

## Global Health Risk Framework: Pandemic Financing: Workshop Summary

### DETAILS

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# GLOBAL HEALTH RISK FRAMEWORK

## Pandemic Financing

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### WORKSHOP SUMMARY

Gillian J. Buckley and Rachel E. Pittluck, *Rapporteurs*

Board on Global Health

Institute of Medicine

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FRAMEWORK: A WORKSHOP ON PANDEMIC FINANCING<sup>1</sup>**

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<sup>1</sup> The National Academies of Sciences, Engineering, and Medicine's planning committees are solely responsible for organizing the workshop, identifying topics, and choosing speakers. The responsibility for the published workshop summary rests with the workshop rapporteurs and the institution.



## Reviewers

This workshop summary has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. 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 workshop 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:

**Juan Costain**, The World Bank  
**Fatima Kassam**, African Risk Capacity  
**Chris Lane**, International Monetary Fund  
**David Nabarro**, United Nations  
**Staci Warden**, Milken Institute

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 workshop summary was overseen by **Martin J. Sepulveda**, IBM Corporation. He 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 workshop summary rests entirely with the rapporteurs and the institution.





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The planning committee and project staff wish to acknowledge the many people who contributed to this report. We extend our sincere gratitude to the panelists and moderators who shared their valuable time and expertise to make the workshop a success. These individuals are listed in the workshop agenda in Appendix B. We are grateful also to the participants who attended the workshop, in person and via the live webcast, and further enriched the discussion.

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<sup>1</sup> The title of this chapter has been updated since the initial release of this report.

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## Acronyms and Abbreviations

AIDS	acquired immune deficiency syndrome
ARC	African Risk Capacity
BCG	Boston Consulting Group
CDC	Centers for Disease Control and Prevention (U.S.)
China CDC	Chinese Center for Disease Control and Prevention
DDO	deferred drawdown option
DEG	Deutsche Investitions- und Entwicklungsgesellschaft mbH (German Investment and Development Corporation)
DFID	UK Department for International Development
Gavi	Gavi, the Vaccine Alliance
GDP	gross domestic product
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
HIV	human immunodeficiency virus
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
IFFIm	The International Finance Facility for Immunisation
IHR	International Health Regulations

IMF	International Monetary Fund
IOM	Institute of Medicine
MERS	Middle East respiratory syndrome
MSF	Médecins Sans Frontières (Doctors Without Borders)
NGO	nongovernmental organization
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OFDA	Office of U.S. Foreign Disaster Assistance
PAHO	Pan American Health Organization
PEPFAR	The President's Emergency Plan for AIDS Relief
SARS	severe acute respiratory syndrome
UN	United Nations
USAID	U.S. Agency for International Development
WHO	World Health Organization
WTO	World Trade Organization

# 1

## Introduction<sup>1</sup>

The world has problems with coordinated international response to outbreaks, particularly with paying for pandemic preparedness and mobilizing money for response. The 2014 Ebola outbreak brought these problems to light, but the basic tension is not new, as summarized in the *Economist* observation (2004) about famine, “If help arrives before people start starving, fewer will die. But it is only when people start to die that the money to save them starts flowing in.” The Institute of Medicine (IOM) workshop on pandemic financing aimed to illuminate the financing tools available to alleviate this tension, closing the gap between the infectious disease event and the response, and ways to fund the systems that could help prevent the outbreak in the first place.

As part of the Global Health Risk Framework initiative described in Box 1-1, the Institute of Medicine convened a 2-day workshop on financing pandemic preparedness and response. The workshop planning committee invited a range of speakers to respond to the statement of task shown in Box 1-2. The planning committee then put together an agenda dividing the day into sessions on marshaling funding for response, identifying triggers and modeling risk, the management and administration of funds,

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<sup>1</sup> This workshop summary is a description of the discussion as it occurred at the August 27-28 workshop. The material is presented roughly in the order it was discussed, and the report is organized into sections corresponding to the sessions shown on the meeting agenda. Views and opinions presented are those of individual speakers and do not reflect the consensus of the group; the planning committee; the National Academies of Sciences, Engineering, and Medicine; or the workshop sponsors.



### BOX 1-1 The Global Health Risk Framework Initiative

Since the 2014 Ebola outbreak, many public- and private-sector leaders have seen a need for improved management of global public health emergencies. The effects of the Ebola epidemic go well beyond the three hardest-hit countries and beyond health. Education, child protection, commerce, transportation, and human rights have all suffered. The consequences and lethality of Ebola have increased interest in coordinated global response to infectious threats, many of which could disrupt global health and commerce far more than the recent outbreak.

With encouragement and input from the World Bank; the World Health Organization; and the governments of the United Kingdom, the United States, and West African countries; and support from various international and national organizations (Ford, Gates, Moore, Paul G. Allen Family, and Rockefeller Foundations; Dr. Ming Wai Lau; the U.S. Agency for International Development; and the Wellcome Trust), the U.S. National Academy of Medicine agreed to manage an international, independent, evidence-based, authoritative, multistakeholder expert Commission<sup>a</sup> on improving international management and response to outbreaks. As part of this effort, the Institute of Medicine convened four workshops in the summer of 2015 to inform the Commission report. These workshops examined questions of **governance for global health, pandemic financing, resilient health systems, and research and development of medical products**. Each workshop gathered diverse perspectives on a range of policies, operations, and options for collaboration to improve the global health system. A published summary from each of the workshops has been independently written and reviewed, and their release will be coordinated.<sup>b</sup>

<sup>a</sup> For more information see <http://nam.edu/initiatives/global-health-risk-framework> (accessed October 30, 2015).

<sup>b</sup> Summaries from the other three workshops can be found at <http://iom.nationalacademies.org/reports/2016/GHRF-Governance>; <http://iom.nationalacademies.org/reports/2016/GHRF-Health-Systems>; <http://iom.nationalacademies.org/reports/2016/GHRF-Research-and-Development>.

and financing preparedness and giving incentives. (See Appendix B for the workshop agenda.)

### WELCOME AND INTRODUCTION

Dr. Victor Dzau, president of the National Academy of Medicine, opened the meeting with brief remarks about the Global Health Risk Framework initiative. He explained that the immediate impetus for the program was the 2014 Ebola outbreak in West Africa, which killed more than 10,000 people and had disastrous social and economic consequences in Guinea, Liberia, and Sierra Leone. Dzau described the outbreak as the failure of multiple systems at the international, national, and local levels (see

**BOX 1-2**  
**Statement of Task**

An ad hoc committee will plan a 2-day public workshop on the financing of global response to pandemic threats, clarifying where the money for surveillance, detection, and response should come from and how it should be spent. The workshop will examine the role of the World Bank's proposed Pandemic Emergency Financing Facility, an organization that will coordinate international financial response to pandemics, particularly how the facility might ensure rapid deployment and prompt remuneration of health workers and minimize transaction times on other expenses.

Speakers will articulate roles for the private sector, especially the reinsurance industry, to bring together multiple financial backers to pool their risks against a global emergency. The workshop will also explore possible underwriting functions of banks, insurers, and investment houses, and analyze how these organizations could ease the financial shock of an epidemic and control the costs of response, including the cost of developing new drugs and vaccines.

The workshop will also give some attention to questions of accounting, describing a system for transparent reporting and auditing of funds. To this end, participants will discuss the management obligations of the investors, creditors, and regulators involved with emergency finance.

The public workshop will feature invited presentations and panel discussions. The planning committee will organize the workshop, select speakers and panelists, and serve as discussion moderators. Commissioned papers may be required to inform workshop discussions. A designated rapporteur will prepare the workshop summary in accordance with institutional guidelines.

Figure 1-1). Financial concerns were a common cause of the slow response, from the ability of international organizations to fund their response to the concerns of the governments of the affected countries that acknowledging the outbreak would hurt their economy.

Dzau presented the opportunity now before the workshop audience and the international community as one of planning to mitigate the consequences of the next infectious outbreak. This concern with future vulnerability motivated the donors mentioned in Box 1-1 to commission the Global Health Risk Framework initiative. He described the international commission and their task to recommend a new strategy for coordinated action against pandemics. The commissioners will be drawing support in this program from the four IOM workshops described in Box 1-1, of which the August 27-28 meeting was the third. Dzau closed his comments by stressing the importance of building political will for change and learning from the lessons of Ebola and other outbreaks before memories fade.

# Inadequate Response to Ebola Outbreak

- Delay to recognize magnitude of outbreak
- Limited financial resources
- Lack of coordination mechanisms between public and private organizations
- Absence of an easily mobilized reserve of pooled funds

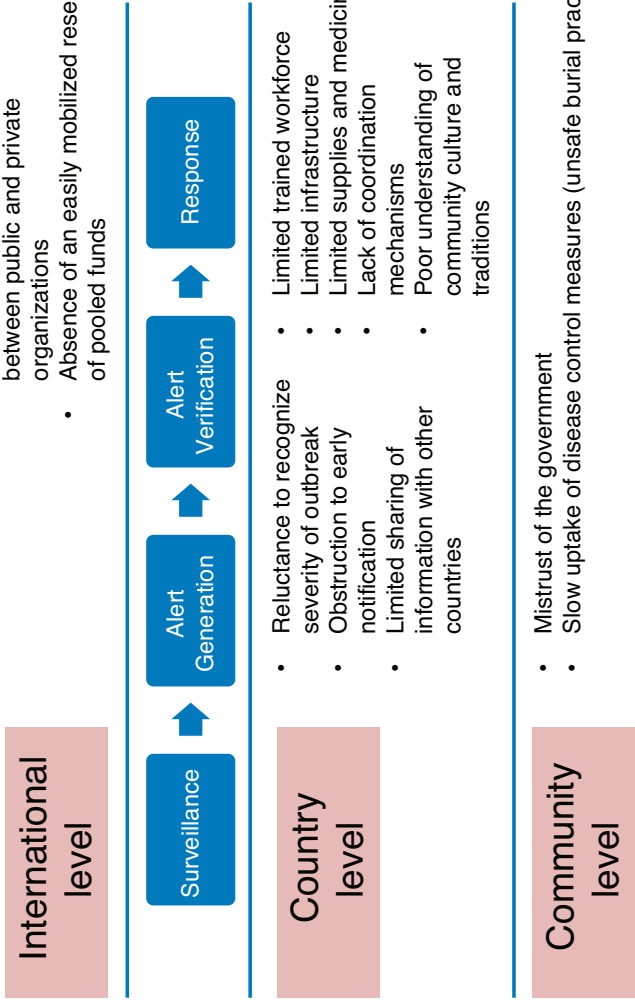


FIGURE 1-1 The response to the 2014-2015 Ebola outbreak had inadequacies at the international, country, and community levels. SOURCE: Dzau, 2015.

## 2

# International Cooperative Action on Pandemics

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- Health centers in the poorest countries cannot manage basic infection control, often lacking even running water and a reliable supply of soap. Bringing these health posts up to a minimum standard would be expensive; introducing infection response units an order of magnitude more so. (Tappero)
- Financial obstacles affect the ability to pay health workers, establish treatment centers, and fund vaccine research. A system should be in place to pay frontline health workers without distorting the labor market. (Tappero)
- Infectious outbreaks have a different risk profile than other threats, as the cost of response increases if action is delayed. (Woo)
- Life insurers and other businesses hold pandemic risk on their books already, but the risk is not being properly mitigated. (Woo)
- Fast spending is necessary during an epidemic and can be enabled by a prenegotiated plan that delineates ex post and ex ante financing. (González-Pier)
- The delay between donor pledges and funding received introduces inefficiency into development, obliging businesses in aid-recipient countries to use credit to meet their operating

expenses. But procurement often requires cash in hand before placing an order, and manufacturing takes time, further delaying the delivery of goods. (Betru)

- Deficiencies in the health systems of Guinea, Liberia, and Sierra Leone delayed recognition of the outbreak at hand. Funding for outbreaks is less a problem than a consequence of health systems strengthening not being particularly high on any public agenda. (González-Pier, Tappero)

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<sup>a</sup>This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

The first panel in the workshop gave a broad overview of the unique financial challenges outbreaks present. Four panelists—Gordon Woo of Risk Management Solutions, Jordan Tappero of the U.S. Centers for Disease Control and Prevention (CDC), Eduardo González-Pier of the Mexican Ministry of Health, and Aron Betru of Financing for Development—discussed the financing and risk profile of pandemic events, from the preparation to the response.

Tappero opened the panel with remarks on his experience with CDC's recent Ebola relief effort. African countries have seen more than 20 outbreaks of Ebola since the virus was discovered in 1976, but the 2014 epidemic was unlike any other in its duration and lethality. Tappero described what would have been necessary to stop the outbreak early: reliable surveillance to identify cases and trace their contacts; isolation facilities to interrupt transmission; laboratory testing to confirm cases; and treatment, which reduces risk of death by 50 percent. Proper management of the outbreak also required changing traditional burial practices, and training health workers on how to use protective equipment and how to follow asymptomatic cases after their release from isolation. All of this was complicated when the recent outbreak started in December 2013 because transmission was happening in remote parts of the Guinea border country, from which the virus eventually spread to Liberia and Sierra Leone. Three months later, when the world recognized the Ebola outbreak, there were already too many chains of transmission to break easily. By July 2014, the virus had reached the densely populated capital cities in the affected countries. At that time, the charity Doctors Without Borders (Médecins Sans Frontières, or MSF) was the only medical nongovernmental organization (NGO) working against Ebola. Tappero explained that MSF came up against a problem of capacity: the organization would have needed more staff, more beds, and more partners to halt the outbreak.

Around the same time, commercial airlines stopped service to affected countries, causing foreign health workers to reconsider volunteering for the response. Tappero saw the September addition of the U.S. military to the response effort as a turning point in the crisis, encouraging other governments to join in the effort, in addition to providing logistical support, air transport, and treatment units. He also pointed to the counterexample of Nigeria, where Ebola infections were promptly controlled, a fact he attributed to the incident management system in place for polio eradication and a cadre of more than 50 trained field epidemiologists.

When asked about the financial obstacles to an efficient response, Tappero cited payment of the local workforce as his first concern. Early in the Ebola outbreak, there was concern that, even as health workers put their lives at risk by continuing to practice, they might not be paid promptly. In an effort to improve the incentives for these workers, the governments increased their pay. But eventually the danger pay inflated salaries to beyond what the medical NGOs could offer, creating a chaotic situation where staff were moving between employers. Tappero thought one of the main financial lessons from this outbreak was that there should be an emergency payment system in place for frontline health workers, and that danger pay should be designed to reward the bravery of health workers while minimizing competition in the labor market. Better financial planning could also avoid concerns about the costs of medical evacuation, thereby reducing barriers to involving foreign volunteers.

Tappero explained that it would cost money to bring health centers in the poorest countries to the point of managing basic infection control; many lack running water and a reliable supply of soap. Mounting an infection response with isolation units and Tyvek suits would be, he acknowledged, an order of magnitude more expensive. But at the same time, the problem could have been controlled more cheaply if response had started earlier. Ebola treatment facilities—relatively simple structures made of plywood, plastic sheeting, and PVC pipe—might have been built with local resources. He also speculated that funding for vaccine research for hemorrhagic and SARS<sup>1</sup>-like illnesses could have done much to speed response.

Gordon Woo built on Tappero's discussion of Ebola, agreeing that if action against pandemics does not happen early, the cost of response goes up. He likened the virus to a loan shark—someone who, if not paid back rapidly, demands exponentially increasing repayment. While President Barack Obama and Prime Minister David Cameron put their countries' resources to bear in fighting Ebola, other countries were slow to commit. Woo commented ironically that the world leaders might have done better

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<sup>1</sup> Severe acute respiratory syndrome.

financing Ebola response from an actual loan shark, at least avoiding the delay of persuading other partners to contribute.

Woo went on to explain how pandemic response has a different risk profile than other kinds of threats. He described the Great Fire of London in 1666, an early impetus for the development of the modern insurance industry. At that time, each insurance company paid for their own fire brigade and was responsible for putting out fires at their clients' homes. In much the same way, he maintained, today's life insurers stand to lose from a major epidemic and would do well to mitigate that risk.

With natural hazards, there are secondary perils to account for. Tropical cyclones are not particularly lethal in themselves, but the damage to property and the water supply increases vulnerability to waterborne outbreaks of typhoid or cholera. And even typhoid and cholera outbreaks do not carry the same international risk as pandemics. Woo emphasized that there are many stakeholders who carry pandemic risk on their books already, and the Global Health Risk Framework initiative would ideally help engage them to take financial measures to mitigate that risk. He saw room in this endeavor for public-private partnerships and gave an example of such a partnership from his work on veterinary surveillance in Singapore.

Eduardo González-Pier expanded on the same topic, sharing experiences from the influenza epidemic that hit Mexico in 2009. He entered the Institute for Social Security soon after the epidemic and dealt with the immediate aftermath as chief financial officer. The lessons learned during that outbreak were all relevant to the 2014 Ebola crisis. During outbreaks, González-Pier explained, having a funding mechanism in place does not guarantee an effective spending response. In the timeline of response, the first stage is the alert, when the epidemic is officially declared. This is followed by the spending stage and, finally, by the resolution.

The 2009 influenza outbreak probably started in March, González-Pier reasoned. The Pan American Health Organization and the ministry of health confirmed the outbreak by April 6 and reported it to the World Health Organization (WHO) as a possible public health emergency of international concern. By April 23, CDC and Canadian government confirmed that the virus was H1N1. The next day the Mexican health council issued an emergency decree, and 4 days after that, procurement was taking place. By the end of the outbreak in August, \$600 million had been spent, with 72,000 cases and 1,300 deaths confirmed.

The response was quick, even though the world was going through an economic crisis. Mexican gross domestic product dropped 6.8 percent in 2009, and the ministry of health was facing budget cuts. But the response worked well because it relied on monies from Social Security and a ministry of finance insurance program. When fast spending is necessary, González-

Pier encouraged negotiating a plan where some financial problems are solved in advance of the emergency, and others are solved later.

The Mexican procurement law has provisions for catastrophic spending, some of which were automatically triggered by the national emergency decree. González-Pier saw these provisions as the most important part of the process, though he acknowledged that there were trade-offs, with the decree hurting the travel and tourism industry. Any given administration might not be aware of all the funding contingencies, and in some countries, the provisions might not have been made, but he encouraged making these provisions and mapping them as much as possible.

Aron Betru continued to develop González-Pier's point about the importance of the tools and processes that bring money to bear in an emergency. Outbreaks do not align with budget cycles; the delay between pledges being made and funding being received can be between 6 months and 2 years. Betru referred to a Brookings Institution paper that quantified the consequences of this inefficiency and estimated that about 28 cents is wasted for every development dollar spent because of delays in reaching its target. These delays oblige businesses to do something called receivables financing, involving credit from commercial banks to meet payroll and other expenses.

Financing for Development's Pledge Guarantee for Health<sup>2</sup> was designed to help mitigate this problem. The program places a guarantee with private commercial banks to fill in funding cycle gaps. Because the guarantee is borrowed against for only short times, always less than 12 months, the transactions are described as "non-balance sheet transactions," cash management tools that require no parliamentary approval.

Betru praised the Mexican government's management of the 2009 H1N1 outbreak, with the declaration of the emergency triggering funding and some reconciling happening later. In poorer countries, however, cash flows work differently. Procurement officers need cash in hand before they can place orders with manufacturers. Then the manufacturers need time to fill the orders, and it takes even more time to deliver the goods. If funds could be mobilized more quickly and manufacturers given advance warning of surge orders, much greater efficiency could be introduced, he reasoned. Session moderator Olga Jonas extended his point, observing that northern cities contract snow removal before it snows so that, when there is a blizzard, the plows can be out immediately.

The subsequent discussion gave some attention to problems with coordination during pandemic emergencies. George Gao of Chinese Center for Disease Control and Prevention shared his observation that the 2014 Ebola

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<sup>2</sup> Supported by the U.S. Agency for International Development, Swedish Sida, and the Packard Foundation.



response would have benefited from better coordination on the ground, and he asked the group to consider who should be the leader in such situations. Tappero built on his point, saying that he had a good opinion of the Ebola response on the ground *after* WHO declared a public health emergency of international concern. He had more concerns with the deficiencies in the national public health systems that allowed the outbreak to go unnoticed for as long as it did, including the lack of a surveillance and specimen-testing system that would have detected an emergency at hand. This point invited some discussion of how different organizations might help pay for such tools, though González-Pier pointed out that funding is not the direct problem; it is rather a consequence of the problem of health systems not being a particularly high priority on any public agenda.

González-Pier continued that the Mexican government was criticized for having overacted to the H1N1 outbreak, but they were able to counter that all their decisions had been made in close collaboration with the international authorities. Betru supported this observation, saying that the fear of overacting is a serious deterrent to many countries facing outbreaks. He suggested having several sets of triggers, including a soft preemergency trigger that could allow the moving of some resources with minimal signaling of an emergency.

Moreover, as Milan Brahmhatt of the World Resources Institute pointed out, Mexico is an upper-middle-income country with a developed health system and strong institutions. Building similar systems in poor countries would require a steady funding stream, streams that are distinct from the emergency response funding. He reiterated a point made by several of the speakers that there are two financial problems to solve: the problem of emergency response and the problem of health systems building. Victor Bampoe of the Ghanaian Ministry of Health agreed, adding that donors have been generous about investing in health in his country. Still, he asked the group to consider what kinds of incentives might be helpful in encouraging health systems building. He found that this is a difficult proposition to sell to people in the ministries, even when the donors are willing to pay for it, because they do not see it as an emergency.

As for emergency funding, Adam Bornstein of the Global Fund to Fight AIDS, Tuberculosis and Malaria (hereafter, the Global Fund) explained that donor mandates, which come from governments or the United Nations or whoever is organizing the donation, can prevent organizations from using their funds and systems during emergencies. It could be helpful to negotiate the terms of a blanket mandate that would allow organizations like the Global Fund to use their capacity and their programs in countries for emergency response. On the other hand, Tore Godal of the Ministry of Foreign Affairs, Norway, was not enthusiastic about that suggestion. He explained that his country had made prompt and generous donations

to Ebola response through MSF, WHO, and the Red Cross. Perhaps there are inefficiencies in that system, but he saw some inefficiency as preferable to having the Global Fund or the United Nations Children's Fund deviate from their missions.



## 3

# Pandemic Emergency Funds<sup>1</sup>

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- The World Health Organization (WHO) Pandemic Contingency Fund will hold \$100 million against use in the first 3 months of a pandemic, drawn down at the discretion of the Director-General. Different grades of emergency will allow accessing of different amounts; the threshold for release of a \$5,000 grant will be lower than that of a \$50,000 or \$10 million one. (DeLand)
- It is not acceptable that the cost of outbreak response falls on poor countries, when the beneficiaries of containment are the rest of the world. (Lane)
- Through the Catastrophe Containment and Relief Trust, the International Monetary Fund (IMF) has extended post-catastrophe debt relief to include health emergencies as well as natural disasters. (Lane)
- The World Bank Pandemic Emergency Financing Facility would buy private crisis insurance for developing countries, allowing payouts to fund response, not losses. Donors will pay premiums for the poorest countries; middle-income countries will be welcome to participate but required to pay their own premiums. (Basu)

<sup>1</sup> The title of this chapter has been updated since the initial release of this report.

- Emergency financing carries trade-offs between giving incentives for preparedness and putting up reasonable barriers to using the funds. (Sands)
- Ebola drew international attention to the need for better health systems. The health systems improvements that the poorest countries prioritize are not usually outbreak surveillance or response. Building compliance with the International Health Regulations (IHR) will be a slow process, requiring considerable capacity building. (Basu, DeLand)
- The poorest countries and fragile states have uncommonly low tax revenue as a proportion of income. Better tax collection and public financial management could do much to expand the budgetary envelope in these parts of the world. (Lane)

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<sup>a</sup> This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

Speakers in the next session discussed different ways to make money available for pandemic preparedness and response, with particular attention to the tools available to multilateral agencies, insurance tools, and innovative financing.

Peters Sands, formerly of Standard Chartered Bank, moderated the first session on the WHO, World Bank, and IMF pandemic financing tools. He invited Katherine DeLand of WHO to start the discussion, asking why the WHO contingency fund was needed and what it would be used for. DeLand explained that the \$100 million fund was a flexible pot of money that could be rapidly drawn down during the first 3 months of an outbreak or emergency with health or humanitarian consequences. The fund would be accessed at the discretion of the Director-General to scale up WHO's response on the ground. Analysts calculated the \$100 million value of the fund based on the amount WHO has spent on emergency response over the past 10 years, especially the amount necessary in the first months of the response. She explained that this is a departure from how WHO funds emergencies now, usually through the overall program budget or an emergency voluntary appeal. Although the organization has enjoyed some success with emergency appeals, she mentioned a concern that the amounts raised in these campaigns are largely earmarked. In the Ebola response, for example, there was tremendous interest in funding the purchase of personal protective equipment, but much less will to support the ordinary administrative aspects of response.

The fund was put in place in May 2015; its operating procedures are still in development. As of the workshop, WHO member states had indicated that the fund should be supported by voluntary contributions. The members also indicated that it should be a revolving fund, but the replenishment process and the algorithm to support the Director-General's decision to access the funds are still in development. DeLand mentioned the different amounts that might be drawn from the fund, and that the threshold for release of a \$5,000 request should be lower than for a \$50,000 or \$10 million one. A recent assessment panel suggested that WHO recognize different levels of public health emergency, which would allow for a more graduated response.

The auditing procedure for the fund is also still being assessed, but DeLand saw promise in the World Food Programme's pre-audit system, which assigns significant authority to people in the field. After the emergency, they run a post-audit as soon as possible to follow up on the disbursed funds.

Like many large development organizations, WHO relies on voluntary contributions from donors, and this complicates support for operating expenses, DeLand explained. The organization has a biennial budget of \$4.4 billion, 25 percent of which comes from sliding-scale membership dues. The remaining three-quarters come from other contributions, and the earmarking on these contributions is variable. She described the contingency fund as something that would ensure flexibility in the use of funds during an outbreak or emergency response.

Next, Christopher Lane of the IMF discussed his organization's Catastrophe Containment and Relief Trust. Although the IMF has long worked with countries facing natural disasters, its involvement with health emergencies is more recent. The organization has financial reserves that it can lend to a country's central bank after a disaster to support the exchange rate or external payments, or to the budget to close the financial gap the disaster is creating. He also mentioned his organization's role as a stabilizing presence in an emergency because of the safeguards on how they lend; when the IMF is willing to contribute to a budget, it can encourage other financiers to do the same.

Low-income countries, Lane explained, do not have the option of borrowing from capital markets during an emergency, as Mexico did during the 2009 H1N1 outbreak. During the summer of 2014, the IMF provided zero-interest loans to Guinea, Liberia, and Sierra Leone. The first disbursement was on September 17, and they continued in January and February as the severity of the outbreaks became more clear. The total amount lent was about \$300 million, but Lane identified a troubling situation where the cost of dealing with the outbreak fell on the poor countries, rather than the international community benefitting from containment. The IMF's

post-catastrophe debt relief trust was introduced after the 2010 Haiti earthquake. But while the post-catastrophe fund provided debt relief in catastrophic natural disasters, it needed to be modified to encompass epidemics.

The IMF set up the Catastrophe Containment and Relief Trust to cover a group of low-income countries and fragile states. The fund was supported with \$150 million from the 2010 debt relief trust and some other monies left over from the debt relief operations of the past decade. An additional \$150 million was requested at the G20 meeting in Brisbane in November 2014. Lane explained that the debt relief trust was approved in February 2015 and disbursed debt relief to the three Ebola-affected countries. While emergency lending is available to all 188 IMF member countries, emergency debt relief is available to 37 countries whose incomes are below 80 percent of the World Bank International Development Association (IDA) threshold.

When asked about the conditions on the loans, Lane explained that IMF emergency financing has no ex post conditions. It only requires that the recipient states take steps to address the economic and financing imbalances that the organization is helping to cover. He also admitted that, by the IMF standards, the amount of money in the Catastrophe Containment and Relief Trust is relatively limited, and, if it were more, ex post conditions might be necessary.

Next Priya Basu of the World Bank described the Pandemic Emergency Finance Facility, which her organization is developing in collaboration with WHO and private-sector partners. At the G20 Summit in November 2014, the World Bank and IMF were encouraged to develop more flexible financing tools for pandemics; the G7 Elmau Summit provided a further endorsement for the World Bank to develop the facility. At the time of the workshop, the World Bank had not started fundraising for the facility yet, but Basu explained the goals of the program as increasing investment in public health systems, improving global coordination for epidemic preparedness and response, and creating a new financing mechanism that can deploy money quickly for health disasters. The World Bank intends for the Pandemic Emergency Finance Facility to complement WHO's contingency fund and other pandemic financing mechanisms.

The fund will be different from the World Bank IDA funding, which deploys money only to governments in the poorest countries. Basu explained that the facility will be able to fund governments as well as other multilateral and nongovernmental organizations that need to be involved in a crisis response. The World Bank will host the fund and collect the money, but then pass it on to suitable response organizations during a crisis.

The new facility will work though buying private-sector insurance coverage for developing countries, but the payouts will fund the crisis response, not losses. Donors will pay the insurance premiums for the poorest countries; middle-income countries will also be welcome to participate but will

have to pay their own premiums. Payouts will be disbursed in response to a trigger, perhaps something that could be identified earlier than WHO's public health emergency of international concern. Basu acknowledged that the parametric trigger for payout is still being developed, as are the cost of the premium and the diseases to be covered. The World Bank's partners and the donors to the facility will have the opportunity to comment on these matters.

Sands pointed out that emergency financing carries inherent trade-offs between giving countries incentives for preparedness and putting up reasonable barriers to using the money. When asked about these trade-offs, Basu explained that the new facility is only a part of the solution. It is not helpful, for example, to push money on countries that lack the absorptive capacity for it. She explained that the funding can motivate prospective recipient countries and donors to develop crisis response plans. The World Bank has worked with governments and other stakeholders to develop such plans for natural disasters. Similarly, the facility would have a prenegotiated plan with countries to define how payouts would be spent.

In the subsequent discussion, the session moderator asked the panelists about the funding their organizations might make available for preventative measures and health systems strengthening. Basu replied that, while the World Bank's existing financial mechanisms can support health systems strengthening, countries do not necessarily prioritize surveillance and preparedness for an outbreak in their spending; the Ebola crisis highlighted the need for greater investment in this area. DeLand continued on this point, describing the 2015 WHO meeting in Cape Town, where member states discussed the IHR, a legally binding instrument aimed at helping the international community prevent and respond to acute public health threats. Even self-assessments have indicated only about 30 percent of WHO member states comply with these regulations. At the Cape Town meeting, the representatives discussed how to make compliance with the IHR a priority in these countries. DeLand reminded the audience that real change is a slow process, requiring considerable capacity building and changing attitudes; this is different from emergency response, which is necessarily a fast process. Lane agreed, observing that there are competing priorities in poor countries and fragile states, a problem complicated by unusually low tax revenues as a proportion of income. Better tax collection could help governments in these countries expand their budgetary envelope, thereby making more investments an option. Simply having more revenue cannot solve the problem without commensurate assistance in public financial management. Much of financial management depends on transparency and public audit. If the audit function in a country is weak, Lane reasoned, a culture of waste and impunity will develop.

When asked how the three multilateral funds complement each other,



the speakers pointed to the relative merits of each instrument. The IMF fund, for example, goes to support exchange rates or to the central bank, so it relieves fiscal space without being tied to any one piece of the outbreak response. The WHO fund has a unique advantage of being available not exclusively for outbreaks, but also for response to natural disasters and humanitarian emergencies. The World Bank facility could then provide surge financing, especially in the event that the WHO fund runs low on time or money. Basu pointed out that, while insurance may not be an inexpensive option, its value goes beyond the financial; such mechanisms can bring greater discipline to crisis preparedness.

## 4

# Adapting Insurance Products for Pandemic Risk

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- Finance ministers are interested in the direct and indirect costs an outbreak could draw from their national budgets. The ability to quantify these costs is essential to involving finance ministers. (Mahul)
- The cost-to-benefit analysis for paying premiums on disaster insurance involves not only the financial cost of the premium, but the political cost of explaining the value of the expense to politicians. Insurance payouts never cover all the expenses incurred in a disaster, further increasing the political cost. (Mahul)
- Insurance is not a single product, but a way of quantifying risk. Risk analytics make abstract problems more concrete and solvable. (Young)
- Insurance companies' claims adjustment process is administratively complicated and expensive. Parametric insurance pays a set sum against a discrete trigger, reducing the insurers' administrative burden. (da Victoria Lobo, Young)
- Through the process of risk modeling, insurance quantifies and draws attention to the risks of an outbreak, encouraging governments and businesses to develop contingency plans. (Kraut)

- Historical examples help insurance companies price risk, but there are only three or four pandemics in the past century on which to base models. Parametric insurance provides a simple way around the uncertainty in pandemic risk, but only better understanding and quantifying the risk can give proper clarity to the trigger. (Kraut)
- Without appropriate measures to reduce or transfer risk, the losses can only increase, making pandemic risk unattractive to any insurer. (Villalobos)
- Banking and insurance tools are suitable to different risks, but the lines between these risks are not always clear. (Mahul)
- In general, banking products back the creditworthiness of the borrower; insurance products back the cost of the risk. Securitizing a loan is difficult if the recipient is not creditworthy, but insurance simplifies the question to one risk and risk reduction. (da Victoria Lobo)
- It is difficult to ask governments to pay premiums to hedge risks against shocks. (Bornstein, Warden)
- Having donors pay insurance premiums obscures the useful link between the price of the premium and the strength of the preparedness system. (Adams)

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<sup>a</sup> This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

Panos Varangis of the World Bank moderated the next panel on adapting insurance products for pandemic risk. He opened by thanking the previous panelists for introducing the topic and commenting on the use of insurance to finance natural disasters and pandemics. A key difference between the two kinds of risk is the externalities associated with epidemics. A disease outbreak poses a risk to countries other than those most obviously affected because of the contagion. Given this significant externality, Varangis questioned how to calculate the true insurance premium and who to hold accountable for payment. Even with insurance for hurricanes, which hit Caribbean countries on a fairly predictable basis, enthusiasm for paying the premium tends to ebb a few years after a serious storm.

Olivier Mahul of the World Bank built on this point. When asked to discuss his experience in setting up financial plans for disasters with governments, he emphasized the importance of involving the minister of finance from the start. Finance ministers tend to respond to data on the economic impact of the disaster, both direct and indirect. Therefore, the ability to

quantify the effects of an outbreak on the national budget, the economy, and fiscal growth will help the finance minister make informed decisions about how to manage the outbreak risk. Furthermore, the emergency funding presented in the previous sessions was mostly short-term aid. Finance ministers, Mahul advised, will be more comfortable with a secure, long-term funding source that can be accessed at the cheapest possible rate and in the most efficient amount, neither too little nor too much. Finally, the ministers need a plan for budget execution (the protocol for monitoring, adjusting, and reporting on a current year's budget). Too often, he observed, disaster appropriations are available to the ministry of finance but cannot be disbursed. A proper budget execution plan, with a protocol for procurement, might help avoid that problem.

Disaster financing mechanisms can be used to engage ministers of finance in planning with health ministers. Mahul gave an example of a recent operation where the government of Sri Lanka took a line of credit from the World Bank for disasters. The credit ensures that, when a disaster strikes, the government will have money available. As part of the process to establish the credit, the World Bank worked with the Sri Lankan finance ministry to invest in disaster mitigation measures. The bank can guarantee that funds be made available after a disaster, but the strategy behind that funding is important. The product used to fund the response—be it insurance, bonds, promissory notes, or more often, a combination of all three—is less important than the process to introduce it. In general, he saw insurance as working best for extreme or rare events and internal reserves as a more suitable funding source for recurrent problems.

Mahul mentioned that one lesson learned over his years in disaster finance was the value of a bottom-up strategy, one where there is money set aside to respond to the country's immediate needs before the extraordinary ones. Ministers of finance are concerned with extreme events, but usually much more bothered by recurrent ones. The parallels with pandemics, he concluded, are meaningful, with finance ministers more likely to be compelled by financing routine health system advances than pandemic surveillance.

The cost-to-benefit analysis for paying disaster insurance premiums is therefore complicated. Mahul described two main costs that enter into the calculation: the financial cost of the premium and the political cost of explaining to a parliament why they have to make appropriations for a premium when there will be many years of nothing in return. Furthermore, insurance payouts will never cover all the losses a country incurs in a crisis; the payout is invariably smaller than what the politicians expect, and that discrepancy also incurs political cost. He observed that the hesitation of many countries to buy the insurance product has less to do with the price of the premium and more with the political liability.

The liability can be overcome, he acknowledged, especially in middle-income countries. In Mexico, for example, the government uses insurance products in balance with other sophisticated reserve financing during crisis periods. Underlying the government's mixing of financial tools is a calculus through which the direct and indirect costs of the crisis are quantified. In outbreaks, the analysis is further complicated by the question of monetizing the cost of human lives. A proper cost-benefit analysis needs to confront these questions, Mahul continued, and generally favors a risk-layering approach, wherein the budget, banks, and insurers finance different risks depending on their size and frequency.

Simon Young of the African Risk Capacity (ARC) built on these points in discussing the value of insurance products to governments. He cautioned the audience to see insurance not as a single product, but as a discipline of risk analytics, the ability to quantify a risk. Even in the example of hurricane risk, he found Caribbean finance ministers were not able to estimate either the probability or the costs of a Category 4 storm hitting their country. Insurance, he found, brought with it a discipline of quantifying risk and making an abstract problem more concrete and solvable. Quantifying pandemic risk requires data that might not be available, and he suggested that an independent source of infection and death rates for known pathogens would be needed for the risk analysis.

For the nine current member countries Young works with in ARC, the process of quantifying risk starts with a 12- to 18-month contingency planning and risk analysis process, where they work with ARC staff and other experts, including the World Bank, on understanding the benefits of insurance. In this stage, countries design their drought response plan and clarify how they will spend the payout. He estimated the value of insurance payouts in time of drought to a country like Niger at five to one, meaning that it would take \$5 in traditional humanitarian response funding to cover \$1 of insurance payout, mostly because the ARC drought insurance pays on an early signal and in a prenegotiated deployment plan. Traditional or ex post fundraising, he cautioned, cannot meet a country's true needs during a disaster.

The ARC insurance program requires countries to take significant responsibility for disaster mitigation, and Young speculated that something similar could be possible in health. Parametric insurance pays out on the hazard of the disaster, and the terms of the trigger are written in the contract. This helps avoid any gray areas or complicated claims management. Insurers and reinsurers, he said, make their money in the gray area of assessing and reimbursing damages. The assessment slows payment and increases labor costs. The parametric product is more simply underwritten, thereby reducing the price of the risk on international markets.

Nikhil da Victoria Lobo of Swiss Re expanded on Young's point about

the claims adjustment process, describing it as an administratively complex and expensive process, which can hurt the financial performance of insurance companies if not managed well. For this reason, he described the parametric insurance product as the future, especially for pandemics and natural disasters, as it removes much of the administrative burden and keeps costs down. He felt that the industry was at the point now where parametric products could be adapted to pandemic risks; though he was not free to share all the information backing his position, he emphasized the feasibility of the tool.

Aside from the ease of the claims process, da Victoria Lobo saw value in the incentives inherent in insurance. In a parametric insurance risk analysis, countries could be told precisely what actions they could take to lower their premiums. Even the poorest countries could reduce their premiums by putting preventative measures in place. The source of pandemic risk is mostly in the countries that can least afford it, and in such places insurance can be a way to reduce that exposure. He maintained that these countries should have insurance regardless of the quality of their prevention plans, but that they should be given a timeline to put preventative measures in place and reduce their premiums.

Gunther Kraut of Munich Re continued on this point, saying that epidemic risk was something all insurers are exposed to, but diversification of risk is important. A catastrophe happening in one country is not usually a risk in another country, but pandemics defy diversification. He described the insurer's motivation to cover pandemic and epidemic risk as "a double bottom-line approach": the insurer has a desire to develop a profitable product for the company and, in the case of outbreaks, this profit motive aligns with the good of society. The world is already exposed to pandemic risk, he continued, but it is not insured.

Kraut echoed the earlier sentiment that risk modeling is a very important instrument through which insurance benefits society. The modeling process draws attention to the full-blown pandemic situation and also to the more likely outbreak scenario, and encourages the development of a containment strategy for this event. The better quantified risk may push businesses to buy, for example, nonphysical business interruption coverage because, if all the workers take ill during an outbreak, that is not a risk any company wants exposed. In this way, he continued, the World Bank's Pandemic Emergency Finance Facility can spur the development of other insurance products over time. Time also gives a better understanding of the risk being insured. New and innovative products will be expensive, but as time passes and the product becomes more established, the market will bring the price down.

Historical examples help insurance companies to price risk, but there are only three or four full-blown pandemic examples in the past century to

inform these models. Stochastic scenario modeling can help build additional information into the risk analysis, or modelers can focus on the early outbreak scenario for which there is more information available. Kraut cautioned against basing the insurance trigger only on the number of fatalities. Parametric products provide a simple way around the uncertainty inherent in pandemic risk, he concluded, but the better defined the risk is, the more clarity that will bring to identifying the trigger.

José Ángel Villalobos of the World Bank continued the discussion of insurance, describing it as one of the final parts of the risk management process. He encouraged the use of historical data in pricing pandemic insurance, going back to the Middle Ages if need be. He also stressed that, without appropriate measures to reduce or transfer risk, the losses can only increase, and no company would be willing to insure it. For example, during the Ebola outbreak, pharmaceutical companies were called on to produce vaccines, but the companies feared possible lawsuits at national and international levels. Villalobos encouraged managing this risk in advance of the epidemic and working out liability insurance for pharmaceutical companies.

In the subsequent discussion, the panelists were asked about the suitability of banking and insurance tools for different kinds of risk. Mahul acknowledged that the line is not always clear. Insurance may be better suited to catastrophic risks, raising the question of what is meant by a catastrophe. He pointed to ARC's emerging position of a disaster as something likely once in 5 or 10 years. In such a case, a cost-to-benefit analysis is still necessary to determine if the insurance solution is the best option. He saw the World Bank's role as helping governments make this calculation, to enable them to stand in their parliaments and guarantee that they will have the necessary money in the event of a disaster. Da Victoria Lobo agreed, discussing the distinction between insurance and banking products. Banking and credit products, he explained, look at the creditworthiness of the recipient; insurance products look at the risk. Private banks might not be willing to lend to the government of Liberia to fund its Ebola response. Securitizing the loan would be complicated, but insuring it much less so because insurance is based on the cost of the underlying risk; the discussion is more about risk reduction than creditworthiness.

Young expanded on this point, explaining that, unlike indemnity insurance which covers actual losses, parametric insurance might be thought of as the derivative of a triggering event. The derivative is available for indirect costs and does not require a full understanding of all the possible outcomes of the trigger event. ARC, he continued, is a capitalized insurance company bolstered on the insurance market that offers its client countries the best possible price for different types of parametric insurance with an eye to risk diversification across Africa. Jeanette Vega of the Chilean National

Health Fund suggested that this diversification could be seen as going against the principle of solidarity, which is important in public health. Da Victoria Lobo responded that pandemic risk is global and shared, much like group risk in a health or life insurance pool. Nevertheless, there is value in understanding how one's individual risk factors affect the pool because that empowers people to reduce their risks.

Martin Meltzer of the U.S. Centers for Disease Control and Prevention questioned the use of insurance products for pandemics because the probability of an outbreak is more difficult to model than the probability of an earthquake or storm. Da Victoria Lobo responded that the people who work on those risks would argue that quantifying them is equally challenging. Especially with climate change, it is hard to say how weather patterns will emerge, and the uncertainty has to be built into all varieties of insurance products. Kraut clarified that giving the probability of occurrence is not the same as predicting the next outbreak. At the same time, Adam Bornstein of the Global Fund cautioned against overselling the value of pandemic insurance as a hedge for risk in the life insurance market, as people in poor countries do not generally have life insurance. He and Staci Warden of the Milken Institute agreed that it is very difficult to get governments to pay premiums to hedge risks against shocks. Jennifer Adams of the U.S. Agency for International Development pointed out that asking donors to pay premiums for the poorest countries might obscure the useful link between premium price and the strength of the preparedness system. She described rapid access to cash as very much a limiting factor in Ebola response, but logistics and management were also serious problems not related to money. Mahul responded that a long-term interest in fiscal discipline could assuage the problem; setting aside an outbreak contingency fund is probably not an option in much of the world, but having the fiscal space to absorb the first weeks of a crisis could be.





## 5

# Innovative Financing Mechanisms for Preparedness and Response

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- The International Finance Facility for Immunisation (IFFIm) secures long-term, legally binding commitments from donor governments whose pledges provide the capital to issue bonds for 20 years or longer. (Sison)
- IFFIm provides Gavi with cheap capital, allowing the organization fiscal space to invest in health systems in the 73 poorest countries in the world and negotiating power with manufacturers to reduce the cost of vaccines. (Egerton-Warburton, Sison)
- Pandemic financing poses two problems: short-term liquidity and risk management. There is probably room for both insurance and banking products in solving these problems. (Sison)
- UNITAID is a global health agency that funds work in HIV/AIDS, tuberculosis, and malaria. Sixty percent of UNITAID funding comes from a levy on air tickets in certain countries. It is a stable and predictable revenue source. Legislators must approve the levy, but it never goes to the national budget, so it is not vulnerable to shifts in political will. (Marmora)
- Funding in international development is a means to do work, not an end in itself. It takes administrative discipline to use funding for its designated purpose, rather than redirecting it to other worthy causes. (Marmora)

- The Global Fund uses revolving funds to draw donor contributions over a period of 5 or 6 years rather than all at once. Donors to a revolving fund are assured that, if their contribution is not used, it will be returned. (Bornstein)
- The Global Fund also has a \$30 million fund that can be drawn down (for expenses related to HIV/AIDS, tuberculosis, and malaria) during health crises and humanitarian emergencies. (Bornstein)
- Social impact bonds might be a good way to invest in pandemic preparedness. As long as there are course correction measures to ensure efficient spending and investors are compensated for their lending, the rate of return need not be particularly high. (Bornstein)
- Pandemic financing for the poorest countries should draw on the credit risk of the rich countries to buy capital as cheaply as possible. (Egerton-Warburton)
- The problem of having money for pandemic response should not be confused with the problem of spending it. Developing countries should be expected to invest in their own people and to improve public financial management. (Marmora)

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<sup>a</sup> This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

After lunch, participants reconvened with a panel on innovative finance for pandemic preparedness and response. Juan Costain of the World Bank moderated this discussion, which started with Paolo Sison of Gavi<sup>1</sup> discussing IFFIm. He described IFFIm as a simple concept—a way to secure long-term, legally binding pledges from nine donor governments (Australia, France, Italy, the Netherlands, Norway, South Africa, Spain, Sweden, and the United Kingdom). Their pledges form the capital base that is used to issue bonds on the capital markets, accelerating 20-plus-year funding commitments from donors. IFFIm bonds are investment grade—the organization has an AA/AA1 credit rating, allowing it to provide cheap funding. Historically, IFFIm has been able to borrow at a funding cost lower than the aggregate of its donor governments. Since IFFIm's inception in 2006, it has issued \$5 billion in bonds, half of which has been disbursed to Gavi, accounting for one-third of the organization's funding.

IFFIm, Sison continued, has allowed Gavi to be more innovative and to act earlier, before donor pledges would be due. The financial space has

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<sup>1</sup> Officially, Gavi, the Vaccine Alliance.

allowed the organization to invest more broadly in strengthening health systems in the countries it serves—the 73 poorest countries in the world—and to have more leverage with vaccine manufacturers. The more capital Gavi can deploy against vaccine purchases, the lower they can bring vaccine prices, and the more sustainable the market becomes.

He explained that IFFIm is a charity with no staff registered in the United Kingdom. The IFFIm board members serve voluntarily and lend their expertise to the facility's management and strategy. The World Bank manages the IFFIm treasury, and Gavi is its only beneficiary. He praised the risk and financial mechanisms the World Bank placed in the IFFIm structure, citing them as the reason why the facility is able to borrow from the market at such attractive rates. The gearing ratio limit, for example, restricts the amount of leverage that IFFIm can have at any point in time. Leverage, in turn, is based on the present value of donor pledges, making IFFIm always overcollateralized. There is also a liquidity requirement that IFFIm have cash on hand to pay for interest and principle on any of its bonds 1 year in advance. All this makes the facility's inherent risk equivalent to AAA and extremely attractive to investors. It is also difficult for any investor to decline to buy a fairly priced bond for immunization, so IFFIm is in the fortunate position of investor interest exceeding Gavi's funding needs, Sison observed.

IFFIm has a unique ability to bridge the time when donors can fund a vehicle and the time when the funds are needed, providing funding quickly and at low cost. These are all features that would be valuable in pandemic response, Sison continued. An IFFIm-like facility for pandemics could do well to replicate the long-term donor commitments that are part of IFFIm. He encouraged the audience to consider what might happen to the donor commitments if they were not needed during the 10- to 20-year period they were made for. Perhaps there could be conditions put on the commitments, he continued, so that if there was no outbreak in the time frame, the commitment could fall away and then be renewed. It might also be possible to have the fund recipient countries pay into the financing vehicle in an amount proportionate to the country's economy.

Sison called back to the previous session on insurance products and described two basic problems to solve. First is the short-term liquidity problem, the need to have cash on hand quickly when in a crisis. The other is the market problem, the need for a market where pandemic risk is better understood, better quantified, and better managed. There is probably room for both insurance and banking products in managing the two distinct problems, he concluded.

Christopher Egerton-Warburton of Lion's Head Global Partners continued the discussion of IFFIm, as he was involved in its development in the mid-2000s. When asked if the current regulatory environment would allow

for developing a similar tool for pandemics, he said that he found political will to be the main driver of government support. If political will is absent, governments tend to give regulatory obstacles as their reason for not participating; but if the will is there, any regulatory challenge can be overcome.

He echoed Sison's point about the value of frontloading (the allocation of costs at the beginning of a program) and emphasized IFFIm's role in providing predictability of funding. The IFFIm balance sheet allows Gavi to procure ahead of donor funding cycles. Similar predictability would be valuable in health systems work, and in most areas of global health and development. Still, Egerton-Warburton cautioned that pandemic financing might not do well to introduce a totally new bond issuer into the market, as that would only complicate the buying and issuing of bonds.

The discussion then switched to analysis of a different innovative financing tool, the UNITAID air ticket levy. Lelio Marmora of UNITAID described the program, saying that, along with mobile communication, the Internet, extractive industries, banking, and finance, air transport is one of the industries that has most benefited from the globalization of the past 30 years. Air transport has seen growth rates of 5 percent a year over the past 30 years and is forecasted to double its passenger load from 3.3 billion to 7 billion per year over the next decade.

The air ticket levy was put in place in 2006 in an agreement between 11 countries and UNITAID; it yields about €200 million per year—a cumulative 2.5 billion for funding the response to HIV/AIDS, tuberculosis, and malaria, working to complement the Global Fund, the President's Emergency Plan for AIDS Relief (PEPFAR), the President's Malaria Initiative, and other programs in the same field. Were the same levy applied to all European countries, he continued, it would make another \$1.7 billion available for international development. The levy is in place, Marmora explained, because of political will in participating countries. But after being made law, the contribution is less vulnerable to shifts in political will. The tax on air tickets cannot be redirected to the national budget, so it is relatively stable. The stability allows recipient countries to know how much money they can expect from the levy, easing their planning and ability to spend.

UNITAID gets about 60 percent of its funding from the air ticket levy, and Marmora mentioned the administrative discipline it takes to keep the funding tied to its purpose, avoiding the temptation to use it for outbreak response, climate change, or any number of other worthy development projects. There are also administrative challenges to spending the money properly within its designated boundaries. He explained that proper spending means minimizing administrative costs, having openness in the management of the organization, and also managing with flexibility and tolerance for risk. Risk taking is an important part of the process, he continued, and

can pay off in greatly increased funding streams. Still, he cautioned, in international development, money is a means, not an end in itself. Increasing funding is not a victory; the victory is what the funding enables.

When asked how to evaluate the value for money of different funding plans, Marmora hesitated. Value for money is a popular concept now, but it is not clear what it means, though he credited Partners in Health, Results for Development, and the UK Department for International Development (DFID) with bringing intellectual rigor to the question. Sometimes “value for money” is used to refer to return on investment, but it can also mean the public health effects of the investment; these are different and sometimes conflicting concepts. For UNITAID in particular, its goal is to support more innovative ways to save lives, so the organization is somewhat removed from the achievement. UNITAID worked with the U.S. Agency for International Development and the Gates Foundation to develop a rapid diagnostic for tuberculosis, but the value for money from that device, while clearly substantial, is hard to calculate. He suggested that part of the value comes from time saved, and therefore lives saved and new infections avoided, and part of it from the more efficient allocation of doctors’ time, to say nothing of the avoided opportunity costs to the patient and his or her family from time spent at the hospital. By its best estimates, the UNITAID portfolio has a return on investment between \$1:\$5 and \$1:\$20. He also mentioned the value for money to the airline industry, a business that stands to be seriously hurt by an epidemic. The industry wants to see the maximum possible investment in a ticket levy.

Adam Bornstein of the Global Fund was the final panelist in the session. He described three main ways his organization raises and deploys capital. There are contributions from donor governments, either through direct donation over 3 years or a promissory note. Recently, some donors have asked that their contributions not be drawn down all at once but over 5 or 6 years. In response, the Global Fund adapted a World Bank system of pulling donor capital from a country or from a promissory note, which allows for a donation to be made on a revolving basis over a fixed number of years. In practice, he continued, if the organization gets a \$500 million donation from one country in a lump sum, and the same amount from another country in a 5-year revolving fund, the donation is available in five \$100 million chunks. If the money is not drawn down in the specified period, it is returned to the country. The money does not need to be repurposed because it is only used on as-needed basis, which Bornstein described as more efficient. He explained that a revolving fund might be useful for pandemic financing. Revolving funds avoid some of the administrative expenses associated with permanent funds. Donors to a revolving fund can also be assured that, if their money is not used, it will be returned.

The Global Fund has a new investment vehicle for emergencies: a \$30

million fund that can be drawn against for health crises and also during complex humanitarian emergencies, but only for expenses related to HIV/AIDS, tuberculosis, and malaria. Bornstein admitted that Gavi had an advantage on the Global Fund in that Gavi is able to leverage its balance sheet for health systems strengthening and similar activities. He speculated that, if funds like the Global Fund had a blanket mandate to use their money during crises, things would change, but otherwise they must spend according to their mandate.

When asked about involving the private sector in pandemic financing, Bornstein emphasized that these people would be interested in the risk-adjusted return on their investment. When asking a private lender for capital *during* an emergency, there is essentially no risk-related return because the risk is already 100 percent. If there were a structure that allowed money to come in ahead of the risk, that might be more attractive to many lenders.

He suggested that social impact bonds might be a good way to invest in pandemics. Social impact bonds take investors' money and put it into an intervention, with measures in place to course correct and to repay governments and investors upon success. He saw the necessary pieces of pandemic management—surveillance, rapid response, a credit line, a cash distribution system, and capacity building—as an interesting structure that would lend itself to a social impact bond, perhaps with returns of 3 to 10 percent.

Private-sector investors, he continued, are happy when their money goes out and is put to work. As long as they are compensated for the lending, he felt the rate of return need not be particularly high. Nowadays, he continued, all investors—public or private—want to see that their capital is being recycled. Provided there are course-correction measures in place to ensure the money is being spent properly and efficiently, finding investors should not be difficult.

In the open question session, the panelists were asked about the value of investing in epidemic prevention. Marmora said that, even from a financial perspective, prevention and building health systems are much cheaper than treatment or response. The problem, he continued, is that politicians do not always see it that way; they are under pressure to spend on the most visible projects with a political impact. Tore Godal of the Ministry of Foreign Affairs, Norway, disagreed. He said that governments are willing to pay for prevention but that the distinction between preparedness and response spending was artificial, as the financing instrument will probably be used for both. Like any investor, his country's government wants to spend efficiently and leverage its balance sheet, perhaps by guaranteeing financing from 2025 to 2035 for any outbreak between 2015 and 2025. This kind of financing could take some risk out of the equation, he observed.

Da Victoria Lobo then asked the panelists how to manage credit in countries with high debt-to-GDP<sup>2</sup> ratios. Sison replied that funding should be tied to the recipient countries' ability to pay, and Bornstein agreed that the International Monetary Fund guidelines on concessionary loans have already set out the terms by which loans do not set back poor or indebted nations. Egerton-Warburton harkened back to the story the audience had heard that morning of how Mexico managed the 2009 H1N1 outbreak. The government had to raise money for response, then ask the World Bank for a loan to pay it back—a loan that was ultimately canceled. Such financing is an option in Mexico because it is a middle-income country and a sophisticated user of capital markets, and it has a good relationship with the World Bank. The same is not true of Liberia, for example. Egerton-Warburton suggested that for the poorest countries and fragile states it would be necessary to invert the process: to give the credit first, borrowing against the credit risk of the donor countries and using the strongest balance sheets in the world to buy fast capital at the lowest possible cost. The domestic contribution would be the last money accessed, not the first. A pandemic financing structure, he concluded, should rely not on Liberia's ability to borrow, but on Norway's. Bornstein agreed, as it is not reasonable to ask any poor country to set aside money for an extreme and unlikely situation when they cannot meet routine expenses. At the same time, a participant observed that the foreign direct investment and private capital flows evaporate with an infectious outbreak, a problem that catches the attention of heads of state and finance ministers more than routine health problems ever do.

Marmora then pointed out that there are really two problems to solve in pandemic financing: the problem of getting money and the problem of spending it. The two, he said, should not be conflated. Funding is just the means to do the work of development, not an end in itself. He cautioned against relying on the budget of G8 countries to support the whole development agenda and asked that more pressure be put on developing countries to invest in their own people. Marmora spent 8 years at the Global Fund before going to UNITAID, so he was aware that the Global Fund has \$1 billion unspent in West and Central Africa because it is extremely difficult to disburse more than \$17 to \$20 million in many countries in the region. "Of course," he continued, "we can throw the money from a plane and say you disbursed it, which is what happened for many years, but if you want to be respectful of the taxpayers' money . . . you have to do the right thing." In some countries this will mean a zero-cash policy, in other places pressure to change the procurement policy, and always considerable attention to fiduciary arrangements for avoiding graft.

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<sup>2</sup> Gross domestic product.



A pandemic, Egerton-Warburton observed, is by definition a situation where things have gotten out of control. Grant capital is needed in such situations, and that money is not to be recouped. At the same time, he welcomed the emerging expansion of private-sector investment in development, and the opportunity for donor governments to make long-term commitments through instruments like IFFIm. He commented on the inefficiency of donors planning for disasters by holding large amounts on their balance sheets until the end of the year, not knowing if that cash would be used.

Bornstein reflected that nobody wants to suggest people should profiteer from pandemics, but people do make money during them. Some people lose money, and others gain. During a crisis, logistics companies and drug manufacturers will be asked to contribute, and there is considerable good will to their contribution. But they also need to make a living. If the private sector is to be involved with pandemics, then it needs to earn a return on its investment if for no other reason than that there is a cost to capital and an opportunity for loss. Therefore, he continued, social impact bonds are a promising financial tool for pandemics.

## 6

# Identifying Triggers and Modeling Risk

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- Financing and surveillance systems can work together in an iterative process to better understand pandemic risk. (Wolfe)
- The reproductive rate of a virus is a function of the number of people in a network and the likelihood of infection passing between any two of them. The principle of social proof, whereby people behave similarly to others around them, influences the spread of human disease; models need to account for the effects of social proof on disease spread. (Woo)
- In the early stages, there is some degree of opinion in identifying the most menacing infectious threats. People have to make decisions on imperfect data, and it is difficult to convey the uncertainty to government agencies. (Meltzer)
- The rarity of pandemics, concerns with data quality, and the instinct to hide potential outbreaks all increase the uncertainty in pandemic modeling. (Madhav)
- The concern with Ebola and avian influenza might be misguided, as the next epidemic will not be a repeat of one we know well. (Troedsson)
- A simple trigger may be desirable given the data limitations and the need to make decisions quickly in a crisis. (Madhav, Meltzer)

- However, using a simple trigger also has downsides. Surveillance for infectious diseases may yield false positives, resulting in an unwarranted alert that could have serious consequences. (Troedsson)

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<sup>a</sup>This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

Prashant Yadav of the University of Michigan convened the last session of the day, a panel on identifying triggers and modeling risk. He put the first questions to Nathan Wolfe, whose company Metabiota worked with the African Risk Capacity (ARC) on incorporating pandemic risk into ARC financing models. Wolfe emphasized that pandemic risks are diverse and should not be grouped together. Throughout history, animal viruses have infected humans, but the relative isolation of human populations helped contain these events. He called the audience's attention to HIV, an animal virus that crossed into humans. Returning to the comparisons between epidemics and natural disasters, he likened HIV to a hurricane still blowing after 40 years; but with epidemics, it is possible to change the course of the storm as it happens.

Wolfe suggested that, like hurricane risk, epidemic risk can be transferred through insurance and that the market for such insurance would only grow over time. He pointed out that, if surveillance activities are limited, response needs to increase, and that the finance mechanism might do well to work in an iterative process with the preparedness and response processes. In the ARC system, the process of insuring the risk requires such iteration, as the country partners work with ARC to develop their contingency plans and better understand the risk to be insured. Wolfe commended the emerging interest in developing stronger surveillance and early warning systems. He pointed to the Cameroonian interagency pandemic prevention program as an example of coordinated surveillance systems across government agencies.

Gordon Woo of Risk Management Solutions built on these points, agreeing that pandemics were different from natural disasters in many ways. Unlike the risk of storms, it is not possible to predict when a new virus is about to emerge, as the propagation of the virus is mediated by complex human behavioral variables. The principle of social proof, whereby people try to behave in similar ways to others around them, influences the spread of human diseases. The reproductive rate of a virus is determined by the number of people in a given social network and the likelihood an infection might be transferred between two people in that network. Customs such as

the exchange of a kiss or handshake as a greeting and other social factors are crucial in calculating the spread of the outbreak. The Ebola crisis transformed social customs, like greetings and funerals, as people in the affected countries changed social norms in an attempt to control the outbreak. Their behavior helped mitigate the crisis, but modeling the spread of disease at the early and later stages of the epidemic would need to account for vastly different sociological variables.

Mathematical modeling of outbreaks in sparsely populated areas, he continued, is complicated. The epidemiologic modeling used for insurance purposes does not generally have to account for this problem as it deals mostly with large catastrophes, but in sparse social networks these equations can break down. Sometimes alarmingly high case-fatality rates are hidden in rural or remote environments.

For Martin Meltzer of the U.S. Centers for Disease Control and Prevention (CDC), the initial concerns in an outbreak generally come down to three points: the potential unmitigated impact of the epidemic (the number of cases, hospitalizations, and deaths), the potential impact of interventions, and the duration of the outbreak. During the 2009 influenza outbreak, the initial data on case-fatality rates were wrong, and the first responses were based on the assumption that the disease was much more lethal than it actually was. There was, however, a spring wave of the virus that afforded some data, which allowed them to better estimate the potential effects of the outbreak and the planned interventions.

He directed the audience to the CDC's Influenza Risk Assessment Tool, which offers a framework for assessing the potential impact of an influenza strain based on its clinical severity and transmissibility relative to previous pandemics and seasonal flus. He pointed out that, often in the early stages, there is some opinion and nuance to making this assessment. There are also challenges to understanding the trigger point for an epidemic, Meltzer continued. First of all, it takes time to collect data and understand the emerging pathogen. There are usually also questions of data accuracy, and the lack of data in some countries means that analysts commonly extrapolate information on the spread and impact of disease in the United States or Europe to other parts of the world.

Meltzer favored simple triggers over those dependent on complicated modeling and data of questionable accuracy. He has found information about virulence and case fatality to be the most compelling data for decision makers in public health. While people have to make decisions on imperfect data, he observed that it can be challenging to talk about probabilities and uncertainties in the data with public health agencies.

Nita Madhav from AIR Worldwide then described the different kinds of models available to quantify the uncertainty Meltzer described. These models can help understand how disease spreads in a population and how

mitigation factors can alter the trajectory of the epidemic. Models can shed light on which mitigation efforts would be suitable for Ebola, for example, and how those are different from those suitable for influenza.

Madhav cited four major pandemics in the past century, acknowledging that there might be differences of opinion about which ones to count. In any case, pandemics are infrequent events, increasing the uncertainty in pandemic modeling, to say nothing of the reliability of the data or the instinct in some places to hide cases early on. She and her team model where an outbreak might start and the response capacity in those places and, with different combinations of variables, attempt to measure how the disease would spread.

Improving data quality would reduce the uncertainty in the models and ease decision making, Madhav continued. Even in forecasting the length of an outbreak, the difference between 12- and 18-month emergencies is meaningful, and all stakeholders would be grateful for better precision in such estimates.

In the open discussion period, the audience raised questions about model ambiguity. Woo acknowledged that ambiguity is a curse of any hazard, but particularly epidemics. He suggested that the best way to deal with the ambiguity would be to convene a group of experts to review a range of models and ask for their judgment on identifying the risk. In catastrophe risk, it is now fairly common practice to use expert judgment as a formal process to quantify risk after modeling and, he continued, modern markets are fairly savvy with handling ambiguity in models.

Meltzer clarified that he saw a difference between the preepidemic modeling, which can be complex and warrant expert attention to the nuance in the data, and the models produced at the beginning of an epidemic to determine the trigger point. The latter, he felt, should be kept simple because the audience during an emergency is diverse and not necessarily well versed in mathematical modeling. Madhav agreed, stressing the value of flexibility in emergency response plans. She found that simplicity in a trigger point was desirable from a response point of view and also from the investors' position, as they may feel comfortable with a model that can be more easily replicated. She assured the audience that, while models are only as good as the data feeding into them, there is still a need to make do with imperfect information.

Tendai Biti, formerly of the Ministry of Finance of Zimbabwe, brought up the particular challenges of fragile states in preparedness. He described his region as being particularly prone to disasters and epidemics because of the lack of infrastructure and capacity. He mentioned a recent cholera epidemic in Zimbabwe that killed 4,000 people in a short time because the agencies were not ready. He questioned how a country like his could even produce reliable data to use in modeling. Yadav suggested that the devel-

oping global network of CDCs might be able to help by supplying a data architecture that could help modelers in less developed countries. Meltzer agreed that this network was growing and improving, but pointed out that there are still only small amounts of relevant data readily available.

Hans Troedsson of the World Health Organization (WHO) then reminded the audience that the emphasis on Ebola and avian influenza might be misguided. The next global epidemic will not be a repeat of the ones history has prepared us for. He recalled his experience managing an influenza outbreak in Vietnam, where the local laboratory found a set of specimens all H5N1 negative but retesting in a more developed country indicated hundreds of specimens were positive. Had they pulled the trigger then, it would have been disastrous because it eventually became clear that the laboratory in the developed country had used the wrong primer and produced false positives. If they had used the simple, conservative trigger in that situation, WHO would have run down its financial reserves quickly. But he recognized that pulling the trigger too late, as in the Ebola crisis, can also have negative consequences.

Woo pointed out that, apart from the question of modeling, this experience pointed to the need for better surveillance in developing countries. Much as the insurance industry paid for the first fire brigade in Britain, he reasoned, the life insurance industry could pay for the surveillance systems badly needed in poor countries. As long as the quality and amount of data available from these countries are poor, then the identification of the trigger will be fraught.

Madhav and Godal saw room for monitoring of population movements, both daily commutes and large-scale migrations, in understanding the spread of epidemics. Tappero agreed, saying that modeling of any trigger point is only as reliable as the data underlying the model. The innovative disease surveillance program in sub-Saharan Africa aims to improve data quality by providing technical and financial support for data collection and monitoring in that part of the world. An integrated electronic data management system could allow for more efficient use of this information.



7

## Financing Challenges In-Country

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- Effective relief financing is timely, targeted, and strategic. Strategic relief financing can position a health system to deal better with emergencies. Investment in public infrastructure and a properly diversified economy could protect developing countries from the economic toll of an epidemic. (Kollie)
- Even in countries with a relatively advanced health system to build on, preparing for an outbreak can take almost a year. (Bampoe)
- Money is not the only limiting factor in emergency response. The basic physical and administrative infrastructure that supports routine operations needs to be in place before a crisis. (Bampoe, Biti, Kollie)
- Weak institutions and technical capacity in developing countries impede aid effectiveness. A sustainable development strategy would give more attention to building institutions and public financial management. (Biti)
- Outbreak response is fundamentally a quick process, where social and political factors will have undue influence on the government's decisions. Misallocation and misuse of resources are not uncommon when working on a short time frame. (Liu)



- During an epidemic, governments must balance the need to control the outbreak against the risk of needless disruption. Failure to control the disease is a more visible error, which can incentivize overreaction. (Liu)
- Where civil society is not strong, governments may prefer to underreact, downplaying a crisis that might reflect badly on them politically or scare off investors. (Biti)
- A good relationship between the ministry of finance and the ministry of health can facilitate the flow of funds in response to health needs. In China, the Ministry of Human Resources and Social Security has served as an intermediary between the two. (González-Pier, Kollie, Liu)

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<sup>a</sup> This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

The second day of the workshop opened with a panel examining the challenges of managing money once it has been disbursed to a country. James Kollie, deputy minister for fiscal affairs in Liberia; Gordon Liu, professor of economics at Peking University; Victor Bampoe, deputy minister of health in Ghana; and Tendai Biti, former minister of finance in Zimbabwe, discussed some of these in-country financing challenges, including the allocation of resources across activities and to short- and long-term needs.

Kollie described how during the Ebola crisis Liberia faced twin problems: revenues were decreasing at the same time that the demand for expenditure increased exponentially. The increase in spending was driven by the epidemic itself. Most of the equipment, facilities, and supplies needed to fight Ebola were not available in-country and had to be brought in. Expenditures for personnel increased because health workers in hot spots needed hazard pay, and enforcing public health rules required additional security.

The decline in revenue was more complicated. The Liberian economy had been hit heavily by the decline in primary commodity prices before the epidemic began. With the emergence of Ebola, many multinational companies and organizations slowed down their work. The mass exodus of expatriates affected the service sector, with ripple effects on other parts of the economy. Kollie called on development partners to invest in key economic infrastructure and help countries diversify their economies before a crisis in order to mitigate such revenue impacts.

To deal with an epidemic effectively, Kollie identified three important qualities of relief financing: it needs to be timely, targeted, and strategic. Timely relief financing might involve an emergency fund that is available

immediately and then replenished through pledging conferences during the crisis. Coordination among donors can ensure that funding, once available, targets actual gaps; benefits are reduced if donors focus on one task and leave other things undone. If applied strategically, relief financing can position a health system to deal better with future emergencies. For example, rather than being placed in isolated areas, treatment units could be built on existing health facilities where they could remain in use after the crisis. In this way, Kollie said, the crisis can become an opportunity.

But mitigating the impact is more difficult once the epidemic is under way. It is important, therefore, to take action before the crisis and invest in resilient systems—not only for health, but also for banking, education, and other social services. Kollie suggested testing these systems in the preparedness stage to make sure they can respond during a crisis. In addition to stronger service delivery, Liberia and its development partners can minimize the impact of future crises by diversifying the economy and making key investments in infrastructure such as power, ports, and roads. Affordable and reliable power is important not only for light manufacturing and value-added work, but for services, including health care. In the same way, good roads that support commerce and industry also ease transit to health posts.

Bampoe reminded the group that Ghana did not have any cases of Ebola, and therefore it provides a different perspective on preparedness than Guinea, Liberia, or Sierra Leone. A few years ago, Ghana was declared a lower-middle-income country, leading to a reduction in donor aid. At the same time, the country has been making increased investments in health—\$1.1 billion per year. While this figure seems large, Bampoe explained that it is not uncommon to run out of something as basic as vaccines. Most of the money is tied up in the national health insurance program, paying health workers, and running facilities.

Ghana has developed a fairly robust health system guided by its experience with avian flu, cholera, and other epidemics, he continued. The country has a national technical coordinating committee that meets to discuss disease issues and an interior ministerial body that provides the policy. Learning from the experience of Nigeria and the United States, Ghana set up a major operations center to serve as a coordinating body between the government and the technical experts. Through a process called a sector-wide approach, all the development partners gather to discuss what to fund. Over the years, the U.S. government and other partners have helped build the Ghanaian health system, strengthening personnel, infrastructure, and the collection of data. Legislation has decentralized the health sector and ensured that health management teams at the district level have access to dedicated resources. Preparing for Ebola meant building on these systems that were already in place.

To combat the disease, Ghana put in place a three-pronged strategy

of public education; point-of-entry screening and strong surveillance and contact tracing; and construction of Ebola treatment units to prepare for case management. In all three, the country built on what already existed. Even so, it took about 3 months to get the needed public education in place and 9 months to prepare the Ebola treatment units. Ghana sent some of its personnel to Liberia and Sierra Leone to have hands-on experience in such units.

Bampoe drew several lessons from Ghana's experience. First, preparations cannot be done overnight. Second, funding is important, but not sufficient; the country must know how the money will be used. Third, more money might not be what is needed. Bampoe observed that, during an emergency, a country depends on the same infrastructure that supports the delivery of goods at other times; improving infrastructure, such as railways, is part of preparedness. Finally, he discussed the importance of the sector-wide approach in bringing donors together under a government-led plan.

Biti, who was minister of finance in Zimbabwe from 2009 to 2013, described the challenges that weak states face in dealing with pandemics and other calamities. One problem is that fiscal expectations are immense. The demands of the provinces far outstrip the budget, and there is no fiscal legroom. Another problem is a lack of institutional and human capacity. Early warning systems in Guinea could have nipped the Ebola epidemic in the bud, but such systems did not exist, and the crisis spread. Acknowledging the inherent trade-offs, Biti asked the audience to make the long-term development of African institutions, human capacity, and fiscal buffers a priority for development.

He described the need for better coordination within the international community, where discord is "a permanent feature" and turf wars among agencies waste valuable time. In fragile states, the problem is exacerbated because donors do not want to give money directly to the government and must spend time deciding who will govern the trust fund. The problem goes beyond interagency coordination: even development agencies and their local representatives may speak at cross purposes.

It is a question of the whole response architecture, according to Biti, who said the focus should be on the various issues that make aid ineffective. A donor may provide the money, but the country can only absorb a small percentage. Donated grain often rots in the warehouse for want of the capacity to move it to the field. Beyond the finance ministry, other government departments—the users of the money—may not know how to prepare a requisition or manage finances. Marshaling money is only one part of the problem. The solution, Biti said, is institution building. He asserted that donors, as well as Africans, focus too much on physical infrastructure while overlooking soft infrastructure, such as a functional system to manage public finances.

Following Biti's remarks, Liu discussed what he called a fundamental economic question: how to balance multiple demands on public spending. In the management of public finance, the government seeks to optimize the allocation of resources guided by economic principles such as value for money (as discussed in Chapter 5) and approaches like cost-benefit analysis of multiple needs.

How the government makes decisions about resource allocation depends in part on the time horizon—whether resources are being designated for long- or short-term needs. In the long run, governments have more time and better information, and economic principles can govern budgetary work across sectors and populations. But in the short term, as when responding to urgent needs in a pandemic, social and political considerations play a much bigger role. According to Liu, this type of short-term decision making often leads to misallocation and misuse of resources. Though underreaction gets considerable attention, overreaction is also a risk. In China and other countries with similar central governments, Liu said that overreactions dominate when it comes to pandemics and other large crises. With the 2003 severe acute respiratory syndrome (SARS) outbreak, the 2008 earthquake in Sichuan, the 2009 H1N1 influenza outbreak, and the 2015 warehouse explosion in Tianjin, such overreaction led to a large misuse of resources, in his estimation. In Sichuan, unpacked boxes of goods are still stacked in warehouses after the 2008 earthquake.

Pandemics and other crises will always bring chaos, but institutional policies can enable efficient catastrophe response. For example, in 2009, the Chinese government began to implement universal health insurance coverage for the entire population. Today, this insurance policy covers primary care services for 97 percent of the population. Primary care insurance is also being used to handle rare but expensive health catastrophes. The Chinese government is establishing separate catastrophe insurance with premiums drawn from the residuals of primary care insurance. Liu saw this as a way to ensure protection for short-term catastrophes as well as long-term primary care.

Liu explained that, when planning for a crisis, governments have to balance the risk of failure to control the disease against the failure to limit needless disruptions. Failure to control the disease is very visible. Governments can easily be held responsible for this first kind of error, but accountability for the second is more elusive, incentivizing overreaction. Liu suggested that the answer again is institutional policy setting, which can improve governance.

Governments can also play a role in minimizing disruptions caused by the public. Driven by fear and panic, these disruptions arise due to misinformation or a lack of knowledge. Providing the public with accurate and transparent information as soon as possible can control rumors and prevent

panic. Liu acknowledged that this is not easy to do. He gave the example of the recent Tianjin explosion: the government did not want to tell the public what had gone wrong until it was sure and, as a result, misinformation spread. Liu concluded that the government should provide the public with information, even if that information is uncertain, before panic and rumors run rampant.

In response to Liu's comments, Kollie and Biti addressed the issue of overreacting versus underreacting to epidemics and other crises, noting that in their countries the incentives tend to favor underreporting. As Kollie observed, reports of disease outbreaks can have negative consequences for economies and can create panic among the population. Properly managing that information is important, not only to protect health but also to promote social stability.

Biti noted that a weak monetary and surveillance tradition in Zimbabwe has created a structural tendency to underreact to crises. In rural areas, people may not react appropriately because they do not understand the situation. Governments, on the other hand, have a tendency to hide or downplay a crisis because it would reflect badly on them politically or from the perspective of investors. He used the example of HIV/AIDS, an epidemic that many African governments denied for years even as it ravaged their populations. Harkening back to Liu's point about accountability, Biti suggested that the incentives would be different if civil society were stronger. In the age of social media, every citizen has a voice, and practices may change.

According to Liu, policy may also change the way a government approaches crises. In general, incentives favor curative action over less-visible preventative measures (Brahmbhatt and Jonas, 2015). But if the central government links the occurrence of any crisis—regardless of how it is handled—with the governor's promotion, local authorities will take a different approach. China has used this policy, and Liu saw promise in it, but cautioned against its overuse as fear of retaliation can discourage the cooperation of local authorities.

In response to a question about whether efforts to improve preparedness should focus on general economic development, overall health systems strengthening, or specific public health capacity building, Bampoe noted that different countries would make different decisions because they are at different levels. But he also stressed that these three areas form a continuum, and none can be strengthened alone. Ghana's three-pronged strategy for Ebola relied on broad social mobilization in addition to employing public health measures like surveillance and preparing health care facilities. He said that these investments need to be made over the long term, and they need to be country led.

Kollie, too, said that prevention needs to be approached holistically. It may be a health crisis, but other systems affect it. He gave the example

of trade restrictions imposed by other countries because of the epidemic in Liberia. When a country is not self-sufficient in food and other essential supplies, such restrictions not only hurt the economy; they damage the response effort. He agreed with Bampoe that strengthening preparedness would look different for each country, and, for some, would require more help from the international community. In Liberia, where the overall budget amounts to half what Ghana spends on health, they do not have the fiscal space to make the necessary investments. Throwing money at only one part, without fixing the surrounding systems, will not get results.

Biti carried this point forward, saying that health care, public health, and economic development are not mutually exclusive. He called for a development model that would build sustainable states and uplift the entire population, not only some parts. Money alone is not enough. According to Biti, the development model must also include democratization and strengthening of both institutions and civil society.

A discussion arose over how to foster a good relationship between the ministry of finance and the ministry of health so that the flow of funds to health needs is as smooth and effective as possible. Eduardo González-Pier acknowledged that, at least in middle-income countries, the relationship is often governed by distrust, with ministries of finance viewing ministries of health as budgetary risks, rather than partners. Kollie noted that, in the case of Liberia, the relationship between the two ministries is good. Many of the people in the ministry of finance worked previously in the ministry of planning, where they worked with other ministries and came to appreciate the strategic nature of government funding. During the Ebola crisis, a core team from the finance ministry worked closely with their counterparts in the health ministry not only to get the money, but to think strategically about where the money was most needed. One priority that has emerged is the payment of health workers; partners can provide medicine and other supplies, but the government must ensure that health workers get paid.

Bampoe observed that the Ghanaian ministry of health has been successful in acquiring resources directly from donors, which has given it some independence from the finance ministry. At the same time, the money coming from the finance ministry to the health ministry has expanded dramatically, despite some concern that the funds are not being used efficiently. In Ghana, 2.5 percent of the value-added tax pays for health insurance, creating some tension with other ministries that have fewer resources. For these reasons, the finance ministry has encouraged the health ministry to get more value out of already allocated funds before asking for more money.

In the parliamentary system of many former British colonies, Biti pointed out, the finance minister has a lot of discretion over the budget. Strong leadership may harness this power in pursuit of a common vision

that prioritizes social goods such as health and education. But, in weak states, these goods can easily become targets of competing interests.

Advocating again for the importance of institutional policy setting, Liu explained how the Chinese government had addressed the problem of trust by bringing in a third party, the Ministry of Human Resources and Social Security, to serve as an intermediary between the ministries of finance and health. Resources are now allocated through the insurance policy.

When asked to what extent the Liberian government had had oversight of external funds coming in for Ebola response, Kollie said that there was no such accountability. They still have no idea how funds were used. While donors demand transparency from recipient country governments, he saw no reciprocation of that openness. To counter this problem, Liberia decided to lead by example; in setting up their National Ebola Trust Fund, they have incorporated detailed accounting requirements and committed to publishing regular reports on how money was spent. They hope that this will motivate donors to follow suit. For now, the ministry of finance has no control over how the funds are spent, making it difficult to direct those investments strategically. Kollie reiterated a point made previously in this panel and others: at a certain point in the crisis, the country and its partners must start thinking about what happens after the crisis and how they can apply relief financing strategically.

Echoing this idea, Martin Meltzer observed that, “The best insurance is to build capacity. The best way to respond to the next pandemic or big epidemic is to use systems already running.” But he noted that there will still be gaps—unmet demand for certain supplies and services—and asked how governments can best prepare to respond to such gaps. In Ghana, they have focused on developing an integrated plan that anticipates common needs and can be built on according to the specific event. Liu suggested that public–private partnerships may serve as a good model; the private sector can provide the essential goods and funds through an insurance mechanism, and the public sector can step in to cover unmet needs.

## 8

# Donor Considerations and Crowding-In

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- Donors can be smarter and more catalytic with their investments by linking funds to domestic financing and demanding clear results. (Godal)
- Improving health systems requires attention to governance, including not only the government's ability to react to a crisis, but its accountability and responsiveness to its citizens. (Adams)
- A well-run domestic financing system will both quickly improve fiscal space and lay the foundation for future progress. (Adams)
- New pools of money for development do not exist; only the relative importance of different funding streams changes over time. More efficient management, especially in procurement, could improve the value of the money available. (Ghosh)
- Limitations in the existing tracking mechanisms and inconsistent reporting by donors make it difficult to ensure accountability or target resources to real needs. (Hohlfelder)
- Strengthening public financial management systems can support preparedness and response, as well as primary health care. (Adams, Yadav)
- Describing poor health systems and the accompanying pandemic risk in terms of macroeconomic vulnerability could help translate those concerns to a different audience. (Ghosh)



- To ensure donor coordination, partners must clearly understand their specific roles and responsibilities, as well as who will lead each aspect of the response. (Godal)

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<sup>a</sup>This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

In the next session, a panel of representatives from four donor organizations discussed the constraints they face, the potential for new and existing funding mechanisms, and the need for better coordination and transparency among donors and other stakeholders in a health emergency.

Tore Godal of the Ministry of Foreign Affairs, Norway, described his country's contributions to the Ebola response. Initially, Norway responded to requests from nongovernmental organizations (NGOs) such as Doctors Without Borders (MSF) and the Red Cross who were already active on the ground. Later it provided support to the World Health Organization (WHO), because of that organization's key role in surveillance and data provision, and to the African Union, because of its commitment to supply health workers to the three affected countries. Norway also channeled funds through the United Nations (UN) Mission for Ebola Emergency Response, the body responsible for coordinating the UN response.

In early October 2014, with cases doubling each week and the U.S. Centers for Disease Control and Prevention (CDC) projecting potentially several hundred thousand cases by early 2015, Norway decided to fund a vaccine trial. They selected the riskiest vaccine, because it was the strongest, and the most difficult country, Guinea, where the epidemic was likely to persist the longest. A clinical phase III trial began in March 2015 with support from multiple partners, using a ring-fence design rather than a randomized trial, which MSF and the Guinean government had opposed. Six days after vaccination, there were no cases of Ebola among the 3,500 people who had been vaccinated, while there had been 16 cases in those who were not vaccinated. Because of the vaccine's clear effectiveness, those running the trial decided to vaccinate the control group as well. Experts have hailed the vaccine as a breakthrough.

Godal emphasized Norway's commitment to financing the prevention and response to outbreaks, but at the same time, the country wants to be smart with its contributions. This has meant increasingly linking to domestic financing and demanding results for its investments, which fall into four main categories.

First, he mentioned the Norwegian investment in research and develop-

ment, an area of competitive advantage for the country. Second, Norway supports the Global Financing Facility of the World Bank, which is directly linked to ministries of finance, not health, in International Development Association (IDA) countries. Godal estimated that linking their contribution to the results through payment for performance improved efficiency by about 20 percent, allowing health workers to deliver more and better care and supporting conditional cash transfers that enable the poorest women to come to the clinic. He saw that this method of support by supplying incentives could also be applied to preventative care. In pandemics, such incentives might be used to reward the first laboratories to identify a confirmed pathogen. Norway's third main category of health spending is in health security. Through bilateral collaboration, the Norwegian Institute of Public Health works to strengthen public health institutes in Ghana and other developing countries. Godal noted that others have developed similar partnerships, and he saw promise in them, as the African Union has set a goal of having a CDC-type organization in every country on the continent. Finally, Norway is the third largest contributor to Gavi and a major contributor to the Global Fund. In order to mobilize the resources necessary to develop robust public health systems, Godal suggested consolidating work on infectious diseases, pandemic threats, and antimicrobial resistance.

Jennifer Adams of the U.S. Agency for International Development (USAID) explained that U.S. bilateral assistance in health is generally directed at essential interventions and priority populations (e.g., mothers, newborns, and children), and priority diseases such as tuberculosis, malaria, and HIV/AIDS. The agency tries to work in ways that help countries improve their health systems, but its ability to support health systems strengthening depends on the strength of the evidence linking such programs to improved health and on the willingness of the Congress to invest over the long term. In Adams' estimation, they now have solid evidence of how health systems improvements benefit health.

The Ebola epidemic has drawn attention to the need for stronger health systems. Adams called Ebola a catalyst, highlighting the importance of investing in resilience, service integration, and interoperability. To support the response and rebuilding efforts, the Congress appropriated \$66 million for health systems strengthening in the countries affected by Ebola, a move that Adams heralded as unprecedented.

There are challenges to building more resilient, higher-performing health systems, particularly in West Africa. One is improving governance. Adams described governance as not only the government's capacity to mitigate the impact of future crises, but also its accountability and responsiveness to citizens. The Ebola epidemic revealed the importance of building trust between government and citizens. She also called attention to gender

imbalances, noting Ebola's disproportionate toll on women and the critical role women will play in the recovery of their communities.

Adams expressed USAID's commitment to working with all partners to build resilient health systems and to marshal new funds for doing so, such as the congressional appropriation for Ebola and the Global Health Security Agenda. She also saw domestic taxation as an important revenue source. In discussing taxes, she first asked whether pandemic preparedness should be considered a public good or a *global* public good, acknowledging that it may be both. The distinction is important because it raises the question of the relative responsibility of a country's government and the international community for preparedness. If it is a public good, donors can still support greater domestic public spending to finance that good.

Adams described the current push for increasing domestic revenues, most recently articulated in the Addis Tax Initiative, signed in July 2015 at the Third International Conference on Financing for Development. Thirty countries and international organizations launched the initiative and signed a commitment to stop the billions of dollars lost every year on account of a narrow tax base, weak administrative capacity, poor tax compliance, and other problems with tax collection in poor countries. The signatories have committed to double technical cooperation and domestic resource mobilization by 2020. They also agreed to an agenda of policy coherence, a way to ease cooperation for international development.

USAID has been involved in projects that deal explicitly with tax administration and compliance for some time. Within its global health activities, the agency has been working with the ministries of finance and health in a small number of countries to increase domestic resources for health. To some extent, this requires expanding the overall size of the economic pie. For countries that have experienced considerable economic growth in recent years, a well-administered domestic financing system can provide immediate benefits, even as it lays the foundation for greater progress over time, Adams concluded.

Gargee Ghosh of The Bill & Melinda Gates Foundation explained that, early in the Ebola epidemic, the foundation provided rapid emergency cash grants to CDC, the United Nations Children's Fund, and WHO. Then in September 2014, while continuing to disburse emergency grants, it announced about \$60 million in grants focused on four priority areas. First, the foundation spent approximately \$13 million to mobilize global organizations to accelerate their actions. Second, it invested almost \$30 million in research on new interventions. Third, it devoted about \$10 million to emergency operations centers in the three affected countries. Fourth, it helped bordering countries prepare for exposure and prevent the virus' spread. She described the foundation's role during the crisis as "providers of cash with deliberate, strategic intent."

She pointed out, however, that the foundation avoided innovative finance tools like pledge guarantees because such mechanisms would have taken too long. Setting up a finance facility through public–private partnership takes at least 8 months, often longer. Contracts must be established in advance, Ghosh urged. Alternatively, donors could incorporate the most useful of these mechanisms into their regular practices so that they could be implemented more quickly.

Beyond the emergency phase of the Ebola response, the Gates Foundation has continued to support research and development of medical products for tropical diseases. They are also eager to translate the urgency people felt about the Ebola response into an urgency for health systems and primary health care. Ghosh said that a major priority for the foundation is building consensus in the global community about a core set of primary health care system indicators—that is, what constitutes a basic system that can both achieve routine functions and scale up in the event of an emergency.

Similarly, the Gates Foundation is investing in the Child Health and Mortality Prevention System, a network of data and surveillance centers around the world that are intended to support both routine service and emergency response. Starting in 6 countries, the system will eventually track child morbidity and mortality data in 20 countries. Ghosh framed the program as an investment in local capacity that could serve as a source of trainers during an emergency.

She expressed skepticism about the idea that large pools of new funds could be found for development. While the relative importance of different sources ebbs and flows over time, the pools themselves have not changed; they include domestic resources, private for-profit resources like foreign direct investment and capital flows, official development assistance, and out-of-pocket payments. Official development assistance has held steady at about \$130 billion per year, with roughly 12 percent of that going to global health, a figure Ghosh did not expect to rise dramatically in the near future. She encouraged the audience to make better use of the funds available—for example, by reconsidering the cash-on-hand procurement model. In terms of domestic resource mobilization, Ghosh cautioned that improving the tax-to-GDP<sup>1</sup> ratio by even a percentage point or two is extremely difficult.

She concluded by saying that routine preparedness must be a shared responsibility between donors and recipient countries; strengthening these systems will require a plan with clear targets. Emergency response, on the other hand, will be externally financed through the mechanisms discussed on the first day of the workshop.

While acknowledging the importance of mobilizing money, especially

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<sup>1</sup> Gross domestic product.

early in the response, Erin Hohlfelder of the ONE Campaign explained that new challenges arose once the funds began to flow. She was particularly concerned with tracking pledges and disbursements and identifying the remaining gaps. It may be possible, she explained, to find information on a single donor's contribution, but the information is collected ad hoc, preventing easy comparisons across sources. Donors' inconsistent reporting and the limits of financial tracking tools only complicate the problem.

She described four different tracking systems used to monitor contributions to the Ebola response: the UN Office for the Coordination of Humanitarian Affairs (OCHA) Financial Tracking Service, a World Bank pledge tracker, the UN Special Envoy on Ebola's consultant reports, and ONE's interactive tracker for resource flows. All four mechanisms shared certain limitations, including understaffing and an overreliance on donor self-reporting. Relying on self-reports allowed for inaccuracies to be carried forward, with a false and confusing appearance of standardization. Furthermore, the different systems are obliged to track and report different information. For instance, OCHA's Financial Tracking Service was designed to track only humanitarian flows, which do not include all kinds of assistance. During the Ebola epidemic, donors were simultaneously pledging humanitarian resources, in-kind contributions, health workforce contributions, long-term recovery functions, and research and development investments. None of these tracking systems followed the money from the pledge or disbursement to final spending. Even if such a system existed, she observed, donors might not report in sufficient detail to allow for that type of analysis.

Hohlfelder acknowledged that donor reporting on funding flows ranges widely. Some donors are very transparent and willing to work with groups like ONE to better track commitments. While a small group of donors provides intentionally misleading information, most are inconsistent in reporting not for malicious reasons, but because of poor coordination within the organization or government. Some donors report only on disbursements or only commitments, for example; they have different methods to account for in-kind contributions. Such discrepancies make true comparisons difficult. Accounting for absorptive capacity only complicates the equation, and she echoed Lelio Marmora's observation that throwing money from an airplane is not the same as disbursement.

Hohlfelder emphasized that better tracking and accountability should not be seen as a dry accounting exercise, but rather as an opportunity to save more lives. She said that at the time of the workshop, more than 1.5 years into the Ebola epidemic, no one could accurately say how much money had been pledged or spent on the response, and this ignorance has hindered recovery. A common complaint during the outbreak was the need for more health care workers. But it was never clear where, or how many,

or what kinds of health workers were needed. It is difficult to support a solution without more specific information on the problem, but human resources flows are as hard to track as financial ones. A country might have committed to sending a certain number of health workers, but it remains frustratingly hard to count how many came or what work they did.

The information problem Hohlfelder described got in the way of donor coordination during the Ebola epidemic, hurting the response. Without a shared, real-time understanding of the gaps, these problems have lingered. She praised the Mano River Union Marshall Plan to rebuild Guinea, Liberia, and Sierra Leone, but saw challenges in determining what remaining emergency funds could be repurposed for recovery, as well as what funds represent new commitments, rather than money bilateral donors were already planning to spend in these three countries.

Hohlfelder emphasized that the push for accountability comes not only from international organizations like ONE, but also from local civil society groups. Activists in Guinea, Liberia, and Sierra Leone are eager to change their countries' reputations for mismanagement; they want to hold people accountable for delivering services. A lack of reliable information gets in the way of translating such sentiments into action.

Some donors abuse the lack of transparency, pledging funds to the Ebola response that otherwise would have gone toward malaria, HIV/AIDS, or child immunization. They get credit for supporting the response when, in fact, their actions damage the larger global health effort that is critical for recovery, Hohlfelder said. Even journalists have found it difficult to obtain sufficient, good quality information about funding for the Ebola response. Some end up conveying misleading information based on the limited data they find; others give up entirely and do not write a story.

Acknowledging the scope of the problem, Hohlfelder once again emphasized the opportunity to develop a better system. In the run-up to the new Sustainable Development Goals, momentum has grown for a data revolution. Better data could give a more accurate picture of returns on investment and provide a stronger foundation for the risk modeling, insurance schemes, and other financing mechanisms discussed during the workshop.

In the question-and-answer session that followed, Prashant Yadav suggested that enabling public financial management systems to have greater agility, or cash velocity, is an often overlooked investment that could benefit both preparedness and response. Adams agreed that improving this agility is an important goal, but not something to do in the midst of a pandemic. Over the past few years, the USAID health program has been working with the ministry of finance and the ministry of health in Liberia on how the finance ministry releases funds to the health ministry to support primary health care throughout the country; USAID then provides funding based

on a results framework. Health experts tend not to have much experience with finance, so the program has involved a lot of mutual learning as USAID health staff learn the constraints on the ministry of finance. They then work with the ministry to address these issues. Under the program, the Liberian government has supported both public-sector health services and primary health care services provided by other organizations in the country. As such, it may serve as an effective model in emergency situations when responders include the private sector, civil society, and NGOs, in addition to the government.

Ghosh was more pessimistic about the prospects of public financial management for pandemic preparedness, saying that the solution must be more comprehensive. But improving public financial management overall remains a challenge. She added that more should be done to communicate the economic impact of health risks. Describing poor health systems and the accompanying pandemic risk in terms of macroeconomic vulnerability could help translate those concerns to a different audience.

Daniel Hanna of Standard Chartered Bank asked about the balance between creating new sources of money and building agile systems, at both the donor and country levels, that can harness existing sources in the right place at the right time. Switching from cash procurement to supply chain financing could help improve agility, but donors may lack the risk tolerance for such a move. The Gates Foundation, along with the Norwegian government and UK Department for International Development, has been trying to identify mechanisms that could balance these concerns with the need to procure products quickly. Ghosh repeated her earlier assertion that there are no new sources of financing; rather, the focus should be on developing mechanisms that can tap into these sources quickly for an emergency response.

Throughout the discussion, a number of panelists and workshop participants returned to the problem of donor coordination. Godal suggested learning from the response to earthquakes and other natural disasters, which happen more frequently. In those relief efforts, partners clearly understand their specific roles and responsibilities, as well as who will lead each aspect of the response. This ensures better coordination. Country leadership also plays an important role, and he encouraged the group to consider this when thinking about financing tools.

Hans Troedsson brought up the related issue of earmarking funds, highlighting the burdens that earmarks place on the recipients, including WHO; these burdens have financial implications and work against donor coordination. According to him, placing restrictions on how money can be spent impedes recipients' ability to get the job done. Godal suggested that recipients could encourage less earmarking by improving accountability and reporting on results. Insufficiency in these two areas has pushed Norway

away from budget support and sector-wide approaches and toward earmarking funds.

Adams pointed out that, even within the U.S. government, coordination remains a major challenge. USAID's Office of U.S. Foreign Disaster Assistance (OFDA) is the first responder in emergency situations, generally natural disasters. In the case of Ebola, a health emergency, OFDA had to work with many other government agencies, including CDC and the U.S. Department of Defense. When OFDA ran out of money, it had to borrow money from the general USAID development budget. The supplemental congressional appropriation, out of which OFDA repaid that loan, involved four different funding streams and a requirement to report to the Congress every 30 days. Tracking this funding requires a lot of work, which must be done by people whose attention is consumed by the emergency response itself. Coordinating and tracking contributions across donors only adds to the complexity.

Reflecting on the difficulty that ministers of finance face when they cannot account for donors' activities, Ann Marie Kimball of Chatham House asked whether donors might consider establishing a code of ethics to improve transparency. Adams praised the idea, but noted that structuring such a code would be complicated. Nevertheless, it could help donors align with country plans and orient them toward strengthening health systems, down to the level of implementation. She suggested that this could be a good time to put something in place, building on the information and experience that has come out of the Ebola response.

A code of conduct is not the only way to achieve greater transparency. If better information would help donors make better decisions about how to allocate scarce resources, there could be a market- or incentive-based solution. Staci Warden described a solution to the information problem in bond markets. Financial institutions submit the price and volume of their trades to Markit, a financial information services company, allowing them access to the aggregate data of all other contributing institutions. Something similar might work for donor funding.

Adams and Hohlfelder cautioned that this information has many different audiences, and data transparency may take different forms according to the end users. USAID now puts all of its expenditure data on a publicly available platform called the Foreign Assistance Dashboard, but many of the agency's partners still prefer to get that information directly from the local USAID office. Other interested parties, such as civil society groups, may not have the benefit of such close relationships. One big data portal will not necessarily fix the problem, Hohlfelder said, noting that the solution must be systemic. The quality and availability of data have serious implications for modeling risk and implementing the various financing tools discussed at the workshop.



Ghosh added that the data problem goes well beyond transparency, which has actually improved, and more attention should be paid to reporting results. Poor measurement methods make comparisons difficult even when donors are spending on the same thing.

Adam Bornstein proposed separating the response and the recovery efforts, especially when thinking about how to distribute resources. The response to a pandemic represents a global public good and could be accomplished somewhat easily, he argued. As evidenced by the Ebola response, the military possesses the capacity to respond quickly. Prequalifying the military to serve as a quick response team for epidemics might be an effective solution and, at least from the perspective of allocating funds, a simple one. Donors would then focus on the long-term rebuilding efforts, maintaining their systems as usual. But Godal objected to the suggestion that the military could be used as a first responder in all situations. Politically, that would not be feasible. Deploying the military should be seen as a last resort, he said, and even then, regional mechanisms like the African Union may offer a better solution.

Godal also disagreed with the distinction between public goods and global public goods: the responsibilities, and the financing, necessarily overlap. Rather than try to divide the available resources, donors should think about how to use them catalytically, he said. Building on this point, Hohlfelder talked about the pressures that governments face to justify their foreign aid budgets, however small they may be. Specific, measurable outcomes provide a more compelling case than long-term investments like health systems strengthening, which are hard to measure and to communicate. The health systems story may be best told in parts, Godal suggested—focusing on management, supply chains, human resources, or surveillance, etc., rather than talking about health systems strengthening. Disaggregating in this fashion could also give donor organizations a way to leverage their resources for building health systems. For example, Gavi might choose to focus on supply chains; the Global Fund might take on responsibility for surveillance and response.

## 9

# The Role of the Private Sector

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- Panic and social distancing can devastate economies. The government can mitigate the effects of an epidemic with effective communication and ongoing investment in general development and resilient financial systems. (Warden)
- Many companies already engage in risk management and business continuity planning, but there is room for better communication with the public sector and shared contingency planning. (Stroman)
- Preparedness has a good return on investment, saving both time and money. (Stroman)
- Engaging the private sector early and establishing relationships before a crisis allow for a faster, stronger response. (Hanna, Stroman, Warden)
- Getting money into an affected country and then into the hands of health workers in the field presents major logistical challenges. Special protocols for emergencies could better facilitate the former, mobile payments the latter. (Hanna)
- The public sector can provide funds, information, and an enabling environment to harness private-sector strengths in service of public goods like preparedness. (Crush)

- Public–private partnerships require a strong private sector, which governments can encourage by creating an environment conducive to business. (Crush)
- Many health systems components represent core capacities of the private sector, including management, organization, data, and logistics. As countries identify gaps in their health systems, they could look to the private sector for ways to fill these gaps. (Sison)

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<sup>a</sup>This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

The next panel considered how to engage the private sector in preparedness and response. In his opening remarks, moderator Eduardo González-Pier pointed out some of the incentives for the private sector to get involved, in terms of both what it could gain and what it would lose in the event of an epidemic or pandemic. But keeping them engaged after the urgency of a crisis wears off has often proved difficult. Four panelists—Staci Warden of the Milken Institute, Trish Stroman of the Boston Consulting Group (BCG), Daniel Hanna of Standard Chartered Bank, and David Crush of the International Finance Corporation (IFC)—discussed the private sector's role in preparing for and responding to epidemics.

Warden described the devastating toll epidemics take on an economy. On the supply side, an epidemic reduces the capacity to produce; on the demand side, it decreases consumption. The 1918 flu pandemic reduced world economic output by 5 percent; the severe acute respiratory syndrome (SARS) epidemic in Canada cost \$2 billion, or 3 percent of gross domestic product, and the Ebola epidemic may cost \$4 billion regionally.

According to Warden, the most important way for the government to cushion the economy from these effects is to invest in general development on a regular basis. These investments include building basic infrastructure such as communications systems, as well as ensuring resilient financial systems and functional capital markets. The macroeconomic environment plays a critical role, she said; an inflationary response, for example, can destroy private-sector growth. She also pointed to the value of the government safety net in mitigating economic shocks.

In the United States and many other countries, the private sector tends to view preparedness and response as the government's job. Warden encouraged early involvement of the private sector as a way to change this mindset. She reiterated Adams' earlier point about the value of taxes as a way to make tangible the private contribution to the government's preparedness program.

The government can do a number of relatively simple things to mitigate the effect of epidemics on the private sector. The bulk of an outbreak's economic impact comes from contagion avoidance and social distancing (Brahmbhatt and Jonas, 2015). The recent outbreak of Middle East respiratory syndrome (MERS) in Korea has not killed many people, but social distancing has seriously harmed the economy. This kind of cost sets epidemics apart from other humanitarian crises. In earthquakes, for example, there is no concern about the contagiousness of the damages.

Effective communication on the part of the government can prevent panic and minimize unnecessary avoidance behavior. Just making information available can provide a valuable service, as the private sector looks to the government for guidance and advice. The government, Warden continued, can encourage the private sector to undertake business continuity planning and lead by example, developing such plans for their own agencies. There are transferable lessons in the contingency plans of any large organization; by sharing their standardized emergency protocols, governments can help private companies develop something similar. She pointed out that companies could vastly improve their preparedness with relatively simple steps such as having an emergency checklist and the contact information of their emergency contacts, a process the government can encourage. One option would be for the government to convene senior management of private companies, taking care not to neglect the small- and medium-sized enterprises, for emergency planning. Planning for pandemic emergencies need not start from scratch. Warden mentioned the extensive counter-terrorism planning the U.S. government has already done and saw that as a starting point for pandemic preparedness.

She acknowledged that the workshop in question was about financial action for outbreaks, but emphasized the value of statutory and regulatory incentives. In 2002, for example, bioterrorism legislation intended to improve the security of the U.S. food supply provided federal funding for preparedness efforts. It can also be useful to identify businesses that will be critical to crisis response and involve them in contingency planning. Warden observed that, while mandates can be problematic, regulation levels the playing field so that no company puts itself at a disadvantage by taking a particular action. Governments can also force the private sector to consider how its activities might add to pandemic risk.

In commenting on the financial consequences of panic and fear, Warden emphasized the role of government in ensuring resilient financial systems. She described how the UK Financial Services Authority runs an exercise every few years to test the resilience of the financial sector. In 2006, they gave a scenario of a pandemic lasting 6 weeks. The exercise inspired recommendations on the management of central banks to ensure sufficient cash in hand and a way to deliver it during an outbreak and a code of conduct

for organizations handling cash, among others. She also encouraged governments to think about regulatory forbearance during an emergency, by definition a rare situation and one where prudential limits are likely to be breached.

When asked how to persuade governments and international organizations to act on the pandemic threat, Warden suggested making the case in terms of the economic cost as well as the human one. Real-time information on the actual costs incurred is helpful; it is also possible to make inferences from the consequences of analogous disruptions, such as strikes. She highlighted the potential for social unrest and likely budget deficits as compelling reasons to invest in preparedness, but acknowledged the lack of cost–benefit analyses to inform decision making.

Corporations look at investment decisions differently, considering capital budgeting metrics like net present value and the internal rate of return. Yet they buy fire insurance, she noted, although the risk of a pandemic is greater than that of a fire; Warden attributed this more to the good market for fire insurance than to any cost–benefit analysis. She concluded that, when it comes to outbreaks, there are many unknowns, and it is important to be aware of and honest about that unpredictability.

Stroman then shared lessons from the work that she and colleagues have done with the World Economic Forum on the role of the private sector in health emergencies. She saw widespread willingness to get involved in outbreak response on the part of the private sector, and potential interest to work on preparedness as well.

Most companies already have business continuity plans and engage in risk management planning, Stroman explained. Though not necessarily profitable, such exercises are still good business, as they can help avoid significant spending during a crisis. She spoke enthusiastically of developing a public–private network for preparedness, but doing so would require connecting public- and private-sector continuity plans. She recognized that such connections do not exist currently; even during the crisis, public- and private-sector communication was ad hoc. As small- and middle-sized businesses have fewer resources to direct to contingency planning, the public sector may need to do more to engage them.

Stroman saw room for the private sector to contribute to public health surveillance. Operating in remote areas, companies are often well placed to recognize a disease outbreak before the public sector does, but they may not know how to respond or even where to report concerns. Stroman mentioned a World Economic Forum pilot program aimed at strengthening relationships among private companies and between the private sector and the government in two or three countries. She hoped there might be interest in better communication about this and various other preparedness programs mentioned during the workshop.

This welcome interest in preparedness pays off, Stroman said. Working with the United Nations Children's Fund and the World Food Programme, a recent BCG study estimated the return on investment in preparedness and found that the programs always saved time during an emergency and usually saved money, too. More research articulating the value of such programming could drive more effort at preparedness in both the public and private sectors.

The public and private sectors each have their comparative advantages. On the private side, there are generally fewer restrictions on how to spend money or contribute in kind, allowing for faster response. By BCG estimates, the private sector contributed around \$500 million, mostly cash, to the Ebola response. While the data are imperfect, Stroman acknowledged, it is clear that the private contribution was substantial and represents a real opportunity if directed well. There is also considerable depth of skill in private industry, which can be tapped in a crisis. In the Ebola response, companies contributed many skills, from logistics to communications to building and running treatment units.

Stroman stressed that companies must know where the gaps are and how those gaps can be filled in order to contribute effectively. Like traditional donors, the private sector would like greater speed and transparency and a better flow of information. Many wanted to help, but had trouble figuring out how to contribute to the Ebola response; contributing to preparedness is only more complicated. She saw room for a single clearing-house to help direct the efforts of the private sector, thereby avoiding this problem.

But the most effective way to address this problem is to prepare in advance, Stroman reminded participants. For example, FedEx and United Parcel Service have long-standing relationships with donor agencies, which paved the way for seamless collaboration during the Ebola crisis; involving telecommunications and data management firms was not as smooth. She ended her comments by further emphasizing the value of early action to involve businesses in preparedness.

Hanna echoed Stroman's call for early engagement, paraphrasing the BCG/World Economic Forum report: a crisis is not the time for the public and private sectors to exchange business cards (World Economic Forum and Boston Consulting Group, 2015). Hanna described his company's involvement in the Ebola response and the lessons he has drawn from this experience.

Standard Chartered was the only large, international bank on the ground in Sierra Leone during the Ebola crisis. It was therefore responsible for payments from multilaterals, and Hanna described the logistical challenge of disbursing money during the crisis. First, the money had to move from the multilateral's central treasury to aid agencies in the affected coun-

try. Then the agencies had to deliver this money to the workers in the field who would actually spend it.

Over the past few years, banks and regulators have considerably strengthened know-your-customer and anti-money laundering rules. The new protocols require things like verified signatories to vouch for exactly to whom and for what monies are disbursed. While these rules are sensible, it is difficult for aid organizations to have that kind of precision during a crisis. Local and international regulations may further slow the movement of funds. For example, aid often moves in U.S. dollars, but the U.S. Department of the Treasury restricts which nationalities can handle those funds; obtaining waivers for this requirement is possible, but takes time. Getting the names and necessary identification in place required a lot of work by Standard Chartered and its clients, and want of a single signature could halt the entire process for days. Hanna suggested that a crisis protocol allowing regulators to waive some of these rules for well-known and respected agencies in situations of demonstrated need could help reduce the time it takes to get money into a crisis-affected country.

Once the money arrived in Sierra Leone, it still had to reach the frontline workers. Only 10 to 15 percent of Sierra Leoneans have a bank account, and neither Standard Chartered nor the local banks have extensive branch networks. Added to this was the difficulty of moving cash around a country in the midst of an epidemic. In the absence of alternatives, aid workers would collect cash from the nearest bank branch and distribute it by hand to health workers and contract tracers. Hanna acknowledged that this was not an ideal solution during the outbreak of a highly transmissible virus. But the response depended on these workers, and paying them was critical. Mobile payments could have solved the problem; although Sierra Leone has such technology, the network is not as developed as in other markets such as Kenya. Mobile phone technology improved other aspects of the response, Hanna noted, describing an African text message campaign to raise funds for Ebola relief.

He described working with the IFC early in the epidemic to provide financial support to local banks. The IFC suggested concessionary funding and guarantees might be useful. But local banks did not want to receive additional funds or to keep lending, however attractive the price, because their balance sheet problems consumed them. Recalling the example of H1N1 in Mexico, he explained that Sierra Leonean banks could not manage the capital response they had in Mexico.

Standard Chartered worked with the UK Department for International Development (DFID) and the CDC Group, a British development finance organization, to set up a \$50 million lending facility for Sierra Leone in only 10 weeks. The facility provided local companies, including small- and medium-sized ones, with the cash necessary to support reconstruction

and response. A lack of working capital had prevented well-placed local businesses from mobilizing supplies and workers to the relief effort. With local products available, aid workers were obliged to import fewer goods, thereby both speeding response and supporting the local economy. Hanna suggested such projects be facilitated in the future by preparing a list of logistics and financial services companies and relevant local partners that might be called on in an emergency.

Crush then discussed the role of public-private partnerships in supporting pandemic response. First conceived as a way of shifting public debt to private companies that might better manage it, the partnerships engage businesses in long-term, contractual arrangements. Unlike the traditional tendering process, their emphasis is on output specifications, rather than input specifications. In a public-private partnership, the government specifies the goals, and the businesses identify cost-effective ways to achieve it. Contracts lock in 10- to 20-year agreements, guaranteeing steady business to the private company and service delivery on tight terms to the government. At their best, these arrangements allow society to benefit from private sector-level services through public-sector funding. The model can work even in fragile and poor states. In Lesotho, the IFC has worked with a public-private partnership to replace the old government hospital with a new hospital and clinics to feed into it.

There are a number of ways governments can encourage partnerships with private industry. First, they can create an operating environment where the private sector can thrive. Some governments do so by creating a public-private partnerships office, but Crush admitted that such arrangements can add to bureaucracy rather than decrease it. Ease of registering property or of obtaining credit are important concerns for business people. He praised regulations conducive to business (ones that protect investors, ease the registration of property, and facilitate trade, for example) as regulations that liberate, not constrain. Citing the IFC's work in Ethiopia, Ghana, Malawi, Nigeria, Tanzania, and Zambia, he said that governments are increasingly willing to embrace pro-business regulation. As more countries get involved, momentum for change increases, and the pool of African experts available to advise their counterparts in the region grows.

Crush encouraged the audience to involve the private sector in mitigating pandemic risk. International public-private partnerships like Gavi and the Global Fund have become important health funders. Private equity funds may also have a role to play. He mentioned the Africa Health Fund, which supports the private sector's health programming with backing from the African Development Bank, the Gates Foundation, the German Investment and Development Corporation (DEG), and the IFC.

Crush was frank about the challenges of getting the private sector to invest in something that is ultimately a public good. But he saw room for



public–private partnerships to work toward this end. Governments can provide funds, information, and an enabling environment to harness the ingenuity and efficiency of private industry, particularly in fields like digital data, financial services, and communications. Raw data from mobile phones lends itself to a wide range of practical uses, he pointed out, and the private sector is well placed to develop innovations in this area—for example, in the field of contract tracing.

Calling back to the other panelists' points about risk sharing and making capital available to small- and medium-sized businesses during a disaster, Crush asked that multilaterals also think of ways to mitigate the larger economic impact of an epidemic, perhaps by working in a coordinated fashion to address affected countries' debt obligations. Another possibility might be to channel grant funding through a mechanism similar to the catastrophe deferred drawdown option, which provides loan financing through the International Bank for Reconstruction and Development (IBRD). He concluded by emphasizing the importance of speed in emergency response. In an epidemic, more than in almost any other situation, the dollar's present value far exceeds its future one. Private industry is good at working efficiently and quickly, something invaluable to pandemic response.

In the subsequent discussion, participants talked about some of the opportunities and challenges for engaging the private sector in response and preparedness, as well as broader health systems strengthening. Over the past couple of decades, health has been increasingly recognized as an investment, not an expense (Commission on Macroeconomics and Health, 2001; Jamison et al., 2013; World Bank, 1993). Yet investments in preparedness have continued to lag, González-Pier reflected. One solution might be to link pandemic preparedness with other agendas, like financial inclusion, that would help bring it into the mainstream.

Prashant Yadav urged the group to consider relatively simple ways to involve the private sector. Formal public–private partnerships require complex deal structuring, but governments and donor agencies could, for example, use private laboratory networks for surge capacity during an epidemic. The Global Fund and other donors could encourage recipients to add laboratory capacity development into their grants. This would have the benefit of building on current systems, rather than creating a parallel one for pandemics.

A few participants expressed doubt about the willingness of companies to share their business continuity plans. Linking plans in their generic form would indeed be difficult, Stroman agreed. But, during a crisis, companies want to know what others are doing and seeing, making a private network very useful. The network could be a new entity, like the Ebola Private Sector Mobilisation Group, or it could build on something established like a

business service organization, such as Rotary International. These organizations provide a noncompetitive space and a single point of contact for the public sector. Another possibility would be for the government itself to convene different private-sector actors, encouraging companies to share among themselves.

Recalling Tore Godal's point about disaggregating the health system, Paolo Sison remarked that many of the health system's components are core capacities for the private sector: management, organization, data, and logistics. As countries identify gaps in their health systems, they could think about how the private sector might view these gaps as areas of opportunity and pursue arrangements based on this overlap.

Warden pointed out that governments do not need to invent every system from scratch: someone else has probably already done what they would like to do, and simply improving communication would be a significant contribution. For example, the United Kingdom could create and distribute a template for the sector-wide simulation they use to test their financial system. The public sector can also serve as a model, and source of information, for the private sector. She mentioned how in bond markets governments establish a yield curve that the private sector can use to price its own debt. In the same way, when a government takes out an insurance policy, it provides a useful reference price for the private sector to do the same. Finally, she added, governments and donors should do no harm. In particular, she called out the "unconscionable" U.S. Agency for International Development policy of tied aid and urged aid agencies to source locally instead.

Hanna commented that the private sector's involvement in addressing pandemic threats can be broken down into three areas: response, preparedness, and investment in public health. During a crisis, the private sector can easily see the need and wants to help. Companies have also increasingly become aware of the importance of preparedness from a business continuity perspective; Hanna suggested that it would not take much to broaden this view so it encompasses a business continuity plan for the whole economy. But encouraging investment in the third area is trickier. Public health deals in long-term public goods, which do not fit well with a company's need to demonstrate the return on investment to its shareholders. Getting the private sector to invest in public health more broadly will require the right incentives, he concluded.

Olga Jonas observed that many institutions, including the World Bank, have policies that allow projects to add contingent components. These components are prepared in advance, but they are only activated and funded in the event of an emergency; they can be designed to include advance procurement or advance financial management. Historically, the health programs take advantage of this policy far less than other fields, notably

infrastructure and agriculture. New instruments are not always necessary, Jonas reflected; sometimes it is a matter of making better use of existing ones.

Finally, Yadav mentioned the flow of remittances into a country, which likely are much larger than the flows of official development assistance and can keep local markets functioning during a pandemic. Hanna noted that a few bond market products have effectively targeted expatriates. It might be possible to combine these types of products with something like a catastrophe bond to tap the financial support of expatriates for extreme events.

# 10

## Incentives and Preparedness

### Highlights and Main Points Made by Individual Speakers and Participants<sup>a</sup>

- Investing in preparedness allows for a faster and more cost-effective response. (Gregory)
- Outbreak management depends on community ownership and the full inclusion of society. Incentives that encourage behavior change are more effective than coercion or force. (Nabarro)
- Greater precision in the way we describe the health system could advance the cause of health systems building. The priority pieces of health systems need stable, protected funding. (Nabarro)
- Compliance with the International Health Regulations (IHR) is an essential enabler of outbreak preparedness, but in the decade since they came into force, only one-third of World Health Organization (WHO) member states have achieved full compliance with them, even by the low standard of self-assessment. (Nabarro and Troedsson)
- Countries that properly report an outbreak may suffer devastating financial consequences when other countries disregard the IHR and impose travel and trade restrictions. (Troedsson)
- The local and national government's leadership capacity is of the utmost importance during a crisis. (Gao, Nabarro)

- Vertical health programs have been some of public health's most successful and efficient strategies, but donors and governments would do well to take a longer view now. Building health systems requires continued attention, and progress will require stable, long-term support. (Troedsson)

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<sup>a</sup>This list is the rapporteurs' summary of the main points made by individual speakers and participants and does not reflect any consensus among workshop participants.

Milan Brahmbhatt of the World Resources Institute moderated the last session, continuing the preparedness theme developed in the preceding session. Preparedness, he ventured, is the most powerful way to understand pandemics as it involves everything from the human behavior through the multilateral coordination. He encouraged the audience to think about the incentives facing governments and international organizations and how they might be revised.

Richard Gregory of the UK Department for International Development (DFID) opened the panel with a discussion of his agency's report *The Economics of Early Resilience and Response*. The report considered whether investments in preparedness and resilience result in a more cost-effective response than traditional humanitarian action. The study modeled three drought scenarios in Bangladesh, Ethiopia, Kenya, Mozambique, and Niger. The first scenario was one of traditional humanitarian response; in the second, an early warning system hastened the humanitarian response; and the third was a prior investment in resilience. Across the different countries, early response cost, on average, 40 percent of the traditional or delayed response cost, and the confidence interval on the estimate was between 7 and 71 percent. Furthermore, the analysis suggested that, although the scenarios were not directly comparable across countries, there was a positive benefit-to-cost ratio of between 2.3:1 and 13.2:1 over 20 years. In short, investing in resilience is highly cost-effective.

The study illustrates the value of early response, Gregory continued, as both cost-effective and frugal. Worries about false signals or hasty response could be minimized in light of its findings, as it would take between two and six early false responses to equal the cost of one delayed action. With this in mind, he encouraged the audience to consider investments in resilience as a high-priority means to humanitarian response. He then mentioned a similar DFID study looking at the agency's actual spending on preparedness that found a return on investment of between 2:1 and 7:1, to say nothing of the response time hastened by 1 week on average. Gregory saw a transferable lesson for the pandemic financing audience: investing in preparedness

allows for a faster and more cost-effective response. He admitted that his group's research was not on pandemics or pandemic models and encouraged analysis that would allow for a precise estimate of the amount by which investments in resilience save money in response.

He called back to the previous day's discussion on value for money and suggested that a financing instrument might be a way to link health systems strengthening with the humanitarian response. He suggested using a prevention, detection, and response framework to organize our thinking. At the level of international institutions, the Stocking report (WHO, 2015) and various commissions can identify ways to improve the international architecture for response. Improving health systems at the country level will also be important. Gregory shared his agency's conclusion that using the IHR too much as a benchmark might be misguided, and that it is better to look at the total health system in a country and think broadly about what pieces need to be improved to support the key work of detection and response. He gave antimicrobial resistance as an example of an area not necessarily articulated in the IHR, but where progress would support broader pandemic preparedness. Attention to the global health workforce, a core group of epidemiologists and health workers who could deploy rapidly, is another important part of preparedness and a priority for the United Kingdom.

Brahmbhatt then introduced David Nabarro, the United Nations (UN) Secretary-General's Special Envoy on Ebola, whose prerecorded comments were shown to the audience. Nabarro reiterated Gregory's points about health systems strengthening, asking for more precision in the way we think about health systems. He said that there are certain priority functions of a health system and that these functions need stable, protected funding. A One Health approach could advance global health security, as outbreaks often have a zoonotic component, and understanding the ecosystem in which humans and animals interact could help reduce the risk of another outbreak.

Nabarro also stressed that national governments are the leaders during an outbreak. He praised the outbreak management done in Guinea, Liberia, Mali, and Sierra Leone, and called for more predictable and systematic support to the logistics and technology that underpin these systems. Long-term support can help build community ownership in the health system. Outbreaks, he pointed out, are transmitted by human behavior. When communities have respectful, open relationships with health workers and feel ownership of the system, behavior change and outbreak control become more manageable.

Ultimately, all of society needs to respond to a health crisis. Nabarro argued that the best response is one where the health sector is empowered to be a critical piece of the response but does not see itself as the entire

solution. He felt that the health system should be attentive to surveillance in human and animal health, responsive to rumors, and able to analyze epidemiologic data. Obviously, the ability to treat patients is essential to a health system, he continued, and treatment needs to include the whole population. Having any marginalized group unreached by services is particularly dangerous during an epidemic, as it allows transmission to persist. Getting to zero cases during an epidemic requires immense organization and discipline, he concluded.

Nabarro reiterated the previous day's point that only 64 countries report basic IHR compliance. He talked about the challenge of meeting the IHR requirements without standardized methods of data collection and data sharing enabled by interoperable information systems. He stressed that funding for these tools needs to be protected and predictable.

Nabarro observed that outbreaks are disruptive to people's lives and to economies, driving a natural instinct to secrecy in the early stages. Outbreaks also require changes to the way people live. Ebola, for example, changed the way people bury their dead. Beliefs and traditions are not easy to change, and he described the futility of thinking they could be changed by government or international decree. Outbreaks ask for meaningful behavior change from people, and he asked that we use incentives to reflect that. He saw meeting the basic needs of households under surveillance as a suitable incentive, providing them with mosquito nets, hygiene kits, help getting to the fields, and boreholes to ensure a safe water source when under quarantine. There are also incentives to comply with response. For example, the Sierra Leonean president introduced combined burial teams to employ funeral home and mortuary workers who had been harmed by the new burial practices, reducing their financial incentive to continue with illegal burials.

Nabarro emphasized that coercion and force are not effective in outbreak management, and that the best strategy is to keep the responders and the community on the same side, citing the Sierra Leonean House of Hope as an example of an innovative and sensitive way to quarantine possible cases. People in House of Hope had access to the outside world, talked on the phone, and, even though they were kept separate, were still part of their communities. He praised these kinds of solutions that go far toward demystifying the outbreak and involving the community.

Then the discussion shifted to George Gao of the Chinese Center for Disease Control and Prevention (China CDC) who drew on his country's experience with severe acute respiratory syndrome (SARS) in the early 2000s. He agreed with Nabarro's point about the centrality of the local government to outbreak response; Gao saw the capacity of the local government to lead during an emergency as of the utmost importance. The Chinese system has government agencies such as China CDC divided into

provincial and subprovincial levels, all the way down to the township level. He saw this organizational system as helpful and as influencing his agency's contribution to Ebola response. He said that, if foreign responders had better relationships with local governments, the response might have been more efficient, and that steps could be taken to build that trust now.

When China sent a team to Sierra Leone for Ebola response, they sent two groups: a diagnostic team and a treatment and quarantine team. He had the impression that the region would be better served by investing in the local CDC workers and providing them with master's- or doctoral-level training in their fields.

Gao also mentioned the problems he had seen on the ground relating to clinical trials and the development of vaccines and diagnostics, cautioning that ethical concerns should not hold back such valuable research in the future.

Hans Troedsson of WHO was the last speaker in the panel. He opened by acknowledging that the audience already seemed sufficiently taken with the idea of investing in resilient health systems. He was grateful for that, describing a functional health system as the cornerstone for any effective emergency response. At the same time, he cautioned against seeing health systems as a magic bullet in pandemic prevention; there are additional challenges beyond health systems building, including designing health delivery and public health systems to complement each other. In his own experience, clinicians and public health workers tend not to understand how to work together, something that happens across countries. He spoke frankly about the limits of what WHO can do, as ultimately the national health system is the responsibility of the government. While WHO has made supporting health systems one of its main priorities, the organization can only support governments, not replace them.

When describing how to support resilient health systems, Troedsson described the value of investing in basic primary care. He acknowledged that vertical health programs in immunization, malaria, HIV/AIDS, and tuberculosis have been some of public health's most successful and efficient strategies. But he asked the audience to take less interest in the short-term gains vertical programs offer. Building health systems is not a one-off, he continued, and it is not possible to simply put money in health systems once and consider the matter finished. Progress in building systems will require stable, long-term donor commitments.

Troedsson then acknowledged that we will never live in a world where every country has a functional health system. Fragile states and conflict zones will always be part of the world. He compared health systems to a home fire alarm. Ideally, every house should be fireproof, but realistically there will always be houses that are not secured against fire. For those



houses, everyone has to invest in a fire brigade to keep fires from getting out of control or spreading.

When asked about the best strategy to encourage better compliance with the IHR, Troedsson mentioned a recent IHR Review Committee meeting, where they discussed lessons learned relating to Ebola. Participants at that meeting agreed that the IHR is a well-functioning set of rules if they are put in place. Still, only one-third of WHO member states have achieved compliance with the core regulations. Eighty-one countries have asked WHO for an extension on establishing core IHR capabilities, and another 48 have no apparent plan for future compliance. Troedsson cited the failure rate of about 70 percent—almost 10 years after the regulations came into force and by the admittedly low standard of self-assessment—as a huge problem. He acknowledged that WHO was too late to call Ebola a public health emergency of international concern, but emphasized that IHR compliance would be the key enabler of success in the future.

In discussing the IHR, he saw two main categories of countries: those with the technical and financial resources to establish the core capacities and those that lack the money and technical capacity to do the same. He encouraged the use of political pressure on the advanced economies to support capacity development in the rest of the world. He also saw problems with the IHR monitoring system based totally on self-assessment and thought that it might be good to introduce an independent assessment.

Troedsson concluded his remarks by commenting on the devastating financial impact of even a suspected outbreak. Forty countries put travel and trade restrictions against Guinea, Liberia, and Sierra Leone at the peak of the Ebola outbreak, in direct contradiction to the IHR-recommended action. This complicated response work, making it difficult to get food and volunteers to the affected communities. Trade can suffer when a country properly reports an outbreak as stipulated in the IHR. He shared an example from Bangladesh, a cholera-endemic country, where an official at the ministry of health reported a new cholera strain in the early 1990s. Immediately, Gulf countries stopped importing seafood from Bangladesh, to the Bangladeshi economy's tremendous detriment. Something similar happened in China when milk products were found contaminated with melamine. Troedsson was the WHO representative at the time; he encouraged the Chinese ministry of health to openness and appreciated the government's transparency. But then other countries quickly stopped importing food from China, in effect punishing the country for observing the food safety component of the IHR. Nevertheless, Troedsson had low enthusiasm for the Stocking commission's suggestion that retaliatory action against the IHR be tried at World Trade Organization (WTO) hearings. He saw this solution as impractical; the emergency would be over years before WTO could act.

In the open discussion, panelists were asked how to know when a coun-

try is sufficiently well prepared. Gao observed that it is difficult to know in real time, but that hindsight gives some insight. Gregory responded that, since most developing countries are so far from being prepared, it seems unlikely the mark could be passed anytime soon. Asked for his perspective as a representative of a donor agency on what kinds of incentives could encourage compliance with the IHR, Gregory expressed hope that the Global Health Risk Framework Commission would consider that exact question. He recognized that, in some countries, IHR compliance is simply not a priority and suggested that, in these countries, working in mutually beneficial partnerships may be the best answer. Troedsson pointed out that it is not reasonable to think every Pacific Islands country would have sophisticated central laboratories, but that much progress could be made by enabling laboratory sharing and collaboration. Gregory added that winning over ministers of finance to the cause of health systems strengthening could also induce much progress on IHR compliance.

Egerton-Warburton observed that, during an emergency, it is not surprising that countries succumb to pressure and ignore the rules to which they have agreed. He thought that such pressures could create a kind of incentive for preparedness. Troedsson agreed, stating that the final action always rests with politicians, not public health or even finance professionals.

Tore Godal observed that standard protocols for testing and ethical review in emergencies might have shortened the Ebola epidemic by about a month. Completing clinical trials before the emergency might have shortened the outbreak by 2 months, altering the trajectory of the last months of the outbreak. He asked that the audience think through how to shorten outbreaks and make trials move more quickly during an emergency.

Prashant Yadav then gave brief closing remarks, thanking the participants and the National Academies of Sciences, Engineering, and Medicine staff. He introduced Ceci Mundaca-Shah, who discussed the Global Health Risk Framework Commission's schedule for the summer and its plan to release the report around the end of the year. She invited any interested participants to communicate their ideas on the topic directly to her and her staff. The meeting then adjourned.



# Appendix A

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# Appendix B

## Workshop Agenda

### The Global Health Risk Framework Project Workshop on Pandemic Financing

National Academy of Sciences Building,  
2101 Constitution Avenue NW, Washington, DC

THURSDAY, AUGUST 27, 2015  
LECTURE ROOM

8:00-8:30 Breakfast available

#### Session 1 Welcome and Overview

Objective: To introduce the agenda and give an overview of the workshop's key themes.

8:30-9:00 Welcome and Introductions  
**Prashant Yadav**, *Vice President and Senior Research Fellow*, William Davidson Institute, University of Michigan  
**Victor Dzau**, *President*, National Academy of Medicine

9:00-10:30 International Cooperative Action on Pandemics  
**Moderator: Olga Jonas**, *Economic Adviser and Coordinator, Operational Response to Avian and Pandemic Influenzas*, The World Bank  
**Gordon Woo**, *Catastrophist*, Risk Management Solutions

**Jordan Tappero**, *Director, Division of Global Health Protection*, U.S. Centers for Disease Control and Prevention (CDC)

**Eduardo González-Pier**, *Vice Minister Integration and Development*, Ministry of Health, Mexico

**Aron Betru**, *CEO*, Financing for Development

10:30-10:45 Break

## Session 2

### Marshaling Funding for Preparedness and Response

Objective: To discuss different options for making funding available in low- and middle-income countries during a pandemic and the circumstances that favor certain options over others.

10:45-11:45 Pandemic Emergency Funds: The World Health Organization (WHO) Contingency Fund, the World Bank, and International Monetary Fund (IMF) Financing Facilities

**Moderator: Peter Sands**, *Former Group CEO*, Standard Chartered PLC

**Katherine DeLand**, *Chief of Staff, Ebola Response*, WHO

**Chris Lane**, *Division Chief, Low-Income Countries Strategy, Policy and Review*, IMF

**Priya Basu**, *Manager, Development Finance*, The World Bank Group

11:45-1:15 Adapting Insurance Products for Pandemic Risk  
**Moderator: Panos Varangis**, *Global Lead, Agricultural Finance and Disaster Risk Finance, Finance and Markets Global Practice*, International Finance Corporation (IFC)

**Olivier Mahul**, *Program Manager, Disaster Risk Financing & Insurance*, The World Bank

**Nikhil da Victoria Lobo**, *Head, Global Partnerships, Americas*, Swiss Re

**Simon Young**, GeoSY Ltd.

**José Ángel Villalobos**, *Senior Insurance Specialist*, The World Bank

**Gunther Kraut**, *Financial Solutions Life*, Munich Re (by video)

- 1:15-2:15 Lunch
- 2:15-3:45 Innovative Financing for Preparedness and Response  
**Moderator: Juan Costain**, *Lead Financial Specialist*,  
 The World Bank  
**Paolo Sison**, *Director Innovative Finance*, Gavi,  
 the Vaccine Alliance  
**Christopher Egerton-Warburton**, *Partner*, Lion's Head  
 Global Partners  
**Lelio Marmora**, *Executive Director*, UNITAID  
**Adam Bornstein**, *Specialist Innovative Health Financing*,  
 The Global Fund to Fight AIDS, Tuberculosis and  
 Malaria
- 3:45-4:00 Break

### Session 3

#### Identifying Triggers and Modeling Risk

Objective: To discuss a verifiable trigger for payout and a suitable group to adjudicate triggers, to understand what models can tell us about pandemic risk.

- 4:00-5:30 Modeling and Triggers for Payout  
**Moderator: Prashant Yadav**, *Vice President and Senior  
 Research Fellow*, William Davidson Institute,  
 University of Michigan  
**Nathan Wolfe**, *CEO*, Metabiota  
**Martin Meltzer**, *Lead, Health Economics and Modeling  
 Unit*, CDC  
**Gordon Woo**, *Catastrophist*, Risk Management Solutions  
**Nita Madhav**, *Principal Scientist, Research and  
 Modelling*, AIR Worldwide
- 5:30 Adjourn

*All participants and guests are invited to a reception in the Great Hall immediately following the meeting.*

- 6:30 Dinner in National Academy of Sciences Building for  
 speakers, moderators, and invited guests



**FRIDAY, AUGUST 28, 2015  
LECTURE ROOM**

8:30-9:00 Breakfast available

9:00-9:15 Welcome and Overview  
**Prashant Yadav**, *Vice President and Senior Research Fellow*, William Davidson Institute, University of Michigan

**Session 4  
Management and Administration of Funds**

Objective: To understand the constraints on donors and discuss how financial tools can be designed to encourage risk sharing and crowding in; to discuss the administrative burden emergency payments place recipient country governments.

9:15-10:45 Financing Challenges In-Country  
**Moderator: Peter Sands**, *Former Group CEO*, Standard Chartered PLC  
**Tendai Biti**, *Former Minister of Finance*, Zimbabwe  
**Gordon Liu**, *Yangtze River Scholar, Professor of Economics*, National School of Development, Peking University  
**Victor Bampoe**, *Deputy Minister of Health*, Ghana  
**James Kollie**, *Deputy Minister for Fiscal Affairs*, Ministry of Finance and Development Planning, Liberia

10:45-11:00 Break

11:00-12:30 Donor Considerations and Crowding-In  
**Moderator: Trish Stroman**, *Partner and Managing Director*, Boston Consulting Group (BCG)  
**Tore Godal**, *Special Adviser on Global Health*, Ministry of Foreign Affairs, Norway  
**Jennifer Adams**, *Deputy Assistant Administrator, Bureau for Global Health*, U.S. Agency for International Development  
**Gargee Ghosh**, *Director Development Policy and Finance*, The Bill & Melinda Gates Foundation  
**Erin Hohlfelder**, *Policy Director Global Health*, ONE Campaign

12:30-1:30            Lunch

**Session 5**  
**Financing Preparedness and Giving Incentives**

Objective: To explain how financial incentives can be used to encourage preparedness and health systems development.

- 1:30-3:00            The Investment Case for Preparedness and the Role of the Private Sector  
**Moderator: Eduardo González-Pier**, *Vice Minister Integration and Development*, Ministry of Health, Mexico  
**Staci Warden**, *Executive Director Center for Financial Markets*, Milken Institute  
**Trish Stroman**, *Partner and Managing Director*, BCG  
**Daniel Hanna**, *Managing Director, Head of Public Sector and Development Organisations: Africa, Americas and Europe*, Standard Chartered Bank  
**David Crush**, *Manager*, IFC
- 3:00-3:15            Break
- 3:15-4:45            Incentives and Preparedness  
**Moderator: Milan Brahmbhatt**, *Senior Fellow*, World Resources Institute  
**Richard Gregory**, *Senior Policy Advisor, Global Health Security*, UK Department for International Development  
**David Nabarro**, *Secretary General's Special Envoy on Ebola*, United Nations (by video)  
**George Gao**, *Deputy Director-General*, Chinese Center for Disease Control and Prevention  
**Hans Troedsson**, *Assistant Director General for General Management*, WHO
- 4:45-5:00            Closing Remarks
- 5:00                  Adjourn



## Appendix C

### Participant Biographies

**Jennifer Adams, M.Phil., Ph.D.**, is Deputy Assistant Administrator in the Bureau for Global Health at the U.S. Agency for International Development (USAID). She is responsible for the strategic direction and management of USAID's programs in health systems, population and reproductive health, HIV/AIDS, and global health security. The global health bureau is comprised of more than 450 staff members, and health programming constitutes one-third of USAID's total budgetary resources.

Prior to this assignment, Dr. Adams headed USAID's Office of Donor Engagement, directing USAID's analysis, communication, and collaborative efforts to generate joint understanding and action on key development priorities with both bilateral and multilateral donor partners around the world. Dr. Adams was appointed the first USAID Development Counselor to China in September 2008. Before her post in Beijing, she was the Mission Director for USAID in Brazil. Dr. Adams has worked for USAID for more than 20 years as a Foreign Service Officer. Her posts include the Central Asian Republics, Senegal, Brazil, and Washington, DC. Her positions included economist, and managing social sector portfolios, including health, education, and environment projects. In Brazil, she initiated a successful public-private partnership, *Mais Unidos*, that engaged the 50 largest American companies to support social entrepreneurship.

Dr. Adams graduated from Johns Hopkins University, has an M.Phil. from the Institute of Development Studies at the University of Sussex, where she was a Marshall Scholar, and a Ph.D. in economics from Cambridge University.

**Victor Bampoe, M.D.**, a Ghanaian national, is the Deputy Minister of Health in his country—a role he has held for a year. Dr. Bampoe is also the Incident Commander of Ghana’s Ebola Emergency Operations Center (EOC). Before being appointed by President John Mahama of Ghana to this role, Dr. Bampoe was a Senior Fund Portfolio Manager at the Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria based in Geneva, Switzerland. In that role, Dr. Bampoe was responsible for managing grants to fight the three diseases in South Africa, with a total value of more than \$800 million. Dr. Bampoe worked at the Global Fund in various capacities from 2005: he served as the Fund Manager in Kenya, Rwanda, Uganda, and Zambia, and was also the Risk Manager, as well as the Team Leader for Southern Africa. Before he took up his role at the Global Fund, Dr. Bampoe worked with the UK Department for International Development (DFID) as a Regional Health and HIV Adviser, and before that as a Medical Officer with the Ministry of Health in Ghana.

Dr. Bampoe is a medical doctor by training, with a specialization in public health obtained at the prestigious Johns Hopkins School of Hygiene and Public Health in Baltimore, Maryland.

**Priya Basu, M.A., M.Sc.**, is currently Manager in the World Bank’s Development Finance Vice-presidency. Her department bridges the World Bank Group with external partners to design and manage game-changing, innovative finance initiatives to serve critical development priorities. Since joining the World Bank in Washington, DC, in 1998 as a Young Professional, Ms. Basu has held various operational positions, leading lending and policy work in the areas of infrastructure financing, financial sector development, financial access for the poor, and small and medium enterprise development in countries across South Asia, East Asia, Europe and Central Asia, and sub-Saharan Africa. From 2005 to 2009 she served as the Bank’s Lead Financial Economist for India based in the country office. Prior to joining the Bank, Ms. Basu worked in investment banking in London. She has previously worked as an economist at the International Monetary Fund (IMF) in Washington, DC, at the Asian Development Bank in Manila, and at United Nations Conference on Trade and Development (UNCTAD) in Geneva. Ms. Basu holds a B.A. (Hons.) degree in economics from Delhi University, a B.A./M.A. in politics, philosophy, and economics from Merton College, University of Oxford, United Kingdom, and an M.Sc. in development economics from the University of Oxford. She is the author of three books: *Creating Resilient Financial Regimes in Asia* (Oxford University Press, 1998), *India’s Financial Sector: Challenges and Policy Options* (Macmillan, 2005), and *Improving Access to Finance in India* (World Bank, 2006).

**Aron Betru, M.B.A., M.A.**, CEO of Financing for Development (F4D), specializes in innovative financing solutions for international development. Mr. Betru is a pioneer in guarantee-backed financing of public health commodities, facilitating millions of dollars in both commercial lending for malaria and trade financing for reproductive health. He has also facilitated stakeholder price negotiations between procurers and suppliers that have yielded millions of dollars' worth of increased access for commodity users. Mr. Betru served as a member of the Bellagio Consensus of 2012 that advocated for multiple method-based promotion of long-acting reversible contraceptives, and was a strategic advisor on matters of market dynamics and country engagement for FP2020.

Prior to joining F4D's flagship program, Pledge Guarantee for Health, during its proof of concept at the United Nations Foundation and facilitating its transfer to F4D, Mr. Betru was a project manager in the Washington, DC, office of Dalberg Global Development Advisors and a member of its Health, Access to Finance, and Strategy practices. Earlier in his career, he was a Senior Associate at McKinsey & Co.'s Philadelphia office and a Summer Associate at Goldman Sachs' Investment Banking Division, where he supported a range of strategic analysis and financial transactional work for clients in the financial services, private equity, pharmaceutical, and government sectors.

Mr. Betru is a member of the Council on Foreign Relations and a regular contributor to the *Global Health and Diplomacy* magazine, writing on innovative finance in public health. He holds an M.B.A. from Columbia University's Graduate School of Business, an M.A. in international relations from Johns Hopkins University's School of Advanced International Studies, and a B.A. in economics and international studies from Northwestern University.

**Tendai Biti** is a Zimbabwean politician who served as Zimbabwe's Minister of Finance from 2009 to 2013, a period which saw him turn around an economy that had been ravaged by hyperinflation of 500 billion percent and an unemployment rate up to 85 percent.

He is also the Secretary-General and a founding member of the Movement for Democratic Change Renewal Team. Mr. Biti rose to prominence after handling high-profile constitutional and labor cases, including a landmark case that saw the notorious Law and Order Maintenance Act, which did not allow demonstrations without police clearance, being repealed.

**Adam Bornstein, M.B.A.**, has more than 20 years of emerging market investment, resource mobilization, and strategy experience in Asia and Africa. Mr. Bornstein is the Innovation Health Financing Specialist with

the Global Fund to Fight AIDS, Tuberculosis and Malaria based in Geneva, Switzerland. He is responsible for developing and structuring alternative funding products, working with government ministries, the private sector, and civil society to identify sustainable pools of health financing. He formerly was the International Finance Corporation's resident representative in Mongolia and before that was senior vice president at CDIB Capital, a Hong Kong-based \$1 billion private equity fund where he was responsible for direct investments in private and public companies across Asia. He earned a master's degree in business administration from Boston University Graduate School of Management and is conversant in Mandarin Chinese and Mongolian.

**Milan Brahmabhatt, M.Sc.**, is Senior Fellow at the World Resources Institute and a member of the project team for the New Climate Economy Initiative of the Global Commission on the Economy and Climate, where he leads the work of the Country Transitions workstream. Before joining the New Climate Economy, Mr. Brahmabhatt worked at the World Bank, as Senior Adviser to the Vice President of the Poverty Reduction and Economic Management Network, dealing with a wide range of macroeconomic and structural policy issues, including the economics of climate change, sustainable growth, and the economics of infectious diseases.

**Gillian Buckley, Ph.D., M.P.H.**, is a Senior Program Officer in the Board on Population Health and Public Health Practice of the National Academies of Sciences, Engineering, and Medicine. She was study director for the consensus reports *Ensuring Safe Foods and Medical Products Through Stronger Regulatory Systems Abroad*, *Countering the Problem of Falsified and Substandard Drugs*, and *Investing in Global Health Systems: Sustaining Gains, Transforming Lives*. Dr. Buckley managed the Standing Committee to Support USAID's Office of Health Systems. She holds a Ph.D. in human nutrition and an M.P.H. in international health, both from Johns Hopkins University; her dissertation examined the effects of prenatal vitamin A supplementation on the cognitive and motor development of Nepali children. She was a Peace Corps volunteer in Nepal from 2000 to 2002.

**Juan Costain, M.Sc.**, a UK national, joined the World Bank in 1996 and recently returned to Washington, DC, to take up the position as Lead Financial Sector Specialist in the Africa region where he has been coordinating the Ebola response of the World Bank's Finance and Markets practice. Mr. Costain's prior recent experience has been as Regional Team Leader for South Asia for the Water and Sanitation Programme, a multidonor partnership administered by the World Bank to support poor people in obtaining affordable, safe, and sustainable access to water and sanitation services.

Mr. Costain has also held various positions at the World Bank in country program management and private- and financial-sector operations covering competitiveness, public-private partnership, public-sector reform, and financial-sector development in Africa and in South Asia.

Mr. Costain returned to the World Bank in 2003 after a 2-year leave of absence managing a specialized emerging market hedge fund in London. Prior to joining the World Bank, Mr. Costain had been employed since 1984 in a variety of investment banking functions at Kidder, Peabody, the investment banking subsidiary of General Electric, and at the Union Bank of Switzerland, based in London and Hong Kong, holding the position of Managing Director responsible for international capital markets, new issues, and emerging markets.

Mr. Costain holds an M.Sc. and a B.Sc. in monetary economics from the London School of Economics, as well as the Chartered Financial Analyst (CFA) designation.

**David Crush, M.Sc.**, has been in the World Bank Group since 2009, first as part of the World Bank's Innovative Finance team in Washington, DC, working with the Global Fund, Gavi, and the International Finance Facility for Immunisation (IFFIm). He moved to the International Finance Corporation (IFC) in 2011 to head IFC's Access to Finance Advisory team in Sub-Saharan Africa and since 2014 he has been Practice Manager in the World Bank's joint IFC/World Bank Finance and Markets Practice responsible for Sub-Saharan Africa.

Prior to the World Bank, Mr. Crush worked (from 1991 to 2009) for the European Investment Bank, the European Union's development finance institution, in the United Kingdom (on financing public-private partnerships) as well as in the Africa, Caribbean and Pacific Department. From 1985 to 1991 Mr. Crush worked for Barclays Bank in the United Kingdom as Senior Economist for Africa and then as a manager in the Sovereign Lending department. He began his career with the UK government working at the African Development Bank in Abidjan, Cote d'Ivoire.

Mr. Crush is a graduate of Cambridge University and has an M.Sc. in agricultural economics from the University of Reading in the United Kingdom. He is also an Associate of the United Kingdom's Chartered Institute of Bankers. In 2014 he was given the World Bank's Excellence in Leadership Award.

**Nikhil da Victoria Lobo**, in his role in Global Partnerships, leads Swiss Re's dialogue with governments, development banks, and nongovernmental organizations in the Americas. The team works on customized solutions to help the public sector manage and transfer their risk to the (re)insurance and capital markets.



Global Partnerships has successfully helped public-sector clients address such complex risks as natural catastrophes, agriculture production, infrastructure financing, and longevity risk, and leverages Swiss Re's broad product offerings. These range from traditional risk transfer to insurance-linked securities and advisory services.

Prior to his current role, Mr. da Victoria Lobo was an underwriter for Swiss Re's corporate insurance business, focusing on the Latin America Fortune 500 companies. He joined Swiss Re in 2001 as an investment professional in Securitas Capital, a private equity firm focused in the insurance industry. He worked on a number of private and public transactions before joining Swiss Re's Latin American reinsurance department as a deputy manager for finance and operations. Mr. da Victoria Lobo holds a degree in finance from The Wharton School of the University of Pennsylvania.

**Katherine DeLand, J.D., M.P.H.**, as the Chief of Staff of the World Health Organization's (WHO's) Ebola Response, has worked closely with the Special Representative of the Director-General and Ebola Response Leader, WHO Country Offices in Guinea, Liberia, Mali, and Sierra Leone, the United Nations (UN) Mission on Emergency Ebola Response, and a diversity of UN agencies and nongovernmental organizations (NGOs) to help drive the efforts to eliminate Ebola in West Africa. Prior to holding this position, she founded DeLand Associates in 2011 to fill a growing niche for independent, flexible, highly trained, and responsive consulting, advising, and project management in international law, health, and public policy. Professionally, her focus has been on multilateral negotiations, large-scale public health project management and donor relationships, whole-of-government approaches to trade and health, and sustainable health and development policy design and implementation. She has worked in Australia, Kenya, Switzerland, and the United States for organizations as diverse as WHO, the L'Etval Foundation, the World Bank, the U.S. Centers for Disease Control and Prevention (CDC), and the University of Sydney. She holds a B.A. in biochemistry and molecular biology from Reed College and a J.D. and an M.P.H. from the University of California, Los Angeles.

**Victor J. Dzau, M.D.**, is the President of the National Academy of Medicine (NAM). In addition, he serves as Chair of the Institute of Medicine (IOM) Division Committee of the National Academies of Sciences, Engineering, and Medicine. Dr. Dzau is Chancellor Emeritus and James B. Duke Professor of Medicine at Duke University and the past President and CEO of the Duke University Health System. Previously, Dr. Dzau was the Hersey Professor of Theory and Practice of Medicine and Chairman of Medicine at Harvard Medical School's Brigham and Women's Hospital, as well as Chairman of the Department of Medicine at Stanford University.

Dr. Dzau has made a significant impact on medicine through his seminal research in cardiovascular medicine and genetics and his leadership in health care innovation. His important work on the renin angiotensin system (RAS) paved the way for the contemporary understanding of RAS in cardiovascular disease and the development of RAS inhibitors as widely used, life-saving drugs. In his role as a leader in health care, Dr. Dzau has led efforts in innovation to improve health, including the development of the Duke Translational Medicine Institute, the Duke Global Health Institute, the Duke-National University of Singapore Graduate Medical School, and the Duke Institute for Health Innovation.

As one of the world's preeminent health leaders, Dr. Dzau advises governments, corporations, and universities worldwide. He has served as a member of the Advisory Committee to the Director of the National Institutes of Health (NIH) and as Chair of the NIH Cardiovascular Disease Advisory Committee. Currently he is a member of the Board of the Singapore Health System and Hamad Medical Corporation, Qatar. He was on the Board of Health Governors of the World Economic Forum and chaired its Global Agenda Council on Personalized and Precision Medicine.

Among his many honors and recognitions are the Gustav Nylin Medal from the Swedish Royal College of Medicine, the Distinguished Scientist Award from the American Heart Association, the Ellis Island Medal of Honor, and the Henry Freisen International Prize. In 2014, he received the Public Service Medal from the President of Singapore. He is a member of the NAM, the American Academy of Arts and Sciences, and the European Academy of Sciences and Arts. He has received eight honorary doctorates.

**Christopher Egerton-Warburton (Edge), M.A.**, is a founding partner of Lion's Head Global Partners, a London- and Nairobi-based merchant bank. At Lion's Head, Mr. Edge leads the firm's activities in the global health field. Recently, Lion's Head designed and established the Global Health Investment Fund, the first impact-focused investment fund dedicated to global health research and development. Prior to establishing Lion's Head, Mr. Edge was the lead banker on the establishment of a new \$5.5 billion multilateral development institution, the International Finance Facility for Immunisation (IFFIm), which funds Gavi, the Vaccine Alliance. Currently, Mr. Edge is a member of the IFFIm Board of Directors.

Mr. Edge commenced his career at Goldman Sachs where he spent 14 years within the Debt Capital Markets group. In his last role he was Head of the Sovereign, Supranational and Agency team. He spent 6 years within the Eastern Europe, Middle East, and Africa (EEMEA) emerging markets team, where he worked primarily in Hungary, Israel, South Africa, and Turkey. Mr. Edge received an M.A. in biochemistry from Christ Church College at Oxford University.

**Elizabeth Emanuel, M.Sc.**, is an international development consultant and has more than 15 years' development experience working in a range of areas including protected areas and biodiversity management; wastewater management; climate change adaptation; environmental education, training, and communication services; sustainable development planning; policy development; energy management and project management; and, most recently, providing advice to advance the green economy in the Caribbean. She works extensively with development partners such as the World Bank, the UN Economic Commission for Latin America and the Caribbean, the UN Environment Programme (UNEP), the UN Development Programme (UNDP), The Nature Conservancy, and the Global Environment Facility (GEF) Integrating Watershed and Coastal Area Management project, among others. She also has experience working a range of regional and international projects such as the Caribbean Catastrophe Risk Insurance Facility (renamed CCRIF SPC), the Inter-American Development Bank (IDB)/UNEP Caribbean Regional Wastewater Programme, the Nile Basin Trust Fund, and the Cooperation for International Waters in Africa. In the Caribbean, Ms. Emanuel has worked for a range of governments—chief among these being Aruba, the Bahamas, Guyana, Jamaica, and Montserrat—developing national development plans and other national policies. She lectures at the master's level at the University of the West Indies in the areas of environmental policy and sustainability, environmental economics, and natural resource valuation. She holds a B.Sc. in economics, an M.Sc. in development studies (concentration in environmental and health economics), and post-graduate diplomas in communications, public-sector management, public policy, public procurement, project management, and corporate governance.

**Gabrielle Fitzgerald, M.P.A.**, was the Director of the Paul G. Allen Ebola Program, where she oversaw Paul Allen's \$100 million commitment to combat the Ebola outbreak in West Africa. Ms. Fitzgerald previously served as the Director of Global Program Advocacy at The Bill & Melinda Gates Foundation, overseeing the policy and advocacy agenda for the foundation's 14 global programs. In this role, Ms. Fitzgerald led efforts that raised \$1.3 billion in funding from new philanthropists to tackle global health problems, and oversaw the Global Vaccine Summit, held in Abu Dhabi in 2013, which brought together global leaders and stakeholders who committed \$4 billion to delivering a polio-free world by 2018.

During Ms. Fitzgerald's tenure at the foundation, she spearheaded their efforts to put malaria on the global agenda—including starting the United Against Malaria campaign, which won *PR Week's* Global Campaign of the Year in 2014. For her leadership, in April 2014 she was awarded the Johns Hopkins Bloomberg School of Public Health's Gold Medallion award. Prior

to joining the foundation, Ms. Fitzgerald spent 5 years at USAID, leading the public affairs strategy for the world's largest funder of HIV/AIDS programs. Previously, she served as the communications director for the U.S. Committee for Refugees. She started her career as a speechwriter for President Bill Clinton at the White House. Ms. Fitzgerald holds a master's of public administration from the Maxwell School at Syracuse University and a bachelor of arts from American University in Washington, DC.

**George Fu Gao, D.Phil. (Oxon)**, is a Member of the Chinese Academy of Sciences (CAS), Fellow of The World Academy of Sciences (TWAS), Fellow of the American Academy of Microbiology, and Director and Professor in the CAS Key Laboratory of Pathogenic Microbiology and Immunology, Institute of Microbiology, Chinese Academy of Sciences. Dr. Gao is also the Vice-President of the Beijing Institutes of Life Science, Chinese Academy of Sciences, and Deputy Director-General of the Chinese Center for Disease Control and Prevention (China CDC).

He obtained his Ph.D. (D.Phil.) degree in 1995 from Oxford University, United Kingdom. He was selected in the Chinese Academy of Sciences "Hundred Talents" program in 2004, and received the National Natural Science Foundation of China (NSFC) Distinguished Young Scholar title in 2005. He is the chief scientist of two consecutive 973 Projects, "mechanism of interspecies transmission of viral pathogens" (2005, 2011), and a leading principal investigator of the NSFC Innovative Research Group. He is also a steering committee member of International Consortium of Anti-Virals, and visiting professor in Oxford University, United Kingdom. He was awarded TWAS prizes in medical sciences in 2012 and was awarded the Nikkei Asia Prize in 2014.

His research focuses on mechanisms of interspecies transmission ("host jump") of pathogens, especially interaction between the enveloped viruses and host, and molecular immune recognition. He has published more than 330 refereed papers.

**Gargee Ghosh, M.Sc.**, Director of Development Policy and Finance, leads The Bill & Melinda Gates Foundation's international policy team that supports ideas and innovations in policymaking—at the global and national levels—to advance human development and address extreme poverty. The team also provides independent analysis and recommendations to the foundation co-chairs and leaders on medium-range trends in development policy.

Ms. Ghosh previously held senior positions at Google.org and in the international development practice of McKinsey & Company, as well as at the Center for Global Development. From 2005 to 2009, she worked in the Gates Foundation's Global Health division, where she helped launch significant efforts in immunization financing and impact investing. In addi-

tion to her foundation responsibilities, Ms. Ghosh is currently serving a 2-year term on President Barack Obama's Global Development Council.

Ms. Ghosh holds graduate degrees in economics from the University of Oxford and in international relations from Georgetown University and she has a bachelor's degree in economics from the University of Victoria in Canada. She is based in the foundation's Washington, DC, office.

**Tore Godal, M.D., Ph.D.**, is an international public health specialist, currently working as a special advisor on global health at the Ministry of Foreign Affairs, Norway. He has facilitated the establishment of a research program for global health in Norway (Globvac) and global partnerships relating to maternal and child health such as the UN Every Woman Every Child initiative and the Global Financing Facility at the World Bank. As the founding executive secretary of Gavi, Dr. Godal was instrumental in the design and development of this alliance on which the Global Fund was also modeled. Previously, Dr. Godal was instrumental in the initiation of the UNDP/World Bank/WHO Special Program for Research and Training in Tropical Diseases, leading the program's pilot project and flagship effort, Immunology of Leprosy. As a director of the Special Programme for Research and Training in Tropical Diseases (TDR), Dr. Godal organized a number of large-scale trials, including on insecticide-treated mosquito nets which showed that African children were saved from dying from malaria if sleeping under a net. Before retiring from WHO, Dr. Godal launched the Roll Back Malaria project. A medical doctor and trained immunologist, Dr. Godal has contributed a great deal to the understanding of mechanisms of immunity to mycobacteria, the pathogenesis of autoimmune disease, and the clinical and subclinical manifestations of leprosy. His research in cancer has led to the development of diagnostic tools, including monoclonal antibodies for leukemia and lymph node cancer. Most recently, Dr. Godal contributed to the initiation and financing of the promising Ebola vaccine trial in Guinea. Dr. Godal has more than 300 publications in peer-reviewed journals.

**Eduardo González-Pier, Ph.D.**, currently serves as the Undersecretary for Integration and Development of the Health Sector in the Ministry of Health of Mexico. He is responsible for overseeing policies and strategies to improve health system performance, including quality assurance for health care services, health technology assessment, metrics and evaluation for health system performance, planning and regulation of human resources for health, as well as the production of statistics and information systems related to the health sector.

Dr. González-Pier has held several positions in the health and social security sectors, including Executive Chairman of the Mexican Health

Foundation (FUNSALUD), a leading health policy think tank; Chief Financial Officer of the Mexican Social Security Institute (IMSS), the largest insurer and provider of health services in Mexico; and Chief Economist and General Coordinator of Strategic Planning at the Ministry of Health of Mexico. Over the past 20 years, he has been involved in the formulation and implementation of various social security and health financing reform initiatives, most recently the introduction of the System of Social Protection in Health (Seguro Popular de Salud). Dr. González-Pier holds a B.S. from Washington and Lee University and a Ph.D. in economics from the University of Chicago.

**Richard Gregory** is Senior Policy Adviser, Global Health Security, in DFID. Prior to this he was Senior Health Adviser for DFID and the United Kingdom Joint Inter-Agency Taskforce on Ebola in Sierra Leone, leading UK technical inputs to the national Ebola response and working closely with the government of Sierra Leone on policy and strategy. Previous DFID roles include Regional Health Adviser for Africa, and country postings to Ethiopia and Pakistan.

**Daniel Hanna, M.B.A.**, is Managing Director and Head of Public Sector and Development Organisations for Africa, Americas, Europe and the Middle East, for Standard Chartered Bank. Mr. Hanna has more than 15 years of banking experience in emerging markets, in particular in Africa and the Middle East, and has provided advice to governments, state-owned enterprises, institutions, and companies on raising equity and debt, restructuring their business activities, and investing in emerging markets. He is the rating advisor to several African governments and in 2015 worked with the United Kingdom's CDC Group for the creation of the USD 50m Post Ebola Reconstruction Facility for Sierra Leone.

Mr. Hanna was previously the co-Head of Wholesale Banking for South Africa and Southern Africa for Standard Chartered based in Johannesburg. He was also the lead author of the Qatar 2020 development report for the Emir of Qatar and a member of the UK China Emerging Leaders Roundtable. He established and ran the UK India CEO Forum for the chairs, Peter Sands and Ratan Tata, under the sponsorship of Prime Ministers David Cameron and Manmohan Singh. Mr. Hanna has previously worked as a visiting Fellow for Chatham House and for the President of the European Parliament. He has master's in business administration (distinction) from London Business School, a Certificate d'Etudes European from Science Po Strasbourg, and a B.A. in economics and politics from Exeter University.

**Erin Hohlfelder** joined ONE in January 2010 and serves as the Policy Director for Global Health. In this role, she leads health research and

policy analysis across ONE's global markets, focusing primarily on infectious diseases, maternal and child health, and health financing mechanisms. Since August 2014, she has also led ONE's organization-wide response to the Ebola outbreak, including the development of an online accountability tool to track donors' response efforts. Before joining the organization, she worked for the Global Network for Neglected Tropical Diseases at the Sabin Vaccine Institute, where she helped to develop and lead advocacy, social media, community engagement, and legislative efforts around neglected tropical diseases.

Ms. Hohlfelder graduated *summa cum laude* from the George Washington University with a degree in international affairs and dual concentrations on international politics and African studies. She also spent time living in Kenya, where she conducted research on integrated care models for female AIDS orphans.

**Olga Jonas, M.P.A., M.A.**, has been responsible for coordinating the World Bank Group's operational response to avian and human pandemic influenza threats and for working with Senior UN Influenza Coordination on monitoring the overall global response since 2006. Among other assignments, she was the lead World Bank author of the joint UN–World Bank global progress reports and delivered presentations on the global response to five ministerial conferences on avian and pandemic influenzas in 2006-2010. Ms. Jonas oversaw the World Bank's global program for avian influenza response and pandemic influenza preparedness, which provided \$1.3 billion to developing countries. This included the Avian and Human Influenza Facility which made grants to countries to improve their public veterinary and human health capacities. She has also addressed other meetings on pandemic threats. Her prior assignments included lead economist work on two replenishments of the International Development Association (IDA), which is a part of the World Bank Group, lead economist of the World Bank/Commonwealth task force on small states, emergency response policy, extractive industries review, and macroeconomic operational work with francophone African countries. Ms. Jonas joined the World Bank Group in 1983 through the Young Professionals Program. Prior to that she held positions at Princeton University, the Bank for International Settlements, and the Organisation for Economic Co-operation and Development. She was educated at Williams College and Princeton.

**Patrick W. Kelley, M.D., Dr.P.H.**, joined the National Academies of Sciences, Engineering, and Medicine in July 2003 as the Director of the Board on Global Health. He was subsequently also appointed the Director of the Board on African Science Academy Development. Dr. Kelley has overseen a portfolio of IOM expert consensus studies and convening activities on

subjects as wide ranging as the evaluation of the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), the U.S. commitment to global health, sustainable surveillance for zoonotic infections, cardiovascular disease prevention in low- and middle-income countries, interpersonal violence prevention in low- and middle-income countries, and microbial threats to health. He also directs a unique capacity-building effort, the African Science Academy Development Initiative, which over 10 years aims to strengthen the capacity of eight African academies to provide independent, evidence-based advice their governments on scientific matters.

Prior to joining to the Academies Dr. Kelley served in the U.S. Army for more than 23 years as a physician, residency director, epidemiologist, and program manager. In his last U.S. Department of Defense (DoD) position, Dr. Kelley founded and directed the DoD Global Emerging Infections Surveillance and Response System (DoD-GEIS). This responsibility entailed managing surveillance and capacity-building partnerships with numerous elements of the federal government and with health ministries in more than 45 developing countries. He also founded the DoD Accession Medical Standards Analysis and Research Activity. Dr. Kelley is an experienced communicator having lectured in English or Spanish in more than 20 countries. He has published more than 70 scholarly papers, book chapters, and monographs. Dr. Kelley obtained his M.D. from the University of Virginia and his Dr.P.H. in epidemiology from the Johns Hopkins School of Hygiene and Public Health. He is also board certified in preventive medicine and public health.

**James F. Kollie, Jr., M.B.A., Ph.D.**, is Deputy Minister for Fiscal Affairs at the Ministry of Finance and Development Planning of the Republic of Liberia, with responsibility for managing the financial resources of the country, developing and administering financial rules and regulations, overseeing matters relating to government accounting and reporting, overseeing matters relating to tax and revenue policies and reform, and overseeing overall expenditure monitoring. Before becoming Deputy Minister for Fiscal Affairs in 2014, he served as Deputy Minister for Revenues in 2012 at the Ministry of Finance and previously as Acting Deputy Minister for Regional and Sectoral Planning at the Ministry of Planning and Economic Affairs in 2011.

Dr. Kollie comes to his position with a unique combination of experience in the private sector, the not-for-profit sector, and the public sector. He brings a wealth of experience and interest in policy formulation and analysis, program evaluation, finance, and accounting.

In 2009, working with the team at the Ministry of Planning and Economic Affairs, he ran the Secretariat of the Liberia Reconstruction & Development Committee, where he used results-based monitoring techniques



to significantly improve implementation rates. During this period, he was instrumental in enhancing coordination between development partners and state actors.

Dr. Kollie's work with the implementation of the Poverty Reduction Strategy as well as his involvement in the development of Liberia's National Vision (Liberia Rising 2030) and the 5-year development plan, the Agenda for Transformation, has well positioned him in fully understanding and appreciating the challenges to Liberia's development as well as what key interventions are required to advance the development goals. Dr. Kollie holds a bachelor's degree in accounting and economics from Zion University College, an M.B.A. in corporate finance from the University of St. Thomas, and a Ph.D. in public policy and administration from Walden University.

**Gunther Kraut, Ph.D.**, joined the Financial Solutions Life department at Munich Re in 2007. Among various other activities, he has developed a certain focus on pandemic risk transfer. He played a leading role in successfully developing and structuring Munich Re's global life pandemic risk retrocession program. Dr. Kraut earned a degree in financial mathematics at Technische Universität München before pursuing management studies at Ludwig-Maximilians-Universität München (LMU). While earning his doctoral degree at the Institute for Risk Management and Insurance at LMU, one of Dr. Kraut's main research areas was the management and regulation of extreme mortality risks.

**Chris Lane, M.A.**, is Chief of the Low-Income Countries Division, Strategy Policy and Review Department at the IMF in Washington, DC. He is responsible for policies relating to IMF lending to and monitoring of low-income countries. In 2015, he led a staff team that proposed a debt relief mechanism for countries hit by public health disasters via "The Catastrophe Containment and Relief Trust." Debt relief has since been provided to the three countries most impacted by the Ebola outbreak and new financing has been raised for the Trust. Mr. Lane has extensive experience of fund support for low-income and emerging market economies. Other relevant experience includes working as a macroeconomic advisor at WHO in 2007-2008, and research on scaling up health spending in developing countries.

**Gordon Liu, Ph.D., M.A.**, is a Peking University (PKU) Yangtze River Scholar Professor of Economics at Peking University's National School of Development (NSD), and Director of the PKU China Center for Health Economic Research. His research interests include health and development economics, health reform, and pharmaceutical economics.

Prior to PKU NSD, he was full professor at PKU Guanghua School of Management (2006-2013), associate professor at the University of North

Carolina at Chapel Hill (2000-2006), and assistant professor at the University of Southern California (1994-2000). He was the 2005-2006 President of the Chinese Economists Society, and the founding chair of the Asian Consortium for the International Society for Pharmacoeconomics and Outcomes Research (ISPOR).

Dr. Liu has served as Associate Editor for Science Citation Index journals *Health Economics* (HE), *Value in Health* (the ISPOR official journal), and *China Economic Quarterly*. Dr. Liu sits on the China State Council Health Reform Advisory Commission, the UN “Sustainable Development and Solution Network” (SDSN) Leadership Council led by Jeffrey Sachs of Columbia University, and co-chairs the SDSN Health Thematic Group.

**Nita Madhav, M.S.P.H.**, is a Principal Scientist in the Research and Modeling group at AIR Worldwide, where she leads the life and health risk research and modeling team. In this role, she has directed development of AIR’s pandemic disease risk models. Since joining AIR in 2005, she has also developed industry exposure databases, created global historical loss databases, and provided planning and logistical support for post-disaster damage surveys. Prior to AIR, Ms. Madhav worked in the Special Pathogens branch of CDC. She earned her B.S. in ecology and evolutionary biology, with distinction, from Yale University, and her M.S.P.H. in epidemiology from the Rollins School of Public Health at Emory University. Her background is in the epidemiology of vector-borne and zoonotic diseases, and the statistical modeling of disease spread.

**Olivier Mahul, Ph.D.**, is the Program Manager of the World Bank’s Disaster Risk Financing and Insurance Program, which is co-sponsored by the World Bank, the Global Facility for Disaster Reduction and Recovery (GFDRR), the Swiss State Secretariat for Economic Affairs, the Ministry of Finance of Japan, and the Ministry of Foreign Affairs of the Netherlands. This program mainstreams disaster risk financing and insurance within the disaster risk management and climate change adaptation agenda in developing countries. Since he joined the World Bank in 2003, Dr. Mahul has been involved in developing disaster risk financing and insurance solutions in more than 40 countries, including Colombia, Costa Rica, India, Indonesia, Mexico, Mongolia, and Vietnam. Dr. Mahul was closely involved in the product development of the World Bank catastrophe drawdown option (CAT DDO), a contingent credit line that provides immediate liquidity to World Bank member countries in the aftermath of natural disasters. The CAT DDO has been approved for several countries, including Colombia, Costa Rica, and the Philippines. Dr. Mahul is one of the key architects of the Caribbean Catastrophe Risk Insurance Facility, which provides the Caribbean island states with parametric insurance against major natural

disasters. He is currently co-leading the Pacific Catastrophe Risk Assessment and Financing Initiative, which offers the Pacific island countries risk assessment and modeling tools to guide their disaster risk management decisions and their disaster risk financing strategies. Dr. Mahul is one of the program designers of the Mongolia Index-based Livestock Insurance Program, an index-based livestock mortality insurance program against extreme weather events. Dr. Mahul also provides the government of India with advisory services on the reform of the India's National Agricultural Insurance Scheme, the world's largest crop insurance program in terms of farmers insured. Dr. Mahul holds a Ph.D. in economics from Toulouse School of Economics and post-doctorates from Wharton Business School and University of California, Berkeley. Dr. Mahul has authored more than 40 publications in international journals and won several academic awards. He recently co-authored two books: *Catastrophe Risk Financing in Developing Countries: Principles for Public Intervention* (with J. David Cummins) and *Government Support to Agricultural Insurance: Challenges and Options for Developing Countries* (with Charles Stutley).

**Lelio Marmora, J.D.**, is the Executive Director of UNITAID. He joined in October 2014 from the Global Fund to Fight AIDS, Tuberculosis and Malaria, where he spent the previous 7 years, most recently as Head, Africa and Middle East Department. In this role he coordinated 170 staff across 4 regional teams and managed a \$8 billion portfolio for 48 countries. Prior to the Global Fund, Mr. Marmora spent 7 years with the World Bank, where he focused on fundraising, resource mobilization, and program design.

A lawyer by training, Mr. Marmora has also worked at a variety of other international organizations such as UN Educational, Scientific and Cultural Organization (UNESCO) and UNDP, as well as for the government in his native Argentina.

**Martin Meltzer, M.Sc., Ph.D.**, is the Lead of the Health Economics and Modeling Unit, and a Distinguished Consultant in the Division of Preparedness and Emerging Infections, CDC, in Atlanta, Georgia. He received his undergraduate degree from the University of Zimbabwe in 1982, and master's and a doctorate in applied economics from Cornell University, New York, in 1987 and 1990, respectively. From 1990 to mid-1995, he was on the faculty at the College of Veterinary Medicine at the University of Florida. In 1995, he moved to CDC, where he was in the first class of Prevention Effectiveness (health economists) Fellows. He led the modeling teams supporting CDC's response to the 2009 H1N1 influenza pandemic, including producing monthly estimates of cases, hospitalizations, and deaths, as well as estimating impact of the vaccination program and use of influenza antiviral drugs. Other responses in which he led the modeling activities

include estimating the residual risk associated with the 2012 contaminated steroid injectable products that caused fungal meningitis among patients, and the 2014 Ebola epidemics in West Africa. Examples of his research include estimating the impact of the 2009 influenza pandemic, the modeling of potential responses to smallpox as a bioterrorist weapon, and assessing the economics of controlling diseases such as rabies, dengue, hepatitis A, meningitis, Lyme, and malaria. Dr. Meltzer has published approximately 210 publications, including more than 100 papers in peer-reviewed scientific journals and more than 34 software tools. These tools include *FluAid*, *FluSurge*, and *FluWorkLoss*, designed to help state and local public health officials plan and prepare for catastrophic infectious disease events. They have been downloaded more than 100,000 times and have been used by local, state, national, and international public health agencies, with jurisdictions exceeding a total of 1 billion persons. Dr. Meltzer is an associate editor for *Emerging Infectious Diseases*. He also supervises a number of post-doctoral health economists at CDC.

**Nachiket Mor, Ph.D., M.B.A.**, is the chairman of the board of CARE India, a board member of the Reserve Bank of India, and a board member of CRISIL. He has a background in finance and economics with a specific interest in financial access and health care. Dr. Mor worked with ICICI, India's second largest bank, from 1987 to 2007 and was a member of its Board of Directors from 2001 to 2007. From 2007 to 2011, he served as the founding president of the ICICI Foundation for Inclusive Growth and during this period was also the chair of the Governing Council of IFMR Trust and board chair of FINO, both leading participants in the field of financial inclusion in India. While at ICICI he also served as a board member of Wipro for 5 years and as board chair of the Fixed Income Money Market and Derivatives Association of India for 2 years. During 2011-2012 he served as a member of the High Level Expert Group on Universal Health Coverage for India appointed by the Planning Commission of India, and during 2012-2013 as a member of the health subcommittee of the National Advisory Council of the Government of India. Dr. Mor is currently also a member of the Board of Directors of the IKP Centre for Technologies in Public Health and Sughavazhvu Healthcare. Dr. Mor is a Yale World Fellow, has a Ph.D. in economics from the University of Pennsylvania with a specialization in finance from the Wharton School, an M.B.A. from the Indian Institute of Management, Ahmadabad, and an undergraduate degree in physics from the Mumbai University.

**Carmen (Ceci) Mundaca-Shah, M.D., Dr.P.H.**, is a Senior Program Officer with the Board on Global Health of the National Academies of Sciences, Engineering, and Medicine. She is currently directing the Multi-Stakeholder

Initiative for Creating and Operational Global Health Risk Management Framework for the 21st Century. Prior to directing this study, she was the study director for the Board on the Health of Select Populations report *Beyond Myalgic Encephalomyelitis/Chronic Fatigue Syndrome: Redefining an Illness*, and she served as a post-doctoral fellow with the Board on Global Health on the *Outcome and Impact Evaluation of Global HIV/AIDS Programs Implemented Under the Lantos-Hyde Act of 2008*. Prior to joining the Academies, Dr. Mundaca-Shah was employed as head of the Surveillance Center of the Emerging Infections Program in the U.S. Naval Medical Research Unit 6 in Lima, Peru. In that role, she led the successful implementation of a technology-based disease surveillance system (Alerta) at sites across the nation and initiated the broad adoption of Alerta in five other countries in South America. Alerta is a partnership involving the Peruvian Navy and the U.S. Navy. Dr. Mundaca-Shah also led the collaborative syndromic surveillance pilot implementation in the Peruvian Ministry of Health. She was part of the Early Warning Outbreak Recognition System Working Group and participated in several studies, including a field visit to evaluate the performance of the system in Lao People's Democratic Republic. She obtained her M.D. from San Marcos University, Lima, Peru, and her M.P.H. and Dr.P.H. degrees from the Uniformed Services University of the Health Sciences, Bethesda, Maryland. Her dissertation work focused on developing a framework to guide the implementation of disease surveillance systems in developing countries. Dr. Mundaca-Shah completed a certificate in emerging infectious disease epidemiology at the University of Iowa.

**David Nabarro, B.M.B.Ch., M.A., M.Sc., MFPHM, FRCP**, is the UN Secretary-General's Special Envoy on Ebola. Since his appointment in September 2014, Dr. Nabarro has worked on behalf of the UN system to provide the overarching strategic and policy direction for a greatly enhanced international response to the West Africa Ebola Outbreak. This includes galvanizing essential support for affected communities and countries from partners around the world. Dr. Nabarro concurrently serves as Special Representative of the UN Secretary-General for Food Security and Nutrition and as Coordinator of the Movement for Scaling Up Nutrition, positions he has held since 2009 and 2012, respectively. These appointments follow an extensive career in global health, nutrition, and development, beginning as a District Child Health Officer in Dhankuta District, Nepal. Since then, Dr. Nabarro has played a catalytic coordination role in the response to several global emergencies, such as the avian and human influenza epidemic of 2005, and crisis response operations in Darfur, Sudan, and in countries affected by the 2004 Indian Ocean earthquake and tsunami.

Dr. Nabarro has lived and worked in government, the UN, NGOs, and academic institutions in Bangladesh, Iraq, Kenya, Nepal, and the United

Kingdom, as well as at UN Headquarters in Geneva and New York. Previous key leadership roles include Coordinator of the UN System High Level Task Force on Global Food Security (2008-2014), Senior UN Coordinator for Avian and Pandemic Influenza (2005-2014), Representative of the WHO Director-General for Health Action in Crises (2003-2005), Executive Director, Office of the WHO Director-General (2001-2003), Head of Roll Back Malaria at WHO (1999-2001), and Director for Human Development in the DFID (1997-1999).

Dr. Nabarro was awarded an M.A., an M.Sc., and a medical degree from Oxford University. He also holds a master's in public health from London University. He is a Fellow of the Royal College of Physicians, and in 1982 was appointed a CBE in recognition of his international public service. He speaks three languages, including French and Nepali.

**Frances Reid, Ph.D., J.D.**, joined CDC Group plc in November 2014, coming from the Millennium Challenge Corporation in Washington, DC, where she was Senior Investment and Risk Officer in the Office of the Chief Executive. She brings to CDC Group extensive experience in investment and finance across global emerging markets. She previously served in senior positions in the U.S. Department of the Treasury, the European Bank for Reconstruction and Development, Lehman Brothers, and Bank of Boston. Dr. Reid's experience covers a range of financial activities, including corporate finance, private equity, investment management, debt restructuring, and development of proprietary financial products. Much of her work has been in emerging markets, particularly in Africa, Asia, and Eastern Europe. She has advanced degrees in both economics and law.

**Peter Sands, M.P.A.**, stepped down from the role of Standard Chartered PLC's Group Chief Executive in June 2015, having been appointed to the role in November 2006. He joined the board of Standard Chartered PLC as Group Finance Director in May 2002, responsible for Finance, Strategy, Risk and Technology, and Operations. Prior to this, Mr. Sands was Director and Senior Partner at worldwide consultants McKinsey & Co. Before joining McKinsey, Mr. Sands worked for the United Kingdom's Foreign and Commonwealth Office.

Mr. Sands is the lead non-executive board member of the Department of Health in the United Kingdom and the co-chair of the India UK CEO Forum. Mr. Sands has held a number of board memberships including the Institute of International Finance and the International Monetary Conference. He is a member of the Global CEO Council set up by the Chinese People's Association for Friendship with Foreign Countries to advise the Chinese government and served on the Monetary Authority of Singapore's International Advisory Panel. He graduated from Oxford University and

holds a master's in public administration from Harvard University, where he was a Harkness Fellow.

**Paolo Sison, M.Sc., M.B.A.**, is Director for Innovative Finance at Gavi, the Vaccine Alliance. Gavi is a public-private partnership committed to saving lives and protecting people's health by increasing access to immunization in poor countries, and is a leading force in innovative finance for development. Gavi's innovative finance mechanisms include IFFIm, the Pneumococcal Advance Market Commitment, and the Gavi Matching Fund.

Before joining Gavi, Mr. Sison spent 10 years in investment banking in London, most recently as Director, Global Banking and Markets, at HSBC, where he was responsible for equity and equity-linked origination in the financial services sector across Europe, the Middle East, and Africa. His capital markets experience includes fixed income, hybrid and derivative origination, and structuring. Previously, he spent 6 years in Manila and in Tokyo, with Ayala Corporation's Strategic Planning Group and with Mitsubishi Corporation's Development & Coordination Department. During this time he looked after the business groups' investments in the financial services and industrial sectors, and was actively involved in business development in the Asia-Pacific region. Mr. Sison holds an M.Sc. in finance from London Business School and an M.B.A. from the Asian Institute of Management.

**Trish Stroman, M.B.A., M.S.**, is a Partner in Boston Consulting Group's (BCG's) Washington, DC, office. Since joining BCG in 2005, her focus has been on health care, with a particular focus in global public health and health services. Ms. Stroman most recently supported the UN Mission for Ebola Emergency Response team with the strategy, planning, and management of the latest outbreak, including aid to the Secretariat during initial mission design and direct support to mission leadership in Accra. Following the Ebola crisis, she worked in collaboration with the World Economic Forum to assess opportunities for improved public-private collaboration in health emergencies. In addition, Ms. Stroman helped to create a business plan for African Risk Capacity, a specialized agency of the African Union, to develop a new insurance product to cover disease outbreaks and epidemics.

In her work with foundations, public-private partnerships, and public-sector entities, Ms. Stroman aims to bring BCG's cutting-edge knowledge to bear, with an eye toward customizing their approach to meet the needs of complex stakeholder environments and long-term, intractable problems like HIV/AIDS or malaria. Ms. Stroman holds an M.B.A. and an M.S. in public health from the University of North Carolina at Chapel Hill and a B.A. in human biology from Stanford University. Prior to joining BCG,

Ms. Stroman was an internal consultant for the physician group at Kaiser Permanente in Northern California.

**Jordan W. Tappero, M.D., M.P.H.**, is Director of the Division of Global Health Protection (DGHP), Center for Global Health, CDC. DGHP is CDC's most visible program for strengthening global health security and developing public health capacity to prevent, detect, and respond to communicable and noncommunicable disease threats around the world. DGHP builds capacity in applied epidemiology through field epidemiology training programs and fosters the development of National Public Health Institutes with Ministries of Health globally. In the event of a global disease epidemic or humanitarian disaster, DGHP often leads CDC global response. Throughout 2015, Capt. Tappero has been leading CDC's newly funded (\$1 billion) Global Health Security Agenda and International Ebola emergency funding efforts, traveling to sub-Saharan Africa and South Asia to open offices there, as well as in South Asia. As a leader in CDC's West African Ebola Response, Capt. Tappero served in Liberia from August to September 2014 as the first CDC Lead for the Public Health and Medical Response within USAID's Disaster Assistance Response Team for West Africa. From late September 2014 through January 2015, he served as Deputy Incident Manager for the Ebola Response out of CDC's EOC, where he assisted with directing the day-to-day international and domestic response activities. Capt. Tappero also led CDC's emergency response following the 2010 Haiti earthquake and follow-on response to epidemic cholera. Capt. Tappero joined CDC in July 1992 as an Epidemic Intelligence Service Officer, is a Captain in the U.S. Public Health Service, and holds three American Board Certifications and a master's in public health from the University of California, Berkeley. He has authored or co-authored more than 250 peer-reviewed publications, as well as textbook chapters on HIV, TB, malaria, meningococcal disease, leptospirosis, Ebola and Marburg hemorrhagic fevers, cholera, and other emerging infections.

**Hans Troedsson, M.D.**, has a medical degree and has worked as a physician in the areas of pediatrics, infectious diseases, and public health in Sweden. He has 20 years' experience of international health at country and global levels. He joined WHO in 1990 and worked in the African Region, South-East Asia Region, Western Pacific Region, and at Headquarters (HQ). He has a vast experience of technical support to regions and countries as well as in the area of research and development at the global level. In the past, he was responsible for coordinating collaboration between the WHO HQ Department of Child and Adolescent Health and Development (CAH) and the World Bank, as well as with other key partners both at country and global levels.



He knows international development cooperation from his work as the Deputy Head of Health Division at Sida in 1995-1997, and as the Project Leader for the development of Sida's Policy for Development Cooperation in the Health Sector. He held the position of Team Coordinator Health Services Delivery in the CAH at WHO/HQ, before he was appointed Director of the Department in 2000. He was WHO Representative in Vietnam from 2004 to 2007 when he actively contributed to avian influenza control and preparedness and health system reforms in the country.

From 2007 to 2009 he was WHO Representative in China in charge of WHO support to the government of China during several main events such as the earthquake in Sichuan, the Olympic Games in Beijing, the melamine food contamination incident, and the early stages of the influenza H1N1 pandemic. In September 2009 he was appointed Director, Programme Management, at the WHO Western Pacific Regional Office in Manila. Dr. Troedsson was the Executive Director of the Director-General's Office from November 2012 through February 2014. Dr. Troedsson was appointed Assistant Director-General for General Management in March 2014.

**Panos Varangis, Ph.D.**, is the global head of IFC Access to Finance SME & Business Advisory Services. He is also the global product specialist for projects with financial institutions in agriculture finance. Before joining IFC, Dr. Varangis served as the Deputy CEO of the Agricultural Bank of Greece for 5 years. He oversaw the corporate, small and medium enterprise (SME), and non-performing loan (NPL) department at the bank, and served on the Board of Directors of the Agricultural Insurance Company, the credit card and mutual fund companies of the bank, as well as on the Board of Directors of ATE Bank, Romania. Prior to this, Dr. Varangis worked for 17 years at the World Bank in various positions at the International Commodities Division, the International Trade Division, and the Research Department and finally at the Agricultural and Rural Development Department where he oversaw a global program on commodity risk management. His work at the World Bank focused on issues related to agricultural policies, commodity marketing systems, rural finance, and risk management. He has published a number of working papers, articles in journals, and chapters in books. He holds a Ph.D. in international economics from Columbia University, New York, and a master's degree in economics from Georgetown University.

**José Ángel Villalobos, M.B.A., M.Sc.**, is originally from Costa Rica. He is an affiliate member of the Institute and Faculty of Actuaries (UK), associate member (actuary) of the *Colegio de Profesionales en Ciencias Económicas* (CRI), associate member of the Chartered Insurance Institute (UK), and a Chartered Property and Casualty Underwriter (USA). He is a holder of an

M.B.A. and an M.Sc. (Actl), both from Heriot Watt University, Scotland. Mr. Villalobos has more than 30 years of experience in the (re)insurance sector (life and non-life) and 3 years working for the World Bank. His current position is Senior Insurance Specialist, Disaster Risk Financing & Insurance Program, Global Practice for Finance and Markets (GFMDR) and Global Facility for Disaster Reduction and Recovery (GFDRR), and he is serving the countries of Latin America and Southeast Asia.

**Staci Warden, M.P.P.**, is the executive director of the Center for Financial Markets at the Milken Institute, where she leads initiatives on strengthening capital markets, access to capital, financial education, and financial-markets solutions, among others. Ms. Warden is chair of the Rwandan Capital Markets Authority. Prior to joining the Milken Institute, she spent 6 years with JPMorgan in London, where she ran JP Morgan's Central Bank client franchise in Europe, Eurasia, and Africa, and 2 years in New York as part of the sovereign-debt-restructuring deal team. Before joining JP Morgan, she was a director at the Nasdaq, where she led their two initiatives for microcap companies, the Bulletin Board Exchange (BBX) and the Over-The-Counter Bulletin Board (OTCBB).

Ms. Warden has spent many years in the not-for-profit and public sectors managing, advising, and writing on issues of international economic development. At the U.S. Department of the Treasury, she ran the international debt-for-nature swap program and participated in the Argentina debt-restructuring and heavily indebted poor countries initiatives. In the not-for-profit sector, she served as startup chief operating officer of the Center for Global Development, an associate in the economic-reform program at the Carnegie Endowment for International Peace, and a development associate at the Harvard Institute for International Development. She has worked or done business in more than 50 countries and has served as an advisor to several ministers of finance on sovereign-wealth management, debt management, and poverty reduction.

Ms. Warden holds a master's of public policy from the Kennedy School of Government at Harvard University, with a concentration in international trade and finance, and has completed her coursework for a Ph.D. in economics from Brandeis University.

**Nathan Wolfe, M.A., D.Sc.**, is the founder and CEO of Metabiota, the pioneering risk analytics company that improves the world's resilience to epidemics. He holds the Lorry I. Lokey Business Wire Consulting Professorship in Human Biology at Stanford University. Dr. Wolfe received his doctorate in immunology and infectious diseases from Harvard in 1998. He was the recipient of a Fulbright fellowship in 1997 and the National Institutes of Health Director's Pioneer Award in 2005. He was named a

World Economic Forum Young Global Leader in 2009, a National Geographic Emerging Explorer in 2010, and one of the Time 100 in 2011. Dr. Wolfe has published 90 technical articles and book chapters. His first book, *The Viral Storm*, has been published in six languages and was shortlisted for the Royal Society's Winton Prize. His work has been published in or covered by *Nature*, *Science*, *Lancet*, *Proceedings of the National Academy of Sciences of the United States of America*, *JAMA*, *The New York Times*, *The Economist*, *The Wall Street Journal*, *TechCrunch*, *Wired*, *Scientific American*, *NPR*, *The New Yorker*, *National Geographic Magazine*, and *Forbes*. Dr. Wolfe has more than 8 years of experience living and conducting biomedical research in Southeast Asia and sub-Saharan Africa. His endeavors have attracted grant, contract, and investment support totaling more than \$100 million.

**Gordon Woo, Ph.D.**, is a catastrophist at Risk Management Solutions (RMS), specializing in the quantitative analysis of extreme risks and disaster finance. In his 15 years at RMS, Dr. Woo has designed computer models for numerous catastrophes, including pandemics. For his work on catastrophe insurance, he was named by *Treasury and Risk* magazine as 1 of the 100 most influential people in finance. In response to the Ebola crisis, he has been engaged in developing initiatives for funding pandemic risk mitigation.

He is the author of the book *Calculating Catastrophe*, published by Imperial College Press. Dr. Woo was educated at Cambridge and Massachusetts Institute of Technology, and was a member of the Harvard Society of Fellows. He is a visiting professor at University College London, and an adjunct professor at Nanyang Technological University, Singapore.

**Prashant Yadav, Ph.D., M.B.A.**, is a Senior Research Fellow at the William Davidson Institute (WDI) and Vice President of the Health Care Research Initiative at WDI. He also holds faculty appointments at the Ross School of Business and the School of Public Health at the University of Michigan. A leading expert on pharmaceutical and health care supply chains in developing countries, Dr. Yadav's research explores the functioning of health care supply chains using a combination of empirical, analytical, and qualitative approaches. He serves as an advisor in the area of pharmaceutical supply chains to The Bill & Melinda Gates Foundation, World Bank, WHO, UK Department for International Development, and many other global health organizations. He is the author of many scientific publications and his work has been featured in prominent print and broadcast media, including *The Economist*, *The Financial Times*, *Nature*, and *BBC*. He served as a member of the Institute of Medicine's committee on strengthening food and drug regulation in developing countries and as an advisory board member of several public-private partnerships, and currently serves as co-chair

of the Procurement and Supply Chain Working Group of the Roll Back Malaria Partnership. Prior to coming to the William Davidson Institute at the University of Michigan, Dr. Yadav was a professor of supply chain management at the Massachusetts Institute of Technology (MIT)-Zaragoza International Logistics Program and a research affiliate at the MIT Center for Transportation and Logistics, where he led the creation of a high-impact research initiative focused on pharmaceutical supply chains in developing countries. From 2008 to 2010 he was also a visiting scholar at the INSEAD Social Innovation Center. Dr. Yadav received his Ph.D. from the Manderson Graduate School of Business at the University of Alabama. He received his M.B.A. from the Foundation for Organisational Research and Education (FORE) School of Management and his bachelor of chemical engineering from the Indian Institute of Technology.

**Simon Young, Ph.D.**, has a background in earth sciences, with a specialization in volcanology. For the past 15 years he has worked as a consultant, providing a broad range of disaster and climate risk management and financing services around the world in both private and public sectors. Between 2006 and 2013, that work was undertaken as CEO of Caribbean Risk Managers Ltd, where Dr. Young was closely involved in the development, implementation, and operations of both the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and the Microinsurance Catastrophe Risk Organisation (MiCRO). Most recently, Dr. Young has been managing CCRIF's expansion into Central America and the implementation of its Excess Rainfall product, and he also represented CCRIF on the deal team for the CCRIF/International Bank for Reconstruction and Development (IBRD) catastrophe bond placed in July 2014.

During 2013 and early 2014 he was lead Advisor to the African Risk Capacity Insurance Company (ARC Ltd) during its startup phase and was formally appointed CEO in July 2014, a position he still holds. He has also been ARC Ltd.'s Underwriter, managing the insurance underwriting process and supporting the company's interactions with the international risk markets.

