: Eradicate Poverty and Transform Economies Through Sustainable Development* was resolving the tension between the anti-poverty and the environmental communities, said Norris. The panel set a goal of eradicating extreme poverty by 2030, but emphasized that this was to be accomplished within a framework of sustainability. He added that the agenda is truly universal, and designed to be applied to all countries, whereas the original MDGs were largely designed by donor nations to deal with recipient countries. This focus on universality—for instance, the willingness of the United States and the Organisation for Economic Co-operation and Development (OECD), in particular, to examine some of their own environmental problems—helped to convince key Latin American actors on the High-Level Panel to participate. Norris mentioned that in a welcome change, environmental concerns are now included within multiple goals and targets.

Another important change in the report, Norris said, is an emphasis on institutions, governance, and peace. More than 40 percent of the world's poor live in areas afflicted with violence and turmoil. Poverty, health, and environmental issues cannot be dealt with until these areas are helped to emerge from conflict. Norris added that budget transparency and a more informed and connected public can lead to better choices in the use of the environment, health spending, and other investments. Unfortunately, not all member states agree on these topics, although he stressed that the process of setting goals and targets was based on consensus.

In terms of specific goals and targets in heath, Norris stated that there is a lot of continuity with the original MDGs (see Box 2-1 for a list of the universal goals proposed by the UN High-Level Panel). Infant and child mortality, maternal mortality, and sexual and reproductive health and rights were part of the original goals, and have been expanded in the new

BOX 2-1
Universal Goals from the UN High-Level Panel Report

1. End poverty
2. Empower girls and women and achieve gender equality
3. Provide quality education and lifelong learning
4. Ensure healthy lives
5. Ensure food security and good nutrition
6. Achieve universal access to water and sanitation
7. Secure sustainable energy
8. Create jobs, sustainable livelihoods, and equitable growth
9. Manage natural resource assets sustainably
10. Ensure good governance and effective institutions
11. Ensure stable and peaceful societies
12. Create a global enabling environment and catalyze long-term finance

SOURCE: UN, 2013.

agenda, to which noncommunicable diseases also have been added—an addition Norris noted was important in terms of environmental health. Including healthy life expectancy as a target was discussed but was not adopted, which Norris said was disappointing. He noted that healthy life expectancy is a fairly new concept, and some public education within the intergovernmental process is needed before it can be accepted. He also noted that healthy life expectancy makes a good proxy indicator for many goals, across many sectors, and in many countries.

The section of the agenda that dealt with environmental issues was challenging, Norris said, adding that although global climate negotiations, trade talks, and financial discussions could not be addressed though the UN High-Level Panel, areas of consensus were identified. Environmental targets under Goal 7 (securing sustainable energy) included the Sustainable Energy for All initiative, which proposed doubling the rate of renewables in the global energy mix, and doubling the global rate of improvement in energy efficient buildings, industry, agriculture, and transport.[5] This

[5] According to the report of the UN High-Level Panel, this goal implies a 2.4 percent annual efficiency gain by 2030 compared with 1.2 percent, which was achieved from 1970 to 2008, according to the Global Energy Assessment from the International Institute of Applied Systems Analysis (http://www.iiasa.ac.at/

initiative has been well received, said Norris. The effort to reduce fossil fuel subsidies is complicated by the enormous sums of money at stake, and although it has been approved at the G8 and G20 levels,[6] it has not achieved much success.

The concept of sustainable consumption and production touches on many environmental areas. Strategies such as post-harvest waste reduction, agricultural efficiency, sustainable fisheries, and water and sanitation improvements have not only a significant environmental impact, but also a significant economic one, and they generate a lot of popular support.

Norris noted that agreement on clear numbers and measures to gather these data is needed to further specific environmental targets in the post-2015 agenda; otherwise, they are likely to be ignored, as occurred in the MDG process. For example, for MDG 7 (ensuring environmental sustainability) and Target 9 (integrating the principles of sustainable development into country policies and programs and reversing the loss of environmental resources),[7] the data underlying these efforts are not very robust, in part because consensus was lacking when the target levels and associated indicators were developed. Norris doubted that member states agreed on the definition of deforestation or which forests would be included in Indicator 25 (proportion of land area covered by forest), and added that there were concerns about land use, with consequent legal implications for both developed and developing nations. Overall, these efforts were not very data-driven, leaving much work to be done for the post-2015 agenda.

Norris concluded his presentation with the observation that environmental and poverty reduction issues need to be considered together, and that financial discussions about these should not just include member states and the international and financial institutions alone. Financial discussions should be broader and include the private sector, private philanthropy, and civil society. Only then can the necessary support and resources be assembled and mobilized to meet this very ambitious agenda.

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web/home/research/Flagship-Projects/Global-Energy-Assessment/Home-GEA.en.html [accessed September 9, 2013]).

[6] The G8, or Group of Eight, is an assembly of world leaders who meet annually to discuss global issues. The G20, or Group of Twenty, is an assembly of finance ministers and central bank governors.

[7] See http://www.unmillenniumproject.org/goals/gti.htm (accessed August 28, 2013).

RESPONSE TO FINDINGS AND RECOMMENDATIONS IN THE UN HIGH-LEVEL PANEL'S REPORT

Sir Andrew Haines, M.D.
Professor of Public Health and Primary Care
London School of Hygiene and Tropical Medicine

Andrew Haines began his presentation by noting concern about the possible marginalization of health in the post-2015 agenda—of the 11 thematic groups for discussion, only 1 included health. Of the MDGs themselves, 3 are specifically concerned with health, and 18 of the 48 indicators are specifically linked to health (and many more are indirectly linked). Only one sustainable development goal is likely to be adopted, he added, which will attempt to integrate both universal health coverage and the determinants of health. There are problems with developing a simple set of indicators for universal health coverage, and Haines noted that the UN High-Level Panel did not include catastrophic health expenditure, an important element of universal health coverage.

Health Linkages in the Proposed Goals

Many of the 12 proposed universal goals in the UN High-Level Panel's report are inextricably linked to health, said Haines:

- Goal 1 (ending extreme poverty) is crucial for the improvement of health.
- Goal 4 (ensuring healthy lives) provides an opportunity to track selected noncommunicable diseases and develop indicators that also reflect some of the environmental determinants of health.
- Goal 5 (ensuring food security and good nutrition) focuses on reducing stunting, wasting, and anemia, although the other end of the spectrum—overweight and obesity—is not addressed.
- Goal 7 (securing sustainable energy) suggests increased use of renewable energy sources, which would result in less air pollution and therefore fewer associated health issues.
- Goal 11 (ensuring stable and peaceful societies) calls for reducing violent deaths by 100,000 by an agreed date, as a possible indicator. Goal 11 also provides an opportunity to address road injuries, which cause about 1.3 million deaths per year. Road transport is increasing and is a major source of greenhouse gas

emissions. The increase in traffic combined with the dangerous state of roads and lack of enforcement of traffic regulations, particularly in low- or middle-income countries, not only causes road injuries (a major burden on health systems) but also inhibits active travel (e.g., walking and cycling).

- Goal 12 (creating a global enabling environment and catalyzing long-term finance) stresses the importance of preventing an increase in the global average temperature of more than 2 degrees Celsius. Many scientists believe that if this increase is exceeded, major changes could ensue that threaten global security and human health in the future.

Haines discussed the dangers mentioned in Goal 12 in greater detail, noting that in the 2012 World Bank report *Turn Down the Heat*, depending on which global emissions pathway is followed, a global mean temperature rise of 4 degrees Celsius could be exceeded by the end of the century—which would have major implications for health and development. He added that, as also noted by Norris, although the UN High-Level Panel report stressed the importance of abolishing fossil fuel subsidies, these subsidies and unsustainable agricultural policies have proved remarkably difficult to eradicate.

Indicators for Linking Health and Sustainability

Citing an article by Rockstrom and colleagues (2009), Haines turned to a consideration of "planetary boundaries," defined as "the safe operating space for humanity with respect to the Earth system . . . associated with the planet's biophysical subsystems or processes." He noted that three of the nine boundaries defined in the article that have already been reached: climate change, human interference with the nitrogen cycle, and biodiversity loss. There is a need, he said, to determine which indicators best reflect the damage to these global systems with particular implications for human health. For instance, climate change might lead to a reduction in grain yields and changes in water availability, and both would have a major impact on human health.

In the quest to identify linkages between health and sustainability, Haines noted that environmental change and its impact on agricultural systems—with the subsequent effect on human nutrition—provides an excellent source of potential indicators. These might be divided into two policy types. The first policy type would be directed toward enhancing

sustainability through reducing damage to the environment (for instance, by reducing greenhouse gas emissions), while the second would focus on increasing the resilience of populations to adverse environmental conditions (for instance, by developing hardier agricultural seeds).

Agriculture

Haines expounded on the range of linkages among agricultural productivity and agricultural systems, environmental sustainability, and human health, noting that livestock production is a significant contributor to climate change, particularly through methane emissions. Developing a metric to link agricultural sustainability with health is complicated by the many complexities of animal product consumption, and fruit and vegetable intake might be simpler to measure. Around 1 billion people are currently food insecure and indicators of undernutrition are gaining support (such as stunting, which has implications for cognitive development and future risks of developing noncommunicable diseases). Obese and overweight people tend to contribute higher per capita greenhouse gas emissions (Edwards and Roberts, 2009) because they tend to consume more food and may use motorized transport more than individuals of normal weight.

Water and Sanitation

Climate change risks and the depletion of aquifers are important challenges for freshwater availability, Haines said. For example, sea-level rise due to both climate change and local environmental changes can contribute to salination of coastal water sources. The achievements of a sustainable safe water supply together with hygienic sanitation in the home are very worthy goals. A suggested indicator for this goal area is the proportion of income spent on water—an important contributor to poverty in many developing countries.

Disaster Resilience

Indicators for disaster resilience are hard to develop but might assess how health facilities might not only be made more resilient to floods and other extreme events, but also assess for reliable clean energy and clean water supplies, including in emergencies.

Sustainable Cities

Although sustainable cities are an important issue—more than half of the world's population lives in cities, and this number will only increase in the future—they are not featured much in the UN High-Level Panel's

report. Local city administrations might be challenged to develop their own set of indicators for sustainable cities, as the drivers of sustainable development are not necessarily federally controlled. Options for short urban journeys by active travel (walking and cycling), public transport, and injuries per kilometer travelled might serve as indicators.

Air Pollution

Air pollution is a major factor in ill health, as noted in the 2010 Global Burden of Diseases, Injuries, and Risk Factors Study (Lim et. al., 2012), which estimated that approximately 3.5 million deaths per year are attributable to household air pollution from solid fuels and 3.2 million deaths result from ambient air pollution (with contributions from household sources). Good measures of ambient fine-particulate air pollution are available in an increasing number of sites around the world, and data about the source of household energy could be readily collected.

Healthy Housing

Urban slums are mentioned in the report from Lim and colleagues (2012). Haines maintained that low-cost housing for the poor should be available and should include basic essentials for healthy life: safe drinking water, clean heating and cooking, and resilience to heat and cold.

Healthy Life Expectancy

Healthy life expectancy is increasingly available as a metric. Haines urged more national statistical agencies to collect data about healthy life expectancy, so that the effectiveness of maximizing health throughout life can be measured. Both universal health coverage and the environmental and social determinants of health are contributing factors to a healthy life expectancy.

Final Remarks

Haines concluded his presentation by noting that although they have not been globally achieved, the MDGs have helped to focus international and national efforts and should be the foundation of continuing efforts. He added that better metrics for monitoring progress toward universal health coverage should be developed. In addition, indicators of "health in all policies" that both reduce environmental damage (e.g., greenhouse gas emissions) and improve health and resilience to environmental change should be developed.

DISCUSSION

A brief discussion among the speakers and participants followed the presentations. Their remarks are summarized in this section.

Are the Goals Achievable?

The first question addressed to the speakers concerned whether these goals—worthy though they may be—are actually achievable in the real world, with its increasing population, increasing poverty and unemployment, and widening gaps between rich and poor.

Haines responded that although it is difficult to persuade either emerging economies or high-income countries to change their lifestyles to facilitate sustainable development for the rest of the world, it is an ambitious program that should be attempted. He said that to simply accept the status quo is wrong. He added that policies such as reducing fossil fuel subsidies are a good option, particularly with the cost of renewables dropping worldwide. The biggest challenge, he said, is in the food and agricultural sector. Human diets are culturally specific and depend on personal preference. To change or modify diets on a mass scale is a difficult project, although, of course, diet has changed as a result of changing food availability. Local initiatives are most successful, and policy changes are much easier at the local rather than the national level.

Norris responded that the UN High-Level Panel members and the UN Secretary General worked hard to identify goals and targets that were ambitious, but achievable. Certain options were included because the panel believed the international community and member states could manage them, while others were deliberately excluded because they were unlikely to be achieved within the 15-year period. For instance, the extreme poverty measure was set at $1.25 per day because that amount was viewed as mostly achievable in 15 years, whereas $2.00 per day was not. There was agreement about ending preventable childhood mortality because it was potentially achievable within 15 years, whereas ending preventable maternal mortality was not considered possible within 15 years. The panel's general approach was to take the original goals and extend them. Although the members could not, of course, put an end to all of the world's ills, Norris felt they had done better than expected.

Rasanathan responded that these high-profile goals led to improved results, and that simply identifying the goals inspired new investment,

resources, monitoring systems, and mechanisms to deliver services. He regretted that some of the new targets lacked numerical indicators, adding that one of the real strengths of the MDGs was the ability to assess their progress. He also noted that including too many potentially unachievable goals not only increases technical difficulties, but also could affect the political landscape by creating an impression of failure.

Human Security as Part of the Framework

The second question involved the dimension of human security, newly added as a fourth dimension to the framework for sustainable development. (The 1992 framework only included social, environmental, and economic dimensions.) A participant noted that no mention had been made of this dimension by the speakers and asked for their opinions on the topic.

Haines responded by noting that security is addressed within many of the universal goals in the UN High-Level Panel's report. He noted that food security is mentioned in Goal 5, reducing deaths from natural disasters is mentioned in Goal 1, and reducing violence is mentioned in Goal 11.

Norris responded by stressing the importance of peace, stability, and the pressures that push families and individuals into vulnerability, adding that these are difficult matters that are a source of contention in the intergovernmental negotiations. He urged the creation of an accurate database to track yearly violent deaths per country as a starting point. He also emphasized the importance of legal and property rights, and access to social services, and disparaged the tendency in the UN to always discuss security issues in terms of Chapter 7[8] authority instead of more personal perspectives.

Rasanathan responded that security is the issue in which there has been the least progress in the MDGs, and that the impact of violence on communities is difficult to measure, with specific targets not yet identified.

Discussing Goals with Local Governments: Are Toolkits Available?

The final question asked what resources or toolkits were available for engaging local municipalities in the discussion about the goals and policies presented by the speakers.

[8] Chapter 7 of the United Nations Charter: "Action with Respect to Threats to the Peace, Breaches of the Peace, and Acts of Aggression."

Norris responded by noting that the role of municipalities in the post-2015 agenda was very prominent in the discussion, although substantial data collection would be needed to achieve these goals.

Balbus responded by referencing ICLEI (originally International Council for Local Environmental Initiatives but changed to ICLEI—Local Governments for Sustainability), an organization dedicated to assisting local governments with sustainability. He suggested that ICLEI's website (www.icleiusa.org) could furnish the resources and toolkits required.

REFERENCES

Edwards, P., and I. Roberts. 2009. Population adiposity and climate change. *International Journal of Epidemiology*. doi:10.1093/ije/dyp172.

Lim, S. S., T. Vos, A. D. Flaxman, G. Danaei, K. Shibuya, H. Adair-Rohani, M. A. AlMazroa, M. Amann, H. R. Anderson, K. G. Andrews, M. Aryee, C. Atkinson, L. J. Bacchus, A. N. Bahalim, K. Balakrishnan, J. Balmes, S. Barker-Collo, A. Baxter, M. L. Bell, J. D. Blore, F. Blyth, C. Bonner, G. Borges, R. Bourne, M. Boussinesq, M. Brauer, P. Brooks, N. G. Bruce, B. Brunekreef, C. Bryan-Hancock, C. Bucello, R. Buchbinder, F. Bull, R. T. Burnett, T. E. Byers, B. Calabria, J. Carapetis, E. Carnahan, Z. Chafe, F. Charlson, H. Chen, J. S. Chen, A. T.-A. Cheng, J. C. Child, A. Cohen, K. E. Colson, B. C. Cowie, S. Darby, S. Darling, A. Davis, L. Degenhardt, F. Dentener, D. C. Des Jarlais, K. Devries, M. Dherani, E. L. Ding, E. R. Dorsey, T. Driscoll, K. Edmond, S. E. Ali, R. E. Engell, P. J. Erwin, S. Fahimi, G. Falder, F. Farzadfar, A. Ferrari, M. M. Finucane, S. Flaxman, F. G. R. Fowkes, G. Freedman, M. K. Freeman, E. Gakidou, S. Ghosh, E. Giovannucci, G. Gmel, K. Graham, R. Grainger, B. Grant, D. Gunnell, H. R. Gutierrez, W. Hall, H. W. Hoek, A. Hogan, H. D. Hosgood, D. Hoy, H. Hu, B. J. Hubbell, S. J. Hutchings, S. E. Ibeanusi, G. L. Jacklyn, R. Jasrasaria, J. B. Jonas, H. Kan, J. A. Kanis, N. Kassebaum, N. Kawakami, Y.-H. Khang, S. Khatibzadeh, J.-P. Khoo, C. Kok, F. Laden, R. Lalloo, Q. Lan, T. Lathlean, J. L. Leasher, J. Leigh, Y. Li, J. K. Lin, S. E. Lipshultz, S. London, R. Lozano, Y. Lu, J. Mak, R. Malekzadeh, L. Mallinger, W. Marcenes, L. March, R. Marks, R. Martin, P. McGale, J. McGrath, S. Mehta, Z. A. Memish, G. A. Mensah, T. R. Merriman, R. Micha, C. Michaud, V. Mishra, K. M. Hanafiah, A. A. Mokdad, L. Morawska, D. Mozaffarian, T. Murphy, M. Naghavi, B. Neal, P. K. Nelson, J. M. Nolla, R. Norman, C. Olives, S. B. Omer, J. Orchard, R. Osborne, B. Ostro, A. Page, K. D. Pandey, C. D. H. Parry, E. Passmore, J. Patra, N. Pearce, P. M. Pelizzari, M. Petzold, M. R. Phillips, D. Pope, C. A. Pope, J. Powles, M. Rao, H. Razavi, E. A. Rehfuess, J. T. Rehm, B. Ritz, F. P. Rivara, T.

Roberts, C. Robinson, J. A. Rodriguez-Portales, I. Romieu, R. Room, L. C. Rosenfeld, A. Roy, L. Rushton, J. A. Salomon, U. Sampson, L. Sanchez-Riera, E. Sanman, A. Sapkota, S. Seedat, P. Shi, K. Shield, R. Shivakoti, G. M. Singh, D. A. Sleet, E. Smith, K. R. Smith, N. J. C. Stapelberg, K. Steenland, H. Stöckl, L. J. Stovner, K. Straif, L. Straney, G. D. Thurston, J. H. Tran, R. Van Dingenen, A. van Donkelaar, J. L. Veerman, L. Vijayakumar, R. Weintraub, M. M. Weissman, R. A. White, H. Whiteford, S. T. Wiersma, J. D. Wilkinson, H. C. Williams, W. Williams, N. Wilson, A. D. Woolf, P. Yip, J. M. Zielinski, A. D. Lopez, C. J. L. Murray, and M. Ezzati. 2012. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the global burden of disease study 2010. *The Lancet* 380(9859):2224-2260.

Rockstrom, J., W. Steffen, K. Noone, A. Persson, F. S. Chapin, E. F. Lambin, T. M. Lenton, M. Scheffer, C. Folke, H. J. Schellnhuber, B. Nykvist, C. A. de Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sorlin, P. K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R. W. Corell, V. J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J. A. Foley. 2009. A safe operating space for humanity. *Nature* 461(7263):472-475.

UN (United Nations). 2013. *A new global partnership: Eradicate poverty and transform economies through sustainable development. The report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda*. New York: United Nations.

UN Foundation and Dalberg Analysis. 2013. *Processes feeding into the post-2015 development agenda.* Available at http://www.unfoundation.org/assets/pdf/post-2015-process-slide-1.pdf (accessed October 7, 2013).

World Bank. 2012. *Turn down the heat: Why a 4° warmer world must be avoided. A report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics*. Washington, DC: World Bank.

3

Health in the Context of Sustainable Economic Frameworks

This chapter presents the summary of a webinar that featured experts presenting current efforts to measure well-being and inclusive wealth in an effort to improve connections between economic and social development and environmental sustainability. The first presentation, from Kevin Mumford, Purdue University, provided an overview of how a country's wealth is conventionally measured by its gross domestic product (GDP) and some of the challenges and opportunities in trying to measure wealth beyond that value. The second presentation, from Anantha Duraiappah, United Nations (UN) University, featured a discussion about efforts to measure inclusive wealth and the possibility of including human capital and health in that measure. The third presentation, from Richard Easterlin, University of Southern California, focused on measures of subjective well-being and happiness and how those measures could be valuable for policy makers. The final speaker, R. David Simpson, U.S. Environmental Protection Agency, reflected on these ideas and provided a response. A brief speaker and audience discussion followed the presentations.

OPENING

John Balbus, senior advisor for public health at the National Institute of Environmental Health Sciences and co-chair of the Global Environmental Health and Sustainable Development Innovation Collaborative, opened the webinar by introducing the topic and its relevance to environmental health. GDP is the most commonly used indicator of the economic health of a country and is often used to gauge standard of living. Of late, there has been interest in using indicators beyond GDP that account for externalities

that can affect the sustainability of economic growth, such as indicators that capture environmental impacts or changes in human well-being.[1]

Economic gain and public health are closely intertwined, said Balbus. Health is both a beneficiary and a prerequisite for sustainable economic development, and as such, a discussion of health in the context of sustainable economic frameworks will likely need to address the indicators and metrics that can encapsulate these externalities and their economic impact. This discussion may help inform the post-2015 development agenda process as the global community looks for a transformative framework to better link economic, social, and environmental dimensions of sustainable development.

GOING BEYOND GDP: OPPORTUNITIES AND CHALLENGES

Kevin J. Mumford, Ph.D.
Assistant Professor of Economics
Purdue University

Kevin J. Mumford outlined his presentation as an introduction to national wealth accounting and using GDP to measure economic development, as well as addressing challenges that arise.

National Wealth Accounting

Mumford mentioned various ideas that have been proposed for adjusting GDP, including green or sustainable GDP measures. Other efforts to go beyond GDP include social indicators (e.g., life expectancy, unemployment, education, or a composite score like the Human Development Index) and environmental indicators (e.g., measures of water and air pollution, climate change, or forest cover). In addition, researchers have looked into direct measures of happiness, such as surveys that ask people to evaluate their well-being.

[1] GDP measures the production of final goods and services. Among these may be both consumption and investment goods (as well as government goods and services and exports). The distinction between GDP and other measures of economic activity is that that GDP measures gross production without netting out capital depreciation or degradation.

Benefits

One promising approach is national wealth accounting, said Mumford. It is a theoretically rigorous approach rather than an ad hoc adjustment to GDP or combining a set of social indicators with arbitrarily chosen weights; thus, national wealth accounting complements income accounting. Published literature suggests that this measure is a better approach to gauging wealth than income accounting. For example, Dasgupta (2001) demonstrated that potential intergenerational wealth is closely related to the measure of a country's comprehensive wealth—the former does not decline if and only if the latter also does not decline. National wealth accounting does not require assumptions about optimality, nor does it require forecasts about a country's future choices, reported Mumford. The direct measure of the productive base is called "comprehensive wealth" (Arrow et al., 2012) or "inclusive wealth" (UNU-IHDP and UNEP, 2012), which Anantha Duraiappah discusses in greater detail. To measure a country's wealth, one would take forms of capital, multiply them by their value or "shadow price," and sum them. Comprehensive or inclusive wealth assesses more than just financial assets. This measure would include equipment, machinery, forest, fisheries, and even human capital, said Mumford. In this case, sustainability means that a country's wealth is not declining, in that the increases in wealth show the country has as many opportunities in the future as it would at present time.

Challenges

Mumford described some of the challenges in wealth accounting. There are three components to wealth that have specific challenges to optimal measurement: reproducible capital, natural capital, and human capital. Reproducible capital—physical assets—is the kind of wealth that is currently measured best. The current national accounts are measuring only investments. To measure reproducible capital, assumptions are made based on 40 years of investment data and a depreciation rate; the stock of reproducible capital can be extrapolated from that. Although directly measuring this would be better, current measures of reproducible capital are done well, said Mumford. Natural capital, which consists of stocks of forests, fisheries, minerals, energy reserves, and similar resources, is also measured fairly well. Mumford noted that there are disagreements about the shadow prices of these resources because they are not actively traded. For example, forests provide services for the population, so the value of the forest is more than simply the value of the wood. Human capital is

more difficult to measure than reproducible or natural capital, stated Mumford. Education and wage data are available, but ultimately the productive base is what needs to be measured—the value of the skills that have been taught, learned, or acquired through experience. Health is even trickier to measure, according to Mumford, because it is part of the productive base but also directly improves well-being through feeling better and enjoying a longer life. Using income on consumption goods and simply feeling better both produce happiness, and well-being is part of a country's wealth, said Mumford. Appraising health presents a great challenge for including human capital in measures of wealth moving forward.

GDP Challenges: Example of Trinidad and Tobago

Countries collect large amounts of data to produce GDP statistics, and GDP is narrowly focused on income accounting. The kind of data that might be desired beyond income are not always produced, for reasons such as a low demand and difficulty in collection. Income accounting may not be sufficient for answering many important economic questions. Mumford pointed out that growth in GDP does not necessarily indicate growth in well-being or denote that an economy is on a sustainable path. As an example, Mumford discussed Trinidad and Tobago, a small country comprised of two islands off the cost of South America in the Caribbean. In total, there are approximately 1.2 million people living in Trinidad and Tobago, and until just recently the country has enjoyed very high rates of GDP growth (8 percent annually) in the past 25 years. In addition, there is a large amount of international business and a stable financial system in Trinidad and Tobago. In 2011, the Organisation for Economic Co-operation and Development (OECD) moved Trinidad and Tobago from developing to developed country status, and the country's average per capita GDP has climbed higher and more rapidly than the world's average, indicating that this country is quickly developing. This number can be misleading, however, Mumford stated, because the GDP growth has been primarily due to extraction of natural resources, which means, essentially, that Trinidad and Tobago is exporting its wealth out of the country. Trinidad and Tobago has 0.2 percent of the world's natural gas reserves, and produces 1.3 percent of the world's current natural gas supply, a significant amount for a small island nation. Natural gas is extracted at a rapid rate, along with oil and other minerals.

Mumford added that the average worker in Trinidad and Tobago spends an average of 4 hours per day commuting, which indicates heavy

traffic. On average, people in Trinidad and Tobago receive 11.9 years of schooling, a lower figure than people in Latin America and the Caribbean (where the average is 13.7 years of schooling), despite Trinidad and Tobago's higher average GDP per capita. This suggests that Trinidad and Tobago may have problems that are masked by its rapid GDP growth.

Income Invested Compared to Income Consumed

Mumford continued by considering whether income growth, such as the growth from export of natural resources in Trinidad and Tobago, is sustainable. From an economist's point of view, extracting resources is not necessarily a negative activity for the country, but it could depend on whether the income from these extracted resources is being consumed or invested. Investments in infrastructure, equipment, machinery, and education will yield future income, and from an economic point of view could engender sustainable income by building a productive base. Other kinds of investments include allowing a forest to grow or letting a fishery restock. On the other hand, if income is used immediately for pure consumption and does not yield future income, it will not create a sustainable path, said Mumford.

To illustrate the point that GDP does not provide a full picture of a country's wealth, Mumford provided the example of a firm looking to invest in a company. If only the income statements (annual revenues and expenses) are available for the evaluation, the balance sheets that display the depreciation or degradation of the various forms of assets would be missing, and the firm would not be able to distinguish between a company that is selling off its assets from one that is healthy and actually selling the goods it produces. At the country level, efforts have been focused on GDP or GDP adjustments because such measurements are established and easy, but GDP tells a limited story.

INCLUSIVE WEALTH: INCORPORATION OF HEALTH INFORMATION

Anantha Duraiappah, Ph.D.
Executive Director, International Human Dimensions Programme,
United Nations University

The focus of Anantha Duraiappah's presentation spans three phases of work on inclusive wealth: (1) the 2012 *Inclusive Wealth Report* (IWR)

released by the International Human Dimensions Programme (IHDP), (2) preliminary results from current efforts to measure inclusive wealth, and (3) challenges associated with developing the 2014 IWR report focusing on human capital and health.

Overview of Inclusive Wealth

Duraiappah noted that the three main points that define inclusive wealth as a measure beyond GDP are that it is a new way to measure progress, a comprehensive approach to health and well-being, and a focus on the sustainability of human well-being. Many suggestions have been made to develop a list of Sustainable Development Goals (SDGs) when the Millennium Development Goals (MDGs) reach their target date in 2015, but it is unclear into what framework these goals would fit. Duraiappah stated that wealth provides the conceptual framework for measuring well-being, and, regarding the focus on sustainability, inclusive wealth measures seek to look into the future as well as at a particular point in time.

Duraiappah presented inclusive wealth as a framework with three propositions that underlie the entire premise. The first proposition is that well-being is defined as the discounted flow of present and future generations' consumption flows. In this proposition, consumption flow is not limited to just material consumption, but also to issues like the utility of having an aesthetically pleasing landscape. The focus of inclusive wealth is able to move from the constraints of well-being, which is difficult to monitor and context-specific, to the determinants of well-being, which comprise the productive base. The second proposition states that the discounted flow of consumption is dependent on the capital assets, the productive base, of the economy. The productive base is comprised of the three capital bases described above by Mumford (reproducible, natural, and human capital). The two with the most impact on wealth are natural and human capital. The third proposition, which is a definition, is that well-being increases as long as the change in the social value of a capital asset base is positive. "Social values" refer loosely to the shadow or social prices of externalities, which tie the inclusive wealth framework to theoretical economics to strengthen it, but also mean that research is required to appraise the values not reflected in market prices. From these propositions, it is clear that inclusive wealth focuses on change rather than absolute amounts, said Duraiappah.

Results from the 2012 *Inclusive Wealth Report*

Duraiappah moved on to present results from the 2012 IWR, which showed changes in inclusive wealth from 1990 to 2008. The 20 countries analyzed in the report comprise approximately 75 percent of the global GDP and 60 percent of the global population. As such, they are major producers and drivers of worldwide change. In the report, most of these countries are defined initially as sustainable, i.e., the change in their productive bases has been positive. Nineteen years later, this value becomes negative, and approximately 25 percent of the countries become unsustainable on a per capita basis. This indicates that the productive base is not growing at the rate needed to maintain the increasing population, said Duraiappah.

In most countries, human capital has increased over time, in some countries more than others (such as Brazil and Germany) (see Figure 3-1). Human capital stems primarily from education in this diagram and does not include health. In Figure 3-1, natural capital is added to show that almost every country experienced a decline during this time period in natural capital, which includes renewable and nonrenewable sources. Finally, in Figure 3-1, the added lines indicate the change in inclusive wealth in these countries. In this graph, China has one of the largest changes in inclusive wealth, which is due to its buildup of produced and human capital and a drawdown on natural capital, said Duraiappah.

Duraiappah noted that although health was not included in the human capital computations, it was discussed in preparation for the 2012 IWR. In 2008, the inclusive wealth index (IWI), or productive base, of Germany's economy totaled more than $19 trillion. In contrast, the value for health capital is significantly greater, more than $411 trillion. This trend was the same for Ecuador. Durappaiah stated that health was kept out of the analysis because that value would be exceedingly dominant, and it was unclear if the methodology to calculate the amount was correct. Recent journal articles have discussed this issue, and the initial response indicates that the number may be correct because health is of a high value to people.

Despite the high value for health, trends show that change over time has been slight for health, whereas changes in other forms of capital have been significant. For example, Germany saw an almost 40 percent increase in human capital between 1990 and 2008; for health, this increase was less than 10 percent. Duraiappah emphasized that human capital is primarily education, and health is measured by longevity, specifically, the

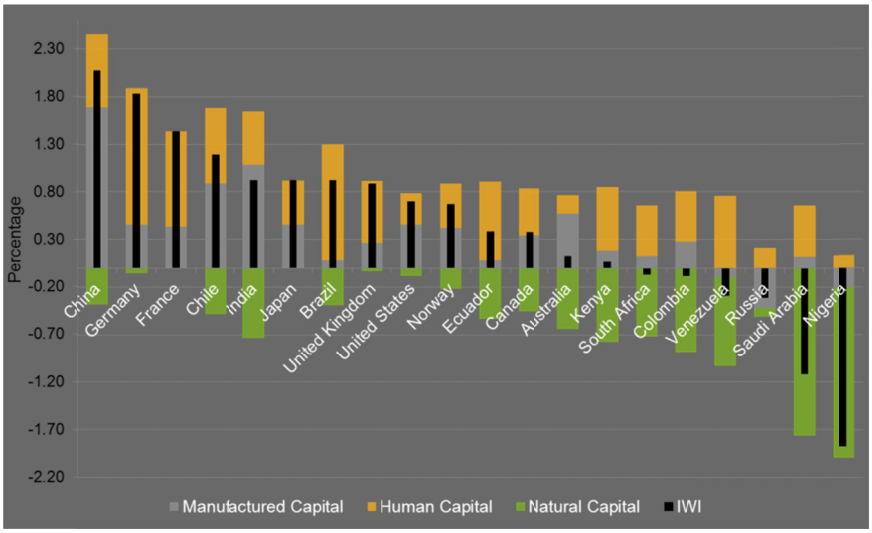

FIGURE 3-1 Annual average growth in manufactured, human, and natural capital and the inclusive wealth index (IWI).
SOURCE: Adapted from UNU-IHDP and UNEP, 2012. Reprinted with permission from Cambridge University Press.

function of an individual's longevity in terms of the marginal value in living an extra year. Whether this is the right shadow value to measure health capital is undetermined.

Current Efforts to Measure Inclusive Wealth and the 2014 IWR

Duraiappah revisited the three main components of health: the utility of simply being healthy, the productivity that comes from being healthy, and the value of living an extra year. The large values for health capital are computed without taking into consideration the first two components, indicating that health is still undervalued. For the 2014 IWR, the focus will be on two components of human capital: education and health.

Duraiappah summarized some of the challenges encountered in measuring health. First, health's value outweighs all other forms of capital by a factor of 20 or more, as demonstrated by the German economy. The next challenge is determining whether the value of a statistical life is the right approach for a shadow or social price. In addition, as mentioned before, only one component of health is captured, and current estimates leave out the utility and productive nature of being healthy. Finally, there

are interdependencies among other forms of capital and health. As an example, Duraiappah used pollution, which significantly impacts health. Theoretically, this should be captured through the shadow price, but in reality it is a difficult undertaking, requiring a computation of the impact of pollution on health and subtracting it directly from the estimate of the productive base. These are challenges that will also be present in developing the 2014 IWR.

HAPPINESS AND PUBLIC POLICY

Richard Easterlin, Ph.D.
Professor of Economics,
University of Southern California

One area of interest for going beyond GDP and other economic measures is subjective well-being, said Richard Easterlin. Subjective well-being is measured through a nationally representative survey that asks participants how they would rate their happiness, satisfaction with life, and standing on a best-to-worst scale. One example of a subjective well-being measure is happiness. In the U.S. General Social Survey, participants are asked, "Taken all together, how would you say things are these days? Would you say that you are very happy, pretty happy, or not too happy?" Similarly, life satisfaction is measured by the World Values Survey using the question "All things considered, how satisfied are you with your life as a whole these days?"

Easterlin stated that there is always a question as to whether the measures of subjective well-being are meaningful. In a report commissioned by President Nicolas Sarkozy of France in 2009, 25 leading economists agreed that "research has shown that it is possible to collect meaningful and reliable data on *subjective* as well as *objective* well-being. . . . The types of questions that have proved their value within small-scale and unofficial surveys should be included in larger-scale surveys undertaken by official statistical offices" (Stiglitz et al., 2009). Official actions have been taken by the OECD and the United Nations to promote the collection and publication of subjective well-being measures. From Easterlin's viewpoint, the meaningfulness of data is indicated by what people say when asked about what makes them happy; the responses of most people around the world are similar.

In a 1965 survey of 12 countries, participants were asked an open-ended question to determine their concerns about factors affecting their happiness. Overall, the three most prominent factors were living level,[2] family, and health (77, 50, and 34 percent of respondents, respectively, indicated concerns) (Cantril, 1965). A high percentage of respondents did not consider broader social matters such as social equity, international relations, and domestic policy to be very important to their personal happiness. The factors that take up the most time in a person's life dominate people's responses about subjective well-being and personal happiness, said Easterlin.

Measures of subjective well-being have a few advantages over indicators like GDP or the Human Development Index, according to Easterlin. Subjective well-being measures can focus directly on a person's feelings about his or her life, rather than relying on indicators that are externally constructed by social scientists or statisticians. They can also be comprehensive and cover a wide range of concerns that impact self-reported well-being, including health and work satisfaction, which are traditionally omitted from measures like GDP. In addition, it can be easier for the population to identify with measures of happiness. Easterlin pointed out that subjective well-being may not be the best measure of well-being, because it does not generally reflect potentially important factors like political or civil rights. However, he argued, it is better than the alternatives that are currently in use.

Policy Implications of Using Subjective Well-Being Measures

Easterlin moved on to discuss the policy implications of using subjective well-being measures. Evidence shows that economic growth does not in itself increase subjective well-being. Longitudinally, rapid economic growth does not impact subjective well-being; however, there is an observed positive, short-term relationship between GDP growth and subjective well-being. Countries with high rates of economic growth do not seem to have more rapid sustainable well-being growth to accompany that trend, said Easterlin. As GDP growth rates increase, financial satisfaction changes insignificantly, with little to no correlation. Similarly, there is no observed relationship in China, for example, between economic growth and improvement in life satisfaction in recent years (Easterlin et

[2] Living level was defined as the quantity of goods consumed by the average person (Cantril, 1965).

al., 2012). Thus, the potential policy conclusion that economic growth leads to greater sustainable well-being is not true, according to the evidence presented.

There are policies that can increase a person's subjective well-being, however. Easterlin stated that there is evidence indicating that full employment and safety-net policies may increase subjective well-being. A comparison of European countries with similar per capita GDPs revealed that subjective well-being is greater in countries with more supportive and extensive social policies. Moreover, subjective well-being is negatively impacted in countries that have transitioned from socialism to capitalism, abandoning employment and safety net policies. For the purpose of this comparison, Easterlin compared "welfare states" (Denmark, Finland, and Sweden) with "semi-welfare states" (Austria, France, Germany, and the United Kingdom) in terms of the generosity of public policies (unemployment, sickness, pension, and overall benefits). Easterlin observed that welfare states with more generous benefits also experienced higher reported values of satisfaction in work, health, family life, and overall well-being than the semi-welfare states, despite similar GDP per capita. In countries transitioning from socialism to capitalism, such as China, Easterlin's analysis demonstrated that unemployment rates and self-reported life satisfaction are inversely related.

Easterlin's final example comes from Costa Rica, which has the highest life satisfaction of any country, according to a Gallup World Poll Survey (Helliwell et al., 2012). Costa Rica has an extensive history of social development through generous policies, including an emphasis on literacy and health care, and Easterlin points to this as the cause of high personal satisfaction. While satisfaction is high, Costa Rica has just one-fourth of the United States' GDP per capita, substantiating Easterlin's argument that economic growth in itself does not increase subjective well-being.

SYNTHESIS AND RESPONSE

R. David Simpson, Ph.D.
Director, Ecosystem Economic Studies,
National Center for Environmental Economics,
U.S. Environmental Protection Agency

R. David Simpson began his presentation by taking a brief, lighthearted turn toward two economics jokes to demonstrate the difficulty of performing accurate national accounting (see Box 2-1).

Simpson related these jokes to the actual practice of national accounting—much of what is calculated makes assumptions, like the can opener, and interpreting these numbers requires caution.

Economists begin with the supposition that people's objective is to achieve things we want, a notion that has roots in the beginnings of economics. Success is measured by the amounts of things that we presume we want to eventually have. Economists discuss this in terms of a person's utility obtained from what they consume, said Simpson. Consumption can be defined broadly, and does not necessarily mean that things are destroyed during consumption, but includes things that we can enjoy repeatedly, such as forests.

Accounting is typically concerned with changes in totals from year to year, or from one time period to another. Measuring well-being would require measuring the utility derived from the things that are consumed and enjoyed. The change in utility from year to year would be additional happiness. Simpson revisited the economic principle that states that the ratio of marginal utilities is equal to the ratio of prices, and from that relationship, one could say that the change in well-being from year to year is a change in the amounts of things we consume from year to year, weighted by the price that we pay for it. The observed market price would typically be the value to consumers.

However, this is measurement on a gross basis, not a net basis, stated Simpson. Only consumption is considered, not capital investment. Capital investment is the consumption that people forego in order to afford more consumption later. The worth of this capital investment would need to be determined. In economic theory, investment is typically assumed to be worth the value of things that could have been purchased instead of putting aside money to invest or save. The procedures followed in national accounting do follow this logic in how things are added up, said Simpson.

BOX 2-1
Two Economics Jokes

Economics Joke #1

Albert Einstein was traveling across the Atlantic in the 1930s. Einstein was, of course, a Nobel Prize recipient and world famous, but there was such a demand for transport that even he had to share a cabin with three other people as he came over on the ocean liner from Germany. Anticipating a long trip, he went to the first cabin mate and said, "Tell me, sir, what is your IQ?" The first cabin mate said, "My IQ is 170." Einstein said, "That's wonderful. We can talk about the prospects for a unified field theory explaining all natural phenomena." Einstein went to the second cabin mate and said, "Sir, what is your IQ?" The second cabin mate said "140." Einstein said, "That's great. We can talk about the prospects for world peace in nuclear technology." Einstein went to the third cabin mate and said, "And tell me, sir, what is your IQ?" The third cabin mate said, "70." Einstein scratches his head for a second, thinks about it, and says, "What's your projection for GDP?"

Economics Joke #2

Three people go on a camping trip. They have a can of beans, but they have brought nothing along with which to open it. The first person is a physicist, and she suggests that they get a large rock and open the can by smashing it with the rock. The economist in the group says, "That's the dumbest thing I've ever heard. You're going to ruin the food if you do that." The second person is an engineer. He says, "Let's build a fire and put the can of food on the fire. The pressure will build up inside, and the can will explode." The economist says, "That is just as dumb as the first suggestion. If the can explodes, the food gets out, but it's all over the place and we're never going to be able to eat it." The other two are exasperated, and they say to the economist, "Okay, you're so smart. What's your suggestion?" To which the economist replies, "Assume a can opener."

There are measurement challenges when considering changes in the quality of things we consume. Market goods like cars and computers undergo product evolution. For example, cars today are safer and more economical than cars produced in the 1950s. It is an even greater challenge to make qualitative adjustments when considering nonmarket goods like the environment, crime, and health. These are the types of things that would provide a more complete picture of how a country is doing, said Simpson, but are not currently measured. This challenge revolves primarily around the fact that most of these things are public goods. For example, improved environmental quality benefits everyone. Because the provision of public goods is not compensated, such prices are not reflected in the market value of goods. Typically, when economists

discuss the value of public goods or valuing year-to-year changes in quality, they refer to the willingness to pay an imputed, or shadow, price, said Simpson.

Flows, stocks, and anomalies also factor in to national accounting. Consumption is a flow, so environmental effects can often be captured in flows—for example, the effects of the Deepwater Horizon were reflected in flows of services like fishing and tourism. What isn't captured, stated Simpson, are the changes in natural capital, e.g., from stocks of fish that aren't caught in the future. According to Simpson, accounting is not always complete and can seem counterintuitive. For example, the way that accounts are currently calculated, GDP increases if more health services are consumed due to pollution. Instead, Simpson suggested that the accounts should be offset by willingness to pay to avoid being sick. Environmental accounts may omit resource depletion, household production, illegal or "off the book" activities, production in the public sector, education, and health.

Another problem brought up by Simpson is equity concerns. Millions of dollars can be spent either to buy a yacht or to buy vaccines for impoverished children in a developing country. Although the money is arguably better spent on the vaccines, accounting may not capture that long-term good.

It may be impossible to include the price of everything in national accounts, said Simpson, and there is debate about how much effort should be devoted to capturing as much as possible. Simpson advised that while economists attempt to determine prices for things not traded in markets, their values should be taken with a grain of salt, and observers should recognize that techniques for these determinations will improve over time.

DISCUSSION

A brief discussion among the speakers and participants followed the presentations. Their remarks are summarized in this section.

Assessing Tradeoffs Associated with Subjective Well-Being

The first question, addressed to Easterlin, was how tradeoffs between the different components that make up subjective well-being get captured for developing policy or allocating resources. Easterlin responded by

using China as an example. Income in China increased fourfold in the past 20 years, but there was no impact on life satisfaction, demonstrating that income increases alone do not help subjective well-being. Jobs, however, allow people to support a family and take care of their health. Easterlin reiterated that welfare states with extensive social programs exhibit higher overall well-being. He said he could only speculate so far as to say that policies that deal with concerns like health and family do more for well-being than policies that just promote economic growth.

Incorporating the True Cost of Goods and Resources

A second question from the audience asked how the true cost of goods (e.g., the cost of production, extraction, or waste handling) could be incorporated into indicators like GDP or subjective well-being. Simpson responded that there are a variety of ways that economists try to put values on nonmarket goods. For instance, longevity has increased over the past century. To measure the value of that increase in longevity, economists use a technique called the "value of a statistical life," which is typically inferred from the risks people are willing to take (e.g., living in dangerous places). Simpson pointed out that there could be controversy in assigning a dollar value like $6 million to a statistical life, which is the value of the probability that someone will die early, and the estimate would not be precise, which is why it's so difficult.

Mumford addressed a follow-up question about how the cost of depletion of long-term resources is reflected in an indicator like GDP or another index of economic growth derived from negative impacts. He reminded the audience that GDP is simply the measure of income and that it may not be right to adjust GDP in a way that counts some incomes less than others if it produces an added cost to society. Mumford said that a more realistic way to look at the issue is to recognize the flow of income and the simultaneous depletion of capital stock. For example, the cost of harming wetlands is not a cost that comes from income flow, rather, it is harming capital stock that could have provided future valuable services. Mumford said that although modified measures of GDP could be useful, it is unclear if it is worthwhile to devote much effort to them. He suggested instead incorporating costs into a broader wealth measure.

Prospects for Wealth and Well-Being Measures in International Settings

Moderator John Balbus asked a follow-up question: If GDP is limited and wealth measures are better suited to incorporate these externalities, what are the prospects for more reliance on a wealth measure in international settings, in conjunction with or in distinction to GDP? Balbus continued by asking if these wealth measures are already being included, and if there is any known opposition to them.

Simpson replied that there is a lot of interest in including different wealth and well-being factors and that progress has been made on several fronts. He noted that in the case of Mumford's wetland example, in order to regard that as a depletion of capital, the wetland's services would need to be quantified. The wetland could serve as a waterfowl nesting habitat, a water purification source, or a tool in flood protection. That would create three difficult nonmarket valuation exercises, and, following that, the appropriate discount rate to convert these values or yearly values into the net present value of the lost asset would need to be determined. Simpson stated that incorporating those factors into national accounts would be the right thing to do, although it would be very difficult and require many assumptions.

Duraiappah added that one possible way forward is to determine not a point estimate of values, but rather an upper and lower bound based on the best information we have. The band would be the difference in stock changes over time. Duraiappah stated that this would possibly be helpful for policy makers.

Mumford added that the focus on GDP is due in part to the more solid methodology for measuring GDP, and the fact that measurement for income is more exact and precise than for wealth. He also pointed out that measuring wealth alone would likely not be sufficient and that GDP would still be useful for answering certain questions related to income. He expressed hope that both types of measures would be used and mentioned that only recently has there been a strong demand for using wealth accounting frameworks to evaluate sustainability. Past efforts include the United Nations' IWR and the World Bank's efforts to measure net savings.

Unconditional Citizen Income and Impact on Well-Being

Balbus shared a comment from the webinar audience. The audience member stated that from the webinar presentations, we can understand how the cost of education and health can generate well-being and happiness, in the same way that they can be included in the budget and addressed in public policy within a health-in-all-polices framework. Balbus asked for the speakers' opinions about an unconditional citizen income and its impact on personal and social well-being.

Simpson responded by stating that there is a longstanding and irresolvable controversy referred to as the tradeoff between equity and efficiency—it would be ideal if the least advantaged members of society were assured a minimal level of well-being, but if we do not allow for some prospects of inequality, then the incentives for creation of wealth are reduced.

Duraiappah added that unconditional citizen income could be conceptualized as unconditional access to instrumental freedoms, rather than restricted income base, which would make a distinction between one's access to opportunities versus endowments. He mentioned that work from Amartya Sen, the 1998 Nobel Prize winner in economics, is a resource for this idea. Sen's work separates freedom into five different instrumental categories (economic facilities, political freedoms, protective security, social opportunities, and transparency guarantees) (Sen, 1999).

REFERENCES

Arrow, K. J., P. Dasgupta, L. H. Goulder, K. J. Mumford, and K. Oleson. 2012. Sustainability and the measurement of wealth. *Environment and Development Economics* 3:317-353.

Cantril, H. 1965. *The pattern of human concerns*. Vol. 4. Cambridge, UK: Cambridge University Press.

Dasgupta, P. 2001. *Human well-being and the natural environment*. New York: Oxford University Press.

Easterlin, R. A., R. Morgan, M. Switek, and F. Wang. 2012. China's life satisfaction, 1990–2010. *Proceedings of the National Academy of Sciences of the United States of America* 109(25):9775-9780.

Helliwell, J., R. Layard, and J. Sachs. 2012. *World happiness report.* New York: The Earth Institute, Columbia University.

Sen, A. 1999. *Development as freedom*. New York: Knopf.

Stiglitz, J. E., A. Sen, and J. Fitoussi. 2009. *Report by the Commission on the Measurement of Economic Performance and Social Progress.* Available at http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf (accessed September 9, 2013).

UNU-IHDP and UNEP (United Nations University-International Human Dimensions Programme and United Nations Environment Programme). 2012. *Inclusive wealth report 2012: Measuring progress toward sustainability.* Cambridge, UK: Cambridge University Press.

4

Health in the Context of Global Climate Change Scenarios

The following chapter is a summary of a webinar on developing scenarios for global climate change. The webinar featured three speakers with extensive experience in developing scenarios: Kristie L. Ebi, ClimAdapt, LLC; Marc Levy, Columbia University; and Stéphane Hallegatte, the World Bank. Scenarios are important in thinking about and preparing for multiple plausible futures, from the expected to the unexpected, in an analytically coherent and creative manner. Scenarios can facilitate research and assessment of the magnitude and extent of changes in climate and associated impacts, the degree to which mitigation and adaptation policies can reduce risks, the interactions among and tradeoffs between climate change impacts and adaptation and mitigation policies, and the relationship between climate change and development. As climate change is a cross-cutting issue for future global development goals and targets, it will become increasingly important to use scenarios when developing regional and national strategies to help ensure sustainable development as climate and development pathways change. Health outcomes, social determinants, gross domestic product, and other factors can be both inputs and outputs of climate change scenarios, providing opportunities for collaboration to develop projections that can better inform global development frameworks.

OPENING

John Balbus, senior advisor for public health at the National Institute of Environmental Health Sciences and co-chair of the Global Environmental Health and Sustainable Development Innovation Collaborative, provided a brief overview of the webinar topic. At first glance, the topic of scenario

development for health in the context of global climate change seems focused on the health implications of climate change, but it more broadly extends to the entire health community. To understand how climate change will impact health in the future, scientists have to understand the ways in which climate change and climate variability affect health in the present, and then project how those impacts will be felt. Part of that involves understanding what the future world will look like in terms of incidence and prevalence of conditions that convey vulnerability to climate change health impacts, noting that climate change acts as a force multiplier or as an additional stressor on top of existing stressors to global populations.

Balbus noted that the scientific community is engaging in international efforts to understand the impacts of climate change broadly, and the health impacts of climate change more specifically to improve existing models. In order to do this, scientists need to be able to produce rigorous scenarios of the future to support these predictive efforts and models.

OVERVIEW OF THE SHARED SOCIOECONOMIC PATHWAYS FOR USE IN NEW CLIMATE CHANGE SCENARIOS

Kristie L. Ebi, Ph.D., M.P.H.
Independent Consultant
ClimAdapt, LLC

Kristie Ebi's presentation provided a historical overview of climate change scenarios, and the process for developing new climate change scenarios. Scenarios have a long history in climate change science, often led by the integrated assessment and climate modeling community. The integrated assessment modeling community coordinates its research and analysis through the Integrated Assessment Modeling Consortium,[1]

[1] The Integrated Assessment Modeling Consortium (IAMC) is an organization of scientific research organizations. The IAMC was created in 2007 in response to a call from the Intergovernmental Panel on Climate Change (IPCC) for a research organization to lead the integrated assessment modeling community in the development of new scenarios that could be employed by climate modelers in the development of prospective ensemble numerical experiments for both the near term and long terms. More information is available at http://www.globalchange.umd.edu/iamc (accessed September 3, 2013).

which has fielded questions from policy makers concerning the costs of particular mitigation policies.

Edmonds and Reilly developed early climate change scenarios in 1984 to provide input into the U.S. Department of Energy carbon cycle analyses. This and other developments led to the first Intergovernmental Panel on Climate Change (IPCC) scenarios released in 1990, followed by a second set in 1992. The 1992 scenarios were used to assess the costs and benefits of mitigation policies and to project impacts; they were designated "IS92" followed by A, B, C, D, E, and F to identify specific scenarios. IS92A was considered a business-as-usual scenario, said Ebi. Use of these scenarios in the IPCC's Second Assessment Report (IPCC, 1993) led to questions about the narratives underlying these scenarios. Increasing scientific understanding of the driving forces for greenhouse gas and sulfur emissions led the IPCC to conduct the *Special Report on Emissions Scenarios* (SRES) (IPCC, 2000).

Ebi explained that the scientists tasked with writing this special report first developed internally consistent storylines of possible future worlds. The four main storylines describe the relationships between driving forces of emissions of greenhouse gases and other radiatively active substances and their evolution during the 21st century. Each storyline presents different demographic, social, economic, technologic, and environmental development pathways, designed to produce a wide range of atmospheric concentrations of greenhouse gases. Quantification of the storylines resulted in estimated emissions of greenhouse gases and sulfur that were used as input into climate models to project changes in patterns of climate variables such as temperature and precipitation.

Ebi noted that the four main storylines were developed along two axes: one axis represents the extent to which a future world is focused on economic or environmental issues, and the second axis represents the extent to which a future world is focused on global or regional issues (see Figure 4-1). To keep the scenarios neutral, names were not assigned; instead they are called A1, A2, B1, and B2. An A1 scenario describes a future world more focused on global issues, with strong international institutions, and with a strong economic drive. As a result, an A1 world has high emissions of greenhouse gases. A B2 scenario describes a world more focused regionally and environmentally, with weaker international institutions, but a stronger focus on issues related to sustainable development. This world has lower emissions. These scenarios have been used extensively by the climate change community to project what may happen as temperatures increase and precipitation patterns change.

During the past decade, knowledge and understanding of climate change science increased considerably, said Ebi. Earth system models now incorporate the full basket of greenhouse gases, land use change, and aerosols (see Figure 4-2).

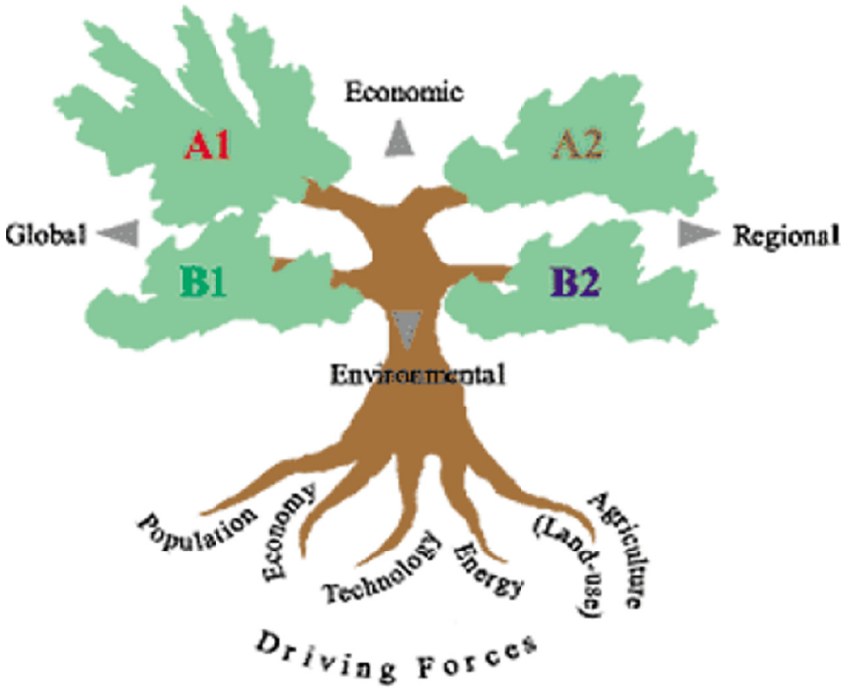

FIGURE 4-1 Four scenario families.
NOTES: Schematic illustration of the *Special Report on Emissions Scenarios* (SRES) scenarios. The four scenario "families" are illustrated, very simplistically, as branches of a two-dimensional tree. In reality, the four scenario families share a space of a much higher dimensionality given the numerous assumptions needed to define any given scenario in a particular modeling approach. The schematic diagram illustrates that the scenarios build on the main driving forces of greenhouse gas emissions. Each scenario family is based on a common specification of some of the main driving forces.
SOURCE: IPCC, 2000. Reprinted with permission from the Intergovernmental Panel on Climate Change.

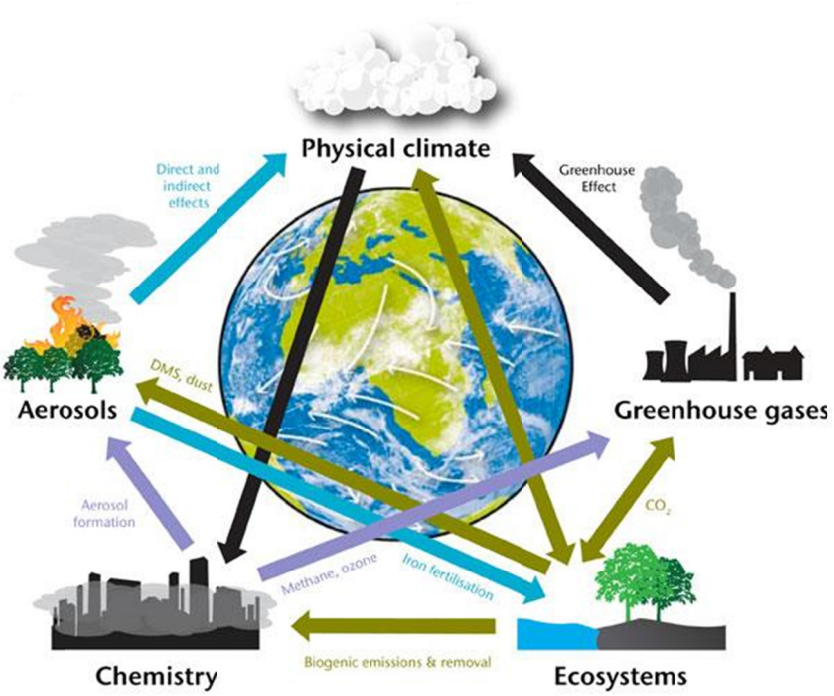

FIGURE 4-2 Unified earth system model.
NOTES: Human activities like burning coal, oil, and gas to power homes, factories, and transport have released huge quantities of carbon dioxide into the atmosphere, causing an enhanced greenhouse effect. This causes an imbalance in the energy cycle that, in turn, impacts the water cycle, atmospheric circulation, and ocean currents, leading to changes in weather and climate. The unified earth system model also represents more than just the physical atmospheric and oceanic processes, including representations of the global carbon cycle, dynamic vegetation, atmospheric chemistry, and ocean biology.
SOURCE: Met Office, 2013. Reprinted with permission © Crown Copyright 2013, data supplied by the Met Office.

Integrated assessment models now incorporate considerably more interactions within the energy–economy–environment system, including more aspects of human and natural systems. Ebi noted that this provides the opportunity to develop much more complex descriptions of how the future could evolve. Further, population projections changed since the release of the SRES, when fertility rates were higher worldwide. A growth in understanding of technology changes is another model improvement, said Ebi.

At the end of the process to develop the SRES, it was jointly decided by world governments and the scientific community that leadership would transfer from the IPCC to the scientific community because of the greater scientific credibility of scenarios developed by the scientific community and more control over a process free from institutional timelines. However, this also means that no single group is in charge of the process, explained Ebi. During the past several years, discussions between the integrated assessment community and climate modelers initiated the process of developing a new set of scenarios. Instead of following the kind of process used in developing the SRES, the integrated assessment modeling community and climate change modelers agreed to first determine a limited number of concentrations of greenhouse gases in the atmosphere in the year 2100. Three criteria were agreed for selecting these concentrations: they spanned a wider range of emissions than used in the SRES; climate modelers could distinguish these concentrations in their models; and at least one integrated assessment model had published results reaching that concentration.

Ebi stated that the four concentrations chosen are termed the Representative Concentration Pathways (RCPs) because they are representative of the full range of possible emissions over the coming century. The RCPs incorporate the full basket of greenhouse gases, including short- and long-term species such as methane and carbon dioxide, land use, and other factors. The RCPs also offer finer-scale descriptions of emission pathways that will be useful for impact modelers. The RCPs are measured in radiative forcing in 2100, in watts per meter squared. The four RCPs are RCP 2.6, 4.5, 6.0, and 8.5. RCP 2.6 is a peak and decline pathway, with a peak in emissions by mid-century, followed by a decline that leads to negative emissions by 2100. In 2100, radiative forcing is approximately 450 parts-per-million (ppm) carbon dioxide equivalent. RCP 4.5 is a stabilization pathway, with stabilization after 2100, and with radiative forcing in 2100 of approximately 650 ppm carbon dioxide equivalent. RCP 6.0 also stabilizes after 2100, with a radiative forcing in 2100 of approximately 850 ppm carbon dioxide equivalent. RCP 8.5 has the steepest increase in emissions, with radiative forcing of approximately 1370 ppm carbon dioxide equivalent in 2100 and no stabilization. Some earth system models extended these emissions to 2300, leading to an improved understanding of the speed at which a decline in emissions would affect global mean surface temperature. One of the insights gained is how slowly radiative forcing would change over hundreds of years once emissions are reduced.

An insight gained from the SRES and confirmed in the work developing the RCPs is that any particular emission concentration can be reached from a wide variety of socioeconomic development pathways, said Ebi. Population and gross domestic product (GDP) are not strong predictors of emissions. A world with a small population that burns large amounts of coal could have high emissions, while a world with a large population that uses strictly green technology could have low emissions.

With that in mind, it was decided that the new scenarios would be developed using a matrix approach. The matrix includes the RCPs and shared socioeconomic pathways (SSPs). Combining a RCP with a SSP forms a scenario. This approach allows scientists to ask new questions, such as what would happen if a world on track for 6.0 watts per meter squared in 2100 interacts with a world that is trying to achieve sustainable development versus a world that is more regionally focused. Or, what could be the impacts in a world continuing current development trends if there is a large or smaller amount of climate change. In essence, the scientific community is being provided with a toolkit to develop scenarios focused on addressing a wide range of research questions. Ebi emphasized that although this is complicated, it is worthwhile to gain a basic understanding of the process to be able to provide more useful input to policy questions. One example provided by Ebi was a question involving malaria that could be answered using the new scenarios: if the world is making progress toward sustainable development, then what might be the burden of malaria attributable to climate change under different RCPs?

SSPs are situated along two axes—one axis focuses on worlds with increasing challenges to adaptation to climate change. The second axis describes worlds with increasing challenges to climate change mitigation. Ebi noted that these axes were chosen because adaptation and mitigation are the two main policy responses to climate change. Challenges to mitigation include high demand for energy resources, a fossil-dominated supply, and slow technology change. Adaptation challenges are concerned with development, and include low economic growth, poorly engineered infrastructure, and barriers to trade.

Five SSPs are being developed, currently unnamed. As shown in Figure 4-3, SSP 1 describes a future world with low challenges for mitigation and adaptation; this represents a world working toward sustainable development. SSP 3 describes a future world with high challenges to adaptation and mitigation; this world would have weak international institutions and potential conflict, said Ebi.

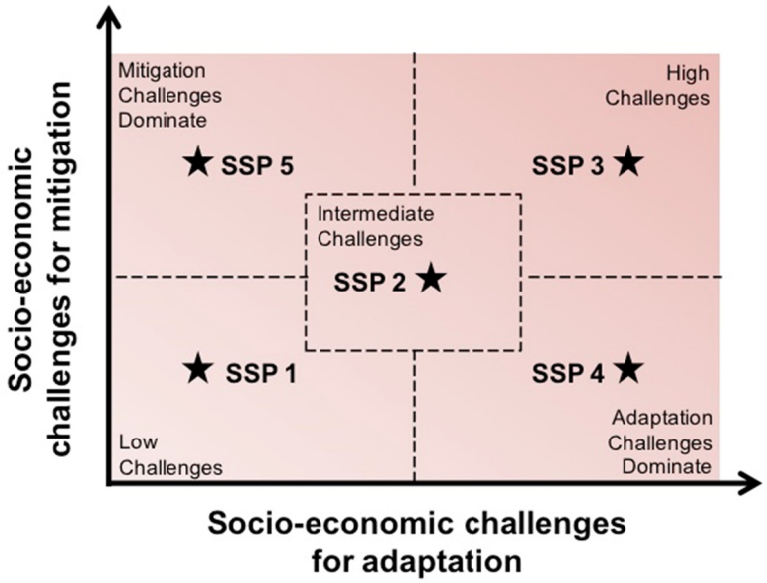

FIGURE 4-3 Shared socioeconomic pathways (SSPs).
SOURCE: O'Neill et al., 2013. Reprinted with permission from Springer Science and Business Media.

Each SSP includes a brief narrative that offers a broad vision of the future, including limited information about health, and quantification of population, urbanization, rates of technological change, income, human development index, income distribution, and more. Ebi expressed hope that this toolkit can be extended to provide information necessary to create scenarios focused on regions and sectors.

Further information on the new scenario approach and the SSPs is forthcoming in two academic journals. An issue of *Climatic Change* will feature 4 papers that lay out the framework described in this presentation, plus 10 additional papers discussing various aspects of the approach. A special issue of *Global Environmental Change* will include a paper that details the full narratives for shared socioeconomic pathways.

Ebi discussed how the SSPs and new scenarios could be used to project the impacts of climate change on health. For example, in SSP1 (a world working toward sustainable development), more children would survive to the age of 5, and major public health problems like malnutrition, diarrheal disease, and malaria would be better controlled. However, chronic diseases would be more prevalent, although better control of

various air pollutants would reduce the burden of air pollution–related mortality and morbidity.

SSP 3 (high challenges to adaptation and mitigation) would be a regionalized world with weak international institutions, said Ebi. The burden of climate-sensitive health outcomes would be expected to rise, with greater challenges to controlling malaria, diarrheal disease, and other public health problems that require global collaboration through international bodies like the World Health Organization.

The International Committee on New Integrated Climate change assessment Scenarios (ICONICS) is the group of scientists working on developing these scenarios, of which Ebi is a co-chair. Within ICONICS are six working groups developing aspects of the SSPs and new scenarios (e.g., narratives, nested scenarios across geography and time). Their website offers further information on these new climate change scenarios and will provide information on accessing relevant scientific papers when available (https://www.isp.ucar.edu/iconics [accessed October 7, 2013]).

REFLECTIONS ON SCENARIO PLANNING

Marc Levy
Deputy Director, Center for International Earth Science Information Network, The Earth Institute
Columbia University

Marc Levy's presentation focused on the quantitative challenges to implementing the scenarios outlined by Ebi. Levy articulated three difficult questions the community encounters in developing quantitative indicators for climate change scenarios:

1. What needs to be included?
2. How to get the variance right?
3. How to get the dependencies right?

These questions provide a sense of what has to happen in order to better characterize future vulnerability to climate change, said Levy.

In regard to the first question, the scenarios developed earlier in the SRES do not adequately specify the kinds of conditions that will shape the degree to which future societies are vulnerable to climate change. The relationship between climate change and various health outcomes is

not simple and one-to-one; thus, a model in which physical aspects of climate change (e.g., temperature and precipitation change) lead to human impacts such as changes to food security or health outcomes would not be sufficient. Socioeconomic conditions mediate the outcomes between the physical drivers of climate change and human society, said Levy.

The goal in developing a model is to identify the most important set of measurable socioeconomic parameters that will play the biggest role in discriminating between areas of high vulnerability and low vulnerability, given a common set of physical stressors. One step in doing this would be to narrow down the set of highest-priority socioeconomic variables. In an effort to identify these variables, an expert survey was conducted within the climate change community. The results yielded a high-priority list of variables considered to be the most important for understanding climate impacts: per capita income, quality of governance, extreme poverty, coastal population, water availability, urbanization, educational attainment, and innovation capacity. More specific and focused scenarios may require additional elements. Levy acknowledged that very few of these socioeconomic variables have been specified in any satisfactory manner in the existing family of climate scenarios, which presents a significant challenge. Past analyses have had to resort to assumptions that these socioeconomic variables would remain constant into the future.

Levy stated that processes are under way to populate quantitative databases over time and space with most of these additional socioeconomic indicators. Some indicators are more simple to quantify than others; for example, innovation capacity has proven more difficult to quantify than something like water availability. Innovation capacity may be an example of an indicator that is evaluated purely in a narrative form.

The second big question is how to get the variance right. In the past, analyses have tended to degrade the specification and the variance over time and space. Over time, linear or monotonically increasing trends tend to be forgotten. Variations from country to country, region to region, and city to city are often dampened, and the differences may be lost in socioeconomic scenarios, said Levy. The scenarios community, however, seeks to evaluate what kind of spatial and temporal variability is appropriate for the kinds of questions that climate change scenarios hope to answer.

The process of generating quantitative indicators now is different from how the SRES was carried out. SRES scenarios all assumed rapid

reduction in cross-national income inequality; however, the variance based on historical data does not predict such a trend. Health researchers in poorer regions have rejected the SRES scenarios because in them is embedded an artificial and unrealistic assumption of rapid growth in per capita income, stated Levy.

Current efforts attempt to be more sensitive to the variance that matters in scenarios, which remains a challenge. When a group of mainstream economic modelers from the Organisation for Economic Co-operation and Development (OECD) projected future income based on observed data for inequality of per capita income across countries, the models persisted in showing a rapid reduction of inequality across countries in these scenarios (see Figure 4-4a). The models used economic theory and data to project future income, but a problem is that the economic models often assume that investment flows to the areas in which capital is scarce and hence (according the models) the return on investment is highest. However, that is not the way the world has worked, so the yielded results are not fit for the purpose of these scenarios. Other methods have been able to develop the right kind of spread. Summary indicators developed by the International Institute for Applied Systems Analysis (IIASA) have been able to show a continuation in one scenario of high levels of inequality, which allows one to use the scenario for examining the impact of climate change on societies in a world that is assumed to maintain high income inequality (see Figure 4-4b).

The third big question from Levy is how to correctly specify the dependencies across the quantitative elements in a scenario. A review of past practices has revealed that this results in challenging tensions. Although scientists want the quantitative relationship among the elements to represent as accurately as possible the state of knowledge about how these things get together, new vulnerabilities may emerge that could impose unwanted determinism in those dependencies. For example, if urbanization rises with income, it would be desired to have indicators that reflect that. However, if infrastructure also increases with income and that is reflected, it may not be possible to have scenarios where rich countries have deteriorating infrastructure to understand the implications for that vulnerability. If there are too many assumptions, these critical vulnerabilities may be missed, said Levy.

The best recommended practice is to make these tradeoffs explicitly and transparently, with careful attention to relevant risks. Scenario exercises at the local level tend to do a better job of this, stated Levy,

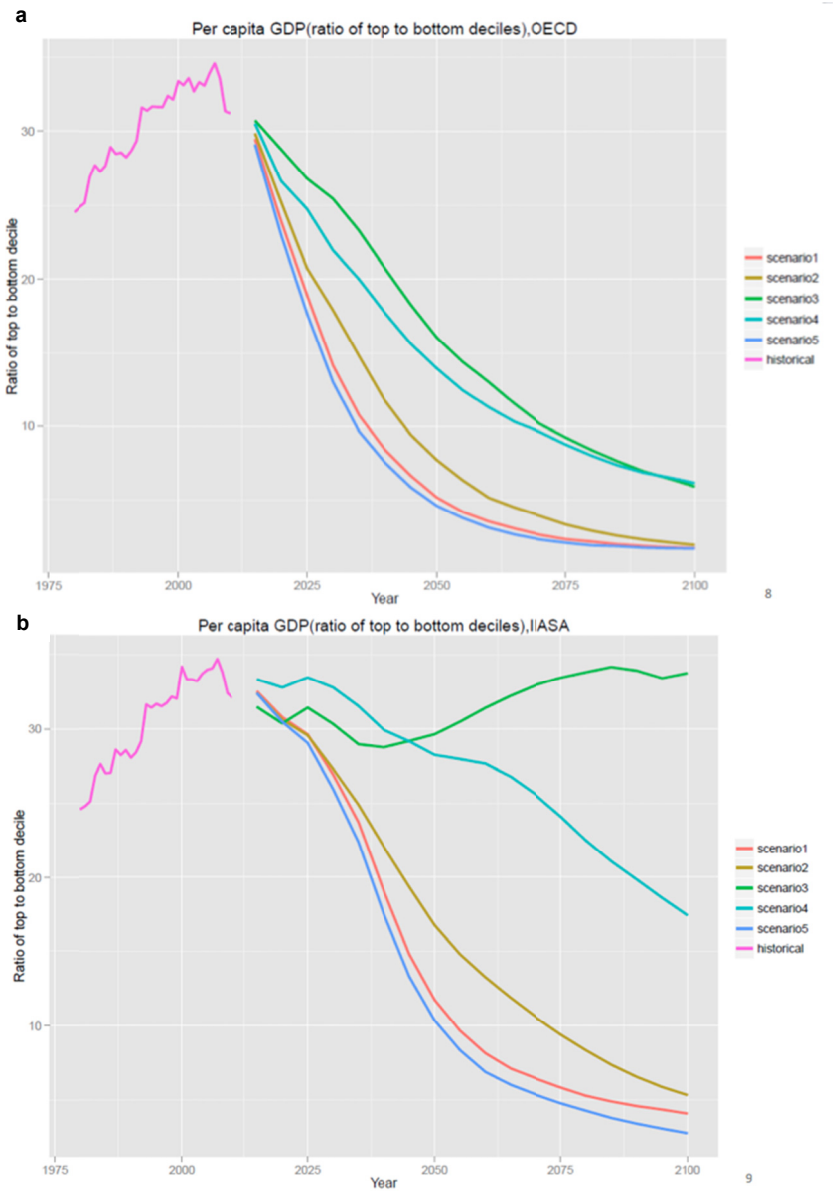

FIGURE 4-4 Future income scenarios based on observed data for inequality of per capita gross domestic product (GDP) across countries from the (a) Organisation for Economic Co-operation and Development (OECD) and (b) International Institute for Applied Systems Analysis (IIASA).
SOURCE: Levy, 2013.

because they are more sensitive to the many ways that different factors could interact to generate risk.

In summary, Levy reported that the baseline condition for incorporating new quantitative indicators is not ideal. There are currently no quantitative scenarios that reflect the phenomena that matter the most for climate change projections, but hard work is being done to implement them. Over the next few years, Levy expects to see high-quality, usable quantitative indicators on income, spatial population, inequality, governance, and health. Variance, which has previously been ignored, is now being considered. Dependencies are being better represented, and there are good examples that exist on a local scale, where communities are carrying out scenario exercises that show intelligent ways to handle the tensions described above. Globally, however, this is not yet being done well, and requires new experiments. Getting these dependencies right is important for bringing together the climate and health communities, said Levy. Health is a background condition that could shape the relationship between climate and other dependencies, such as poverty. In turn, health impacts from climate change will differ based on characteristics of the population. Levy stated it is especially important to understand the intents of actions in response to climate change, and to consider these dependencies in future scenarios.

ENGAGING KEY PARTNERS AND INSTITUTIONS IN DEVELOPMENT AND DISSEMINATING CLIMATE CHANGE SCENARIOS

Stéphane Hallegatte, Ph.D.
Senior Economist,
The World Bank

The process of developing scenarios for climate change is ongoing and will not end in the near future, said Hallegatte. As scenarios are improved, communities will hopefully get engaged and will help develop their scenarios from a user point of view. Hallegatte's presentation focused on the future of climate change scenarios, and who will need to be engaged to improve their utility.

Three issues need to be addressed in developing new SSPs for climate change scenarios. The first issue is scale. Many existing scenarios are on a global scale, although issues of interest exist on a local

scale. Local scenarios will need to be developed based on existing global ones to be used in analyzing policy decisions. Most policy decisions will require local-scale scenarios, and even the well-designed global scenarios cannot address all needs, said Hallegatte. The link between global and local scenarios exists but is not a deterministic one. For example, the health impact of local pollution depends partly on global choices described in scenarios, such as oil price, availability of electric cars. But it also depends on local choices such as urban forms and availability of public transport. The impacts of natural disasters also depend on things that occur on a global scale, such as foreign aid, but also on many local choices, like the decision to build dikes. A great improvement in global governance, however, does not connect strongly to local scenarios. The hope is that in the next few years, people will take newly developed global scenarios and downscale them to the local level for their use, said Hallegatte. Eventually, it may be possible to aggregate many local scenarios into new global scenarios and compare them to global scenarios that were chosen earlier.

The second issue concerns the content of scenarios, which needs to be appropriate for analyzing various policy decisions. Past scenarios were lacking necessary health information and had very little content on inequality within countries; for example, there were no details on governance or the development of health care insurance. The new generation of scenarios will make progress in that direction, but Hallegatte expressed doubt that the supply side of the scenario would be able to provide the health community with all it needs to do its work. Engagement from users will be needed to identify what is required in these scenarios, which could lead to analyses beyond climate change and opportunities for the scientific community to introduce more health considerations than the scenarios currently have.

Lastly, the third issue is relevance, and determining which scenarios are most relevant for a given question. Hallegatte stated that the problem is that there are many possible futures, but there can only be a small set of scenarios. In this generation of scenarios, there will be five SSPs that need to be able to be used for many research questions and policy analyses. Ideally, it would be possible to have a different set of scenarios for each research question and each policy analysis. One possible option for that is to have a dataset with many scenarios in addition to the five primary scenarios. A set of scenarios created to inform decisions on waterborne illnesses would be different in terms of land use and agricultural practices from a set of scenarios created to inform decisions

on local air pollution. To answer questions about various health issues, scenarios will differ based on variables like demographics, economic conditions, or access to services, and maybe not so much in terms of availability of renewable energy.

Hallegatte concluded by reiterating that there is a great possibility for various communities to engage in the scenario development process and to make sure that the process is driven by not just the producers of scenarios, but also the users. He echoed the sentiments of Ebi and Levy that the webinar provided an important opportunity for future engagement.

DISCUSSION

A brief discussion among the speakers and participants followed the presentations. Their remarks are summarized in this section.

Mechanisms to Address the Governance of the Selection Process

Balbus noted that the presentations highlighted the need to consider many different variables in a limited number of scenarios, which results in a certain amount of arbitrariness. At the same time, scientific work on climate change seeks to be as solidly based and widely accepted by the broad scientific community as possible. Given the challenge of dealing with some amount of subjectivity, Balbus asked what are the intended mechanisms within the IPCC or ICONICS to address the governance of the selection process?

Ebi replied first, reminding the audience that the scientific community is leading the effort, which means that no particular body is in charge and core funding is lacking to move this process forward. The IPCC has facilitated some meetings that require at least 40 percent participation from developing countries; however, it has been a challenge to keep people engaged without sustained funding. One option going forward is called Future Earth, said Ebi, and seeing if this process could take on governance issues as a core activity. Future Earth is an organization that is replacing others moving forward, including the International Human Dimension Program, the International Geosphere-Biosphere Programme, and others that have focused on various aspects of what needs to be understood about how the future will evolve and interact with global environmental change.

Levy added two additional points. The first is that the simple act of generating five SSPs means that it will be possible to do scenario analysis on climate impacts using a set of five reference scenarios, which will make the results comparable in a meaningful way. The second point is that nobody is going to be satisfied with only using those reference scenarios, and people will likely tinker with them as desired. In addition to the reference scenarios, the community needs a set of methods for documenting deviations from the scenarios in a simple and transparent manner so that users can understand how the scenarios differ.

Hallegatte noted that the community is trying to achieve a lot with these scenarios, but at the same time, trying to tailor scenarios to certain questions. He acknowledged that the five scenarios will not be able to meet all the needs and will probably need to be complemented by other models and narratives. The scenarios will only be one piece of the puzzle, and what is needed right now is more engagement.

Potential Use of Climate Change Scenarios in the Health Community

Carlos Santos-Burgoa thanked the speakers and commented on the potential use of scenarios in the health community. He suggested other assumptions about health that could be included in a scenario, such as the prevalence of chronic diseases and access to universal health coverage. Assumptions of risk from disease or lack of coverage would be desired in a scenario for health.

Ebi responded by saying that she was excited for the opportunity to engage the health community through this webinar, and that trying to quantify the health sector remains a challenge. Although the health community has struggled to develop future projects, the SSPs may be useful for examining health issues, like the burden of childhood mortality or chronic disease in the future. Ebi noted that the agricultural sector is developing scenarios as well, and there could be an opportunity in working with them on issues like food security.

Linking Social Determinants of Health and Climate Change Scenarios

A member of the audience asked how the social determinants of health should be approached around or within climate change scenarios, and to what extent are the social determinants of health assumed in the scenarios (versus something that is an output of the models).

Ebi responded that the variables placed in SSPs are those that will be important for projections of impacts or for looking at adaptation and mitigation policies. As an input, the social determinants of health would need to be quantified. She noted that it is important to have projections for them out to at least the year 2050 to better inform the modeling work that will provide information on the impacts of climate change.

Hallegatte commented that everything in the SSPs is an input or an output. Health and other factors, such as GDP, can be both inputs and outputs, which makes collaboration among sectors vital.

Predicted Health Impacts of Climate Mitigation Initiatives

The final question from the audience asked if models can predict the health impacts of major kinds of climate mitigation initiatives, policies, or movements; e.g., if the United States stopped using gasoline to power vehicles in favor of hydrogen fuel. Balbus replied that these are exactly the kinds of questions that the integrated assessment models were created to explore. He noted that the webinar focused on how to provide the scientists working with these models with the best information about global health in the future, which can be incorporated into the models and be used to create more accurate assessments of climate change mitigation and adaptation efforts.

REFERENCES

IPCC (Intergovernmental Panel on Climate Change). 1993. *Climate change 1992: The supplemental report to the IPCC impacts assessment*. Canberra, Australia: Australian Government Publishing Service.

IPCC. 2000. *Special report on emissions scenarios*. Prepared by Working Group III of the Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press.

Levy, M. 2013. *Incorporating quantitative elements into socioeconomic narratives and scenarios*. Presentation at the Institute of Medicine Webinar on Health in the Context of Global Climate Change, Washington, DC.

Met Office. 2013. *Met Office delivers new climate simulations to international modeling activity.* Available at http://www.metoffice.gov.uk/research/news/cmip5 (accessed October 7, 2013).

O'Neill, B. C., E. Kriegler, K. Riahl, K. L. Ebi, S. Hallegatte, T. R. Carter, R. Mathur, and D. P. van Vurren. 2013. A new scenario framework for climate change research: The concept of shared socio-economic pathways. *Climatic Change.* doi:10.1007/s10584-013-0905-2.

A

Webinar Agendas

WEBINAR #1 AGENDA

Health in the Context of Sustainable Economic Frameworks

May 23, 2013
2:30 pm–4:00 pm EDT

This webinar series is organized with support from
the National Institute of Environmental Health Sciences
and the Pan American Health Organization.

Webinar Goals and Objectives

- Provide an overview of current work under way focusing on gross domestic product (GDP) and the "beyond GDP" initiative.
- Discuss novel economic frameworks that include health capital in the assessment, including measures of both mental and physical well-being as well as the human health impact of exposures and risks.
- Identify opportunities for further engagement with the various "beyond GDP" efforts.

Opening

John M. Balbus, M.D., M.P.H. (Moderator)
Senior Advisor for Public Health
National Institute of Environmental Health Sciences

Going Beyond GDP: Opportunities and Challenges

Kevin J. Mumford, Ph.D.
Assistant Professor of Economics
Purdue University

Inclusive Wealth: Incorporation of Health Information

Anantha Kumar Duraiappah, Ph.D.
Executive Director
International Human Dimensions Programme
United Nations University

Happiness and Public Policy

Richard Easterlin, Ph.D.
Professor of Economics
University of Southern California

Synthesis and Response

R. David Simpson, Ph.D.
Director
Ecosystem Economic Studies
National Center for Environmental Economics
U.S. Environmental Protection Agency

Discussion

Closing

John M. Balbus, M.D., M.P.H.

ADJOURN

WEBINAR #2 AGENDA

Health in the Context of Global Climate Change

June 27, 2013
2:30 pm–4:00 pm EDT

This webinar series is organized with support from
the National Institute of Environmental Health Sciences
and the Pan American Health Organization.

Webinar Goals and Objectives

- Provide an overview of the set of shared socioeconomic pathways being developed to aid in the modeling and analysis of climate change mitigation and adaptation.
- Discuss key narrative elements that can be utilized to describe health in the context of changing global climate change.
- Identify mechanisms for developing and disseminating these climate change scenarios.

Opening

John M. Balbus, M.D., M.P.H. (Moderator)
Senior Advisor for Public Health
National Institute of Environmental Health Sciences

Overview of the Shared Socioeconomic Pathways for Modeling Climate Change Mitigation and Adaptation

Kristie L. Ebi, Ph.D., M.P.H.
Independent Consultant
ClimAdapt, LLC

Engaging Key Partners and Institutions in Developing and Disseminating Climate Change Scenarios

Stéphane Hallegatte, Ph.D.
Senior Economist
The World Bank

Reflections on Scenario Planning

Marc Levy
Deputy Director, The Earth Institute
Columbia University

Discussion

Closing

John M. Balbus, M.D., M.P.H.

ADJOURN

WEBINAR #3 AGENDA

Health in the Context of United Nations Processes to Develop Post-2015 Goals and Sustainable Development Goals

July 25, 2013
2:30 pm–4:00 pm EDT

This webinar series is organized with support from
the National Institute of Environmental Health Sciences
and the Pan American Health Organization.

Webinar Goals and Objectives

- Provide an overview of the sectors in which health-related indicators are best supported scientifically and could have the most impact within the various United Nations processes under way.
- Review the key points and gaps in existing efforts to develop new goals and indicators for the post-2015 development agenda.
- Discuss challenges associated with comparing across cobenefit studies from various sectors with varying levels of evidence and identify a minimum set of standards for a simple comparison framework.

Opening

John M. Balbus, M.D., M.P.H. (Moderator)
Senior Advisor for Public Health
National Institute of Environmental Health Sciences

Overview of the Report *A New Global Partnership: Eradicate Poverty and Transform Economies Through Sustainable Development*

John Norris, M.P.A.
Executive Director
Sustainable Security and Peacebuilding Initiative
Center for American Progress

The Global Thematic Consultation and Incorporating Environmental Health into the Post-2015 Development Agenda

Kumanan Rasanathan, M.B.Ch.B., M.P.H.
Health Specialist
United Nations Children's Fund

Response to the Report's Findings and Recommendations

Andrew Haines, M.D., MBBS
Professor of Public Health and Primary Care
London School of Hygiene and Tropical Medicine

Discussion

Closing

John M. Balbus, M.D., M.P.H.

ADJOURN

B

Webinar Speaker Biosketches

John M. Balbus, M.D., M.P.H., serves as senior advisor for public health at the National Institute of Environmental Health Sciences (NIEHS). He also leads NIEHS efforts on climate change and human health. In this capacity, he serves as Department of Health and Human Services principal to the U.S. Global Change Research Program, for which he also co-chairs the Interagency Cross-Cutting Group on Climate Change and Human Health. Dr. Balbus has authored studies and lectures on global climate change and health, transportation-related air pollution, the toxic effects of chemicals, and regulatory approaches to protecting susceptible subpopulations. Before joining the NIEHS, Dr. Balbus was chief health scientist for the nongovernmental organization the Environmental Defense Fund. He served on the faculty of The George Washington University, where he was founding director of the Center for Risk Science and Public Health, founding co-director of the Mid-Atlantic Center for Children's Health and the Environment, and acting chairman of the Department of Environmental and Occupational Health. He maintains an adjunct faculty appointment at the Johns Hopkins Bloomberg School of Public Health. Dr. Balbus received his A.B. degree in biochemistry from Harvard University, his M.D. from the University of Pennsylvania, and his M.P.H. from the Johns Hopkins Bloomberg School of Public Health.

Anantha Duraiappah, Ph.D., is the executive director of the International Human Dimensions Programme on Global Environmental Change (IHDP) in Bonn, Germany. He is an experienced environmental-development economist whose work largely focuses on the equity of access and use of ecosystem services. In his previous post as chief of the Ecosystem Services and Economics Unit of the United Nations Environment Programme, Dr. Duraiappah was involved in the initiation of the Intergovernmental Platform on Biodiversity and Ecosystem Services and has since then played a pivotal role in its approval process. He initiated

the *Inclusive Wealth Report* and continues to successfully incorporate his expertise in fields related to the green economy, science–policy interaction, economics, development, and ecosystem services into his work at IHDP.

Richard A. Easterlin, Ph.D., is a professor of economics at the University of Southern California. He is a member of the National Academy of Sciences and the American Academy of Arts and Sciences. Dr. Easterlin is an internationally renowned scholar for his work in economic history, economic demography, and subjective well-being. He has written extensively about the spread of modern economic growth, including its causes and consequences, and is the recognized founder of happiness economics. In recent years he has studied changes in subjective well-being over the lifecycle, with a view to clarifying the relative role in determining people's feelings of well-being of living levels, family life, health, and job conditions. Prior to joining the University of Southern California, Dr. Easterlin was on the faculty of the University of Pennsylvania for almost 30 years. He has also been a visiting professor and scholar at the California Institute of Technology, Stanford University, Texas A&M University, the University of Washington, the University of Warwick in England, and Lund University in Sweden. He is a past president of the Economic History Association and the Population Association of America, a fellow of the Econometric Society, and a distinguished fellow of the American Economic Association.

Kristie L. Ebi, Ph.D., M.P.H., has been conducting research on the impacts of and adaptation to climate change for more than 15 years, primarily extreme events, thermal stress, foodborne diseases, and vectorborne diseases. She has worked with the World Health Organization, the United Nations Development Programme, the International Development Research Centre, the U.S. Agency for International Development, and others on designing and implementing adaptation measures in low-income countries, and has worked with the Center for Climate Strategies on identifying adaptation options for U.S. states conducting vulnerability and adaptation assessments. She was a lead author for the human health chapter of the Intergovernmental Panel on Climate Change's fourth assessment report and was lead author for human health for the U.S. Synthesis and Assessment Product *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems*. She has edited 4 books on climate change and health, and has authored more than 80 publications. Dr. Ebi's scientific training includes an M.S. in toxicology,

a Ph.D. and M.P.H. in epidemiology, and 2 years of postgraduate research at the London School of Hygiene and Tropical Medicine.

Professor Sir Andrew Haines, M.D., MBBS, is a professor of public health and primary care with joint appointments in the Department of Social and Environmental Health Research and Department of Nutrition and Public Health Intervention Research at the London School of Hygiene and Tropical Medicine. He was previously director (originally dean) of the London School of Hygiene and Tropical Medicine for almost 10 years, having previously been professor of primary health care at University College London between 1987 and 2000. He also worked part time as a general practitioner in North London for many years. Dr. Haines' research interests are in epidemiology and health services research, focusing particularly on research in primary care and the study of environmental influences on health, including the potential effects of climate change and the health cobenefits of the low-carbon economy. He has been a member of a number of major international and national committees, including the Medical Research Council (MRC) Global Health Group (chair), the MRC Strategy Group, the UK Health and Social Care Policy Committee (chair), and the World Health Organization Advisory Committee on Health Research (chair). He was a member of the United Nations Intergovernmental Panel on Climate Change for the second and third assessment reports and is currently a review editor for the fifth report.

Stéphane Hallegatte, Ph.D., is a senior economist with the World Bank. His work includes macroeconomic dynamics and green growth strategies, urban economics and environmental policies, climate change vulnerability and adaptation, and disaster risk management. He is a lead author of the Intergovernmental Panel on Climate Change's (IPCC's) special report on *Managing the Risks of Extreme Events and Disasters to Advance Climate*, published in 2012, and a contributing author to the IPCC's fifth assessment report, to be published in 2014. He also co-led with Marianne Fay the World Bank flagship report *Inclusive Green Growth: the Pathway to Sustainable Development* in 2012 and is a core writing team member for the 2014 World Development Report *Managing Risks for Development*. Dr. Hallegatte holds an engineering degree from the École Polytechnique and a Ph.D. in economics from the École des Hautes Études en Sciences Sociales in Paris.

Marc Levy is deputy director of the Center for International Earth Science Information Network, a unit of Columbia University's Earth Institute. He is also an adjunct professor in Columbia's School of International and Public Affairs. He is a political scientist specializing in the human dimensions of global environmental change. His primary research areas are climate–security linkages, global environmental governance, and sustainability metrics. He has published in a wide variety of subtopics, including emerging infectious disease modeling, anthropogenic drivers of global change, sustainability indicators, vulnerability mapping, and public–private partnerships. His research has been supported by a variety of agencies, including the National Science Foundation, the U.S. Agency for International Development, the National Institutes of Health, the National Aeronautic and Space Administration, the United Nations Environment Programme, and the International Institute for Applied Systems Analysis. He has served on several committees of the National Academy of Sciences, as well as on a number of international assessments, and is currently a lead author of the chapter on human security in the Intergovernmental Panel on Climate Change's fifth assessment report. He is incoming chair of the World Economic Forum's Global Agenda Council on Measuring Sustainability.

Kevin J. Mumford, Ph.D., is an assistant professor in the economics department at Purdue University, where he has been since 2007. He has a Ph.D. in economics from Stanford University and a B.A. in economics from Brigham Young University. His research has focused on taxation, fertility and families, labor supply, poverty, and the role of human capital in measuring national wealth (economic sustainability). Dr. Mumford has received research grants from the Purdue Research Foundation, the Institute for Research on Poverty, the Upjohn Institute for Employment Research, and the Alfred P. Sloan Foundation. In 2010 he was awarded the John and Mary Willis Young Faculty Scholar Award for research excellence.

John Norris, M.P.A., is the executive director of the Sustainable Security and Peacebuilding Initiative at the Center for American Progress. In that role, he served as senior adviser to John Podesta during his work on the Secretary General's High-Level Panel of Eminent Persons for the Post-2015 Development Agenda. Mr. Norris has served in a number of senior roles in government, international institutions, and nonprofits. He previously served as the executive director of the Enough Project at the Center for American Progress and was the chief of political

affairs for the United Nations Mission in Nepal. Previously, Mr. Norris served as the Washington chief of staff for the International Crisis Group, conducting extensive field work and senior-level advocacy for resolving conflicts in Africa, the Balkans, and South Asia. Earlier in his career, he served as the director of communications for U.S. Deputy Secretary of State Strobe Talbott. He also worked as a speechwriter and field disaster expert at the U.S. Agency for International Development. Mr. Norris is the author of several books, including the *Disaster Gypsies*, a memoir of his work in the field of emergency relief, and *Collision Course: NATO, Russia, and Kosovo*. He has published commentary in the *Washington Post*, the *Los Angeles Times*, the *Wall Street Journal*, and elsewhere.

Kumanan Rasanathan, M.B.Ch.B., M.P.H., FAFPHM, is a public health physician currently working for the United Nations Children's Fund (UNICEF) in New York on district health system strengthening to improve the delivery of maternal and child health services in Asia and sub-Saharan Africa. He is also the UNICEF focal point for health in the post-2015 development agenda and was a member of the task team managing the global thematic consultation on health for the post-2015 discussions. Prior to joining UNICEF, Dr. Rasanathan worked at the World Health Organization (WHO) in Geneva on primary health care and social determinants of health. His work on social determinants focused on a range of issues including climate change, human rights, noncommunicable diseases, economic crises, migration, and social protection. Prior to joining the WHO, Kumanan worked in a range of roles in Australia, China, New Zealand, and the United Kingdom as a clinician, researcher, policy maker, and programme manager in clinical practice, vaccine clinical trials, primary health care, national health policy, and reducing inequities in maternal and child health.

R. David Simpson, Ph.D., is director for ecosystem economic studies in the National Center for Environmental Economics at the U.S. Environmental Protection Agency. His other positions have included senior fellow at Resources for the Future, associate professor at Johns Hopkins University's School of Advanced International Studies, and visiting professor at University College London. His work has focused on the nonmarket valuation of biological resources, and he has published a number of papers on these and other topics. Dr. Simpson has consulted in the development of the United Nations' System of Economic-Environmental Accounts and serves on the Policy and Technical Experts

Committee advising the World Bank's Wealth Accounting for the Value of Ecosystem Services program. Dr. Simpson received his B.A. in economics from Whitman College and a Ph.D. in economics from the Massachusetts Institute of Technology.