Global Health Risk Framework: Governance for Global Health: Workshop Summary

DETAILS

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GLOBAL HEALTH RISK FRAMEWORK

Governance for Global Health

WORKSHOP SUMMARY

Alison Mack, Megan R. Snair, and Eileen R. Choffnes, *Rapporteurs*

Forum on Microbial Threats

Board on Global Health

Institute of Medicine

The National Academies of
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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:

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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 **MELVIN WORTH.** 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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Contents

Acronyms and Abbreviations

AFRO	World Health Organization Regional Office for Africa
AIDS	acquired immune deficiency syndrome
CDC	U.S. Centers for Disease Control and Prevention
DRC	Democratic Republic of the Congo
ECOWAS	Economic Community of West African States
ERC/IASC	United Nations Emergency Relief Coordinator/Inter-Agency Standing Committee
FAO	UN Food and Agriculture Organization
FMT	Foreign Medical Team
GHSA	Global Health Security Agenda
GOARN	Global Outbreak Alert and Response Network
GPHIN	Global Public Health Intelligence Network
HIRO	Heads of International Research Organizations
HIV	human immunodeficiency virus
HQ	headquarters
IASC	United Nations Inter-Agency Standing Committee
IHR	International Health Regulations
IOM	Institute of Medicine

ISARIC	International Severe Acute Respiratory and Emerging Infection Consortium
LSHTM	London School of Hygiene & Tropical 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
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health
PAHO	Pan American Health Organization
PHEIC	public health emergency of international concern
ProMED	Program for Monitoring Emerging Diseases
PVS	Performance of Veterinary Services
SARS	severe acute respiratory syndrome
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNMEER	United Nations Mission for Ebola Emergency Response
USAID	U.S. Agency for International Development
WFP	World Food Programme
WHA	World Health Assembly
WHO	World Health Organization
WTO	World Trade Organization

1

Introduction[1]

From its onset in December 2013 to its slow disappearance in late 2015, the West African Ebola epidemic has revealed deep and pervasive fault lines in the existing mechanisms to address emerging infectious disease threats to global public health—faults that have been previously identified, warned against, and largely met with inaction through various World Health Organization (WHO) review panels and by infectious disease experts. Nearly 6 months after Médecins Sans Frontières brought the Ebola epidemic in West Africa to the world's attention in March 2014, WHO declared the outbreak to be a public health emergency of international concern (PHEIC), triggering powers under the 2005 International Health Regulations (IHR).[2] By November 2015, the epidemic had resulted in more than 28,000 cases and 11,000 deaths.[3]

Beyond the near-term challenge of ending ongoing Ebola transmission, this epidemic has again demonstrated the inadequacy of the international framework for managing global public health communicable disease events.

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

[2] The IHR are explained in detail in Chapter 3.

[3] Total suspected, probable, and confirmed cases and deaths from the 2014 West Africa Ebola outbreak as of November 1, 2015. See more at http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html (accessed November 30, 2015).

Governance structures—intra- and interinstitutional and across sectors—did not perform as intended, and insufficient communication across vertical and horizontal response structures added to the misunderstanding of severity. The Ebola outbreak grew to catastrophic proportions in Guinea, Liberia, and Sierra Leone and began to threaten nations far beyond West Africa.

Over the past 40 years, globally significant outbreaks of HIV/AIDS, H1N1 influenza, severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and other infections have illuminated many of the same deficiencies in global health governance. Lacking the political will to create and implement a robust global public health framework, many thousands have lost their lives, and billions of dollars have been incurred in economic damage. Once again, multiple expert panels have been assembled at international levels to assess what went wrong in this latest public health crisis, and to recommend actions related to governance of global health that can be taken at the national, regional, and international levels to prevent another outbreak from emerging and negatively impacting so many countries and populations.

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 the health sector. 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; WHO; 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[4] on improving international management and response to outbreaks. As part of this effort, the Institute of Medicine (IOM) 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 gath-

[4] For more information on the Commission, see http://nam.edu/initiatives/global-health-risk-framework (accessed October 20, 2015).

ered 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.[5]

MEETING OBJECTIVES

Building on more than a decade of workshops on such topics as SARS, H1N1 influenza, and the emergence of MERS, the Academies' Forum on Microbial Threats coordinated the Governance for Global Health Workshop, which was held on September 1-2, 2015, at the Wellcome Trust in London, United Kingdom. The workshop was designed to explore global, national, and local capabilities, to include those required by the International Health Regulations (2005); to facilitate the collective action of the governmental, intergovernmental, corporate, and nonprofit sectors as they contribute to preparedness and response; to describe options to strengthen global, regional, national, and local systems to better prepare, detect, and respond to epidemic diseases; and to study interrelations between sectors.

"We are here to consider the key elements of good governance for global health, to characterize the needs, gaps, and barriers in our current approaches, to consider alternative models of global health governance, to examine indicators and metrics of an effective, accountable, anticipatory and resilient system," David Relman of Stanford University told workshop participants. This effort, he continued, supports the Global Health Risk Framework Commission's goal of building actionable recommendations that lead to improved global health governance: a high-stakes result on which the health and welfare of the world's population depend.

This document is a summary of the presentations and discussions that took place at the workshop and is not meant to be a comprehensive overview of how best to achieve ideal governance for global health security issues. Achieving compliance with the core capacities of the IHR and improving the complex systems within which WHO, the United Nations, member states, and nonstate actors work together is a multifaceted and challenging ambition. Due to limitations of attendance and the rapid timing of this workshop, this summary captures suggestions and ideas from individual speakers and participants on how to accomplish these goals, but they may not be complete or all-encompassing. For workshop objectives, see Box 1-1.[6]

[5] Summaries from the other three workshops can be found at http://iom.nationalacademies.org/reports/2016/GHRF-Finance; http://iom.nationalacademies.org/reports/2016/GHRF-Health-Systems; http://iom.nationalacademies.org/reports/2016/GHRF-Research-and-Development.

[6] A full statement of task for the workshop can be found in Appendix C.

BOX 1-1
Workshop Objectives

- Mobilize for the Global Health Risk Framework Commission suitable evidence and expert opinion to inform their deliberations around the pros and cons of alternative approaches to improved governance for global health.
- Illuminate the definition of governance for global health and its scope.
- Consider the key elements of "good" governance, such as targets and benchmarks, monitoring, transparency, honesty, civil society engagement, and accountability.
- Document key successes and lessons learned from past global infectious disease outbreaks and other public health emergencies and how they may inform preparation and response to future outbreaks and emergencies.
- Characterize needs, gaps, and barriers in current approaches to addressing global infectious disease outbreaks and other public health threats.
- Consider compliance-enhancing mechanisms to drive good governance and implementation of existing international norms, such as measures of compliance and monitoring for compliance, incentives for compliance, identifying and working with key actors to improve compliance, and "shadow" reports such as by independent experts and civil society.
- Consider indicators and metrics that may be used to guide and assess the resilience of the global health infrastructure to future outbreaks and emergencies.

ORGANIZATION OF THE REPORT

This workshop report summarizes the discussions that took place in London, including perspectives around the need for global health risk governance, as well as potential models for consideration. Chapter 2 discusses the definitions of governance and the field of players involved, and Chapter 3 highlights lessons illuminated from past outbreaks—with several still waiting to be implemented. Chapters 4 and 5 cover the challenges for fragile states and challenges in designing strong governance for global health. Chapters 6 and 7 take a more in-depth look into suggested elements of a governance framework and potential models for comparison that could be employed by WHO and other stakeholders. Finally, Chapter 8 shares some closing thoughts on the four models presented at the workshop, paying particular attention to decision making, measurement, and accountability.

2

Need for Global Health Risk Governance

Highlights and Main Points Made by Individual Speakers and Participants[a]

- Challenges in global governance for health include the increasing role of nonstate actors, the influence of decisions made outside the health sector (e.g., trade, defense, and immigration), and the issue of overstepping national sovereignty by global decision makers. (Takemi)
- Many definitions of global health governance—including the workshop's working definition—tend to focus on actors, processes, principles, and objectives, neglecting or obscuring the central act of exercising political power. (Fidler)
- The World Organisation for Animal Health (OIE) and the World Health Organization (WHO), in collaboration with the World Bank, are investigating ways to harmonize their assessments of national capacity for disease management, using tools and indicators from both the Performance of Veterinary Services (PVS) Pathway and the International Health Regulations (IHR). Further investment in disease prevention and rewarding transparency in outbreak reporting could improve this effort further. (Thiermann)
- There is a need to create linkages among all levels of government and nonstate actors, including the community, and to provide support in the face of weaker governance. National

and local governments can build larger-scale responses sustainably on the foundation of existing community structures. (Takemi)

[a] 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 following working definition of governance for global infectious disease control was provided in the workshop agenda:

> In the context of infectious disease outbreaks of global significance, governance encompasses a range of integrated policy, information management, command, and control mechanisms for facilitating collective action to achieve the objectives of prevention, detection, and response. Of necessity, these mechanisms integrate actions across intergovernmental organizations, sovereign nations, communities, the corporate sector, humanitarian agencies, and civil society. They operate in not only the realm of health, but also to a variable extent in collateral spheres to include agriculture/food security, diplomacy, education, finance, migration/refugee care, security, and transportation.

This chapter discusses the varying ways of defining "governance for global health" and the implications a definition may have on the structures that follow. Speakers considered challenges of the current system, recent changes in the diversification of players involved in the global health field, and the continuing need to create linkages between all levels of government.

DEFINING GOVERNANCE FOR GLOBAL HEALTH

From his perspective as a politician and global health diplomat, Keizo Takemi, professor at Tokai University, called for collective action to address infectious diseases that threaten human security. A member of the Japanese House of Councillors and the Liberal Democratic Party, Takemi emphasized the role of health in security at every governmental level. In Japan, he noted, infectious diseases increasingly are regarded as threats to national security, and policy makers have recognized the importance of controlling infectious threats at the earliest possible stage. As hosts of the 2016 G7 summit, Japan will contribute to international discussions on governance for global health—discussions they attempted unsuccessfully to initiate in 2008, he reported. Since then, efforts to define what global governance encompasses, in a world lacking any such authority, have been spurred by humanitarian crises with global repercussions, among them emerging infectious diseases.

Takemi offered two contrasting definitions of governance for global health: "the way in which the global health systems are managed" and "the organized social response to health conditions at the global level." Both concepts raise a series of fundamental dilemmas, he noted: the lack of government at the global level, the critical influence decisions made outside the health sector (e.g., trade, defense, and immigration) have on health, and the increasing role of nonstate actors in the response to global health crises.

The issue of sovereignty often impedes critical discussion of these dilemmas by decision makers, Takemi observed. Politicians do not want to be perceived as interfering with the sovereignty of nation states, yet global governance demands it. Similar tensions hindering collective action arise between international agencies with deep organizational interests. Less inflammatory (but equally obstructive) barriers between sectors narrowly limit the scope and effectiveness of decision making, while the proliferation of nonstate actors in the health sector further complicates the response. The West African Ebola crisis starkly illustrates these roadblocks and their consequences for collective action to ensure global health, Takemi stated. He acknowledged the failure of three decades of well-documented warnings on the potential impact of emerging infectious diseases (and other global health threats) to galvanize sufficient political will to avert the Ebola tragedy.

Infectious Disease Preparedness and Response: The Road to the IHR

David Fidler of Indiana University defined the overarching goals and essential properties of good governance for global health as applied to infectious disease preparedness and response, and described the political context for implementing these elements through the IHR. Tracing the evolution of the concept of global governance for infectious diseases, he examined its status in the wake of the West African Ebola outbreak. Many definitions of global health governance—including the previously included working definition—tend to focus on actors, processes, principles, and objectives, neglecting or obscuring the central act of exercising political power, Fidler observed. The extent to which the exercise of political power is "good" can be evaluated on the basis of attributes such as legitimacy, transparency, accountability, equity, justice, and effectiveness, he explained.

Well before the West African Ebola epidemic, efforts were made to reform the institutional architecture for global health governance that "didn't go anywhere," Fidler recalled. Instead, a new strategy was adopted that united global health with global security. "Through global health security, we were trying to rethink what we meant by health; we were rethinking the idea of security, national and international security," he explained. The resulting pluralistic global health security concept was based on principles of good governance such as participation and organization. The embodi-

ment of the global health security strategy as applied to infectious diseases was the IHR 2005: a strategic effort to fulfill the categories of "good governance," Fidler remarked. Featuring participation by state and nonstate actors, its function was prevention, protection, and response against known and unknown epidemic threats. It empowered WHO and its leaders in new ways, and it integrated national security, economic interests, and human rights. The IHR 2005 was a vast improvement over the ineffective 1969 version of the IHR, he stated.

Ebola, however, caused problems on several fronts, Fidler said. An outbreak response that was initially open and inclusive for those willing to help lapsed into dominance by major powers; the need to address a humanitarian disaster in addition to controlling an outbreak—a situation not anticipated in the IHR 2005—resulted in a crisis in leadership; and principles of national security, economic interests, and human rights were damaged or seriously threatened. Although the crisis was eventually brought under control, this was achieved not through organized collective action, but through an expeditionary military campaign combined with the efforts of several ad hoc organizations and foreign member states, he concluded.

This disaster, Fidler hypothesized, resulted from "the gap between what we think we have as governance and the actual essence of governance, which is the exercise of political power." At the World Health Assembly (WHA) meeting in May 2015, he noted, WHO member states expanded WHO's responsibilities but did not increase assessed contributions. The WHA did not seek accountability for WHO's failed response to Ebola, nor did they agree on ways to interact more productively with civil society. WHO member states agreed to a new emergency fund, but one supported only by voluntary contributions, which can lead to accountability issues. Such weak efforts to improve global health governance for infectious diseases were overshadowed by those of other institutions, such as the G7, the Global Health Security Agenda, and the World Bank Group, he said—evidence that proliferation in governance is occurring without "any serious connection to how political interests are formed or political power is exercised."

Jeffrey Duchin of Seattle–King County Public Health and the University of Washington, asked for examples of instances in which the exercise of political power with regards to global health has been reconciled with principles of good governance. Fidler said that the IHR in their conception represented an alignment of political interest and the willingness to exercise political power that moved global health governance forward. However, the IHR fell short in the Ebola crisis because political support for them did not last when they were first enacted, and compliance with the core capacities of the IHR was not enforced. Among proposed post-Ebola models of global health governance for infectious diseases, some of which bypass WHO, it

remains to be seen whether the exercise of power—through the commitment of resources such as money, political capital, influence, capabilities, and personnel—would adhere to the principles of good governance, he stated.

Including Other Nonstate Actors in Global Governance Discussions

Responding to this point, WHO Director-General Margaret Chan observed that partnerships and donors outside WHO often neglect less wealthy and powerful countries, but insisted that those are the voices that need to be heard. However, she also urged change in WHO and United Nations (UN) agencies to reflect the fact that no existing government can provide the services and support needed to address health crises such as Ebola without the engagement of nonstate actors, including civil society, academia, and industry. Unfortunately, during the Ebola crisis, WHO member countries could not agree to include nonstate actors as part of the debate and discussion, she recalled.

"The legitimacy of WHO as a place where less powerful countries can come and have a voice obviously is not shared by those governments that want to go outside WHO in order to get something done," Fidler observed. Does that decision reflect the good governance notion of legitimacy, he wondered? How can the political interests of nonstate actors be brought into alignment with WHO's authority? Duchin asked if it were possible to plan for the possibility that political interest and power might not align to produce good governance in a future crisis. Fidler did not think it could be anticipated, only remedied after the fact, as is now being contemplated concerning revisions to the IHR, which for many countries has become merely a checklist that did not align with their own national health priorities. Peter Piot of the London School of Hygiene & Tropical Medicine argued that power relations can evolve, and WHO needs to remember to look broadly across the global health field when considering interests.

Fidler, however, predicted that such seemingly limited "fixes" to the global health governance system would have far-reaching and unanticipated consequences due to the system's complexity. "We need to prevent trying to find the solution to today's problem," Alejandro Thiermann of the OIE argued, using H5N1 as an example. Every time there is an outbreak, the focus is on that specific need, but following H5N1 the next epidemic was severe acute respiratory syndrome (SARS), he noted, for which the world was unprepared. Thus, between crises, global health should concentrate on assisting countries that have the will and not the means to comply with international norms. Doing that effectively requires monitoring and measuring improvement, he advised, and adjusting approaches to maximize preparedness for the next crisis in an all-hazards manner.

Performance of Veterinary Services Pathway: A Potential Model for Governance

Thiermann described the design and implementation of compliance-enhancing mechanisms to drive good governance as embodied in the international Terrestrial Animal Health Code. He also discussed the various means by which compliance with these measures has been monitored, measured, supported, and improved. Expanding the definition of "global health" to include animals, plants, and ecosystems, according to the concept of One Health,[1] Thiermann defined global veterinary governance as a global public good. He described the OIE's efforts to establish, monitor, and encourage worldwide compliance with standards for veterinary services.

Founded in 1924 in the wake of an outbreak of rinderpest in Europe, the OIE is comprised of 180 member countries, which host its 301 centers of expertise. The organization's mandate has since evolved to encompass information sharing on animal health issues and threats, scientific collaboration, and the establishment of international standards for terrestrial and aquatic animal health, Thiermann explained. To address the later goal, OIE developed its Performance of Veterinary Services (PVS) Pathway (OIE, 2013) (see Figure 2-1), which he described as a "system of measurement and evaluation that is an effective foundation for improving animal and public health at the national, regional, and international levels."

The continuous process that is the PVS Pathway begins with a request to the OIE from a member country for evaluation of its veterinary services, Thiermann said. The OIE-trained experts, approved by the country, conduct a qualitative assessment of national performance on 47 criteria specified in the OIE's terrestrial animal code. Those standards are focused in the following four areas: human, physical, and financial resources; technological capability and authority; interaction with interested parties; and market access. Each of these competencies is judged on a five-point scale, he explained, and it is up to the country to decide whether to publicize the confidential results of the evaluation. Of its 180 member countries, 133 had requested an evaluation as of April 2015, he reported; 123 have been completed, 69 are available on a restricted basis, and 20 are published on a public website. This illustrates some of the differences between the public and transparent process of the PVS Pathway and the OIE evaluations, and the closed process that member states go through regarding self-assessment in reporting compliance with WHO's IHR. For achieving core competencies of the IHR, only 30 percent of countries have declared themselves compli-

[1] The One Health paradigm has been defined as "the collaborative effort of multiple disciplines—working locally, nationally, and globally—to attain optimal health for people, animals and the environment" (AVMA, 2008).

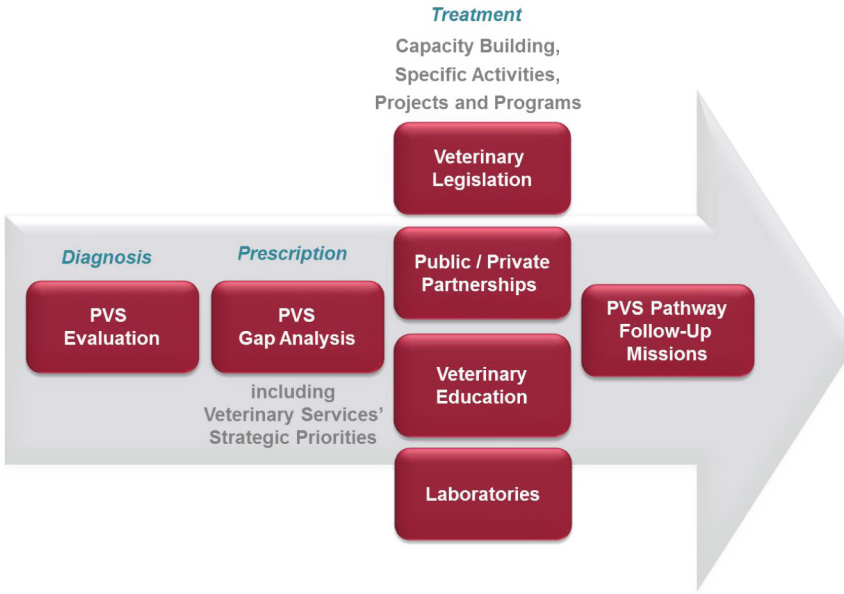

FIGURE 2-1 The Performance of Veterinary Services (PVS) Pathway, developed by the OIE.
SOURCE: Thiermann presentation, September 1, 2015.

ant after they were enacted in 2005, with no country lists or assessments posted publicly.

After reviewing the evaluation, the member country can request a visit from another OIE expert panel in order to plan and budget strategic actions over 5 years to improve compliance with the OIE PVS standards in the general areas of trade, animal health, veterinary public health, veterinary laboratories, and management and regulatory services. As of April 2015, 96 countries had requested this gap and costing analysis, he said; 80 had been completed, and the results of 13 were available on the Internet. Additionally, in many countries, veterinary legislation is outdated or inadequate, Thiermann pointed out. Thus, any OIE member country that has undertaken a PVS evaluation may request a mission to advise and assist them in modernizing national veterinary legislation according to the OIE Animal Health Code. Also, 3 to 5 years after receiving a "gap evaluation" or legislative mission, an OIE member country can request a follow-up mission to measure progress toward implementing the PVS Pathway, he noted.

Combining the results of PVS evaluations conducted to date, Thiermann presented a "global PVS diagnosis" in which he identified several common weaknesses, some noticeably similar to IHR compliance weak-

nesses. These include gaps in the chain of command between local, regional, and international agencies; shrinking budgets for veterinary services; unsuitable veterinary legislation; an aging population of veterinary practitioners; absence of and lack of control over veterinary paraprofessionals such as laboratory and field technicians; inadequate emergency preparedness and response; underperforming surveillance and laboratory networks; and product safety and sanitation failures, such as the development of antimicrobial resistance. To address these shortcomings, the OIE and its member countries must collaborate with other stakeholders, including the private sector and intergovernmental organizations, he advised. Thiermann noted that the OIE and WHO, in collaboration with the World Bank, are currently investigating ways to harmonize their assessments of national capacity for disease management, using tools and indicators from both the PVS Pathway and the IHR. While this initiative offers potential to improve response to infectious diseases, he said, further investment must be made in disease prevention, such as helping countries comply with obligations as expressed by the OIE or the IHR, and rewarding transparency in reporting infectious disease outbreaks.

The OIE's support of the PVS Pathway has cost less than $10 million to date, most of it derived from donations from member nations to the organization's trust fund, Thiermann pointed out. When asked how being independent from the UN system affected the OIE's ability to fulfill its mission, he replied, "I think it is certainly a plus that we are not in the United Nations in the sense that it [the OIE] is a very small, flexible organization." As such, he said, the OIE can make rapid, technical decisions under relatively little influence from government or private-sector interests. While their budget is limited, member donors have built a trust fund that is currently three times the size of the OIE's annual operating budget, he reported. This has allowed them to support some capacity-building activities of their own, in addition to investments by the World Bank that are informed by the PVS Pathway.

DIVERSIFICATION OF GLOBAL HEALTH

Focusing on the concept of global health governance as it is applied to infectious diseases, Fidler described the dramatic expansion in expectations for "good governance" in this arena since the mid-1800s. At that time, global governance for infectious diseases was initiated under the International Sanitary Conferences and International Sanitary Conventions. Subsequently, institutions such as WHO, the United Nations Children's Fund (UNICEF), the General Agreement on Tariffs and Trade, and the United Nations Environment Programme began to complicate the picture, leading to today's broad spectrum of governance actors, which also includes the World Trade Organization (WTO), the Joint United Nations Programme

on HIV/AIDS (UNAIDS), the G7, the Global Fund,[2] and the Gates Foundation. This expansion occurred through a series of "proliferation moments" associated with specific infectious disease threats, he explained, including HIV/AIDS and UNAIDS; emerging infectious diseases and the Global Fund; and SARS and the 2005 revisions to the IHR. Another such "proliferation moment" may follow from the Ebola crisis, he observed.

The increasing ranks of actors on the stage of global health governance are creating major political problems, according to Fidler. Competition for scarce resources has led to complaints that some diseases (e.g., HIV/AIDS) receive funding disproportionate to that of other health threats. The vast array of actions, processes, and mechanisms promulgated by multiple actors creates tension over agenda setting and has undermined the authority of WHO, once considered the central international agency for health governance. This lack of coordination has prompted calls for "collective action on collective action," as exemplified by Takemi's previous statements.

Amid greater awareness of and attention to global health, the field has become more diversified and less dominated by WHO, Takemi added. For example, he said, UNAIDS was created in 1996 to respond specifically to the HIV/AIDS epidemic, while UNICEF and the United Nations Population Fund have each developed strategies for child, maternal, and reproductive health that are not formally coordinated. At the same time, nonstate health organizations, which lack political accountability, have increased in numbers and presence. However, the legitimacy of these nonstate actors has been enhanced by their inclusion in the governance of stakeholder organizations such as the Global Fund.

How to Leverage the Private Sector

Public–private partnerships have also proliferated to address global health concerns. Takemi described Japan's Global Health Innovative Technology Fund,[3] a consortium representing pharmaceutical companies and government representatives from several sectors, and partnered with the Gates Foundation and the Wellcome Trust. Such schemes, he asserted, encourage research and development on the part of pharmaceutical companies to meet global health threats arising among impoverished populations, as exemplified by Ebola in West Africa. The Ebola outbreak hit an area where people are particularly vulnerable and have suffered poverty for a long time, Takemi said. Under these circumstances, neither the nation states nor the intergovernmental organizations were able to effectively pre-

[2] The Global Fund to Fight AIDS, Tuberculosis and Malaria, see http://theglobalfund.org/en (accessed April 18, 2016).

[3] See https://www.ghitfund.org (accessed January 8, 2016).

vent, contain, or control the spread of Ebola. Instead, the risk of infections gradually expanded to other countries, leading the world to question the effectiveness and the legitimacy of the existing global health framework.

This situation demonstrates the need to create linkages among all levels of government and nonstate actors—beginning with the community—and to provide support where governance is weak, Takemi stated. People still rely on and are influenced by the decisions of the traditional leaders, he noted, and national and local governments can build larger-scale responses sustainably on the foundation of existing community structures. Piot also observed that the proliferation of global governance actors happened because the world is increasingly interconnected. However, the situation demands consolidation at a governance level on a par with the UN Security Council. Further, he advised, an agreement should be brokered among WHO member states and other political powers in order to delegate responsibility in a health crisis. It is time to fix this specific problem, rather than overhaul global health governance, he concluded.

STRENGTHENING EXISTING SYSTEMS

Examining the implications of these challenges, Takemi first discussed the need to enhance resilient and sustainable health systems through collective action at multiple levels of governance.[4] Health systems must address the wide-ranging effects of poverty, civil upheaval, cultural beliefs, and other factors that undermine health, he insisted. He described the experience in Japan showing that it is necessary and effective to develop and implement a comprehensive policy package that incorporates social welfare, labor, economy, trade, and industry to tackle various socioeconomic challenges and maximize opportunities for growth. For example, in the 1950s and 1960s, such policies not only spurred the development of effective drugs for tuberculosis and high blood pressure by Japanese companies, but also expanded access to community-based, preventive health care. In examining options "post-Ebola outbreak," Takemi encouraged increased attention to the community-centered approach, as they are the targeted audience.

Takemi also advocated that WHO continue to play the leading role in addressing infectious disease outbreaks and characterized the criticism leveled against the organization for its delay in declaring the Ebola epidemic a public health emergency of international concern as unfair, saying it was fueled by a vast array of unfortunate factors. We should take this opportunity to increase the political momentum around global governance and

[4] As part of the Global Health Risk Framework, a separate workshop summary on building resilient and sustainable health systems explores these concepts in more depth and can be found at http://iom.nationalacademies.org/reports/2016/GHRF-Health-Systems.

leadership issues, he advised, including at the next G7 summit. To secure and sustain financial resources for emergency responses, the World Bank Group has proposed the creation of a pandemic emergency facility in conjunction with WHO and private-sector partners. An insurance mechanism, activated by crisis, would trigger companies to fund the facility, which in turn would pass on resources to the agencies involved in a containment effort, he explained.

Overcoming the IHR's insufficiency to contain the spread of infectious diseases will require action on multiple fronts and involve several nonhealth sectors, Takemi noted. For example, enlisting the WTO to mitigate disincentives to report infectious disease outbreaks could help achieve this. Noting that only one in three WHO member states has achieved health capacity goals mandated by the IHR (WHO, 2015c), he advocated the creation of financial incentives for nations that report health emergencies, provided through the global health governance framework. He also emphasized the need for strong leadership, at the level of heads of state, and extending beyond the health sector, as well as international solidarity to support common political approaches.

While models presented at the end of this summary explore a new agency as an option, Takemi argued that no new agency is needed to coordinate the spectrum of organizations responding to global health emergencies. However, he said, WHO does need to work more closely with other UN agencies (e.g., UNICEF, the Food and Agriculture Organization, and the World Food Programme) and with the World Bank Group to influence global and national policy, as well as to respond to specific health threats. Mechanisms must be developed to coordinate the efforts of these agencies with groups delivering services to affected populations, such as nongovernmental organizations and military units, he added. Incorporating many different international agencies, each with their own politics, will be challenging, he warned. However, improved collective action can lead to progressively developing a tangible coordination mechanism to mutually accompany bilateral cooperation and enhanced collaboration with nonstate actors.

In conclusion, Takemi envisioned a common policy extending from the community level on the foundational concept of human security, and linked to collective action at the national and global levels. Proposals for strengthening global governance for health need to be aligned and supported by both effective leadership and political action, he insisted, saying that governance is not just architecture. Looking toward the 2016 G7 summit, Takemi noted that Japan would participate in continued discussion of global health issues at several interim international meetings, as it prepares policy recommendations.

3

Lessons from Past Outbreaks

Highlights and Main Points Made by Individual Speakers and Participants[a]

- The 2009 H1N1 pandemic tested the new International Health Regulations (IHR) (2005), highlighting progress but also exposing persisting problems, including the absence of enforcement in fulfilling core capacity obligations, less emphasis on "pre-PHEIC"[b] response, and conflicting roles of the World Health Organization (WHO). (Fidler, Fineberg, Heymann)
- Incentives should be used to encourage IHR compliance; disincentives should be used to discourage IHR violations and interference with traffic and trade. (Piot, Stocking)
- Declaring a PHEIC was highlighted as a persisting issue and suggestions for alternatives included a graded system to replace the binary trigger, and delegating responsibility for making the determination to an independent committee instead of the WHO Director-General. (de Goyet, Heymann, Piot)
- Bidirectional communication at the international, national, and community levels is critical during a health emergency response, and efforts should be made to better engage affected communities and nations to ensure ownership of a response. (Chan, Elias, Liu, Phumaphi, Stocking, Tomori)

- Donor nation responsibility for ensuring core capacity must be stressed, especially within the broader context of strengthening health systems overall. (López-Acuña, Stocking)
- Rather than reinvent global health architecture, creating a strong mechanism for inclusion of nonstate actors in the system, led by WHO as the coordinator, can lead to swifter mobilization of state, nongovernmental organization (NGO), and private-sector teams and assets and avoid the hiring of nonsustainable staff in a crisis. (Elias, Heymann, López-Acuña)
- Presenting infectious diseases in terms of a threat to national security may be useful to politicize the issue and compel policy makers to take action, but this language can also fuel a climate of fear that could inhibit a country's outbreak reporting and thereby delay a global response. (Liu, Takemi, Tomori)

[a] 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.
[b] Public health emergency of international concern.

In this chapter, various lessons emerging from past global outbreaks of infectious disease are explored through multiple perspectives, from severe acute respiratory syndrome (SARS) in 2005, to H1N1 in 2009, to the recent Ebola outbreak in West Africa, each of which marked a milestone in the history of the IHR. Participants synthesized what information has surfaced from these and other infectious disease challenges to inform efforts to strengthen and better coordinate governance for global health, and to identify ways to modify the IHR to allow it to achieve its intended purpose.

SARS AND THE 2005 REVISION OF THE IHR

The first IHR—legally binding regulations agreed upon by all nations represented by WHO, as described in the introduction to this overview—became law in 1969. Reflecting that less globalized world, they were intended to stop infectious diseases at national borders, and to ensure the maximum security against the spread of disease with a minimum interference in world traffic, explained David Heymann of Public Health England/Chatham House. The IHR 1969 required countries to

- Notify WHO of outbreaks occurring within their borders of three infectious diseases: cholera, plague, and yellow fever (such reports were accepted from countries in which the event occurred);

- Take only those protective measures against these diseases specified by WHO via the IHR; and
- Equip their borders (e.g., ports, airports, and frontier posts) adequately to prevent vector proliferation.

At that time, WHO published the outbreak reports it received "in very small print on the back of the weekly Epidemiological Record," Heymann recalled. Other countries could choose to react by, for example, requiring travelers from a country experiencing an outbreak of yellow fever to show proof of vaccination against the disease upon entry. But by the 1990s, with the rapid expansion of international trade and tourism, the economic impact of reporting the IHR-required diseases—which mainly affected developing countries—had become severe. Moreover, the regulations failed to address the growing threat of emerging infectious diseases, influenza, and other unknown threats.

In 1996, the WHO Director-General established an emerging infections program that in part was tasked with revising the IHR based on a 1995 World Health Assembly (WHA) resolution. The vision for the revised IHR was "a world on the alert and able to detect and collectively respond to international infectious disease threats within 24 hours, using the most up-to-date means of global communication and collaboration," Heymann said. These revisions were intended to establish a climate in which infectious disease outbreak reporting, while not enforced, was expected and respected. Implementing this vision within WHO required several key policy decisions—many of them precipitated by the emergence of SARS—Heymann explained.

The first was a move to act on information about disease outbreaks from sources other than countries, such as the Program for Monitoring Emerging Diseases (ProMED)[1] and the Global Public Health Intelligence Network (GPHIN)[2]—again showing the importance of understanding the proliferation of the players on the global health field that can support IHR goals. As compared with countries, these nonstate sources delivered far more actionable surveillance that controlled infectious disease outbreaks, he noted (see Figure 3-1).

The first report to the Global Outbreak Alert and Response Network (GOARN) on the disease that would be named SARS came from ProMED

[1] ProMED is an Internet-based reporting system dedicated to rapid global dissemination of information on outbreaks of infectious diseases that affect human health. For more, see http://www.promedmail.org (accessed November 18, 2015).

[2] GPHIN, developed by Health Canada in collaboration with WHO, is a secure Internet-based multilingual early warning tool that continuously searches global media for information about disease outbreaks. For more, see http://www.who.int/csr/alertresponse/epidemicintelligence/en (accessed November 18, 2015).

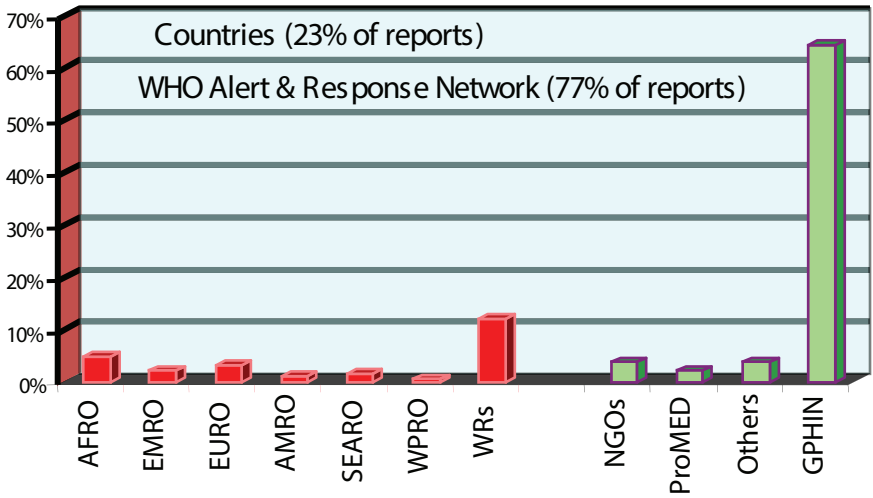

FIGURE 3-1 Information sources reporting public health risks to WHO through the Global Outbreak Alert and Response Network (GOARN) in 2003.
NOTE: AFRO = WHO Regional Office for Africa; AMRO = WHO Regional Office for the Americas; EMRO = WHO Regional Office for the Eastern Mediterranean; EURO = WHO Regional Office for Europe; GPHIN = Global Public Health Intelligence Network; NGO = nongovernmental organization; ProMED = Program for Monitoring Emerging Diseases; SEARO = WHO South-East Asia Regional Office; WHO = World Health Organization; WPRO = WHO Regional Office for the Western Pacific; WR = WHO representative.
SOURCE: Heymann presentation, September 1, 2015.

and GPHIN and occurred on November 16, 2002. (See Figure 3-2 for a full timeline of the SARS surveillance and detection evolution, as well as policy decisions prompted by events.) The route by which SARS achieved international transmission and factors contributing to local case clusters were identified by Margaret Chan's epidemiologic team in Hong Kong, Heymann noted.

They shared this information globally, leading to another policy decision by WHO: recommending that travelers avoid countries where environmental transmission could be occurring, a decision that profoundly affected economies and industries. In a break with prior policy, WHO then decided in April to publicly criticize the Chinese government for failing to report the initial SARS outbreak. This was a decision that was very difficult for the Director-General to make, Heymann said—but it got results, and the SARS pandemic was extinguished by mid-July.

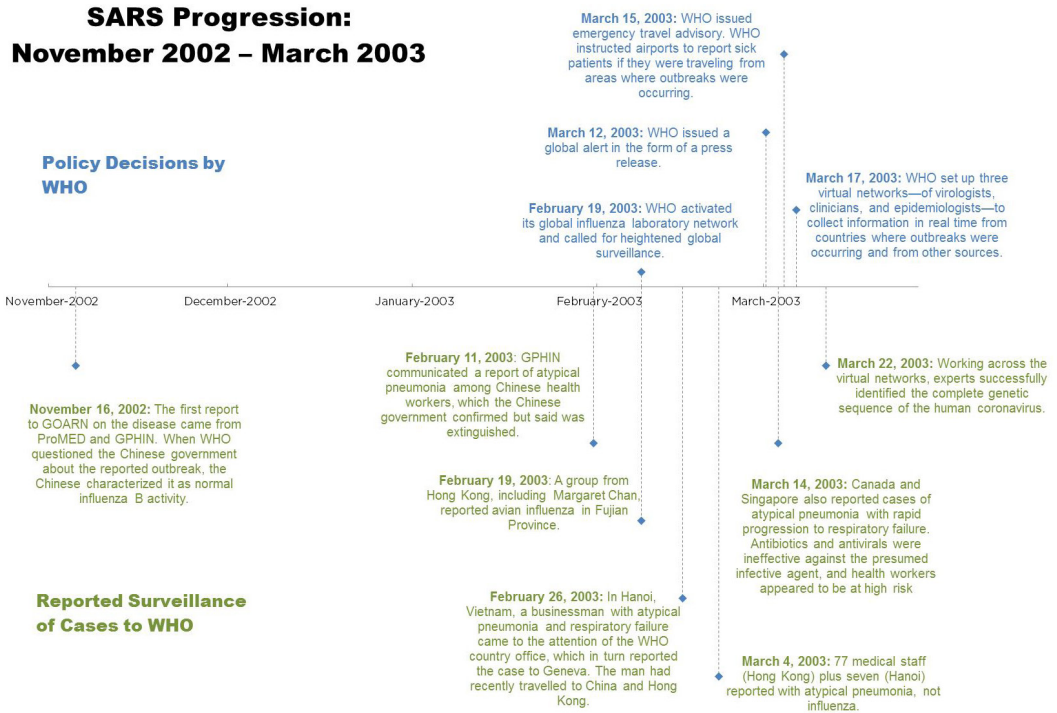

FIGURE 3-2 Progression of SARS through reported surveillance events and WHO policy decisions from November 2002 through March 2003.
NOTE: GOARN = Global Outbreak Alert and Response Network; GPHIN = Global Public Health Intelligence Network; ProMED = Program for Monitoring Emerging Diseases; SARS = severe acute respiratory syndrome; WHO = World Health Organization.
SOURCE: Adapted from Heymann presentation, September 1, 2015.

It was fortuitous that WHO had developed the vision of the IHR reform before SARS struck, and also that the WHA occurred amid the pandemic, providing an opportunity to institutionalize policy decisions made during the crisis, Heymann said. Thus, in 2003, the WHA approved new norms for reporting and responding to infectious diseases, including the use of reports from nonstate sources, the reporting of all infectious diseases with potential for international spread, and a formal framework for proactive international surveillance and response to all PHEICs.

The resulting 2005 revision of the IHR moved the focus of the regulations from controlling infectious diseases at borders to detecting and containing diseases at their sources by strengthening core capacity and, as Heymann observed, "from passive to proactive, using real-time global surveillance evidence, and from three diseases to all public health threats." Briefly, the IHR 2005 addressed the following objectives:

- Strengthening national capacities. Unfortunately, Heymann noted, because national capacities are self-assessed, many countries have missed multiple deadlines and are now asking for extensions until 2016.
- Reporting all public health threats. A decision tree[3] developed by the Karolinksa Institute in Sweden guides disease reporting according to tested criteria.
- Proactive surveillance. An IHR focal point in each member country provides direct contact with WHO for notification, consultation, and verification of disease threats.
- An openly accessible event management system for data entry and assessment.
- National containment of public health risks, and collaborative risk public health measures for events of international importance.

While recognizing the IHR 2005 as a significant step forward in global health governance, Heymann highlighted four perceived shortcomings of the regulations following the West African Ebola outbreak through questions to the participants. He asked: (1) Are they too restrictive as they are currently written? (2) Instead, should they focus more on core capacity with flexibility for alert and response? Additionally, he wondered if (3) they provided for the right level of community engagement required in countries where the government is not high functioning, and finally (4)—with the emphasis on the declaration of a PHEIC—he asked if they have perhaps taken the emphasis away from the pre-PHEIC response that could prevent

[3] For more on this decision instrument, see http://www.who.int/ihr/publications/annex_2_guidance/en (accessed November 19, 2015).

the threshold from being met at all. Heymann later described three essential elements for preventing the need ever to declare a PHEIC:

- WHO: an organization with the expertise, staff, and partnerships necessary to stop outbreaks;
- A facilitation mechanism (possibly an external decision-making body) that determines when outbreak intervention should occur and which national core capacities need to be strengthened; and
- Broad-based, global advocacy for health security.

We should be concerned with strengthening those three areas now, rather than worrying about what happens when health emergencies occur, he argued; discussions of global governance for health risks should focus on prevention.

THE IHR AND THE 2009 H1N1 INFLUENZA PANDEMIC

Harvey Fineberg of the Gordon and Betty Moore Foundation described a significant test of the IHR 2005 that occurred when H1N1 influenza spread across the globe following an outbreak in Mexico, beginning in February 2009 (Fineberg, 2014; WHO, 2011). By the end of April, the virus had spread throughout the Americas, and to Europe, the Middle East, and New Zealand, leading WHO to declare a PHEIC on April 25, 2009. By June 9, when 73 countries had reported more than 26,000 laboratory-confirmed cases, WHO declared a pandemic. Some critics have since asked if this pandemic was that severe and if WHO declared the threshold too early. But as Fineberg explained, although overall incidence was in the hundreds of thousands, this pandemic ranks below the average annual influenza burden worldwide. However, high mortality among younger people raised the burden of disease considerably.

As chair of an international panel charged by the WHA and the WHO Director-General in 2010 to examine the performance of the IHR and WHO in the course of the 2009 pandemic, Fineberg examined a broad range of evidence and prepared a report that was submitted to the WHA in 2011 (WHO, 2011). Summarizing key insights from this report, he noted that this first test of the 2005 IHR revealed the following challenges:

- Vulnerabilities in global, national, and local public health capacities;
- Limitations in the availability, accumulation, and applicability of scientific knowledge in responding to the outbreak;
- Difficulties in decision making under conditions of uncertainty and stress;
- Complexities in international cooperation;

- Challenges in communication among experts, policy makers, and the public; and
- shortcomings of WHO decision making and implementation.

Fineberg discussed the report's conclusions and their significance for global governance. Overall, the IHR 2005 "helped make the world better prepared to cope with public health emergencies," he stated. However, mandated core national and local capacities were not fully operational in 2009, nor were they on a path to timely implementation worldwide—a situation that still persists 6 years later. However, the report did identify several areas in which the IHR 2005 had proved successful in 2009:

- Strengthened cooperation, communication, and technical support through national focal points;
- Increased country capacity for addressing pandemics, including surveillance, risk assessment, and response;
- Streamlined decision making;
- Attention given to economic and social interests; and
- Strong public health rationale and solid scientific information provided to justify health measures that affected international trade.

In addition to the previously noted failure of many member states to fulfill their capacity obligations under the IHR 2005, another major shortcoming revealed by the 2009 H1N1 pandemic was the absence of any means to enforce the regulations, as Fidler, Heymann, and others had acknowledged. These gaps, in addition to the issues raised by Heymann's final questions, give a basis to rethink and perhaps improve on the current IHR, Fineberg suggested.

Fineberg offered international collaboration and mobilization for technical assistance as examples of ways to ease the IHR implementation process for countries. To this end, the 2011 panel recommended sharing resources, further improving the event information site managed by WHO, making appropriate resources available at the national level, and clarifying the effects of decisions made by countries in the course of their implementation of the IHR. WHO also performed well in many areas of its response to H1N1 (2009), Fineberg reported. Without discounting these successes, he turned to four key structural problems in the organization that were revealed in this crisis, and which are ongoing. First, WHO functions simultaneously as the world's moral voice for health, and the servant of its member states. Thus, he asked, is WHO's foremost responsibility to the member states that authorize its budget and define the agenda? Or is its higher responsibility to the health and well-being of all humanity? That tension obstructs effective governance, he suggested. The second impediment

to WHO effectiveness is its budget, which Fineberg called "incommensurate with its responsibilities." Third, WHO's governance structure—designed to respond to focal, short-term emergencies and also to manage multiyear disease programs—is not appropriate for mounting an intense, global response to a dynamic pandemic. In the case of H1N1 (2009), the organization was forced to rely on "volunteerism from within," repositioning essential staff to emergency posts, which is not sustainable. Lastly—as was even more prominent in the West African Ebola epidemic—separation of authority and autonomy between WHO's regional offices and its headquarters weakened the organization's ability to exert "command and control" during the crisis response, Fineberg observed.

Based on their review of the global response to H1N1 (2009), the panel identified several specific challenges to consider in preparations for future health emergencies. Key challenges include WHO's previously described structural impediments; full implementation of the IHR monitoring, reporting, and national response capacities; actionable data acquisition, monitoring, and management; communication and coordination across national and nonstate actors; and capacity, protocols, and resources to mount and sustain a comprehensive response to health threats, organized through a unified command structure. The absence of any means of enforcement for IHR compliance still persists well beyond the 2009 epidemic and continues to present a challenge in implementation. Additionally, as Fineberg stated, the conflicting roles and responsibilities of WHO and whom they are accountable to continue to stand in the way of nimble and adequate responses to global outbreaks. The reality that the world is ill prepared to respond to a severe influenza pandemic or to any public health threat stands as a core challenge to be met through global governance, Fineberg concluded.

WEST AFRICA EBOLA OUTBREAK, 2014-2015

Several speakers gave a range of perspectives regarding the response to the recent Ebola outbreak in West Africa, illuminating several areas within the IHR and lessons from past PHEICs that have yet to be remedied, as well as highlighting new and different challenges that have not been experienced in prior disease outbreaks.

Médecins Sans Frontières

Joanne Liu, president of Médecins Sans Frontières (MSF; also known as Doctors Without Borders), recounted the organization's experience of the ongoing West African Ebola epidemic (MSF, 2015a,b). MSF has responded to several Ebola outbreaks over the past two decades involving as many as

425 cases, she reported—experiences incomparable to the latest epidemic of more than 28,000 confirmed, probable, and suspected cases. MSF cared for about one-third of the 15,000 patients with confirmed Ebola, of whom about half survived. Twenty-eight MSF workers also became infected with the virus during this outbreak, and nearly half died. "There is no context in the last 10 years where we lost so many staff," she observed. Through years of experience with Ebola, MSF has developed a six-part strategy to address outbreaks: ensuring access to care and isolating patients, contact tracing, raising community awareness, conducting alerts and surveillance, supporting safe burial and decontamination, and providing health care for non-Ebola patients. However, she noted, because Ebola spread so widely in West Africa, MSF had to compromise or abandon many of these activities in the course of the epidemic.

The West African epidemic unfolded as a series of phases, according to Liu's description. In the first, which occurred between December 2013 and March 2014, viral transmission occurred undetected. While this often happens in early phases of Ebola outbreaks, typically it lasts only 8 weeks, which was not the case in this outbreak, allowing the virus to spread much farther geographically, largely unnoticed. Once MSF recognized the extent to which Ebola had spread throughout West Africa, the second phase began as the organization began to sound the alarm, hoping to warn the world of its severity and potential as a global threat. Liu recalled how MSF attempted, unsuccessfully, to gain public and political attention to the mounting crisis. Several factors contributed to the severity of this epidemic, as has been described in detail in subsequent reports, including the Forum on Microbial Threat's March 2015 workshop summary, *The Ebola Epidemic in West Africa* (NASEM, in press). Reflecting on the many and daunting challenges faced by MSF (and eventually other responders), Liu particularly urged preparation for future Ebola outbreaks in the following areas:

- Surveillance, recognizing the potential for widespread infection;
- A pool of experienced health care workers;
- Vaccines and treatments for Ebola; and
- Rapid international response, including an international center of operation.

Weaknesses of the Response

Liu attached particular significance to two shortcomings of the response to Ebola in West Africa, namely communication with the community in terms of content. Their community conversations were "one-way" and ineffective, provoking fear among many who did not understand reasoning

behind the enforced protocols. Echoing other speakers, she lamented the vacuum of leadership at national and international levels. Recognizing that a period of denial typically follows the first warning of an imminent health crisis, she remarked that her goal, and that of MSF, is to reduce the amount of time that elapses between alarm and action. Fear of Ebola itself—with its horrific symptoms, high mortality, and lack of consensus with regard to treatment—may have lengthened this period, she speculated.

By July 2014, in the wake of 1,400 cases of Ebola and 800 deaths, a desperate MSF had reached its limit. On August 8, WHO declared Ebola a PHEIC, moving the epidemic into its third phase. Ebola had long since met the criteria for a PHEIC, Liu believed. Unfortunately, she added, WHO's announcement, while galvanizing action, also spurred "global hysteria about Ebola," detracting from the needed international assistance. She also observed that Ebola had been introduced into the realm of security and protection, in which patients are no longer the focus anymore, but safety of travelers and other countries is.

In May 2015, the Ebola epidemic entered a phase that Liu called "the long sprint to zero." Cases continued to be reported in Sierra Leone at the time of the workshop in September 2015, and Liu said she expected a lengthy conclusion to the epidemic, requiring focus and commitment. She and other participants warned against shifting funding and response toward reconstruction too soon, noting that such a mistake had been made in Haiti after its catastrophic 2010 earthquake. She also emphasized Ebola survivors' need for ongoing medical care and social support, which, if met, will help them provide valuable insights into the persistence and long-term effects of the virus, which have previously been unknown. Another consideration, now that an effective Ebola vaccine appears imminent (WHO, 2015a), is to ensure its accessibility in high-risk locations, Liu continued.

Turning to the IHR, Liu highlighted the need to understand, and then address, reasons why countries have not achieved compliance with regard to infectious disease surveillance and response. She also urged advance planning and policy—including agreements to share data, specimens, and critical information—to enable research to be conducted during future outbreaks of emerging infectious disease, in order to maximize results and avoid the delays that occurred during the recent crisis. At conferences, meetings, and workshops such as this one, discussion directed toward the technical and political means of responding to infectious disease threats tends to neglect the needs of the affected populations, Liu observed. She warned that the equation of sickness and security could contribute to a climate of fear that impedes action in a health crisis where it is most needed, and called for political will to minimize the gap between sounding the alarm and an effective response.

Lancet Harvard–London School of Hygiene & Tropical Medicine Independent Panel on the Global Response to Ebola

The Harvard Global Health Institute and the London School of Hygiene & Tropical Medicine (LSHTM) convened an Independent Panel on the Global Response to Ebola in early 2015. Peter Piot served as chair of this panel and discussed the group's meetings and charge to analyze major weaknesses in the global health system exposed by the Ebola outbreak, and their goal to offer medium- to long-term institutional changes required to address them.[4]

Piot expressed limited expectations for their report's impact, saying they did not have any ambitions to reform WHO itself or the entire system, but felt there were pieces of the system that could be improved. The panel's recommendations fall into four categories (see Box 3-1). The first of these, "preventing major disease outbreaks," describes two recommendations, of which the first is the development of a "global strategy for national core capacities" that encompasses investment in establishing such a strategy, monitoring its performance, and sustaining national core capacities for implementing it. A similar recommendation was made at the last G7 Summit, but without a plan, timeline, or budget, Piot recalled.

The panel's second recommendation, for "incentives for early reporting of outbreaks and science-based justifications for trade and travel restrictions," seeks to encourage compliance with the IHR. Those incentives would include economic and financing support proposed by the World Bank as part of a pandemic emergency facility, Piot stated. However, the panel agrees that the trigger for disbursement of these incentives should be controlled not by the World Bank, but by a risk assessment carried out under the aegis of WHO or the IHR. Piot also noted the panel's support for disincentives for violating the IHR. WHO, he stated, should have the ability to announce when national governments delay reporting diseases, or impose trade and travel restrictions without a scientific or public health rationale. Private firms such as airlines and shipping companies that impose such restrictions can be dealt with through mechanisms in the broader United Nations (UN) system, he added.

The panel's recommendations on responding to major disease outbreaks include support for a "unified WHO Centre for Emergency Preparedness and Response," as proposed by the separate Ebola Interim Assessment Panel (discussed later in this chapter), but with the additional proviso that it be semiautonomous, Piot reported. This combined health and humanitarian agency would incorporate GOARN and the UN's humanitarian teams,

[4] A report from this panel was published online in *Lancet* on November 22, 2015. For more information see http://thelancet.com/journals/lancet/article/PIIS0140-6736(15)00946-0/fulltext (accessed November 23, 2015).

BOX 3-1
Summary of Recommendations from the Harvard–LSHTM Independent Panel on Global Response to Ebola[a]

Preventing Major Disease Outbreaks

1. Develop a global strategy to invest in, monitor, and sustain national core capacities.
2. Strengthen incentives for early reporting of outbreaks and science-based justifications for trade and travel restrictions.

Responding to Major Disease Outbreaks

3. Create a unified WHO Centre for Emergency Preparedness and Response with clear responsibility, adequate capacity, and strong lines of accountability.
4. Broaden responsibility for emergency declarations to a transparent, politically protected Standing Emergency Committee, with mandate to declare emergencies.
5. Institutionalize accountability by creating an independent Accountability Commission for Disease Outbreak Prevention and Response—a multistakeholder platform.

Managing Knowledge Production and Sharing

6. Develop a framework of rules for sharing data, specimens, and benefits.
7. Establish a global fund to finance, accelerate, and prioritize research and development, particularly for vaccines.

Governing the Global System

8. Sustain high-level political attention through a Global Health Committee of the Security Council.
9. Focus on core functions of WHO.
10. Provide good governance of WHO through decisive, time-bound internal reform and assertive leadership.

[a] As presented by Piot on September 2, 2015. For an updated list of the final recommendations as published in the *Lancet*, see http://thelancet.com/journals/lancet/article/PIIS0140-6736(15)00946-0/fulltext (accessed November 23, 2015).
SOURCE: Piot presentation, September 2, 2015.

he continued, and would be led by an executive director accountable for performance to a dedicated board of directors, and supported by a protected budget, in order to shield it from outside influence. Because not every outbreak warrants a global response, the Centre would provide a "third

line of defense" for severe outbreaks that create humanitarian crises, Piot stated. That response would be triggered by a mechanism within the UN's humanitarian system and overseen by its Office for the Coordination of Humanitarian Affairs (OCHA).

The panel's fourth recommendation, to "broaden responsibility for emergency declaration to a Standing Emergency Committee, with mandate to declare emergencies," echoes UN consultant Claude de Ville de Goyet's position that the decision to declare a PHEIC should be made by an independent advisory group, rather than by the WHO Director-General, but Piot suggested WHO should still be involved. For example, the WHO Director-General could chair the Standing Emergency Committee, but the committee should convene its own meetings, rather than wait for a request by the WHO Director-General, and their deliberations and decisions should be transparent. The proposed Standing Emergency Committee should consider replacing the all-or-nothing PHEIC with graded warnings, Piot added (similar to statements made in Chapter 7 by López-Acuña). He also related his panel's view that the committee should be financed through assessed contributions or un-earmarked voluntary contributions from WHO member states.

The panel's fifth recommendation, to "institutionalize accountability through an independent commission for disease outbreak prevention and response," was inspired by the extraordinary lack of accountability associated with the response to the Ebola crisis, as well as to past health emergencies, Piot said. Rather than having ad hoc committees review what went wrong after every crisis response, there should be a systematic assessment by representatives of civil society and independent experts, as well as of governments, he advised. The panel's proposed independent accountability commission for disease outbreak prevention and response, which could be created by the WHO Director-General, would track and analyze the contributions and impact of national governments, donors, and other responders, he explained.

Two of the panel's recommendations concern the management and sharing of knowledge and data. The first, "framework of rules for sharing data, specimens, and benefits," reflects the frequently ignored truth that withholding such information costs lives, Piot observed. A framework to ensure the free flow of such critical resources must be created and enforced, he said, but his panel struggled to design one that was sufficiently practical to be implemented. Similarly, the panel endorsed previous proposals to establish "a global fund to finance, accelerate, and prioritize R&D [research and development], particularly vaccines," he reported. Concerning global governance for outbreak response, the panel first recommended "sustaining high-level global political attention to health at the UN Security Council," reflecting their belief—as previously expressed by Fidler—that "health and

health security should be dealt with where there is a political power and in the multilateral system," Piot explained. The goal, he added, is for the Security Council to create a global health security committee that meets regularly, and also as needed.

Describing WHO as locked in a "downward spiral," constrained by increasingly earmarked funding and lacking the confidence and trust of many donors, Piot asserted that the organization requires a "new deal." The panel recommended that WHO limit its responsibilities to delivering certain yet-to-be-defined core functions; this, he explained, would rescue the organization from the sometimes unrealistic and conflicting demands of its member states, and allow it to renegotiate its funding. Lastly, the panel recommended "good governance through decisive, timebound reform, and assertive leadership," Piot reported. Leadership should also explicitly address engagement with nonstate actors, "something that the executive board of WHO does not take on at the moment," he observed.

In concluding his presentation, Piot urged his audience to bear in mind that, while discussions of global health governance tend to be abstract, their objective is to save lives. Now that the Ebola crisis has generated new momentum for change, we must use it, he urged, "to improve what has to be improved, and to keep going what can be kept going."

UN High-Level Panel on Global Response to Health Crises

Joy Phumaphi of the African Leaders Malaria Alliance described work to date by this separate multinational panel,[5] which is chaired by the president of Tanzania, Jakaya Mrisho Kikwete. Their objective is to prepare a report, with recommendations, to advise the UN Secretary-General on ways to strengthen national and international systems to prevent, respond to, and recover from health crises. While the panel will not focus on the technical health response, Phumaphi explained that the Secretary-General will take their recommendations to the UN General Assembly for endorsement or approval. Using lessons learned from every recorded health crisis, the momentum generated by the recent response to Ebola, and information gleaned from concurrent initiatives, the panel seeks to characterize early outbreak alert and response mechanisms, as well as the recovery process, and to identify the parties responsible for implementing these activities and ensuring their completion, she said.

Perhaps because most members of this panel are politicians, they have chosen to focus first on responding to people and their communities, and then on countries, subregions, and the international community, Phumaphi noted. At the time of the workshop, the panel was in an information-

[5] See http://www.un.org/press/en/2015/sga1558.doc.htm (accessed January 8, 2016).

gathering stage, had hosted three meetings, and also had visited affected communities in Guinea, Liberia, and Sierra Leone, she reported. They met the heads of state, local authorities, civil society, traditional leaders, UN colleagues, private-sector groups, and civil society international NGOs who are participating in the response, and have sent a panel member to the Democratic Republic of the Congo and to Senegal, she noted, in addition to meeting with WHO in Geneva and the African regional office in Brazzaville, and attending relevant workshops. From these experiences, the panel has distilled several areas in which they plan to focus their recommendations. The first concerns WHO: how to strengthen it; what role it should play in outbreak preparedness, alert, response, and recovery; and what national, regional, and international structures and formal mechanisms are needed to support those roles. These questions relate to another area of focus she described: how to make the outbreak response mechanism more reliable.

Regarding community-level governance for health emergencies, the panel plans to identify structures and mechanisms that will enable communities to be well prepared and resilient in the face of health emergencies, as well as supporting structures and mechanisms at the corresponding national and international levels. Their considerations include community health security, engagement, and ownership; the participation of traditional leaders and community health workers and their training, care, and maintenance; the fostering of trust in the system and those responsible for it; and the implications of surveillance at the community level. Phumaphi reflected on observations by Chan and others that leadership at the country level should come from the top, from the head of state or the prime minister's office, and also about the benefits and risks of command-and-control approaches to health governance. Whether they are health or economic or political in nature, Phumaphi assured that they would not ignore regional entities and believed they need to play a role in any new governance or response mechanisms. This reflects the panel's general conclusion that responding to health crises goes far beyond the health sector and, thus, requires a crosscutting approach, she added.

Throughout the work of the panel, Phumaphi summarized that they are following a set of principles: to focus on people, to promote global public health as a public good, to encourage accountability and transparency, to stress the importance of leadership at every political level and in the technical sphere, to serve communities above all, and to engender trust. "We are not expecting something perfect," she said, "but we are expecting to have something that is practical, that can be applied; something that will not sit on the shelf; and something that is adaptable and versatile."

Ebola Interim Assessment Panel

In March 2015, Chan appointed Dame Barbara Stocking of the University of Cambridge, a former director of Oxfam Great Britain, to chair the Ebola Interim Assessment Panel, an independent group of six distinguished experts. The panel was requested to examine WHO's response to the West African Ebola outbreak and report to the WHA in May 2015 after engaging people across NGOs and communities involved in the Ebola response. The final version of this report was published on June 30.[6] Stocking presented concise versions of many of the report's recommendations. In the realm of global health security, she emphasized the need for leadership at all levels of governance, from the community to the national to the international, and introduced the set of recommendations shown in Box 3-2.

Commenting on these points, Stocking stated that the United Nations, through its General Assembly and Security Council, is the obvious agency to coordinate high-level understanding and monitoring of the state of global health security. The involvement of the UN Security Council was crucial to controlling the West African Ebola epidemic and should be extended, she said, and the report advised that an annual global health security report be prepared for the WHA, perhaps by an independent body that could also examine WHO's progress toward increased health emergency response capacity.

Stocking reinforced Chan's earlier point that the IHR should engage heads of state, not just ministries of health, because these high-level decision makers are ultimately responsible and accountable for their countries' core capacities as mandated by the IHR, as well as for honoring provisions to maximize travel and trade. To pursue universal achievement of core capacities, her panel recommended that WHO create a prioritized plan and budget. Incentives would advance this plan, and should also be applied to encourage countries to report outbreaks, she said; but to do so effectively requires knowledge of existing core capacities and monitoring of the use of incentives for their improvement. Any such assessment should be conducted independently, she added, perhaps by the sort of peer-review process employed by the World Organisation for Animal Health (OIE), previously described by Thiermann in Chapter 2.

The IHR stands at a crossroads, Stocking observed; the regulations, and the premises upon which they are founded, are crucial, but only if they can be delivered. At the very least, she thought new financing mechanisms are necessary to provide incentives for transparent reporting of outbreaks, as are disincentives for violating provisions of the IHR. The latter could

[6] For the full Report of the Ebola Interim Assessment Panel, see http://www.who.int/csr/resources/publications/ebola/ebola-panel-report/en (accessed November 24, 2015).

BOX 3-2
Summary of Recommendations from the Ebola Interim Assessment Panel[a]

- WHO should propose a prioritized and costed plan to develop IHR core capacities for all countries.
- All levels of WHO should be strengthened to increase the organization's ability to independently identify health risks and declare health emergencies.
- The IHR Review Committee should consider incentives to encourage countries to notify public health risks to WHO.
- The IHR Review Committee should consider disincentives to discourage countries from taking measures interfering with traffic and trade.
- The IHR Review Committee should consider the possibility of an intermediate level that would alert and engage the wider international community at an earlier stage of a health crisis.
- The UN Secretary-General's High-Level Panel should put global health issues at the center of the global security agenda.

[a] As presented by Stocking on September 1, 2015.
SOURCE: Stocking presentation, September 1, 2015.

potentially be undertaken by the World Trade Organization as a nontariff issue, she suggested, but acknowledged that this raises the sensitive issue of countries' being responsible for the health of their own people—raising the point of shared sovereignty and the difficulty of achieving that. It is important to understand that WHO's ability to act is strongly defined by directives and financing from its member states, which had yet to agree to contribute to any contingency fund for emergency response, Stocking observed. Moreover, she added, member states must build true emergency preparation in the form of core capacity, by partnering with other agencies, the private sector, and with NGOs.

Responding to Charles Clift's concern that WHO may not be up to the task of coordinating the global response to health emergencies, Stocking remarked that WHO's primary role is the safeguarding of public health globally. Although WHO did not fulfill this role adequately in the Ebola crisis, she wondered, "if not WHO, who else would do this, and how would that happen?" The panel did consider this option, she explained, but after estimating the cost and time required to establish a new agency, they concluded that WHO should continue as the lead agency for health emergency response, as it is currently designated by the UN. It is expected to do that

in emergencies, but she noted that substantial change will be needed to connect that to public health emergencies such as outbreaks.

Leadership and Coordination

Stocking dismissed the concern that WHO cannot simultaneously perform normative and emergency functions, insisting that many organizations are capable of doing so with separate developmental and humanitarian functions—if they have good leadership and management. While unanimous in supporting WHO's leadership of emergency health responses, the panel also advised formal integration of this function into the existing global humanitarian system, which includes such UN agencies as the World Food Programme and the United Nations Children's Fund. She noted that the UN's Inter-Agency Standing Committee (IASC), which includes the principals of all UN agencies, as well as representatives from major NGOs engaged in humanitarian response, provides a structure for this process. Because coordination and planning is a core function of WHO, taking on this leadership role will not require hundreds of new staff positions or the creation of a separate agency.

In closing, Stocking focused on the issue of community engagement as a significant—and in some locations, ongoing—failing of the response to the Ebola crisis, and the need to establish connections with communities before health emergencies occur. In Liberia, where progress against the epidemic has been strongest, communities took charge of the response, devising and implementing appropriate solutions to transmission control. Stocking argued that, while core capacities matter for surveillance in developing countries, the effectiveness of the outbreak response in these settings depends on the fundamental level of development, especially at the community level.

ORGANIZATION AND COORDINATION OF GLOBAL HEALTH ACTORS

Multiple areas of discussion arose in response to the information presented through examination of past outbreaks and various lessons that emerged. These key areas included consideration of which global structures to consider when questioning reorganization and ideal formats, such as WHO, GOARN, and the IHR as is currently set up. Additionally, many issues surrounding coordination were highlighted, building off the earlier section on the proliferation of nonstate actors involved in global health matters, and the difficulties of data and information sharing both prior to and during an emergency response.

Global Structures to Consider

Daniel López-Acuña, who worked for more than 30 years with WHO, insisted that any discussion of governance must address political economy as a central issue. From his perspective, the international community and some political powers have created one way or the other "a balkanization of the global health architecture and the global health governance," he stated. Rather than "reinvent the wheel" of global health architecture, he argued for rethinking global action mechanisms to include nonstate actors. Referring to Liu's presentation, López-Acuña characterized the West African Ebola crisis as "a history of late awakenings" involving both GOARN and the humanitarian response system of international global security. This is a problem of structure, not governance, he argued; the solution is to fix structures that failed. WHO can coordinate the necessary "global system where we can have a swift mobilization of civil and military assets of public health, clinical and logistic teams," he advised, saying that "we don't need to disregard or disestablish the good things that we already have in place."

Heymann reported that WHO is working on a plan for a global health emergency workforce, which WHO Director-General Chan and others subsequently discussed. Heymann expressed his hope that such a plan would not only foster cooperation among that organization, other NGOs, civil society, and industry, but also obviate the need for WHO to hire nonsustainable staff in times of crisis. Perceived gaps in leadership at the level of global health are real, Fineberg asserted. "The point of governance is not to substitute for effective leadership, as it never can. But I think it is still important to have a governance structure, which allows leadership when it exists to exert itself in the most constructive and effective manner."

Fineberg noted that any post-Ebola global health governance structure will be challenged by the need for sufficient representation to have legitimacy, and simultaneously, sufficient power for rapid, global decision making and action. As one efficient method to achieve this, he described a pre-positioned, predetermined, delegated, time-limited, constrained authority, agreed upon by state and nonstate actors. This workforce would activate under stated conditions to provide unified capacity for material, staff, transportation, communication, local relations, and essential resource deployment, he added.

Can the IHR Build Capacity?

The roots of the IHR lie in the colonial era, and many countries feel that the regulations' central message is "keep your disease within your territory. Don't bring it to me," observed Oyewale Tomori, president of the Nigerian Academy of Science. He characterized the OIE as more successful

than WHO in encouraging the reporting of infectious disease outbreaks by affected countries, and speculated that is ultimately the case because delegates to the OIE tend to be technocrats, while representatives to the WHA tend to be politicians.

Heymann agreed with Tomori's assessment of the IHR and warned that similar perceptions compromise the Global Health Security Agenda, among other initiatives. "That emphasizes even more why WHO is so important," he continued. "WHO is where the countries have their confidence. WHO is what should be used to make sure that the strengthening of capacities in countries is not seen as a colonial vestige of 'keeping those diseases out of my own country.'" Further explaining why he considers the IHR 2005 too restrictive, Heymann said that the world now waits for WHO to announce a PHEIC before responding to an infectious disease outbreak. For example, he noted, while the Middle East respiratory syndrome (MERS) coronavirus continues to emerge and spread, everybody is waiting for a PHEIC to be called when GOARN should be in there stopping it, working with the government to do so before it reaches that threshold.

Institutional systems, structures, and architecture are comprised of people, Tomori reminded the audience, and we must identify those people who are truly responsible for response to health crises. "Margaret Chan gets blamed for what is happening in WHO, when in fact the person you should be taking to court is the [WHO representative] in Guinea, and the Minister of Health in Guinea," he argued. WHO has effectively challenged countries to take responsibility in health crises, as it did Nigeria in 2008 to address polio, he noted; it should use that power more often. "I think this meeting unfortunately should have had the African leaders here to listen to what is happening," he added.

Heymann commented that, although an improvement, the 2005 revision to the IHR has fallen short by failing to bridge the gap between noncompliant governments and communities where the actual response to infectious disease takes place. He added that he has progressed to thinking that informal governance might be best, noting that, "informal governance avoids a lot of political difficulties . . . [and] permits better engagement of people who were involved in that governance structure. It also may be more effective." He noted that the effective but informally governed Global Polio Eradication Initiative[7] simply meets once per week by telephone to plan next steps—an example that convinced him to change his stance, held since 1996, that the IHR represented "the most important tool for the world."

Addressing the Ebola Interim Assessment Panel's recommendation for a WHO-developed "prioritized and costed plan to develop IHR core capacities for all countries," López-Acuña noted that this issue should

[7] See http://www.polioeradication.org (accessed April 18, 2016).

also concern national and donor governments. Little if any health-targeted development aid or funding from national investment plans has gone to support core capacity strengthening, he observed. "We are talking about strengthening the health system, ensuring global health security, but we are not putting the money where our mouth is, neither as national governments, nor as donor agencies," he said. Stocking agreed that donor nation responsibility for ensuring core capacity must be stressed, but within the broader context of strengthening health systems overall.

Chan responded to Heymann's announcement by asserting that both formal and informal global health governance are needed, and that this combination succeeded in limiting Ebola's spread to Mali, Nigeria, and Senegal. The formal treaty set the tone, she explained, but ultimately she had to "pick up the phone and talk to the leaders of the country to impress upon them what are the trade-offs for action or nonaction," she recalled. "It worked in those three countries." To improve the effectiveness of the IHR, Chan urged the adoption of peer or independent evaluation of national health capacities, similar to the OIE's Performance of Veterinary Services (PVS) Pathway. Informal governance would continue to come into play for noncompliance, she added, and it should enable WHO to extend its relationship with the pharmaceutical industry beyond crisis response.

Is GOARN's Structure Sufficient?

Larry Gostin of Georgetown University remarked that Heymann had made a compelling case for creating a "nimble, flexible" workforce for response to infectious disease outbreaks and other health emergencies. Gostin wondered what role GOARN might play in this scenario, and how GOARN could be made more effective with sustainable funding, to which Heymann responded that increasing staff at WHO would not achieve this. GOARN was run by five people during the SARS outbreak, with technical support from WHO, as well as experts seconded from the United Kingdom, the United States, and other countries once the outbreak was announced. It will be important to define what WHO does as part of GOARN, he added, which should include setting up logistics platforms, helping to support governments with training, and coordinating the responders.

To maintain this workforce, WHO needs a revolving contingency fund of $2 to $3 million, Heymann stated. Because donors will supplement that amount if a major infectious disease outbreak occurs, the fund will be replenished after each such event. But, there needs to be a clear chain of command within WHO to sound the alarm when outbreaks occur, assign responsibilities in the response, and carry it out, Heymann advised. GOARN did respond to the West African Ebola outbreak in March 2014, he noted—it would be interesting to know why it did not sustain that response until

the epidemic had "gotten to zero." GOARN's risk assessments should be transparent and made widely available, Heymann insisted—and perhaps done by an independent committee. GOARN was calling for action on Ebola in West Africa long before it was taken, he said; if those deliberations had been transparent, perhaps GOARN's efforts would have been more effective.

Raising Political Will

Keizo Takemi of Tokai University reinforced Liu's message that political will drives the global response to health crises. He noted that, prior to its action on the West African Ebola crisis, the UN Security Council had accepted two resolutions pertaining to HIV/AIDS (which has claimed far more lives than Ebola) but had not acted on SARS or H1N1. To politicize an infectious disease threat at the UN level, we must carefully design for it, and use the timing and available military assets to help bring issues to a higher level of decision making at the United Nations, Takemi argued. Policy makers who recognize infectious diseases as a threat to their own national security will understand their overall importance to the collective global and human security, he continued. He therefore endorsed the concept of security as an effective way to politicize the threat of infectious diseases and compel policy makers in the United Nations and WHO to take action.

Liu responded that, while she recognizes the need to create interest at the highest levels of global decision making, she did not want the issue of security to eclipse a "people-centered" response to infectious diseases. "Caring for patients or the community being infected is not a convenient side product," she insisted. "The collective safety is actually the sum of the individual safety."

While describing herself as one of WHO's most ardent critics, Liu stated that she supported a leading role for the organization in responding to future infectious disease threats. "I think WHO has been a convenient scapegoat throughout [the Ebola] crisis," she said. It is important to understand and learn from mistakes made in responding to Ebola—by MSF, as well as by WHO, she continued. Voicing her disappointment that the affected countries who endured the largest burden of the Ebola outbreak have not been better represented in these high-level discussions, she warned against one-way communications, whether they involve affected countries or communities.

Coordination of Stakeholders

What should be the role of a civil society organization? Gostin asked Liu. What are its responsibilities with regard to the UN institutions, among

others? Chris Elias of the Gates Foundation suggested that his organization failed to fully recognize and respond to the severity of Ebola in West Africa for many months because "in the absence of a clear framework for engaging nonstate actors, we weren't engaged." Noting that the standard ratio for NGO to in-country workers in the field is 1 to 10, Liu stressed the role of nonstate actors as trainers and mentors to a country's health care workforce. Such training was particularly critical for Ebola in West Africa, she said, but it needs to go beyond responding to a single disease or health crisis. That is the challenge for global health governance: maintaining capacity and competence in every country to face the next outbreak, no matter what its cause.

Acknowledging the proliferation of such nonstate actors "with good intention, but very limited capacity and knowhow," Liu suggested a response model based on the International Federation of the Red Cross: a trained pool of people, who could be called on in an emergency and organized through a larger command-and-control structure. Eduardo Gotuzzo of Universidad Peruaña Cayetano Heredia noted that civil society organizations can provide vital help in responding to national health emergencies—including infectious diseases with potential for international transmission—but that countries need to coordinate those efforts.

In West Africa, Liu reported, such coordination occurred, but it was inconsistent, highlighting an important governance issue when looking across a multinational geographic region: in one country, the minister of health led the response to Ebola; in another, it was the minister of defense; in some places, donor nations led the effort. Each of the three leadership structures had strengths and weaknesses that should be reviewed carefully for the lessons they can teach, she advised.

Information Sharing

Jennifer Gardy of the University of British Columbia highlighted the importance of data as a tool for addressing infectious disease threats, and the extreme difficulty many countries face in collecting epidemiologic data. Global health governance should involve stewardship of such data—and on related issues including culture, demography, climate, media use, and more, she argued. She proposed that a smartphone-based tool that facilitated data sharing would allow knowledge, rather than political agendas, to drive disease detection and intervention.

Progress made within existing governance structures could inform future efforts to address infectious diseases, according to Elias. For example, he said, efforts to eradicate polio, which had stagnated over the previous decade, have moved forward impressively over the past 3 years, due in part to a data-sharing agreement that allowed key partners in the polio

response to share data in real time. Another important factor was a strong command-and-control response to polio outbreaks, as occurred in Nigeria, Elias noted. Finally, echoing Liu's point, he observed that the polio "end game" depended on community mobilization. Meeting community health needs more comprehensively has improved polio vaccination rates, helping the push toward eradication, he stated.

If any organization can overcome barriers to information sharing between states, nonstate actors, and industry, it is WHO, Chan insisted. In the case of polio, she noted, "I twisted a few arms, and we managed to get all the information we need." Informal governance means "helping countries to understand the value they can bring to global health and not insulting them in public"—and by engaging government leaders without "naming, blaming, and shaming" them, she explained.

4

Challenges for Fragile States

Highlights and Main Points Made by Individual Speakers and Participants[a]

- Communities in fragile states often lack local health governance and capacity to recognize, report, and respond to infectious outbreaks, creating critical gaps in the global risk framework. Engaging such communities will require context-specific messages and attention to high levels of preventable mortality common in such settings. (Wise)
- Elements of governance for public goods include legitimacy, institutional design, and technical requirements for infectious disease surveillance and outbreak response. Technical intervention can mitigate a threat, which can lead to increased legitimacy, and a positive cycle is created. (Wise)
- Global health governance needs to be linked to national and local health governance to be sustainable. Strong legitimacy and trust in governance can enable information authority and reduce divides between communities and those that govern them. (Kapila, Wise)
- Mechanisms should be considered that can simultaneously advance local health priorities and public health humanitarian values while reducing infectious disease outbreak risk. (Kapila, Wise)

- The rapidly growing private market for health care often contributes to the weakening of public state health systems and the overall provision of care, yet a strong primary care platform could function as a first line of notification in disease detection. (Heywood, Kimball)
- The need for persistent community engagement and mobilization is demonstrated in issues such as population movement, weakening of democracy, and government corruption, which all lead to exclusion of health care users in the design of the system, and overall health system decline. (Heywood)
- Community mobilization should be central to the risk framework, and those key stakeholders should be actively included in the process. This involves giving users of health care systems far greater input, agency, and power, and creating frameworks accountable to those being served. (Duchin, Heywood, Wise)

[a] 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 this chapter, various participants offered diverse perspectives on health challenges facing communities in politically unstable countries and regions. They described how local circumstances affect global health risks, including challenges within countries with differing public and private health system infrastructures, and considered directions governance might take to span these political spheres, including accountability and community involvement.

ELEMENTS OF GOVERNANCE FOR PUBLIC GOODS

Communities in fragile states often lack local health governance and capacity to recognize, report, and respond to infectious outbreaks, creating critical gaps in the global risk framework. Engaging such communities to address infectious disease threats will require context-specific messages and attention to high levels of preventable mortality common in such settings, according to speaker Paul Wise of Stanford University. Revising or replacing the architecture of relationships between the World Health Organization (WHO), the United Nations (UN), and other international agencies and their major funders will not significantly improve health governance in fragile states, Wise stated. Rather, he argued, "the exercise of power will need to be played out on the ground in some of the poorest places on Earth," and it must recognize and address the provision of public goods

in these communities, including the question of legitimacy, which can be judged by how governance is achieved and how policies perform. He noted that in some states at particularly high risk for infectious disease emergence and transmission, governance does not adequately address community needs and can be actively predatory.

Mukesh Kapila of the University of Manchester criticized the viewing of governance predominantly through the lens of power. "I couldn't but reflect from my experiences in 30 years working for the United Nations, the Red Cross, and WHO that that's what has gotten us into the mess that we are in," he stated. "The exercising of power actually isn't going to take us anywhere at all. In fact, what we need to do is to give up power, and the more power you give up, the more influence you gain," he insisted. Characterizing the West African Ebola crisis as a failure of trust, Kapila argued that "a proper paradigm for global health governance would be about the amount of trust there is between the governed and the governors." Global health governance unlinked to national and local health governance is not sustainable, he said. While Wise thought that governance is always related to the exercise of power, he acknowledged, WHO's power and how it is distributed and respected is a question of trust and deep legitimacy.

Where legitimacy is weak, governments lose informational authority, Wise continued. This situation tends to delay community mobilization to address disease threats, regardless of capability or public interest. It is important to note, however, that weak governance does not equal weak communities, as they can often be some of the most resilient. But when there is a divide between the communities and those that govern them, and interests and motivations are not aligned, the gaps that are created can lead to tragedy—as seen during the Ebola epidemic in southeast Guinea, when health workers, journalists, and volunteers seeking to assist communities were attacked, resulting in eight deaths, he said. Although this incident was interpreted in the Western press as stemming from ignorance or superstition, its real cause was political, Wise explained. This occurred in an area that had experienced more than three decades of assaults from a hostile national government, whom the health workers seemed to represent. In order to combat this active evasion of government authority by communities, governments often turn to coercive tactics, including examples like attempting to quarantine the Liberian community of West Point using state authority. This may seem to work at the outset, but it will not be a sustainable or effective solution.

Wise also described a second component of governance for public goods in fragile states—institutional design—as comprising formal procedures and accountability and formal relationships with international and nonstate actors such as the International Health Regulations (IHR). These elements interact with mechanisms of legitimacy, and also with a third component of

public good provision: technical requirements for infectious disease surveillance and outbreak response. In order to transform technical interventions into political currency, three requirements must be met, he said: people must perceive that an infectious outbreak poses a real threat, they must believe that the technical strategy can mitigate that threat, and they must consider implementation of the strategy a responsibility of the state.

These relationships create a virtuous cycle when a technical intervention effectively mitigates a perceived threat, Wise explained. The evidence of mitigation increases state legitimacy, which improves the capability of the health strategy to work as it was designed, he continued. This political currency, which is explicit in counterinsurgency doctrine, is related to, but distinct from, the use of military logistic capability (e.g., logistical assets). However, he added, it is important to recognize that the process of transformation from technical strategies into political currency exposes the health sector to political assault and threatens the neutrality[1] of health workers and health services—as has occurred with tragic consequences for polio eradication workers in Pakistan.

Combining Diverse Disciplines

Technical characteristics influence institutional governance requirements as each intervention places a distinct burden on governance, Wise stated. As a result, local health governance tends to be heterogeneous. Wise acknowledged that security and governance in parts of the world that are most concerning cannot be fixed easily. However, he argued, because governance capacity is heterogeneous, and each intervention places different demands on governance, strategic governance reforms can be designed to meet specific technical requirements. These reforms must not only address issues of infectious disease surveillance and response, but must also address local public health needs, he added. It would be peculiar, if not perverse, to try to implement governance reforms in places with extremely high young child and maternal mortality, and have the reforms be confined to outbreak surveillance and response, he observed, because the former problem is ongoing and typically a priority for those communities suffering, and the latter is intermittent if not rare. Mechanisms should be considered that can simultaneously advance local health priorities while reducing outbreak risk, Wise stated.

The pursuit of strategic governance reform will require a new set of integrated health and governance strategies drawing on "combinations

[1] "Neutrality is not the same thing as being apolitical," Wise asserted. "Neutrality is an active process and to be neutral demands a deep understanding of the local political dynamics. . . . There is no room to be apolitical here."

of diverse disciplines who have never spoken to each other, such as political science, global security, and maternal and child health," and expanding well beyond the purview of complex humanitarian emergencies, Wise said. He also urged the creation of a new taxonomy of strategic governance health interventions, which support good governance as well as cost effectiveness through integrating political and technical considerations. It will be that kind of integrated approach that will best ensure that policies, programs, and recommendations prove both effective and just, he concluded.

"Today no one has the power to do anything," Kapila asserted. "No one has a monopoly of knowledge—not even academies of science or World Health Organizations—and the problems are too big for anyone to do command and control." Instead, he said, what is needed is leadership based on passion and basic public health humanitarian values that bring the world together for a common cause, rather than a structured systematic approach, which can quickly become outdated. That shared knowledge is the legacy of Ebola and all the other failures to address health and humanitarian crises.

SUSTAINING HEALTH SYSTEMS IN THE FACE OF EVOLVING THREATS

Mark Heywood, of Section27, South Africa, noted that the people of Africa, who constitute about one-tenth of the world's population, bear nearly one-quarter of the global disease burden. He described major health challenges including HIV/AIDS, which kills approximately 180,000 people annually, despite the fact antiretroviral treatment now reaches up to 3 million Africans. Registered deaths from tuberculosis number 80,000 per year and include an unknown number of multidrug-resistant cases. Thus, the issue of health risk in Africa is local as well as international, he said. Of South Africa's insufficient 74,000 community health care workers, 40,000 are being integrated into the country's health system, Heywood reported, and each earns a monthly wage of about $100. While this framework is not a strong basis for building effective health systems, it can play a role in disease identification, he pointed out. At the same time, tuberculosis, the leading cause of death in South Africa, infects an estimated 80 percent of the population—many of whom remain unaware of the disease that kills them.

While Ebola has given this issue of infectious disease risk greater visibility, it has had a long salience, as several speakers and participants had already observed, and Heywood asked if the political will to truly tackle this risk was sufficient. If mitigating and managing health risk is not a priority, he declared, the root causes of these risks will fester while their symptoms—in the form of epidemics—continue to be managed. Well before the West African Ebola crisis, he said, "we knew that weak health systems

failed to identify microbial threats, and that epidemics further weaken such systems," but the momentum to break this current cycle is lacking. In Africa, despite instances of improved health outcomes such as declining rates of infant mortality, there has been a general weakening of health systems, Heywood asserted. He noted the weakening of public state health systems and growth of private systems as a contributor to this decline.

Strong, Accessible Primary Health Care

The rapidly growing private market for health care often works against the interests of the public provision and management of health care. In South Africa, just 17 percent of private health care costs for the population equals 100 percent of public health care spending. In sub-Saharan Africa, more than 50 percent of all expenditures on health are out of pocket, primarily for private health care, driven by the poor quality of public health care systems. However, despite consumer belief to the contrary, private health care generally underperforms compared to public health care, particularly with regard to addressing HIV/AIDS.

Ann Marie Kimball of Chatham House remarked that much of the discussion during this series of Global Health Risk Framework workshops had focused on the chronic health care deficits that set the context for the Ebola crisis. While primary care should be functioning as a first line of alert and notification in disease detection, she said, many solutions propose international command-and-control functions that would seem to be fairly late interventions. Heywood observed that community health care has long been a programmatic issue in health, recalling that a significant community health care workforce was built up in response to HIV/AIDS to manage patients and the deceased, provide home-based care, and support the search for treatment. However, that community-based primary care workforce could have played a far wider role, he argued, such as taking on other aspects of preventive care and disease surveillance. Instead, investment in that health workforce has receded along with the perceived threat of HIV/AIDS, highlighting the sustainability challenges when solutions to broad health challenges are disease specific.

CONTRIBUTORS TO DECLINING HEALTH SYSTEMS

Heywood also highlighted other contributors to the decline of health systems in recent years, including issues such as population movement, weakening of democracy in some locations, and overall government corruption. These contributors illuminate the persistent need for community engagement and mobilization, as well as government accountability in order for global health strategies to be successfully implemented. Long

before the current Syrian refugee crisis, Africa has experienced multiple episodes of mass migrations from conflict zones over many years, he said. As many as 2 million undocumented Zimbabwean migrants currently reside in South Africa—people whose health needs and care are neither assessed nor supported. Additionally, the weakening of democracy and the closing political space for civil society has become an added challenge. Users of health care systems are increasingly excluded from governance, he noted, widening the gap between those who govern and those who are governed.

Heywood explained that, over the past 3 years, more than 60 countries have drafted or passed laws that curtail nongovernmental organization (NGO) activity, including in the field of health. Meanwhile, the growing influence of major powers such as China and Russia in African countries has worrisome implications for the future of democracy, human rights, accountability, and transparency—and, thereby, the legitimacy of health governance as Wise discussed previously. Adding to the worries of foreign power influence and curtailed NGO activity on the ground, corruption also impedes the management of health systems at local, provincial, national, and global levels. Within South Africa, Heywood noted, corruption-related losses to health care (both public and private) amount to approximately $2 billion per year, and the country's national health laboratory services currently risk collapse due to mismanagement. Examining all of these contributors holistically, it is not difficult to see the adverse implications for many health systems throughout the world when good governance—legitimacy, institutional design, and salient technical interventions—is not practiced and the communities which these health systems are designed to serve are cut off from decision making.

A Need for Community Mobilization

Viewing the response to Ebola through the lens of HIV/AIDS, Heywood advised a return to mobilized communities setting agendas and driving responses and mitigating risks that can be carried into the risk framework. To do this, he added, would require giving users of health care systems far greater input, agency, and power than they currently possess—and allowing them to maintain it beyond any individual crisis. Infectious disease outbreaks should be seen as parts of a continuum of vulnerability and risk, which requires a continuum of response and engagement to try to build responses, he urged.

"We pay a lot of lip service to community mobilization, but what role actually is assigned to communities?" Heywood asked. "How do we start speaking of communities as partners rather than looking at communities as victims?" To begin to answer these questions, two tasks must be tackled—the near-term process of establishing a risk framework, and the long-term

process of addressing the root causes that make communities vulnerable to infectious outbreaks—and this cannot be done without the active participation of those community members. He advised identifying strong communities that persist in the face of weak governance and leveraging their strengths for others.

Directing Government Accountability

For WHO to mean something in communities within fragile states, it must be accountable to the world's people, Heywood insisted. We should be asking how to bring the moral and political authority of WHO back into play in relation to people's needs, and in relation to people's risks. Duchin of Seattle–King County Public Health and the University of Washington pointed out the importance of developing a governance framework that addresses the potential for significant political upheaval, and Wise advised that awareness of political dynamics must somehow be integrated into health intervention programs from their inception. Duchin also expressed concern that many African colleagues—key stakeholders in this process—were not part of this workshop discussion, again highlighting the gap between the governed and those that govern.

Lessons learned regarding command-and-control capabilities from emergency responses to complex humanitarian emergencies are to some extent informative, Wise said. However, they are based on an acute response that typically lasts weeks, after which the average survivor stays at a United Nations High Commissioner for Refugees camp for 20 years. Governance need not be confined to infectious disease, Wise observed, but should be accountable to the people that are being served. However, infectious outbreaks cross borders and, therefore, arouse the interest of powerful Organisation for Economic Co-operation and Development countries, which can create challenges between priorities—especially when bilateral donors become involved.

5

Challenges in Design of Governance for Global Health

Highlights and Main Points Made by Individual Speakers and Participants[a]

- Top challenges for the World Health Organization (WHO) during the Ebola crisis included the absence of national detection and response capacities, limited surge capacity from the international community, and the conflict between sovereignty and collective action against a shared threat. (Chan)
- The highest barrier to global health governance is the conflict between the rights of sovereign states and the need for global solidarity. If their ability to intervene is limited, this can add difficulty to the recommendation that WHO should promote and maintain global health security as a core function, but would also address their potential role in an outbreak. (Chan, Clift)
- WHO's three-tiered, decentralized structure and autonomous regional offices obscure command and control and were an impediment to the organization's coordinated response to Ebola, but questions remain on whether a command-and-control organization is feasible and the best solution. (Clift, Fineberg, Gostin, McIff)
- All of the World Organisation for Animal Health's (OIE's) member countries were involved in the Performance of Veterinary Services (PVS) Pathway development, the evaluation is voluntary, and the goal of the mission is to address the

country's disease burden and not to detect emerging diseases—altogether resulting in successful benefit to both the prevention and detection of infectious disease. (Thiermann)
- To ensure global public health security, WHO should not try to replicate other institutions with a greater capacity to respond, but should continue to be a coordinator and work to collaborate with the United Nations (UN) humanitarian system. (López-Acuña, McIff, Stocking, Takemi)
- The theoretical discussion of the global health emergency workforce development should be balanced with examination and learning from real-world cases, input from traditional and cultural leaders, and political leadership. (Elias)

[a] 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.

This chapter focuses on applying what WHO and member states have learned about governance design from the challenges of the West African Ebola crisis, as well as other epidemics, to addressing future infectious threats. Workshop participants examined recent proposals for enhancing global preparedness and response to health emergencies, in regards to both the WHO system and other global health actors, and considered how existing global security initiatives and frameworks can coordinate their efforts to create more synergy and avoid gaps in communication, workforce, and resources.

WORLD HEALTH ORGANIZATION

Margaret Chan noted how the West African Ebola crisis illustrated challenges faced by all responders to infectious disease outbreaks, described the weaknesses and shortcomings it revealed in the world's outbreak preparedness and response capacities, and highlighted successful outcomes as well as setbacks. Highlighting the elusive spread of the virus in Guinea and then Liberia and Sierra Leone in early 2014, Chan stated that no type of ideal governance design can manage the invisible. Therefore, in order to truly leverage the International Health Regulations (IHR), every country must be able to detect potential outbreaks. However, it can be extremely difficult for countries measuring mortality and morbidity rates to pinpoint a disease like Ebola in the midst of deaths from Lassa fever, yellow fever, typhoid fever, dengue, and cholera, making early disease detection challenging. Chan, like many other speakers and discussants, noted the failure of the IHR 2005 during the Ebola crisis and the lack of established core

capacities for early disease detection, timely and transparent notification, and response on the part of Guinea, Liberia, and Sierra Leone. Conversely, she observed that when Mali, Nigeria, and Senegal experienced their first imported cases, these governments quickly caught them, launched an emergency response, and prevented or swiftly curtailed transmission. Chan acknowledged that the challenges WHO faced during the Ebola crisis fall into three broad categories:

- The absence of national detection and response capacities, compounded by poor infrastructure for both transportation and communication;
- Weak preparedness and response capacity within the international community, including extremely limited surge capacity; and
- The conflict between sovereignty and collective action against a shared threat.

The problems created by the third category of conflict between the rights of sovereign states and the need for global solidarity represent the highest barrier to global health governance, according to Chan. She noted several examples from WHO's recent experience that illustrate this point:

- The government of a country affected by Ebola refused to issue visas to some members of a WHO response team. They were eventually approved, but precious time was lost.
- One government abruptly decided to report only confirmed cases of Ebola, not suspected or probable cases as required by WHO, highlighting potential mismatches in reporting when looking across geographic regions.
- Many countries imposed traffic and trade restrictions that isolated the three affected countries and vastly increased their hardship. Several airlines suspended flights to West Africa, impeding the arrival of response teams, equipment, and humanitarian aid.
- WHO advised against certain extreme control measures shown to be ineffective, if not counterproductive. However, neither WHO nor any other external authority can dictate what happens within a sovereign state.

Ultimately, leadership—including command and control—by the presidents of the three affected countries helped to control Ebola, but community engagement was decisive, Chan reported. When people understand and own a problem, they carve out their own socially and culturally acceptable solutions, she observed, such as how to isolate ill people from the healthy. Community engagement was far more effective than quarantines enforced

by armed military personnel, she argued. With 32 laboratories deployed to the 3 affected countries and Nigeria, the speed and precision of diagnostic testing gradually approached levels in wealthy countries, Chan said. Data collection and reporting also improved considerably, but it is still far from perfect, she added. The numbers of treatment beds increased quickly, as treatment centers were built by Médecins Sans Frontières (MSF), followed by WHO, both working beyond their usual roles.

Future Directions

Looking to the future, WHO engaged in several research projects to improve outbreak response over the course of the crisis, according to Chan. They inventoried the qualifications and skills of Foreign Medical Teams (FMTs) and created a register for matching response needs to those who can meet them most efficiently. WHO also developed Ebola-specific personal protective equipment by bringing together manufacturers and experienced clinicians to select designs that offer maximum protection for the health care workers yet allow clinicians to work in reasonable comfort under very hot and humid conditions. An Ebola vaccine appears imminent, thanks to a broad effort involving the people of Guinea and scientists working with partners around the world, including WHO (Henao-Restrepo et al., 2015). WHO has also prequalified four rapid point-of-care diagnostic tests for Ebola.

Based on lessons learned in this epidemic, WHO is creating a blueprint for research and development during outbreaks of high-risk pathogens, Chan reported, which features a generic clinical trial protocol, arrangements for fast-track regulatory approval, and expedited development of new medical products.[1] "All of these achievements were made possible by the unprecedented collaboration of multiple partners," she said, noting by example a field laboratory constructed in collaboration with 19 institutions and partners in two major networks.

Chan urged all involved to be honest and learn together, so that changes driven by this epidemic make it possible not only to get to and maintain zero, but also to help the affected countries rebuild their health systems. Managing the global regime for controlling the international spread of disease is a central and historical responsibility of WHO. But while they have extensive experience and vast networks of collaborating laboratories and institutional partners, the organization's current assets are insufficient to manage a disease event that is unexpected, severe, and sustained, she reported. Chan did note that informal arrangements existing between WHO and the UN Secretary-General for activating all assets within the UN system to address urgent health problems have been engaged to control H5N1

[1] More on research and development during outbreaks can be found in Chapter 6.

avian influenza, the 2009 influenza pandemic, and the West African Ebola outbreak. These arrangements are now being formalized under the guidance of David Nabarro, she said. She also briefly highlighted WHO's ability to work in unison across regions, in their relationship with the Economic Community of West African States (ECOWAS), a subregional group to address the challenges across the seven regions instead of within each individually.

WHO's Global Health Security Role

A few participants asked whether Chan accepted WHO's perceived responsibility for promoting and maintaining global health security as legitimate, especially considering the operational or interference implications that responsibility may have in certain circumstances. Formally, the Director-General cannot interfere in sovereign states, Chan acknowledged, but she said she has spoken regularly with the presidents of Guinea, Liberia, and Sierra Leone, as well as with those of Mali, Nigeria, and Senegal, saying it is necessary to intervene at that level. As an example of this, Chan described an occasion when the president of an affected country demanded that a planned mobile laboratory be sent to his constituency rather than the location WHO had chosen. "I pick up the phone, talk to the president. I said this cannot happen," she reported. "So I do interfere, but I don't go on a microphone." Government leaders are very receptive if you talk to them privately about honoring their commitments, she concluded, whereas public approbation inevitably misfires.

The duty of the Director-General is, first, to tell governments that they need to take responsibility for their citizens' care, and second, to be a good global citizen and not export problems to other countries, Chan stated. At the same time, she added, national governments facing health emergencies must recognize that they cannot serve their people's needs without assistance. She added to previous comments regarding the proliferation of the health field and advocated for including nonstate actors, such as civil society and communities, academics, and the private sector, and encouraging open dialogue, transparency, and accountability. Regarding appropriate circumstances for WHO to take an operational role, Chan replied that the organization had, on many occasions, mobilized and coordinated assets from around the world. In some instances, WHO has been "the provider of last resort," but only to an "absolutely failed state," she explained, noting that they always get the support of civil society or governments.

The West African Ebola crisis—unlike the hundred or so outbreaks that involve WHO each year—outstripped the organization's response capacity and that of many others, Chan observed. Ebola taught lessons that can prepare the world for a crisis on that scale or larger, such as an influenza

pandemic, she said. "We are not there yet, and Ebola is just a warm-up exercise," she warned, cautioning that the next pandemic is certain to come.

Perspectives from External Partners

In addition to Chan's internal critique of WHO and discussion of relevant future opportunities to explore, other speakers also added their external perspectives. Highlighting difficulties in IHR compliance, the disagreement on potential roles of WHO, and the complex structure of the UN system, speakers and participants explored various design options for future governance changes for global health.

Chatham House Report

In 2012, two working groups, which included several participants in the current workshop, were established by Chatham House to examine the topics of global health financing and governance.[2] Charles Clift of Chatham House reported that there was very much less agreement concerning what sort of restructuring of WHO might or might not be desirable or indeed possible. The report reflects those differing opinions and includes recommendations crafted by Clift alone, he explained. Because it was completed well before news of the West African Ebola outbreak had circulated widely, the report did not tackle WHO's role in that event, but it instead provides an overview of reforms the organization could undertake in order to better fulfill its overall mandate.

Clift pointed out that WHO's efforts to help member states meet the core capacity provisions of the IHR has not only been unsuccessful, but it does not directly address the organization's potential role in a disease outbreak, as distinct from any national response. To address this perceived deficit, the Chatham House report recommends that one of WHO's core functions should be promoting and maintaining global health security—a responsibility that includes preparedness for health emergencies, supporting the implementation of the IHR, and polio eradication, as well as outbreak response, he noted.

WHO's appropriate role in outbreaks is the subject of a longstanding debate that has intensified with the Ebola crisis, as Clift observed (Farrar, 2015; Garrett, 2015; Gulland, 2014; WHO, 2015b). As Chan noted—and

[2] For the full reports of these working groups, see "What's the World Health Organization For?" (Clift, 2014) at https://www.chathamhouse.org/sites/files/chathamhouse/field/field_document/20140521WHOHealthGovernanceClift.pdf (accessed April 18, 2016) and "Shared Responsibilities for Health: A Coherent Global Framework for Health Financing" at https://www.chathamhouse.org/sites/files/chathamhouse/field/field_document/20140521HealthFinancing.pdf (accessed November 30, 2015).

disputed—in her presentation, many among the general public and the press believe that WHO should be staffing frontline operations. "WHO is the UN specialized agency in health, we are not the first responder. . . . [T]he government has first priority to take care of their people and provide health care," she told *The New York Times* in September 2014 (Fink, 2014). She added that WHO is a technical agency and is unlike international nongovernmental organizations (NGOs), the Red Cross, or similar agencies who are working on the ground to provide direct services.

If WHO has a limited role to help countries deal with their own problems, it is surprising that the organization designed and built Ebola treatment centers, Clift remarked. But if there is no one to coordinate, then the question arose of whether or not WHO should step in to execute the work. If that is the case, should that become a core function? Clift wondered. In order to judge whether WHO's efforts in the Ebola crisis were successful or not, Clift attempted to define WHO's responsibilities and set boundaries for their work, noting that much of the criticism of WHO stems from unrealistic expectations. He offered the following points under the heading, "What Should WHO Be Doing?":

- At all times provide expert advice to governments on the implementation of the IHR, in particular the core capacity requirements for surveillance and response.
- Work with affected governments, and provide expert advice, to understand what external help they need to deal with an outbreak.
- Coordinate the supply of expertise and materials that governments need to supplement their own efforts, drawing on resources from member states and other donors, the Global Outbreak Alert and Response Network (GOARN), FMTs, and others.
- Mobilize financial resources from member states and donors in sufficient time and commensurate with country needs.
- Ensure effective and timely coordination with the UN system and its Global Health Cluster.[3]

[3] The UN's response to humanitarian crises is organized according to nine thematic clusters, each led by a UN agency. The agency functions as "provider of last resort" and is accountable to the UN Humanitarian Coordinator. The aim of the cluster approach is to strengthen partnerships and ensure more predictability and accountability in international responses to humanitarian emergencies, by clarifying the division of labor among organizations, and by better defining their roles and responsibilities within the key sectors of the response. The nine clusters, together with their lead agencies, are Nutrition (UNICEF), Health (WHO), Water/Sanitation (UNICEF), Emergency Shelter (UNHCR/IFRC), Camp Coordination/Management (UNHCR/International Organization for Migration), Protection (UNHCR/OHCHR/UNICEF), Early Recovery (UNDP), Logistics (WFP), and Emergency Telecommunications (OCHA/UNICEF/WFP). Clusters can be activated in response to both sudden emergencies as

- Fulfill obligations in the IHR regarding potential public health emergencies of international concern, including prior to a formal declaration.

Several commentators identified WHO's three-tiered structure—in which international, regional, and national offices frequently act independently of each other—as an impediment to its response to Ebola, Clift said. As Gostin and Friedman (2015) have noted, "the poor cohesiveness between headquarters (HQ) and AFRO[4] became evident during Ebola. AFRO did not convene health ministers or open a regional coordination centre until 3 months after Ebola was confirmed in Guinea; the Guinea country office reportedly impeded aid and technical assistance." To some extent, this incoherence reflects conflicts that arise between the individual interests of its member states and the cause of global public health, as previously described by both Fineberg and Chan. Also, as Fineberg and other commentators have pointed out, regional WHO offices are autonomous, permitting each to adapt to local conditions but obstructing their coordinated participation in global disease response under WHO's direction (Fineberg, 2014). This lack of coordination in the face of an epidemic like Ebola has created buzzwords of "command and control" and raised the prospect of an outbreak-response force convened by WHO (or perhaps another organization) that could suddenly operate with military speed and efficiency, Clift said.

Questioning his own conclusions regarding WHO's structural deficits, Clift acknowledged that he had yet to see an objective analysis of what WHO actually did wrong in the West African Ebola epidemic. Some might cite the late declaration of the public health emergency of international concern (PHEIC) as one such shortcoming, he added, although he then expressed the belief that an earlier declaration was unlikely to have changed the response on the ground. "It may be true that we can contemplate better structures and governance for WHO that appear more efficient, but the underlying political relationships and conflicting interests between WHO and member states, or between different actors at the different levels of WHO, are not necessarily transformed simply by introducing a command and control operation alongside WHO's existing decentralized structure," Clift suggested. Moreover, he questioned whether WHO could effectively combine both decentralized and centralized modes of operation, and whether a command-and-control organization is politically and practically feasible.

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well as ongoing emergencies. See more at https://business.un.org/en/documents/249 (accessed January 8, 2016).

[4] WHO Regional Office for Africa.

A U.S. Government Perspective

Colin McIff of the U.S. Department of State considered ways to make WHO and the UN health governance system more effective and efficient during health emergencies. From the outset, he maintained that the United States stands behind WHO's leadership and its role as the agency poised to lead and coordinate the international response to global health emergencies. At the same time, McIff emphasized that U.S. support for WHO in this role—and that of other governments—is not unconditional. He characterized this post-Ebola period as a singular opportunity to make WHO "fit for purpose"—capable of mounting an effective response to outbreaks and other health emergencies—but predicted that the international community will be compelled to seek solutions elsewhere if this attempt fails.

The U.S. government endorses and supports WHO's efforts to launch a global health emergency workforce, and also the creation of a new global contingency fund to underwrite WHO's initial response to a global health emergency, approved by the World Health Assembly (WHA) in May 2015, McIff stated. However, WHO currently lacks the capacity, institutional systems, and corporate culture to meet the above mandates, he observed. Thus, reforming WHO stands as an important collective opportunity for the global health community. Even so, the U.S. government believes that WHO should coordinate and mobilize the envisioned global health emergency workforce, which would incorporate GOARN, a new robust platform for managing FMTs, and WHO's role as Health Cluster lead in humanitarian response, he explained. McIff depicted the global workforce as a collection of specialized capacities, each of which would retain their independence and be called on only as needed. WHO—as that organizational core—would not be expected to "do everything" in the event of a health emergency, he noted, but rather would be poised to ensure the timely deployment of appropriate international capacity as need arose. The UN had previously implemented a response framework for humanitarian emergencies that is well known and accepted, according to McIff. Extending this model and taking a collective, "whole-of-agency approach" to all emergencies "is going to be very critical," he observed. The U.S. government advocates the creation of a structure containing all assets within outbreak preparedness and humanitarian response, in order to deliver a unified "all hazard response," he said.

McIff noted that it remains to be determined what "command and control" means in the context of WHO's decentralized structure. Although western countries might favor emergency response to be directed from the organization's international HQ, he noted, his South African colleagues

at "Friends of WHO Emergency Reform"[5] argued that bypassing WHO's regional offices would amount to "cutting out the countries where many of these emergencies and disasters are taking place." Countries at highest risk for infectious outbreaks want a transparent understanding of the command-and-control structure and chain of command, and they rightly want regional directors to be included and be held accountable for their decisions, he explained.

McIff concluded his presentation with a list of next steps to be taken in the development of a WHO-led emergency response network:

- Establishing distinct human resource and information technology systems within WHO to support the rapid mobilization of emergency response teams.
- Creating long-term and systematized relationships between WHO and its key partners in emergency response, particularly within the broader UN system. He noted that ad hoc agreements between WHO, the World Food Programme, and the United Nations Children's Fund (UNICEF) were significant to the Ebola outbreak response and should be made permanent and systematic, "so that in the next crisis we are not trying to figure out where air bridges are going to come from or who will develop the community mobilization strategy and how that will relate to public health needs."
- Designating a special representative with organization-wide authority to implement timely decisions in response to an emergency, as eventually was done on an ad hoc basis during the Ebola crisis.
- Developing recommendations, informed by discussion at the 2015 WHA and analysis by its Ebola Interim Assessment Panel (2015), to organize the broader UN system to respond to health emergencies, including deployment of proposed World Bank financing.

The U.S. government agrees with the general view that WHO's declaration of a PHEIC in the Ebola crisis was late, particularly given the slow international response that followed it, McIff stated. This situation suggests that health ministries—not to mention prime ministers' offices and ministries of finance and other affected sectors—may not understand what a PHEIC means, he observed. Changes must be made not to replace national leadership in these offices, but to allow such leaders to do their jobs, he asserted.

At the 2012 WHA, "we didn't do anything unfortunately to mobilize on the Fineberg recommendations," McIff recalled. That has changed, he said, and the WHA is now putting forth a sustained effort to address global health threats. He also noted that there is more money available to support

[5] See http://www.who.int/about/who_reform/emergency-capacities/NFR_Informal-consultation_21July.pdf (accessed January 8, 2016).

the WHA's commitment to fully implement the IHR in West and Central Africa and in other at-risk states by 2019, and all parties should take advantage of the momentum. The G7 recently made a similar commitment involving 60 countries, and the United States has designated more than $1 billion for capacity building in 30 countries, he reported, with additional funding expected from European countries.

ROLES AND RESPONSIBILITIES OF GLOBAL HEALTH ACTORS

McIff noted that the Global Health Security Agenda (GHSA)[6] provides another opportunity to strengthen core capacity and health systems. He reported that more than 50 countries now participate in the GHSA, many of which were motivated to participate by the potential benefits for their health systems. These countries view the GHSA as a way to nationalize and incorporate the IHR into their health systems in meaningful ways, he said. The United States views the GHSA as an accelerant for the IHR, not a parallel system, McIff stated. Beyond supporting the development of core capacities specified in the IHR, the GHSA should encourage good practices (e.g., peer-review system assessments) in participating countries that potentially can be universalized through WHO, he added.

Thiermann, whose previous description of the OIE's voluntary peer-review PVS Pathway contrasted with that of the IHR's self-assessed mandate for core capacity, reviewed several reasons why he believes the OIE's approach has had greater success. First, all 180 of the OIE's member countries, including 52 African nations, were engaged in developing the PVS Pathway. Second, evaluation is voluntary and occurs at the request of the country. Third, the primary goal of the mission is to address the country's disease burden, not to detect emerging diseases that cause alarm for external countries. The resulting improvements in animal health, public health, and food security benefit both the prevention and detection of emerging infectious diseases. Incentives for reporting outbreaks counteract the potential impacts on trade and expedite calls for assistance.

Combining Public Health and Humanitarian Systems

Regarding global health security, López-Acuña insisted that it is WHO's overriding purpose and responsibility to maintain it. Stocking characterized WHO as the guardian of global public health, managing health emergency responses and alerting the global health community to threats. McIff also emphasized WHO's preeminence as a coordinator of the many institutions that together ensure global health. He added that WHO should not try to

[6] See http://www.globalhealth.gov/global-health-topics/global-health-security/ghsagenda.html (accessed January 4, 2016).

replicate MSF or the U.S. Centers for Disease Control and Prevention or other institutions that have capacity to respond, but WHO should continue to take a strong coordinating role and deploy resources as needed in a responsive way. Takemi noted the lack of alternatives to WHO as the coordinator of global health emergency response, and that no concrete suggestions have been put forward for collaboration between the UN humanitarian system and WHO. Stocking added that much remains to be done to develop an effective, timely outbreak response plan to coordinate both entities, as the humanitarian side is unfamiliar with the IHR, and the WHO side does not understand the humanitarian response network infrastructure. She described the UN Mission for Ebola Emergency Response (UNMEER) and said it should be seen as a last resort (a position McIff also endorsed, on behalf of the U.S. government).

Humanitarian–health collaboration is an ongoing challenge and a problem that WHO in particular must address as part of its process of internal reform, McIff observed. "It's not necessarily about squashing the two sides together," he said. "It's about making sure that they can function effectively and communicate effectively with one another while carrying out their distinctive mandates." There is also a need to break down barriers between animal and public health, McIff stated. Interest in animal health and its impact on trade are a major reason countries are interested in the GHSA, he observed.

Gostin summarized the consensus view of the IHR and the role of WHO in health emergency response, saying that most believe the IHR is a useful governing instrument, but the lack of compliance has caused most of the problems. Several participants had also advocated the need for an empowered WHO, Gostin observed. "We have to understand what its essential functions are and make it fit for purpose, but the WHO is needed," he said. But regarding leadership, as illustrated in the earlier exchange among Chan, Fineberg, and Liu, Gostin agreed that national sovereignty cannot be overcome by international structures such as WHO. The conflict between collective action and sovereignty as it applies to the IHR is something that must be managed with foresight and planning, well in advance of a health emergency, Gostin argued. Stocking added that the UN Secretary-General's panel may be the best place to address the sovereignty question.

WHO as an Emergency Responder

Peter Daszak of EcoHealth Alliance expressed concern that an emergency response function for WHO would be expensive to establish, and would create similar tensions within the organization as occurred between WHO and NGO responders during the Ebola crisis. Given the growing frequency of spillover events from wildlife, outbreaks will become pandemics

more often and have greater economic impact, he predicted, and he thought it might make more sense to design a response force specifically to address major pandemics—more than just a unit within WHO. Clift disagreed, saying the expense of setting up a new institution is prohibitive, unless it is absolutely necessary.

Stocking noted that her panel concluded that the emergency response function in WHO should report to the Director-General, who decides when to announce a PHEIC. It remains to be decided how WHO fits into the wider emergency response system, she continued, but a likely scenario is already employed by the United Nations, whose humanitarian agencies mostly coordinate work done on the ground by non-UN responders (e.g., international NGOs, local NGOs, and governments). "There is already a lot of cooperation," she observed, and her panel felt that WHO needed to join existing systems of coordination.

Global Health Emergency Workforce

The global health emergency workforce could be comprised of separate components for infectious disease surveillance and detection, and for emergency response operations, both of which could serve as engines for capacity building, McIff observed. Such an opportunity presented itself when the African Union deployed health teams to West Africa to deal with a common threat to security, he noted, but better communication between WHO and the teams could have allowed them to work more effectively together.

Elias of the Gates Foundation encouraged examination of other health workforces to guide the development and organization of an emergency response entity, saying that too often discussions of governance tend to be top down and retrospective in nature. For example, the WHO polio workforce in Nigeria, with a staff of more than 2,200, along with more than 10,000 UNICEF-employed community mobilizers, is close to having eliminated the disease, he reported. Reasons for this success include political and technical leadership, but also the contribution of traditional and cultural leaders in dispelling fear in their communities, "silo-busting" collaboration among people attending to different aspects of the response, and operational flexibility.

Similarly, Elias suggested an in-depth case study on challenges faced and overcome by responders to the 2014 polio outbreak in Syria last year. There are some lessons to be learned about how good leaders taking assertive action in an imperfect governance system have actually solved some very important public health problems, he said. While a "top-down and theoretical discussion" can be useful, he observed, it must be balanced with accounts of obstacles that have been overcome in real-world environments to achieve success in public health.

6

Elements of a Governance Framework

Highlights and Main Points Made by Individual Speakers and Participants[a]

- Calls for improvements in capacity building, better training, and enhancing health systems by the global health community have gone largely unheeded since 2003, and the current complex global governance structure makes it difficult to understand transparent accountability. (Farrar)
- A dedicated platform for coordination could ensure interoperability between the United Nations' (UN's) humanitarian response and the World Health Organization's (WHO's) outbreak response systems, with more active engagement of the UN International Strategy for Disaster Reduction (UNISDR) acting as an opportunity for additional coordination in preparedness. (López-Acuña)
- Research conducted during epidemics could provide critical information during a response and could be augmented through predetermined guidelines and a "real-time learning officer" who would be charged with ensuring protocols are effectively implemented, ensuring records are better kept, and directing fundamental baseline clinical research. (Farrar, Fineberg, Kimball, Liu)
- Because WHO is not a homogeneous organization, strong and capable regional offices can make significant contributions

to overall governance. Regional structures can enable better cohesion between nations and help create a global entity while maintaining unique country-level diversity. (de Goyet, Kapila, St. John)

- An incident management system features elements of good governance and could be a model for a framework but would require improving integration of nonstate actors, especially community-level nongovernmental organizations (NGOs), creating a communication structure, training in emergency response, and making provisions for decision making. (Anyene, Duchin)
- Private-sector partners who wanted to assist in the Ebola response were uncertain whether they should interface with the United Nations, directly with affected countries, or through WHO, and they additionally want to better understand opportunities and limitations for their involvement. (Marmot)

[a] 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 and participants explored evidence on governance for global infectious disease control related to mechanisms for improved global health governance in this chapter on pieces of a governance framework at various levels. López-Acuña discussed the concept of global health security and the current alert and notification systems when a health emergency reaches pandemic levels, complemented by Jeremy Farrar of the Wellcome Trust who discussed challenges and opportunities for research in outbreak response. Speakers also gave perspectives on roles of the WHO regional offices, national governments, local humanitarian organizations, and the need and benefits of public–private partnerships in creating a holistic governance framework.

OVERVIEW OF GLOBAL HEALTH SECURITY

López-Acuña focused on the issue of global health security and the proposed collaboration by the UN humanitarian agencies and WHO in response to health emergencies with humanitarian impact. To clarify in discussions of terms like "global health security," López-Acuña offered his own definitions and perspectives on a number of key concepts:

- **Global health security** is both the process and the outcome of keeping global health risks under control and ensuring the maintenance

of a "global health order." Global health security encompasses alert and response to disturbances in this order, which can only occur through collective action and, therefore, depend on collaborative agreements at global, regional, and national levels. As such, the concept of global health security transcends the nation-state paradigm, but its process is intergovernmental in nature. Command-and-control models for attaining global health security contradict the notion of collaborative, intergovernmental action by nation-states, although it is possible to manage specific actions effectively using certain command-and-control elements. Linking the concept of global health security with that of national security is difficult, as individual member states' positions may not align. Not all humanitarian emergencies have global health security implications, which argues against subsuming global health security within the humanitarian system.

- **Global health risk** is a term that has yet to be clearly defined. The International Health Regulations (IHR) 2005 define a *public health risk* as the likelihood of an event that may affect adversely the health of human populations, and especially one that may spread internationally or present a serious and direct danger. "This is vague from a public health perspective and weak in terms of linkages with humanitarian emergencies," López-Acuña observed.
- **Global health governance** is implemented through the global health architecture, comprised of institutional arrangements focused on global health. A proliferation of entities, funds, mechanisms, and multistakeholder partnerships for global health over the past two decades have joined long-existing multilateral and bilateral structures to create a new global health landscape, characterized by parallel and sometimes duplicative objectives and governance structures.
- **Global public goods for health** are health interventions that require international collective action, such as those that ensure global health security. They should encompass global platforms and mechanisms to attain collectively agreed-upon objectives. A true global public good for ensuring health security would include collective responsibilities, action, financing, and accountability.
- **A public health emergency of international concern** (**PHEIC**) as defined in the IHR 2005 is an extraordinary event that constitutes a public health risk to other states through the international spread of disease and that potentially requires a coordinated international response. López-Acuña also raised the question as to whether a sensitive and graded system should replace the all-or-nothing trigger represented by a PHEIC.

- **A humanitarian emergency** is an event or series of events that seriously threatens the health, safety, security, or well-being of a community or population. Populations vulnerable to such threats—those in which individuals or groups have a reduced capacity to resist and recover from life-threatening hazards—are most often poor. The United Nations' consultative Humanitarian System-Wide Emergency Activation responds to major, sudden-onset humanitarian crises resulting from natural disasters or conflict. The decision to proceed with the activation is based on the scale, complexity, urgency, capacity, and reputational risk associated with a given event. A clear provision for humanitarian crises triggered by epidemics will need to be developed jointly by the humanitarian and the outbreak alert and response communities within the United Nations, López-Acuña observed.

Elias responded to López-Acuña's conclusions that it is currently impossible to supersede the nation-state paradigm, that WHO should lead any global public good for ensuring health security, and that decisions regarding emergency alert and response should be informed by an independent advisory committee. With the possible exception of a new independent accountability mechanism, the framework for global health security proposed by López-Acuña strongly resembles the status quo, yet would take a long time to establish, Elias observed. He therefore expressed concern that the systemic constraints López-Acuña described would obstruct the path to truly effective change—the kind of change that could have made a difference in the response to Ebola in West Africa. Elias asked what might accelerate this effective change, given the outlined constraints, and López-Acuña suggested greater advocacy and resources for building national core capacities. Bilateral, multilateral, and foundation-based investments in core capacities would have the additional benefit of performance measurements, he added. Second, the accountability commission process could be designed to produce rapid feedback as a basis for action. Finally, he suggested, a structure for efficiently organizing international medical teams responding to both outbreaks and humanitarian emergencies could be established quickly by adapting existing platforms and scaling up.

Farrar observed that the global health community's repeated calls—since the 2003 severe acute respiratory syndrome (SARS) epidemic—for such obvious improvements as capacity building, enhancing health systems, and better training have gone largely unheeded. To continue to pursue "business as usual" to the extent recommended by López-Acuña is unacceptable, Farrar insisted. The currently diffuse governance structure for global health threats admits no accountability, he explained; authority and accountability need to reside within a single, transparent structure. Today,

he observed, "nobody is really sure who is carrying that responsibility, and as a result, nobody carries it." Although the long-requested capacity building, training, and long-term investment are undeniably needed, if that is all the change that is demanded, once again nothing will change, he argued.

The Alert System

To ensure health security, WHO should be leading any health interventions in the name of global public good, López-Acuña stated, and the WHO Director-General, in close consultation with member states and advised by an independent scientific committee (appointed by the United Nations' Executive Board, not by the WHO secretariat), should make all relevant decisions. Upon declaration of an alert, relevant action should be primarily implemented through national health authorities in the affected countries in collaboration with WHO, he said. Where health systems are fragile, response can involve a health coalition led by WHO and may also entail a humanitarian response that engages relevant nonstate actors. If necessary, civil or military assets standing by in established locations worldwide can be mobilized as well. An independent accountability commission, authorized by the UN Executive Board, should oversee this response, which cannot be appropriately managed through command and control, he concluded.

A global alert system cannot ensure global health security until every country attains the IHR-mandated core capacities, López-Acuña insisted. Sanctions should also be imposed on countries that hide information about health threats within their borders, he added. The system must provide reliable information for decision making and swift action, and it should incorporate advanced information and communications technology. The current global response system is the weakest component of what is needed to ensure health security, which clearly represents a vital need and a global public good, according to López-Acuña. Its shortcomings were apparent during the Ebola crisis, during which the Global Outbreak Alert and Response Network (GOARN) effectively mobilized expert epidemiologic capacity, but not the international clinical care teams that were needed to compensate for inadequate core capacities in the affected countries. A coordinating mechanism that mobilizes appropriate clinical teams from member states could build a more comprehensive global health workforce, he observed.

Institutional capacity for multihazard emergency preparedness and response systems must be developed at national, regional, and local levels within every country, López-Acuña declared. This process will take decades, he predicted, as it encompasses capacity building, financial sustainability, and infrastructure strengthening. Each country's emergency preparedness and response systems should be aligned with structures that fulfill national responsibilities under the IHR, he added. While the United Nations' human-

itarian response system and WHO's IHR-related alert and response system should be prepared to recognize and act on the subset of health emergencies that require their coordinated efforts, each system must maintain its distinct objective and governance mechanisms, López-Acuña stated. A dedicated coordination platform could ensure the international interoperability of both systems when collaboration is necessary, he suggested. Additional measures to support a coordinated response to health and humanitarian emergencies would include more active engagement of the UNISDR in the prevention and mitigation of global health risks as part of its preparedeness agenda, and the mainstreaming of actions to address global health risks in the UN Development Assistance Framework, he noted.

Notification of a Public Health Emergency of International Concern

In conclusion, López-Acuña asserted, it is possible to enable global public good for ensuring health security from basic elements of the existing health and humanitarian response architecture. Enhanced by greater interconnectedness, these elements could remain situated within the parameters of the current WHO but have improved systems performance. Because the designation of a PHEIC and the associated responses can be delayed due to a multitude of factors and generate challenges because of travel and trade implications, among other issues, López-Acuña suggested replacing the current notification system with a phased international response strategy. This phased approach would be based on the magnitude of a given health threat and the appropriate governance of its response.

- **Phase I:** Emergency with a health impact; response led by WHO together with member states.
- **Phase II:** Health emergency with humanitarian implications; response jointly led by WHO and the UN Emergency Relief Coordinator/Inter-Agency Standing Committee (ERC/IASC).
- **Phase III:** Health emergency with implications for global security; response led by the UN Secretary-General, in close collaboration with WHO and with support from the UN Security Council and ERC/IASC.

Not all PHEICs create humanitarian emergencies, nor do all outbreaks represent a threat to global health security. Some outbreaks can and should be managed by national, regional, and global health sector mechanisms and platforms within the framework of the IHR 2005, López-Acuña said, provided the stipulated core capacities are in place. However, disease outbreaks that overwhelm national capacities can create humanitarian crises that require an international response; these events, he argued, ought to be

considered humanitarian emergencies. It is only for the relatively few outbreaks that have an international impact as well as a humanitarian dimension that WHO's outbreak alert and response and the United Nations' humanitarian systems must collaborate.

Embedding Research and Development

Farrar observed that the glut of meetings that have followed each major epidemic over the past two decades have done little more than rewrite history as the horrors of the experiences faded away. Meanwhile, infectious disease dynamics have continued to change, with social factors increasingly driving transmission. Reiterating previous comments of applying retrospective solutions to future unknown epidemics, he declared that effective preparation will require a broad spectrum of research, encompassing clinical studies, disease mapping and modeling, epidemiology, biomedical research, and social sciences such as anthropology and ethics.

The most challenging—and potentially rewarding—aspect of conducting this ambitious program of research is its context within the chaos of unfolding epidemics. Speaking from his own experiences, Farrar added, there is a responsibility to do something called research, however that may be defined. This tension between response and research is magnified by the fact that the two activities tend to be siloed, and that the research community itself is highly specialized, he noted. Thus, he stressed, it is important to remember that research—implemented as policy and practice—can save lives and needs to be incorporated into the response (Farrar, 2014).

Unfortunately, the life-saving potential of research has remained largely untapped in recent epidemics of Nipah, SARS, enteroviruses, H5N1, H1N1, Middle East respiratory syndrome (MERS) coronavirus, and Ebola, Farrar pointed out. Ebola may be the first emerging infectious disease for which a safe and effective vaccine is developed; by contrast, influenza vaccines are unacceptably ineffective and avian influenza vaccines largely nonexistent, he noted. Similarly, it remains to be determined whether antiviral treatment saves lives or prevents secondary transmission of the influenza virus, arguably the most devastating global health threat and the cause of a 2009 pandemic to which one-sixth of the world's population was exposed. Farrar noted that the International Severe Acute Respiratory and Emerging Infection Consortium,[1] an effort under way by the Heads of International Research Organizations (HIRO),[2] is developing universal research proto-

[1] See https://isaric.tghn.org (accessed January 8, 2016).

[2] HIRO includes representatives of the U.S. National Institutes of Health, the European Union, the Wellcome Trust, the UK Medical Research Council, and other organizations from Canada, China, India, and South Africa.

cols for use during epidemics and attempting to resolve associated consent and ethical issues beforehand. Findings from studies conducted during outbreaks must be integrated with and supported by equally vital research conducted between epidemics, he added.

Any discussion about global health governance must include provisions for research, Farrar insisted. The ethics of research approaches should be debated in civil society in order to ensure that the voices of patients and affected populations are heard by the many and often dissociated actors who may implement research protocols during an epidemic, he advised. Mutual understanding among these disparate communities can provide a basis for conducting studies that saves lives, he observed. Duchin asked Farrar if governance for the research activities he proposed should be integrated into an overall global health governance structure or if it should involve a separate system. Ideally, Farrar replied, research would be governed as an integral part of the global health structure and system, albeit through different expertise than would be needed to govern emergency response. Such a structure is needed to counteract specialization and encourage collaboration between such seemingly aligned disciplines as public health and clinical medicine, as well as between the long-separated animal and human health communities, he noted. Training—although currently a cause of "siloing"—could also promote greater understanding between the various health communities, he added.

Gotuzzo of Universidad Peruaña Cayetano Heredia and Daszak of EcoHealth Alliance emphasized the importance of research on zoonotic diseases, and particularly diseases of wildlife, due to their predominance among emerging disease threats. Fineberg suggested that a "real-time learning officer" could be charged with ensuring that research protocols were effectively implemented during an epidemic. Kimball of Chatham House extended this hypothetical position to address the need for better record keeping during epidemics, which in turn would help plan research to be conducted in future outbreaks. Perhaps this research officer could be "multivalent," she said—capable of facilitating randomized controlled trials for drugs and vaccines, but also able to design and direct the "bare minimum" of clinical research to describe protocols and outcomes during an epidemic.

The upstream establishment of guidelines and frameworks for research in advance of an epidemic would make a "huge difference" to improving the collection of vital information, Liu of Médecins Sans Frontières observed. Just as evidence-based algorithms for clinical care save lives, algorithms for conducting research during a chaotic epidemic response can ensure that information leading to improved practices is collected without compromising care—and, thereby, that even more lives are saved. Research for improving epidemic response should extend beyond the clinic to examine the entire spectrum, including nonhealth sectors, advised Kumanan

Rasanathan, senior health specialist at UNICEF. He suggested two practical considerations worthy of study: the role of the community health worker and the utility of community mobilization and health literacy messages. "There will always be great uncertainty during emergencies, and yet decisions need to be made," Relman of Stanford University observed. How should governance at all levels address and communicate uncertainty in a scientifically appropriate way? Farrar replied that learning how to communicate uncertainty and being comfortable with that is absolutely critical.

Along with algorithms and procedures for research in the context of an epidemic, it will also be important to build regional or local capacity for conducting these studies, as well as greater public awareness about research, stated Margaret Hamburg, former commissioner of the U.S. Food and Drug Administration. This will support important research in neglected areas of public health and medical care, build capacity for basic health care, and facilitate the ability to conduct clinical trials and other studies in the context of an emergency, she pointed out. "It's very tragic if we go through something like a pandemic or an Ebola event without learning whether certain proposed therapies actually work or harm people," said Jesse Goodman of Georgetown University. Well-prepared protocols and advance resolution of ethical issues represent an important part of public health infrastructure, he added, and he noted that the U.S. Institute of Medicine is likely to undertake a deep examination of the subject of health research during emergencies. There are many barriers to action, Farrar acknowledged, "but we shouldn't forget the ethics of inaction."

WHO REGIONAL OFFICE ROLES

Claude de Ville de Goyet, consultant to the United Nations and former director of emergency preparedness for the Pan American Health Organization (PAHO), discussed governance for health emergencies on the part of WHO regional offices. Goyet urged participants to consider the ways this structure benefits member states and their populations in general, beyond the context of the Ebola crisis. Conflicts that arose between WHO headquarters (HQ) and the Regional Office for Africa (AFRO) in that crisis were longstanding, he suggested, and particular to that region. But conversely, the sharing of power between HQ and other regional offices, while sometimes difficult, had not impeded the management of the H5N1 influenza pandemic, nor that of SARS.

AFRO has a serious governance problem, Goyet declared, but he did not know if the problem was due to structure, implementation, or regional autonomy. In contrast to AFRO, PAHO is "respected for its level of health governance," Goyet observed. He offered several reasons for this, including PAHO's original purpose of controlling yellow fever and other infectious

diseases, and its comparatively high level of funding. PAHO entered the realm of regional governance for disaster preparation in 1977, following an earthquake in Guatemala. Since then, the office has taken an all-hazards approach to emergency response, emphasizing mutual assistance between states and cooperation across borders and among subregional disaster management organizations, he said. Most WHO regions have adopted an all-hazards response approach resembling PAHO's, which emphasizes preparedness and proactive, on-site coordination.

As previously noted, the United Nations' response to humanitarian crises is organized according to nine thematic clusters, each led by a UN agency such as UNICEF, WHO, and the World Food Programme (WFP). Most countries engage with the clusters as a way to strengthen their ministries of health and promote local governance—a trend that reflects a beneficial balance, Goyet asserted: emergency funding should be limited as compared with funding for strengthening capacity. A good example of partnership between countries and the UN clusters is the Foreign Medical Teams (FMT) Initiative,[3] he observed. Established by the Global Health Cluster, the FMT Initiative coordinates the assistance of medical teams during health emergencies, employing a model developed for earthquake response. Its success shows that health governance for outbreaks requires adaptation, not reinvention, he said. The WHO HQ and regional offices should play distinct roles in a health emergency, according to Goyet, who offered a side-by-side summary (see Box 6-1). With regard to the final point around maintenance of public health programs, Goyet speculated that the fear-driven shifting of resources for basic health care to Ebola control may have cost more African lives than it saved. Liu pointed out that the significant challenge of infection control in health care centers—which became Ebola amplification centers at the height of the epidemic—frequently forced their closure. Both agreed that this gap in care should be addressed in planning for future events of this scale.

Responding to Goyet's remarks, Kapila of the University of Manchester asserted that the region is not the cumbersome and outmoded level of governance that some have suggested, but instead is increasingly represented in the United Nations and other organizations. WHO must make a virtue of its regional offices because they are owned and loved by member states, he advised. Goyet suggested that the trend is not so much toward regionalization as toward subregionalization, in the form of subregional health and

[3] Recognizing that uncoordinated medical team deployment can disrupt national emergency coordination plans, the United Nations' Global Health Cluster established the FMT Initiative, a global mechanism to assist governments with the coordination of medical teams during public health emergencies. See https://extranet.who.int/fmt/page/about-us (accessed January 8, 2016).

BOX 6-1
Roles of WHO HQ and WHO Regional Offices in a Health Emergency[a]

WHO Headquarters

- Norms and standards (e.g., the FMT Initiative) in the preparedness phase
- Tasking of the regions and WHO representatives
- Quality control and independent monitoring of the epidemiologic situation on site and of the operations carried out by the regions
- Technical, financial, and logistic support to the region in the crisis
- Mobilization of GOARN public health experts and FMTs
- Mobilization of resources
- When required, appointment of a crisis manager in the affected countries
- If due to the scale of the problem or the lack of capacity or governance in a region, HQ should be ready to assume direct on-site coordination responsibility (this action should be employed rarely, and perhaps only after recommendation by an advisory committee)

WHO Regional Offices

- Implementation of preparedness activities with the corresponding budget
- Promotion of intercountry mutual assistance and cross-border initiatives
- Contacts with the national authorities and (sub)regional organizations
- Direct management, coordination, and support to field operations (unless the emergency is on an interregional scale or larger)
- Supporting the ministry of health in on-site coordination and tasking of external assistance, FMTs, and UN clusters
- Ensuring maintenance of basic public health programs, in partnership with the ministry of health.

[a] As presented by Goyet on September 2, 2015.
SOURCE: Goyet presentation, September 2, 2015.

disaster management institutions, but that these need support from above, as well as a common voice at the global level. Regionalization is a must because WHO is not a homogeneous organization, stated Ron St. John, currently a consultant to WHO. Regional structures enable cohesiveness among countries and, in turn, can be linked to create a global entity that nonetheless reflects diversity, he added.

ROLE OF NATIONAL-LEVEL GOVERNANCE

As a preface to his discussion of governance for health emergencies and the provision of WHO assistance at the national level, St. John asserted that WHO must retain its global authority but is ripe for fundamental change. Expressing his disdain for the term "command and control," St. John instead embraced the term "management" and noted that command and control merely describes the management of time, resources, and information. This was his task as an emergency manager in Canada during events that included the repercussions of 9/11 and the anthrax mailings, SARS, Hurricane Katrina, and several natural disasters. These experiences taught him that even minor emergencies are at least initially chaotic, and that gaining and keeping the trust of affected populations and communities is essential to effective emergency management. He also confronted the unfortunate reality that the massive costs of emergency response dwarf what is generally spent on emergency preparedness in the form of planning and training—reinforcing earlier calls for attention to health capacity building, which can create a more prepared health system and community.

Establishing Incident Management Systems

Typically, local first responders to any emergency manage it on their own unless and until their capacities are exceeded, St. John observed. At this point an emergency management framework should be activated, engaging local, state/provincial, and national governance levels, with information and requests for assistance flowing from lower toward higher governance levels, and resources flowing in the opposite direction. Ideally, a multidisciplinary team would convene at an emergency operations center—perhaps within a single room—to manage incident response. These activities comprise an Incident Management System.

In reality, capacities for managing health emergencies vary widely among countries, and among their local and state/provincial agencies, St. John noted. Information sharing and coordination is often weak between governmental levels in the health sector, as is planning for necessary surge capacity, he said. The concept of the emergency operations center tends to be limited to the national security sector and less applicable to public health responses. The health sector understands the application of the Incident Management System to disasters such as earthquakes, but not to epidemics, according to St. John. Political and economic disincentives to reporting an outbreak present significant barriers to implementing the Incident Management System, he observed, but he presented the use of an Incident Management Framework, assuming all levels are operational and national capacity has been exceeded (see Figure 6-1). Moreover, as compared with

FIGURE 6-1 Use of an Incident Management System in an international response.
NOTE: HQ = headquarters; IMS = Incident Management System; WHO = World Health Organization
SOURCE: St. John Presentation, September 2, 2015.

acute disasters, epidemics are fraught with uncertainty as to their transmission dynamics, severity, and duration—characteristics which also contribute to the "fear factor" mentioned by Goyet—highlighting Farrar's previous comments about the critical need to be able to successfully communicate elements of uncertainty to the public during an outbreak.

"I believe the Incident Management System can be adapted to any complex health emergency, even in WHO," St. John stated. He pointed to elements of an Incident Management System for outbreaks already present within WHO, for which PAHO's successful Ebola emergency operations center could serve as a model. Every WHO country office should have a designated, trained incident manager, he proposed—a role that he estimated would require about 100 full- or part-time positions worldwide. Flexible, scalable plans for activating an Incident Management System and providing surge capacity must also be put in place, he said. In a complex health emergency, such as occurred during the SARS outbreak, the WHO-led Incident Management System within the health sector should coordinate with Incident Management Systems in other groups and other sectors, he advised. Ben Anyene of the Health Reform Foundation of Nigeria cautioned that the Incident Management System, as it currently exists, does not adequately integrate nonstate actors that increasingly contribute to emergency response efforts. Nonstate actors tend not to be represented at emergency operations centers, he observed, and yet they perform a variety of functions that others cannot. He advocated for including them in the overall system and any type of operations center.

Duchin observed that the Incident Management System features several elements of good governance as previously discussed (e.g., flexibility, scal-

ability, and ability to incorporate at global, regional, and local levels) and therefore could provide a model for a governance framework. Fleshing out this structure would require integrating input from a variety of different stakeholders, creating a communication structure, and making provisions for decision making, logistics, and functionality, he continued. It would also need to be accompanied by guidance on appropriate training for development of these types of systems.

ROLE OF LOCAL HUMANITARIAN ORGANIZATIONS

Ben Anyene is leader and founding member of the Health Reform Foundation of Nigeria,[4] which works within the contexts of national, state, and local health governance in that country. Illustrating the point made by Stocking and others that the lack of basic health care constitutes an actual and ongoing health crisis for low- and middle-income countries (LMICs), Anyene reported that, each year in Nigeria, more than 50,000 women die in childbirth, and 1 million children under 5 years of age die from preventable diseases. "Why shouldn't we be responding to this health care crisis, rather than waiting for the next big disease outbreak?" he asked.

In Nigeria, as in most LMICs, frameworks for emergency preparedness and response, if they exist at all, are limited to the deployment of relief materials such as food and blankets after a crisis has occurred, Anyene reported. "Most response activities by nonstate actors during a disease outbreak and other health crises are often those of ad hoc and unregulated arrangements with adverse consequences," he added. This situation is unlikely to change unless politicians, and the business interests that control them, recognize the economic benefits of emergency preparedness, he said.

Despite the strain placed on Nigeria's weak health care system by a variety of diseases and civil disputes, it is slowly improving, Anyene reported. Quality health care in Nigeria is largely privatized and not affordable to the vast majority of citizens, so community-based and faith-based organizations attempt to fill this gap, supported by a culture that traditionally values extended family and community solidarity, he observed. When health crises overwhelm local responders, agencies such as the Nigerian Centre for Disease Control, the Nigerian Emergency Management Agency, the Nigerian Red Cross, and the Nigerian arm of the International First Aid Society may be engaged, but there is no governance structure in place to organize their activities. Even so, he noted, containment of the recent Nigerian Ebola outbreak occurred through the coordinated efforts of different levels of government and international partners, and featured emergency

[4] See http://www.herfon.org.

operation centers, good contact tracing, and incident case management. The same could be said for Mali and Senegal, he added.

Further strengthening of health emergency response capacities should involve the creation of accountability frameworks to encourage "effective synergy" among relevant government agencies and local and international organizations, Anyene advised. He also suggested that training in health emergency response become part of Nigeria's mandatory civic education program, which includes a year of service in the country's National Youth Service Corps, and that similar training be extended to local humanitarian organizations.

The impact of Ebola in West Africa demonstrates the need for LMICs to build their own capacity and governance for responding to health emergencies and, thus, cease to depend upon international intervention, Anyene concluded. Response efforts at national and subnational levels should be guided by principles of humanitarian assistance, he added, and directed toward solving immediate problems, implementing evidence-based interventions, strengthening health systems, and creating value for money.

ROLE OF PUBLIC–PRIVATE PARTNERSHIPS

Rebecca Marmot of Unilever discussed how her company and the private sector in general have responded to both ongoing health crises and health emergencies such as the West African Ebola epidemic. As one of the world's largest companies, Unilever produces foods and goods for home and personal care that reach markets around the world. Unilever's business strategy recognizes the following key environmental factors, according to Marmot: climate change and associated weather extremes (e.g., flooding and drought); volatile political situations, leading to increased human migration; and the nutritional "double burden" of hunger in some places and obesity (and its attendant pathology) in others. Along with other private-sector players, Unilever is developing strategies to serve corresponding needs in communities around the world, and to work more efficiently with the public sector—particularly the health sector—in meeting these challenges, she said.

Through its Sustainable Living Plan, Unilever aims simultaneously to expand its business and make a positive global impact, Marmot stated. The targets for this plan are informed by the United Nations' Millenium Development Goals[5] and Sustainable Development Goals.[6] Unilever's disaster and emergency response strategy is embedded within this more general

[5] See http://www.unmillenniumproject.org/goals (accessed December 18, 2015).

[6] See http://www.un.org/sustainabledevelopment/sustainable-development-goals (accessed January 8, 2016).

plan, Marmot explained. In addition to costing the company more than $300 million per year, disasters exact an inestimable toll on their customers and the communities in which they live, she said, with the Ebola crisis further focusing efforts by the company to refine its response to such events. Addressing the three pillars of preparedness, relief, and rehabilitation, Unilever aims to maximize positive impact on communities while minimizing the business impact of disaster. The company's preparedness activities include training farmers in climate-resilient practices and their employees in disaster preparedness, as well as planning to ensure continuity in supply chains and logistics. Unilever also seeks to support relief efforts with appropriate products, such as soap, detergents, emergency sanitation packs, and fortified foods acceptable to the affected population.

Noting that rehabilitation "is probably the area where the private sector has the biggest opportunity to make a positive impact," Marmot said she hoped to gain insight on ways that her company and others could better support the rebuilding of communities and economies. "When communities are displaced or impacted by health crises or by pandemics, by disasters, they are not waiting for a handout," she observed. "They are desperate to get back on their feet as quickly and efficiently as possible, to get schools open, to get commerce up and running, to be able to get supplies back into the communities where they are most needed." Marmot shared the principles that form the foundation of Unilever's emergency response strategy (see Box 6-2).

"Unilever has a fairly sizable presence in West Africa, particularly in Nigeria," Marmot noted, explaining, "when the Ebola crisis started to unfold, we, like many others, were slow in our response." Eventually they turned to their three-tiered approach. Their efforts included partnering with NGOs such as Save the Children, donating their products, offering the services of their distribution and supply chain teams to plan logistics, and training responders in behavior change techniques to help them address the many social challenges they faced, she said.

Unilever's intent—and that, presumably, of the many private-sector organizations that responded to the Ebola crisis—was not to solve it, but to contribute the "private-sector mindset" to efforts by NGOs and government responders, Marmot explained. Unfortunately, she added, there was confusion and disarray about how private-sector partners should approach the situation: whether to work with existing partners in the United Nations, or directly with the governments of affected countries, or to go through WHO? She described how complicated it can be to understand the optimal way for the private sector to contribute value to a response.

Unilever also seeks better alignment with the UN cluster system in anticipation of future health emergencies, said Marmot. In general, the private sector wants to know how to be useful to health emergency response

BOX 6-2
Principles of Unilever's Emergency Response Strategy[a]

- **Serving where the company, and the private sector in general, can have the greatest positive impact.** For example, Marmot said, "We have the behavior change skills and expertise to be able to work with our partners to be able to help develop the right kinds of collateral to influence people to drink clean water, to utilize proper sanitation behavior. What we don't have," she added, "is the capability to roll those sorts of programs out at scale."
- **Limiting unintended consequences of their actions.** For example, by ensuring that by providing their products free of charge to an affected population or community, they will not undermine the livelihoods of local shops and operators. It would seek expertise and guidance from partners in government and the public sector in order to do the right thing. It would advocate for systems change, such as participating in this workshop and the International Oversight Group that planned it.
- **Taking a holistic approach to community needs.** For example, Unilever worked with UNICEF on programs to improve clean water, hygiene, and sanitation practices in the Philippines that later helped communities affected by Typhoon Haiyan.

[a] As presented by Marmot on September 2, 2015.
SOURCE: Marmot presentation, September 2, 2015.

efforts, whether it involves skills, expertise, product development, or devising new governance models. The private sector also wants to understand limitations, as well as opportunities, for involvement in efforts to address global health emergencies, she stated. Unilever has played a role in developing the Sustainable Development Goals and hopes to contribute to developing the Global Health Risk Framework as a model for emergency response to be developed and tested before the next crisis strikes. For such a framework to succeed, she concluded, "business and the NGO community and UN and civil society will need to interact even more than they have done before."

Kimball asked the public-sector speakers to reflect on their experiences working with the private sector in response to health emergencies. Goyet characterized his experiences as short-term responses to emergencies of variable quality, saying that in order to avoid conflicts of interest, he had not accepted donations from the private sector, only expertise. The private sector is both ubiquitous and a resource, Anyene observed; the various concerns about its involvement in emergency response could be addressed

in the design of the Global Health Risk Framework and made specific to individual companies through transparent formal agreements, he suggested.

Kimball wondered why business service organizations, such as Rotary International, are not the primary conduit for business involvement in emergency response, since that would remove the possibility of competitive advantage for any one company. Marmot stressed that the possible contributions companies can make to a recovery effort extend well beyond those that might appear to boost their sales and, most significantly, would involve the use of their expertise in solving complex problems associated with emergency response. Unilever's participation in multisectoral efforts to effect systemic change, such as the World Economic Forum, is another way the company engages with civil society for the common good, she added.

7

Comparing Hypothetical Models of Governance for Global Health

Main Points Highlighted by Individual Speakers and Participants[a]

- Linking national security with global health threats can raise public and political awareness, but it ignores universal health coverage, which is the foundation of population health security. The two concepts should be linked, and community involvement prioritized, to provide a more comprehensive approach. (Kimball, Rasanathan, Shibuya)
- The global health system would benefit from improved elements of resilience such as diversity (including traditional healers and community members in systems design), self-regulation (such as two-way feedback loops to improve information synthesis), and adaptation (to more easily permit self-correction). (Kimball)
- Strengthening the World Health Organization (WHO) and improving coordination among national governments and actors within the United Nations (UN) system should also include how to better leverage UN assets and resources, improve data sharing, and bridge cultural differences between humanitarian systems and disease outbreak systems. (López-Acuña, Rasanathan)
- Responsibility at the country level to build health capacity needs to be shifted back to member states from WHO and the international and regional levels. Improvement at the country

level has been variable with different country offices possessing different response capacities. (Elias, Tomori)

- Mistrust of global health governance is a recurring issue, with statements at the country level advocating for global support without overstepping national sovereignty and related decision making. (Heywood, Kapila)

[a] 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.

This chapter outlines four different potential models of global governance for health risks in terms of their underlying assumptions and their strengths and weaknesses, analyzed by various speakers and participants. "These four models are simplified, and they are in many ways oversimplified, but sometimes there is clarity in oversimplification," explained Gostin. He also noted that these models are neither mutually exclusive nor exhaustive of all possibilities for global health governance. The model presentations were followed first by comments from a three-person reactor panel, then by a general discussion.

MODEL 1: A REFORMED WHO

"The case for reforming WHO does not just rest on its supposed failures in relation to emergency response, but rather, most reform proposals over the past two decades have focused on improving the effectiveness of the WHO's technical and normative work."

—Charles Clift, Chatham House

Clift described a model based on the Chatham House report he discussed in Chapter 5. WHO's performance during the Ebola crisis—although it unfolded after the Chatham House report was prepared—highlighted problems in its organizational structure, governance, and culture. He thought that WHO's role in disease outbreaks should not be examined in isolation from its normative functions, but instead urged the audience to consider how much of WHO's resources should be devoted to outbreak response. To introduce the model, Clift outlined the following assumptions behind it:

- Reforming WHO would address the main reasons that the Ebola response was unsatisfactory.
- Reforming WHO is necessary if the "structural causes of any shortcomings," as noted in the report of the Ebola Interim Assessment Panel, are to be corrected.
- "Business as usual" or "more of the same" is not an option, as noted in the report of the Ebola Interim Assessment Panel.
- The member states of WHO have an appetite for its fundamental reform.[1]

Clift then presented a series of reform proposals in several key areas. The first involved the insulation of WHO's technical work from its political interests, based on the assumption that the excessive intrusion of political considerations in WHO's technical work damages WHO's credibility. To meet this challenge, the Chatham House panel advised that WHO should provide for a clear distinction between its technical departments and those dealing with governance by appointing a Deputy Director-General with responsibility for technical work and its integrity, akin to the role played by Chief Scientists in UK government departments. In addition, the panel echoed previous suggestions that the position of WHO Director-General be limited to a single 7-year term. Second, based on the assumption that WHO's structure of elected regional directors constrains its effectiveness in both its "normal" work and its disease outbreak response capabilities, the panel offered the following alternative proposals

- A unitary model, in which WHO, like other UN organizations, determines the need for regional and country offices on the basis of operational requirements, and in which regional directors are appointed directly by the Director-General; and
- A decentralized model, like that of the Pan American Health Organization (PAHO), with regional offices that are directly funded by member states, rather than indirectly via their assessed WHO contribution.[2]

[1] Upon introducing this assumption to the workshop, Clift added, "The hypothesis is they probably don't, but discuss."

[2] Under this alternative, Clift acknowledged, "some regional offices might not survive. That may or may not be a good thing, depending on your point of view." He also noted that some regional offices could align with existing regional organizations, such as the African Union, Asia-Pacific Economic Cooperation, and the Association of Southeast Asian Nations. "Many different organizations that have grown up organically in the regions could be used to fulfill some of the health functions of WHO regional offices," he observed.

Furthermore, the Chatham House panel assumed that WHO's 150 country and 6 regional offices are superfluous, that some are either too large or too small, and that not all are staffed appropriately to local needs (as demonstrated by the Ebola crisis), Clift reported. They therefore proposed the following reforms:

- A comprehensive and independent review[3] intended to match the staff profile of country offices to their host countries' needs, and
- An internal review of the mix of skills and expertise of country and regional office staff to ensure that these fit with its core functions and leadership priorities.

On the subject of finance, the Chatham House panel assumed that reform is necessary in order to persuade member states to support stable funding arrangements to fulfill WHO's core functions, including responding to disease outbreaks, Clift stated. Clarifying that this does not necessarily mean providing more money overall, he pointed out that WHO's administration and management costs could be substantially reduced as a result of reforms to regional and country offices, which currently consume more than 60 percent of the organization's budget. Clift suggested that "one reason why member states are very reluctant to increase their contributions is that they don't trust the organization to do what it says." Thus, the panel recommended that WHO and its member states examine how to enhance their effectiveness by increasing value added by regional and country offices, and reducing administrative and management costs. He concluded that the same level of work could be done with fewer people with the right skill set, but acknowledged that people are reluctant to tackle that as an issue.

WHO will only change if charged to do so by its member states, Clift insisted. Thus, he said, a bargain must be made in which the states encourage more courageous reform actions on the part of the organization, while also offering the incentive of more stable funding for WHO's core functions, including outbreak response.

MODEL 2: WHO PLUS

As Stocking had previously described, the Ebola Interim Assessment Panel she chaired proposed the creation of a center for humanitarian and outbreak management attached to WHO and under authority of the Director-General that combined strategic, operational, and tactical func-

[3] This was suggested by WHO's Executive Board in 1997, and subsequently in external reports from the joint intelligence unit of the United Nations and other evaluators, but was never undertaken, Clift pointed out.

tions. A member of that panel, Ilona Kickbusch of the Graduate Institute of International and Development Studies, Geneva, Switzerland, offered remarks informed by the panel's work, as well as by her own views. Kickbusch emphasized that any model would oversimplify the complex system involved in global health governance for infectious diseases, warning that any changes made in one part of the system will impact another part. Therefore, the panel attempted to target changes that would produce a positive system-wide dynamic and avoid destructive effects.

> "Most countries have a responsibility in their constitutions to protect their peoples, as does the European Union. Health security is sort of the global public health side of things, combined with universal health coverage."
>
> *—Ilona Kickbusch, Graduate Institute of International and Development Studies, Geneva, Switzerland*

The Ebola Interim Assessment Panel's recommendations are based on several assumptions, which Kickbusch described. The first and foremost of these was the declaration by WHO's member states that the responsibility for health security rests with the organization, which should be strengthened to fulfill this core function. While differing from the Chatham House panel in the suggestion not to separate the technical and political functions of WHO, the Ebola Interim Assessment Panel felt both elements needed to be better managed at the level of the member states, as well as within the secretariat, Kickbusch stated. Having been "disappointed [and] infuriated" by the World Health Assembly's (WHA's) rejection of a 5 percent increase in assessed contributions that would have provided for such strengthening, the panel proposed that this measure be reintroduced, she reported.

The Ebola Interim Assessment Panel's proposed center for humanitarian and outbreak management attached to WHO would bring together emergency, humanitarian, and International Health Regulations (IHR) functions, Kickbusch explained, and it would work in two modes. In the "everyday" mode, the center would monitor and support the control of limited outbreaks and, especially, facilitate outbreak preparedness through simulation and workforce training as is currently performed in the security sector. The shift into "crisis" or "command-and-control" mode would be initiated by a specific mechanism. Both modes, and the transition between them, would be governed by the center's director, in consultation with the WHO Director-General, and guided by an advisory board in such a way as to create transparency and ensure effectiveness.

"This system has to be able to respond quickly to very, very different kinds of outbreaks and emergencies," Kickbusch advised. "There are things

about the next crisis we are not going to be prepared for, but we have got to be able to adjust much more quickly and have much more accountability and transparency in relation to what is happening." In order to support this activity, she called for an increased health security budget within WHO as well as an increased political commitment from member states.

The Ebola Interim Assessment Panel largely agreed with the recommendations of the Chatham House report with regard to the role of the WHO regions, country offices, and the representatives to the WHA, according to Kickbusch. She noted that staffing needs to be country and region appropriate, and there should be a prioritized and costed plan for all WHO functions. In considering the IHR, the Ebola Interim Assessment Panel embraced the underlying concept of "pooled sovereignty," Kickbusch stated. On that basis they concluded that compliance requires peer review rather than self-assessment, a notion that she reported is now more acceptable to member states than it once was. Relatedly, peer review, along with various incentives, disincentives, and sanctions, is currently being discussed by WHO's IHR Review Committee. Because a public health emergency of international concern (PHEIC) is "something we all want to avoid," there should be intermediate measures available, as well as more transparent decision-making processes along the way.

The proposed WHO center for humanitarian and outbreak management is intended as a "global space of responsibility," Kickbusch said. Recognizing the typical separation—and sometimes competition—between the priorities of health security and universal health coverage, she advanced the view of health security as human and social security. WHO, she added, has tended to keep these agendas separate, and that must change, as many including Chan have acknowledged. Reforming WHO according to the Ebola Interim Assessment Panel's recommendations will require the highest political commitment, extending well beyond the health sector, Kickbusch asserted, specifically adding that they are looking to the UN high-level panel to work on political and funding support of WHO.

MODEL 3: AN EXECUTIVE AGENCY

> "The executive agency model is activated only when a multisectoral global response is required to reduce health risk. This allows the UN system to create an enabling environment in which WHO takes the lead in the health sector or cluster."
>
> —*Yasushi Katsuma, Waseda University, Japan*

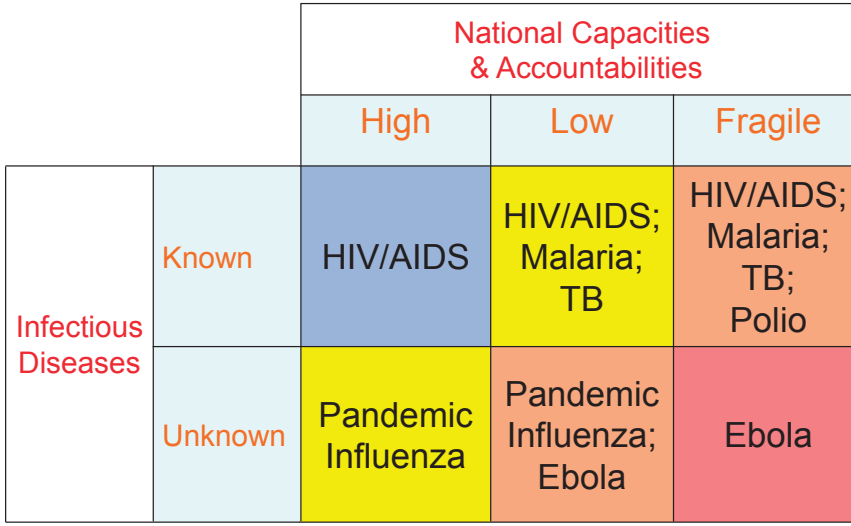

FIGURE 7-1 Typology of health risk as a matrix defined by levels of capacities and accountabilities versus known and unknown infectious diseases.
NOTE: TB = tuberculosis.
SOURCE: Katsuma presentation, September 2, 2015.

Yasushi Katsuma of Waseda University, Japan, presented a model in which WHO, hosted by the UN Secretary-General, executes a strategic operational and tactical role in a health emergency. As Gostin noted, this model aims to take advantage of WHO's expertise and legitimacy, while tapping into the UN's higher-level political authority and support.

To provide context for the executive agency model, Katsuma described a typology of health risk as a matrix defined by two variables: infectious diseases that are either known or unknown, and national capacities and accountabilities for outbreak response that are high, low, or fragile (see Figure 7-1). Thus, he explained, a known infectious disease like HIV/AIDS represents a different risk in the United Kingdom, where national capacities and accountability for response are high, than in Somalia, a fragile state. This matrix, in turn, defines four different types of health risks and appropriate responses, which he characterized as follows:

- **Type 1:** when the infectious disease is *known* and the national capacities are *high*. Governments of such countries may not need support from WHO.
- **Type 2:** when the infectious disease is *known* and the national capacities are *low*; or, when the infectious disease is *unknown* and

the national capacities are high. In these cases, WHO must respond at the international level, but within its typical capacity, including engagement and communication efforts.

- **Type 3:** when the infectious disease is *known* and the national capacities are *fragile*; or, when the infectious disease is *unknown* and the national capacities are *low*. These cases require a multisectoral development response within the UN Development Assistance Framework (UNDAF), with WHO taking the lead in the health sector.[4]
- **Type 4:** when the infectious disease is *unknown* and national capacities are *fragile* (e.g., the initial months of the Ebola epidemic in West Africa). This situation requires a multisectoral humanitarian response by the UN Office for the Coordination of Humanitarian Affairs (OCHA), with WHO taking the lead in the Health Cluster.

The proposed executive agency model is activated only when a multisectoral global response is required to reduce health risk, as in Type 3 and Type 4, Katsuma stated. This allows the UN system to create an enabling environment in which WHO takes the lead in the health sector or cluster. For a Type 3 risk, at the global level, response would involve the UN Development Group, including the World Bank Group, chaired by a UN Development Programme (UNDP) administrator, with the active participation of WHO, he explained. At the regional level, greater harmonization would be needed between the WHO regional offices and the regional offices of UN programs and funds such as the UN Children's Fund (UNICEF), UNDP, and other agencies, he observed. The country-level response to a Type 3 risk involves a UN team headed by a UN resident coordinator who is familiar with local health issues, along with the UNDAF, in which WHO takes the lead in the health sector.

For Type 4 risks, the most complex and demanding, the executive agency model stipulates a global-level response involving the WHO Director-General, as a member of the UN Chief Executives Board, working closely with the UN Secretary-General, Katsuma said (see Figure 7-2 for mapping of global response). The UN Inter-Agency Standing Committee (IASC) would harmonize the humanitarian work of UN programs and funds, the UN specialized agencies including WHO, and nongovernmental organizations (NGOs) and other responders, he added. OCHA—headed by an emergency relief coordinator in a humanitarian crisis—would activate the resources of the UN Central Emergency Response Fund. This, too,

[4] Based on his extensive experience in the UN system, Katsuma observed that the UN response to such Type 3 health risks "seems to be working quite well," so he characterized these situations as "business unusual, but I think we don't have to worry too much about it."

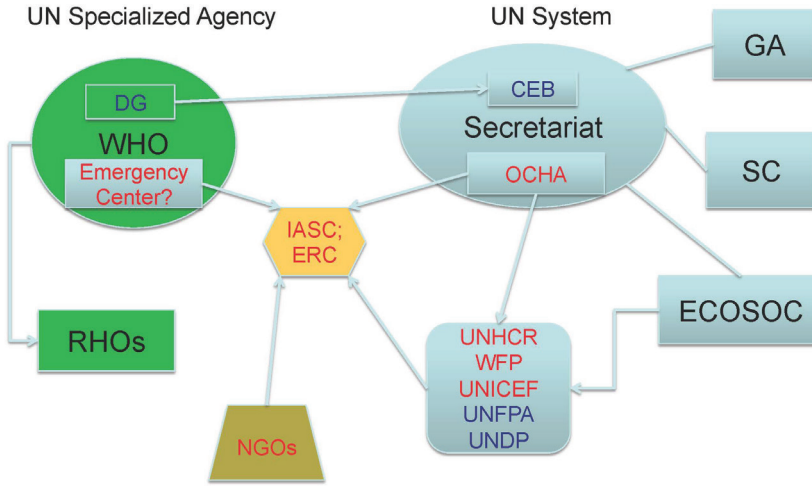

FIGURE 7-2 Global actors potentially involved in a response to a Type 4 health risk under hypothetical Model 3.
NOTE: CEB = UN System Chief Executives Board for Coordination; DG = WHO Director-General; ECOSOC = UN Economic and Social Council; ERC = Emergency Relief Coordinator (head of OCHA); GA = UN General Assembly; IASC = Inter-Agency Standing Committee; OCHA = UN Office for the Coordination of Humanitarian Affairs; RHO = regional health organization; SC = UN Secretary-General; UNDP = UN Development Programme; UNFPA = United Nations Population Fund; UNHCR = United Nations High Commissioner for Refugees; UNICEF = United Nations Children's Fund; WFP = World Food Programme.
SOURCE: Katsuma presentation, September 2, 2015.

could be a recipient of the possible World Bank pandemic emergency facility, as previously discussed.

The regional response to a Type 4 health risk, according to the executive agency model, would harmonize the regional health organization and the regional office of UN programs and funds—a process that Katsuma described as practically necessary, but politically difficult, due to the mismatch between WHO's regions and those of the UN humanitarian system. At the country level, a UN team headed by a UN humanitarian coordinator familiar with local health issues would again be optimal, he said. Emergency planning would occur in the context of the UN Consolidated Appeals Process, in which WHO takes the lead in the Health Cluster; the same would occur in a multisectoral humanitarian response by OCHA, he noted.

Several challenges are presented by the Type 4 health risk response

described above, Katsuma noted. At the global level, the WHO's proposed emergency preparedness and response center would need to be coordinated with UN programs and funds within the framework of OCHA, but that option does not seem to be currently under discussion, he observed, nor is there a provision for harmonization with NGOs within the framework of the IASC. OCHA would also need to increase staff members trained to respond to complex health/humanitarian emergency situations, he said. Capacities of regional health organizations would need to be enhanced for health emergency preparedness and response, and the aforementioned harmonizing of WHO's regional offices and those of the United Nations' humanitarian programs and funds would need to take place, he continued. At the country level, WHO or the relevant regional health organization would need to develop a health emergency team that could be dispatched quickly to an affected country and work as part of the UN country team.

It often happens that a UN mission comes to a country and attempts to bypass the UN country team, Katsuma observed. Instead, the UN humanitarian coordinator appointed to lead the UN country team should be familiar with local health issues. This, he acknowledged, would be a difficult position to fill, because the typical person in that position would often be involved in development programs, not humanitarian aid. Therefore, it may be necessary during a health emergency for the UN to replace an incumbent resident coordinator with a humanitarian coordinator who is better prepared to lead in a complex health humanitarian situation, he said.

MODEL 4: A SEPARATE AGENCY

> "The real question I think we need to pose is whether it's a governance issue requiring a new entity—or if it's a problem of systems coherence, a problem of leadership at all levels, and a problem of coordinating the existing infrastructure and arrangements."
>
> *—Daniel López-Acuña, Former WHO Senior Adviser to the Director-General*

The final model envisions an independent, interagency entity for global health risk governance, under the authority of the UN Secretary-General. Its presenter, López-Acuña, announced from the outset that he did not support this approach, but had offered to describe its advantages and disadvantages, which reveal established systems and capacities far more complex than any model might encompass. López-Acuña proceeded to catalog the various

and sometimes disparate entities that currently address global health risks, along with their leadership:

- The Global Outbreak Alert and Response Network (GOARN), as specified by the IHR (WHO-led);
- The IHR and other relevant mandates of the WHA (WHO member states and secretariat);
- The UN's humanitarian coordination architecture:
  - Emergency Relief Coordinator (ERC) and Undersecretary General for Humanitarian Affairs (UN-led),
  - The IASC (UN and non-UN membership),
  - Humanitarian country teams (UN-led),
  - OCHA (UN-led), and
  - Criteria for defining an L3 humanitarian emergency[5] (UN-led with IASC);
- The UN Office for Disaster Risk Reduction;
- Special Envoy of the UN Secretary-General (position assigned for H5N1 avian influenza, Ebola, and food security);
- Ad hoc UN health emergency missions (e.g., UN Mission for Ebola Emergency Response [UNMEER]);
- UN Security Council resolutions (passed for HIV/AIDS and Ebola by member states); and
- UN General Assembly resolutions (member states).

Systems Coherence

As he introduced these agencies, López-Acuña highlighted several relevant points. Noting that GOARN and the IHR are essentially led by WHO, he reminded the audience that WHO is not merely its secretariat or HQ but is comprised of member states which (among other things) negotiated and ratified the IHR as a binding mandate. The humanitarian coordination architecture led by the UN is a massive entity, López-Acuña observed, of which WHO is part, but the overall system is governed by the UN General Assembly, not the WHA. Thus, he asked, is it realistic to believe that the interagency mechanisms and governance structures linking the multiple elements of the United Nations' humanitarian coordination architecture can, or should, be recreated in a new entity? The current system may not function perfectly, but he urged attention to the breadth and depth of existing mechanisms and agencies involved in global health risk governance.

Going further, López-Acuña stated bluntly that the current system lacks coherence, consisting of three parallel tracks. The WHO-led infectious

[5] See http://www.refworld.org/pdfid/512deb632.pdf (accessed January 8, 2016).

diseases/IHR track is "good for alert, but weak for response," he said. It is not clearly or formally linked with the humanitarian response track, which has been well developed over the past decade but lacks sustainability or provision for preparedness or recovery. He characterized the third track, comprising prevention, preparedness, and risk mitigation, as compartmentalized, neglected, and insufficiently mainstreamed into the development agenda. These shortcomings have precipitated the abuse of such weak, ad hoc solutions as UNMEER, he observed.

The WHO constitution defines several functions relevant to governance for global health risk, as noted by López-Acuña. Per Article 2, WHO

- Directs and coordinates authority of international health work;
- Establishes and maintains collaboration with the United Nations, specialized agencies, governmental health administrations, professional associations, and other groups as deemed necessary;
- Assists governments, upon request, in strengthening health services;
- Furnishes appropriate technical assistance and, in emergencies, necessary aid upon the request or acceptance of governments;
- Stimulates and advances work to erradicate epidemic, endemic, and other diseases; and
- Proposes conventions, agreements, and regulations (WHO, 1948).

Article 28 defines the responsibility of the WHO Executive Board (comprised of representatives of 34 member states) as follows: "to take emergency measures within the functions and financial resources of the Organization to deal with events requiring immediate action. In particular it may authorize the Director-General to take the necessary steps to combat epidemics, to participate in the organization of health relief to victims of a calamity and to undertake studies and research the urgency of which has been drawn to the attention of the Board by any Member or by the Director-General." Article 56 states that "a Special Fund to be used at the discretion of the Executive Board shall be established to meet emergencies and unforseen contingencies." This article implies the commitment of member states to contribute to such a fund, López-Acuña pointed out, a commitment which he supported over creating something new.

The WHA recently approved the following resolutions reaffirming WHO's role in emergencies, López-Acuña noted. But while these mandates are clear, they have not been adequately resourced or effectively managed:

- Resolution WHA 64.10 on strengthening national health emergency and disaster management capacities and resilience of health systems and

- Resolution WHA 65.20 on WHO's response and role as the health cluster lead in meeting the growing demands of health in humanitarian emergencies.

López-Acuña briefly introduced the UN's complex humanitarian coordination architecture under the IASC (see Figure 7-3). Led by the ERC, the IASC is an interagency forum for coordination, policy development, and decision making. Its membership represents 10 UN agencies, and nearly as many external agencies as standing invitees. Another feature of the humanitarian coordination architecture—cluster coordination—was established in 2005.[6] Clusters are groups of humanitarian organizations (UN and non-UN) working in sectors (e.g., shelter, food, and health) that are activated to meet clear humanitarian needs, when there are numerous actors within sectors and when national authorities need coordination support. In leading the Health Cluster, WHO works with more than 50 UN agencies and NGOs to organize and coordinate the health response to an activating crisis.

But despite the existence of this extensive health and humanitarian architecture, Ebola in West Africa became a humanitarian emergency and a global health risk, López-Acuña observed. In September 2014, after the late awakening of the alert and response system and of the humanitarian response, UNMEER was launched as a "remedial action" to reduce the reputational risk of the UN system and the international community at large, López-Acuña stated. The United Nations had never created an entity like this before, and it was created quickly, by resolution of the UN General Assembly and of the UN Security Council, he pointed out: a temporary measure to meet immediate needs. It ended on August 1, 2015, after which WHO again assumed oversight of the UN system Ebola response, he reported. UNMEER came very late in the game, and many people in the affected countries believe it created unnecessary layers of bureaucracy and additional coordination challenges, he observed. "I don't think we should be looking at that as a paradigm of institutional response for the future," he concluded.

López-Acuña reinforced earlier statements that global health risks extend well beyond the domain of health. He disagreed that WHO's constitutional mandate is unclear; rather, he insisted that it is weakly implemented and cannot be enforced. He also disagreed that an independent entity could solve the problem of member state noncompliance with the IHR, due to the persistent, difficult issue of sovereignty. While he agreed that no entity is currently charged to deal with global health risks specifically, a reformed

[6] See http://www.unocha.org/what-we-do/coordination-tools/cluster-coordination (accessed January 8, 2016).

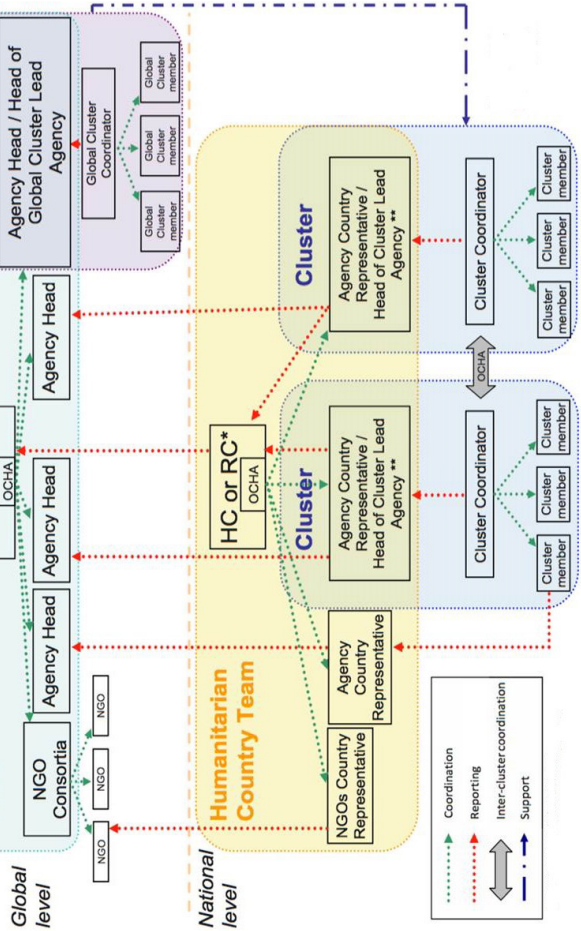

FIGURE 7-3 Humanitarian coordination structure under the Inter-Agency Standing Committee (IASC). Whenever possible the Humanitarian Country Team and the clusters complement and support national/local coordination structures.
NOTE: ERC = Emergency Relief Coordinator; HC = Humanitarian Coordinator (OCHA); NGO = nongovernmental organization; RC = Resident Coordinator (OCHA); OCHA = Office for the Coordination of Humanitarian Affairs.
* If a separate HC position is not established. ** The Agency Country Representative reports to his/her agency on agency responsibilities and to the RC or HC on cluster responsibilities.
SOURCE: López-Acuña presentation, September 2, 2015.

WHO could coordinate the many existing mechanisms that might contribute to such an effort. The synergy of existing global entities, mechanisms, or platforms is essential, he observed. To ensure that it works seamlessly, he urged greater efforts toward systems coherence.

In conclusion, López-Acuña believed that an additional UN independent entity of interagency composition to deal with global risks is not really needed. The global architecture is already crowded, he pointed out, and the creation of new entities contradicts the course the United Nations has taken to reform and streamline, guided by the recent Sustainable Development Goals. Most of the capacities and functions needed to address global health risk governance—and many of the mandates to do so—lie within the purview of WHO, López-Acuña argued.

CONSIDERATIONS ACROSS HYPOTHETICAL MODELS

Several participants shared their reactions to the hypothetical models and the strengths and weaknesses across the different options. Kenji Shibuya of the University of Tokyo spoke from his perspective as advisor on global health to the Japanese ministry of health, as the country prepared to host the 2016 G7 Summit. Reflecting on the workshop discussion, he agreed with various other speakers that scapegoating WHO for the shortcomings of the Ebola response in West Africa was not a solution. However, he cautioned participants to be realistic about the difficulties they may encounter to make real change, and enlisted a quote from a 1994 editorial in *BMJ*:

> In the absence of strong leadership, there are long-hidden fault lines in WHO structure opening up, first the dislocation between management and staff, dissociation between headquarters and regional offices, and the contradiction between WHO high profile particular intervention programs and its stated goal of integrating primary care. (Godlee, 1994)

Clearly, WHO has not changed much in two decades, Shibuya observed, but the world has changed—and in particular, the world of health and humanitarian responders. He agreed with Piot of the London School of Hygiene & Tropical Medicine and Goyet among others, who advocated for pragmatic and effective, but limited, reform of existing global health governance, rather than trying to overhaul the current system—or add to it new governance entities. We can achieve more effective global governance only through a series of impactful changes, he insisted.

Linking Universal Health Coverage to Health Security

Regarding the proposed models, Shibuya first observed, "we still tend to focus on 20th-century dogma of classic health security at the population level, namely border control." As other speakers have stated, linking national security with global health threats can raise public awareness of the need for preparedness, but a border control/national security approach to outbreak prevention and control is insufficient, he observed. Namely, it ignores universal health coverage, which is the foundation of both individual and population health security. Linking the two—rather than creating a new, separate disease control entity—is an idea Japan hopes to emphasize at the next G7 Summit, he remarked.

We should not underestimate the extent to which the public distrusts authority, Shibuya observed. Recalling St. John's statement that "if you lose the trust, you lose the battle," Shibuya described WHO as "losing the trust of the general public and . . . exaggerating the dissociation between the public and their authority." Thus, in the wake of the Ebola crisis, he urged WHO to avoid any more growth of the system in Geneva, and instead to use forums to bring UN agencies together with private-sector and civil society members to encourage open dialogue and transparency. He noted that several robust, pragmatic solutions had already been raised in the few days of discussion. Finally, Shibuya suggested that designers of the framework for global health risk governance could learn valuable lessons from other sectors, such as finance and cybersecurity. They can provide examples of frameworks, demonstrate how they handle crises, invite buy-in by developing countries, and open dialog with stakeholders, he advised.

Kimball of Chatham House recalled that "unprecedented and tragic failure" at all governmental levels—not just on the part of WHO—created the Ebola crisis. She observed that there is a drive to learn from these types of compelling situations and highlighted several key principles that were articulated throughout the workshop, including the importance of community involvement, expanding on systems that are already built and can be scaled up, and, importantly—to "do no harm." While we have a resilient global health system, Kimball asserted, adjustments are needed in several key areas of awareness, diversity, self-regulation, integration, and adaptation (Kruk et al., 2015). In some areas, these principles do exist, but the information does not reach poor and developing countries, or the diversity is weak because traditional healers or the humanitarian community is not included in systems design. Regarding self-regulation, she described feedback loops that allow a two-way flow of information. Lacking such a system, the Minister of Finance of Liberia had absolutely no idea how much money was coming into his country, who it was coming from, and what it was for, she observed. This occurred because donors failed to moni-

tor and report what happened to the funds they supplied. Finally, related to adaptation, she noted the importance of mechanisms that permit self-correction rather than requiring disruptive structural modifications—which could include incentives for the IHR compliance.

With these attributes in mind, Kimball addressed the four models, endorsing the proposed center for health risk management within WHO, and in particular its mandate to coordinate the work of nonstate actors in emergency response. However, she added, the funding of such a center must be structured to ensure that the money is ring fenced, that the resources are being well used, and that that center is functioning as it was designed, she advised. She also advocated the use of simulation exercises to "pressure test"—and thereby improve—health emergency responses coordinated through the WHO center. For example, she said, it would be important to know if the center reaches out to the rest of the United Nations, if its alerts and terminology are understood, and if it efficiently mobilizes logistics. "This can all be done through simulation over the first year, and it needs to be very closely monitored," she added.

Rasanathan of UNICEF, outlined several comments on the models that resulted in five main points:

1. The tragedy of the Ebola epidemic shows that global health systems need to better support countries' preparation for and response to disease outbreaks. What happens in countries is crucial to global health governance, he observed, but change is needed at every governmental level. Model 1 is necessary, but not sufficient, to support that goal, he concluded.
2. Governance must take into account the specific challenge of responding to outbreaks in countries already in crisis or weakened by recent upheaval. These countries have fragile health systems.[7] Ebola exacerbated the poor delivery of essential health interventions, adding to the toll from the disease. However, he advocated consideration of how efforts geared toward governance and disease outbreaks can strengthen health systems to respond to everyday needs of the community. This approach is equally applicable to preparedness and response; linking health security and the universal health care agenda, and thereby gaining the trust of communities, is essential for effective response to global health threats, he declared.
3. The world needs a strong WHO; there is no credible alternative. History suggests that institutional proliferation does not necessarily strengthen national health systems or country capacity overall,

[7] For example, he said, in Sierra Leone before Ebola in 2013, 40,000 children under age 5 died of all causes.

Rasanathan stated, and it can also impose costs associated with fragmentation and duplication. Moreover, countries clearly do not want to deal with even more health actors, all of which argues against Model 4.

4. Models 2 and 3 have much within them to recommend, he stated, and endorsed strengthening WHO and improving coordination among various global actors, including UNICEF, as well as how they collaborate with both national governments and the existing humanitarian response architecture. "The key questions are how to better coordinate the different global and regional or national actors, including within institutions themselves, and in particular how to handle the challenge of multisectorality."
5. A strengthened WHO at the helm of global health risk governance must make better use of the UN system's assets and resources, such as the existing humanitarian emergency response system and the cluster system, and bridge the deep cultural differences between those who work on disease outbreaks and those who traditionally work on humanitarian emergencies, Rasanathan stated. This strengthened WHO should also consider innovative mechanisms that can be mobilized in an outbreak, including long-term agreements with civil society organizations in the private sector, he said. All organizations, including WHO, need to overcome horizontal and vertical segmentation, so as to flexibly respond to crises without changing their formal structure. This requires better data sharing between sectors (and clusters during outbreaks) and timely technical guidance.

Given these considerations, Rasanathan cast his vote for Model 2, with the proviso that WHO proves capable of coordinating all the necessary functions of global health risk governance. If not, he offered that aspects of Model 3 might be required, although there should be caution in considering a greater role for OCHA. In either case, he added, "it is essential to use the imprimatur and status of the Secretary-General to bring together the UN system and other actors, given that only the Secretary-General has . . . the status to steer and control the agencies in working together." The roles of the Security Council and General Assembly need further definition in the framework, he noted. Finally, Rasanathan observed that no matter the model, issues of genuine community involvement, the special needs of post-conflict and fragile states, and working with civil society and the private sector need considerably more thought.

Evaluation of IHR Compliance

While WHO has many reasons to refrain from public evaluation of member states' compliance with the IHR, the Ebola Interim Assessment Panel felt that "a report that clearly showed how countries were fulfilling their legal commitments" was needed, according to Kickbusch. This report, she stressed, was not intended to be simply a ranking or a list, but a way to show countries, by example, how to meet the regulations' provisions. In addition, she said, the report could highlight emerging security issues and promote a better overall understanding of health security. As to the question of who appoints the members of the independent oversight board (and, therefore, to whom they owe their allegiance), Kickbusch suggested that the WHO Director-General and the governing bodies of the United Nations could jointly appoint the board—much as they did the Ebola Interim Assessment Panel—and charge them with delivering an independent report. Any such body would be informing the United Nations, as well as reflecting on the WHO member states, she pointed out.

"Before we start reforming WHO, I think there are many other things we need to reform," Tomori of the Nigerian Academy of Science observed. African countries have shifted responsibilities for national health capacities to WHO, which in turn has been weakened in that region by decades of misapplication and misappropriation of funding, he lamented. "As donors and recipients, we are being dishonest with each other about building capacity," Tomori declared. "You are building your own capacity to do for me what I should be doing for myself." In Africa, capacity has been built in an environment where it simply cannot function, he argued, and reforming WHO at the regional and international levels will not help this situation. The solution will require leaders of African countries to reform themselves and create an environment where this process is possible to maintain, he concluded.

Lacking Improvement at the Country Level

Elias of the Gates Foundation expanded on the notion, raised by both Kickbusch and López-Acuña, that the "models" actually represented complex systems. He cautioned against the unintended consequences of disturbing the existing system of global health governance—and especially the consequences of replacing it altogether. As others have noted, WHO's structure is less a problem itself than the overall coordination of the complex system that it is a part of—the global health governance architecture, Elias stated. Gradual improvements in the structure of WHO and its interactions with nonstate actors and civil society at the global level have produced positive (if not dramatic) results over the past decade. However,

improvement at the regional and country levels over the same period has been "hypervariable," resulting in "very strong country offices and some exceptionally strong regional offices, and . . . very weak country offices and weak regional offices." When a health threat arises within a weak jurisdiction, as was the case with Ebola in West Africa, crises ensue, he observed.

Elias said he favored Model 2 as the likeliest means to achieve leadership, coordination, and alignment within the UN system. Model 1, he declared, provided an insufficient "shock to the system," while Models 3 and 4 threatened to overwhelm it. However, he acknowledged, many details of Model 2 remain to be resolved: funding, the member states' inclination to change WHO's governance structures, and—given criticisms of UNMEER—linkage with the broader UN system. Looking beyond WHO reform and IHR compliance, Elias urged attention to opportunities for improving global health governance through more effective engagement with the private sector, civil society actors, and foundations. In particular, he advocated management of data and information on outbreaks as a "critical resource" and investment to promote citizen activism for capacity building.[8]

Critical improvements in global health require political and technical leadership at the national level, as well as within the global health community, Elias pointed out. "I don't think we can lay the whole blame for this [Ebola crisis] on the WHO or the UN system," he said, noting that engaging levers for effective change outside the UN system, and building strong systems at the ground level as Tomori stated, would be preferable to making changes within its complex network.

Accountability at the International Level

Kapila spoke in his role as UN Special Adviser for the inaugural World Humanitarian Summit in May 2016, the 25th anniversary of the UN resolution that established its current humanitarian architecture (as depicted in Figure 7-3). He noted that mistrust of global health governance is a recurring issue that emerges across all types of meetings. In country after country, he said the message was that the global community should be there to support efforts but should not be overstepping sovereign nations and decision making. The UN Secretary-General has appointed a High-Level Panel on Humanitarian Financing, which is due to report in December 2015, according to Kapila. Their charge is to find a predictable financing mechanism for global humanitarian needs, including health emergency

[8] Here, Elias noted UNICEF's U-Report program, a free SMS-based system that allows young Ugandans to report on their communities and work with other community leaders for positive change. See http://ureport.ug/about_ureport (accessed January 8, 2016).

needs. The panel's recommendations for achieving this goal resemble those of several post-Ebola commissions and panels with regard to independent assessments of capacities and accountabilities, he noted. They did not mandate reforms of the UN system, but instead focused on "changing processes, attitudes, approaches, improving tools, and most of all, providing inspiration to people who need hope." Accordingly, he dismissed Model 4, saying that trying to change the IASC or UN system would be a waste of time. Processes and mindsets need to change, not structures, he argued; new tools and technologies must be brought online.

Heywood of Section27, South Africa, expressed agreement with Kapila's views, and characterized WHO as a democratic structure that acts in undemocratic ways, insulating itself from aspects of democracy that bring about change. "There's neither accountability nor consequence for the failings of the WHO," he observed, and wondered how they might be introduced. "Accountability isn't accountability of bureaucrats to each other," Heywood declared. The people whose health depends on WHO must gain influence over the organization, he insisted. Unfortunately, he added, there is little financial support to encourage such citizen activism "because lots of people, including donors like the Gates Foundation, are nervous of some of the things that citizens do and say." "If we don't address those issues around citizen activism, developing and protecting peoples' voices, then it will be very, very difficult to do anything other than leave the WHO as something that sits in some sort of space in Geneva about which ordinary people have no understanding and no interest," he concluded.

8

Closing Comments

A final brief discussion session followed comparisons of the four global health governance models and subsequent remarks and discussion on research and humanitarian considerations. Two main themes emerged in this exchange: the assignment of decision-making responsibilities during health emergencies, and the need to define and measure health outcomes as a means to ensure accountability.

CONVERGENCE ON ELEMENTS OF A SUCCESSFUL MODEL

Throughout the discussion of the various hypothetical governance models, it was difficult to settle on a clear solution that was distinct from the others, but several supported themes across the different elements emerged. Conversations elicited a need for change at multiple levels of governance, but the degree of that change and the types of focus that should be employed varied across models and among participants. In Model 1, which called for a "reformed World Health Organization (WHO)," Clift and Stocking agreed that staffing of offices should be country and region appropriate. Tomori and Elias noted that it would be insufficient because there is a need for reform at the regional and national levels, which cannot be solved through changes in international governance structures. Tomori especially called for a focus on national ownership and reform, and Elias advocated for building strong systems on the ground level, with national political and technical leadership.

Model 2, which proposed a "WHO Plus" arrangement, would include peer review rather than self-assessment of the core competencies of the

International Health Regulations (IHR), and a WHO Center for humanitarian and outbreak response as proposed in the Ebola Interim Assessment Panel. While this model received much support, it was contingent on whether WHO can coordinate across systems at the level that is needed. While he favored the model, Elias pointed out that challenges in funding and linkages to the United Nations (UN) remain. Kimball, Rasanathan, and Shibuya also supported the need to combine universal health care and health security in this proposal, as leaving them as separate pieces of a solution would not provide the advancement needed. Additionally, more effective engagement with the private sector was said to be necessary for this model to work well, according to Elias, Heywood, and Rasanathan.

The third model discussed was a proposal for an executive agency that would play a strategic operational and tactical role in a health emergency, with a matrix of health risk typologies where only Types 3 and 4 would involve WHO being the lead. A regional response to a Type 4 health risk would allow for greater harmonization between WHO and UN regional offices and programs, which was endorsed by Rasanathan. A few participants noted the global difficulty this would involve because of the lack of coordination between WHO's proposed emergency preparedness and response center and the UN programs and funds within the framework of Office for the Coordination of Humanitarian Affairs. Additionally, there is currently no provision for harmonization with nongovernmental organizations (NGOs) under the framework of the Inter-Agency Standing Committee. Rasanathan supported a strengthened WHO taking on global health governance, but called for the need to bridge the cultural differences between those who work on disease outbreaks and those who work in humanitarian responses, and proposed that all organizations need to overcome segmentation and improve flexible response capacities.

Finally, the last hypothetical model called for a separate agency to be created, as the current system lacks coherence, according to López-Acuña. However, even the creation of the UN Mission for Ebola Emergency Response, a temporary creation in response to Ebola, caused unnecessary layers of coordination challenges, he said. Additionally, López-Acuña disagreed that a separate entity could solve IHR compliance, because of the difficult issues of independent, national sovereignty and the challenges that international officials have with overstepping that sovereignty. Many participants disagreed overall with creating a new entity, including Elias, Kapila, and Rasanathan, saying that changing structures will not have the impact everyone is looking for, but processes do need to change.

DECISION MAKING IN HEALTH EMERGENCIES

Fineberg noted that several workshop participants had advocated changes to the decision-making and assessment processes that occur once a potential health threat emerges, such as assigning the decision of whether to declare a public health emergency of international concern (PHEIC)—now the sole responsibility of the WHO Director-General—to an independent committee. Likewise, he observed, some discussants recommended the creation of a committee for response assessment that would be responsible to the World Health Assembly or some other group of member states, rather than to the WHO secretariat. "If part of the core objective is strengthening capacity of the WHO to carry out the core functions that we are describing, I can well appreciate the merit of a distinctive independent evaluation mechanism that would report to the states or to the states group," he stated. However, he disagreed with the notion of distributing decision-making authority away from the WHO Director-General, as is called for in the Independent Panel on the Global Response to Ebola. Instead, he argued, there should be a well-established pathway for sharing information and advice, recognizing that eventually a decision has to be made, and someone has to be responsible. That responsible party should also be responsible for acting on the decision, and continuing to consider it as additional information accumulates. Rima Khabbaz of the U.S. Centers for Disease Control and Prevention reminded the audience that an international panel currently advises the WHO Director-General on possible PHEICs—not a completely independent mechanism, she acknowledged, but an important source of input. Perhaps a trigger could be devised that would automatically call this group together, she suggested.

López-Acuña agreed with Fineberg. "I don't think that the solution is going to be to divide the decision-making power by committees that are externally independent," López-Acuña stated. Rather, the WHO Executive Board should select advisors on possible PHEIC declarations, not the Director-General. He did, however, advocate the creation of an independent, nonpoliticized accountability commission to evaluate WHO's performance in responding to health emergencies. Additionally, he and Heymann both saw the need for introducing intermediate measures into the PHEIC decision-making process, to help alleviate the outbreak before it reaches full and worldwide emergency status.

MEASUREMENT AND ACCOUNTABILITY

Over the course of the workshop, several discussants argued that funding for health emergency preparedness and response should be linked to a system of monitoring and evaluation for the sake of accountability, to

improve current efforts, and to inform future preparedness and response strategies.

If there is a demand that WHO, NGOs, and other organizations operate differently as they respond to global health emergencies, then there need to be defined measures and outcomes and accountability for the changes being sought, Goodman asserted. Revisions to any system should incorporate such performance measures, he added. For example, he noted, the public health preparedness capacity of individual states in the United States is measured by their performance in exercises. Similar evaluations could be applied to other emergency responders. We must also identify ways for WHO and NGOs to ensure that they are using resources effectively to deliver core competencies, he added.

"I think it's extremely important to build performance measurements of the different responsibilities of the different layers of a system—particularly performance measurements of the core capacities in the countries," López-Acuña agreed. Such measures, he advised, should be pragmatic, easily accomplished, and connected with actionable recommendations. Moreover, because evaluative measurements could also be used to identify needs for investment, performance measurements should occur both before and after funding is provided, he concluded.

One might also evaluate the process of creating a unified global health risk framework, and the framework itself, Relman observed, suggesting that this effort may not be successful unless there is evidence of meaningful impact. In the end, what really matters is the improved health of the world's people, and improved capacity to anticipate, respond to, and recover from global health threats, which are inevitable. But how to measure whether or not that impact has occurred is more difficult, Relman acknowledged, insisting that measurement that is predictive of improved health and improved public health capacity is the most important of all.

A

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B

Glossary

Abiotic: Nonliving chemical and physical factors in an environment.

Aerosolize: To disperse (as a medicine, bactericide, or insecticide) as an aerosol.

African swine fever: A highly contagious tick-borne hemorrhagic disease of pigs, warthogs, European wild boar, and American wild pigs. With high-virulence forms of the virus, it is characterized by high fever, loss of appetite, hemorrhages in the skin and internal organs, and death in 2 to 10 days on average. Mortality rates may be as high as 100 percent. It is caused by a DNA virus of the *Asfarviridae* family.

Agent (of disease): Factor such as a microorganism whose presence is essential for the occurrence of a disease.

Anthropogenic: Caused or produced by humans.

Anthroponotic: Transmission from human to human and potentially from human to animal.

Antibiotic: Class of substances that can kill or inhibit the growth of some groups of microorganisms. Used in this report to refer to chemicals active against bacteria. Originally antibiotics were derived from natural sources (e.g., penicillin from molds), but many currently used antibiotics are semi-

synthetic and modified with additions of man-made chemical components. See *Antimicrobials*.

Antibiotic resistance: Property of bacteria that confers the capacity to inactivate or exclude antibiotics or a mechanism that blocks the inhibitory or killing effects of antibiotics.

Antibody: A protein produced by the immune system in response to the introduction of a substance (an antigen) recognized as foreign by the body's immune system. Antibody interacts with the other components of the immune system and can render the antigen harmless, although for various reasons this may not always occur.

Antimicrobials: Class of substances that can destroy or inhibit the growth of pathogenic groups of microorganisms, including bacteria, viruses, parasites, and fungi.

Asymptomatic: Presenting no symptoms of disease.

Avian influenza: Any of several highly variable diseases of domestic and wild birds that are caused by orthomyxoviruses and characterized usually by respiratory symptoms but sometimes by gastrointestinal, integumentary, and urogenital symptoms.

Bacteria: Microscopic, single-celled organisms that have some biochemical and structural features different from those of animal and plant cells.

Bushmeat: Wildlife species that are hunted in the "bush" or forests.

Chikungunya: A febrile disease that resembles dengue, occurs especially in parts of Africa, India, and southeastern Asia, and is caused by a togavirus of the genus *Alphavirus* (species *Chikungunya virus*) transmitted by mosquitoes especially of the genus *Aedes*—called also *chikungunya fever*.

Cholera: Any of several diseases of humans and domestic animals usually marked by severe gastrointestinal symptoms; an acute diarrheal disease caused by an enterotoxin produced by a comma-shaped Gram-negative bacillus of the genus *Vibrio* (*V. cholerae* syn. *V. comma*) when it is present in large numbers in the proximal part of the human small intestine.

Civil society: A social sphere separate from both the state and the market. The increasingly accepted understanding of the term civil society organizations (CSOs) is that of nonstate, not-for-profit, voluntary organizations

formed by people in that social sphere. This term is used to describe a wide range of organizations, networks, associations, groups, and movements that are independent from government and that sometimes come together to advance their common interests through collective action. (See http://www.who.int/trade/glossary/story006/en [accessed April 18, 2016].)

Climate: Average meteorological conditions over a specified time period, usually at least a month, resulting from interactions among the atmosphere, ocean, and land surface. Climate variations occur over a wide range of spatial and temporal scales.

Climate change: A change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Communicable disease: An infectious disease transmissible (as from person to person) by direct contact with an infected individual or the individual's discharges or by indirect means (as by a vector).

Coronavirus: Any of a family (Coronaviridae) of single-stranded RNA viruses that have a lipid envelope with club-shaped projections and include some causing respiratory symptoms in humans.

Cytokine: Any of a class of immunoregulatory proteins (as interleukin, tumor necrosis factor, and interferon) that are secreted by cells, especially of the immune system.

Dengue fever: An acute infectious disease that is characterized by headache, severe joint pain, and a rash and that is caused by a single-stranded RNA virus of the genus *Flavivirus* (species *Dengue virus*) transmitted by mosquitoes of the genus *Aedes*—also called *breakbone fever* and *dandy fever*.

Disease: As used in this report, refers to a situation in which infection has elicited signs and symptoms in the infected individual; the infection has become clinically apparent.

Dual use research of concern: In the life sciences, research that, based on current understanding, can be reasonably anticipated to provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, agricultural crops and other plants, animals, the environment, materiel, or national security.

Ebola: A disease caused by the Ebola virus. Also called *Ebola virus disease* and *Ebola hemorrhagic fever*.

Ecosystem: Mutually interrelated communities of species and abiotic components, existing as a system with specific interactions and exchange of matter, energy, and information.

Emerging infection(s): Any infectious disease that has come to medical attention within the past two decades or for which there is a threat that its prevalence will increase in the near future. Many times, such diseases exist in nature as zoonoses and emerge as human pathogens only when humans come into contact with a formerly isolated animal population, such as monkeys in a rain forest that are no longer isolated because of deforestation. Drug-resistant organisms could also be included as the cause of emerging infections since they exist because of human influence. Some recent examples of agents responsible for emerging infections include human immunodeficiency virus (HIV), Ebola virus, multidrug resistant *Mycobacterium tuberculosis*, and influenza A (H1N1).

Emerging infectious diseases: Infections that are rapidly increasing in incidence or geographic range.

Endemic: Present in a community or common among a group of people; said of a disease prevailing continually in a region.

Enzootic: A disease of low morbidity that is constantly present in an animal community.

Epidemic: The condition in which a disease spreads rapidly through a community in which that disease is normally not present or is present at a low level.

Epidemiology: Study of the distribution and determinants of health-related states or events in specified populations. Epidemiology is the basic quantitative science of public health.

Epizootic: A disease of high morbidity that is only occasionally present in an animal community.

Eradication: Reduction of the worldwide incidence of a disease to zero as a result of deliberate efforts.

Etiologic agent: The organism that causes a disease.

Etiological: Of or pertaining to causes or origins.

Etiology: Science and study of the causes of diseases and their mode of operation.

Extrinsic incubation period: Time required for the development of a disease agent in a vector from the time of uptake of the agent to the time the vector is infective.

Fragile state: A region or state that has weak capacity to carry out basic governance functions and lacks the ability to develop mutually constructive relations with society. According to the Organisation for Economic Co-operation and Development, fragile states are also more vulnerable to internal or external shocks such as economic crises or natural disasters.

G7: The Group of Seven. Comprises seven leading industrialized nations: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. In addition, the European Union sends representatives to all the meetings.

G7 Summit: The summits give the G7 heads of state and government the opportunity to discuss their respective positions in personal meetings. A summit declaration containing the key outcomes is issued at the end of each summit meeting, sometimes along with additional reports and action plans.

Global Fund: The Global Fund to Fight AIDS, Tuberculosis and Malaria. A 21st-century partnership organization designed to accelerate the end of AIDS, tuberculosis, and malaria as epidemics. Founded in 2002, the Global Fund is a partnership among governments, civil society, the private sector, and people affected by the diseases. The Global Fund raises and invests nearly $4 billion per year to support programs run by local experts in countries and communities most in need.

Global Health Security Agenda (GHSA): A unifying framework to improve our global response to disease outbreaks and close gaps in surveillance and response so that disease threats are stopped at the earliest possible opportunity. It builds on existing programs and policies to improve health and spurs progress toward full implementation of the World Health Organization's (WHO's) International Health Regulations 2005 (IHR), the World Organisation for Animal Health (OIE) Performance of Veterinary Services (PVS) Pathway, and other relevant global health security frameworks. (See http://www.cdc.gov/globalhealth/healthprotection/ghs/faqs.htm#two [accessed April 18, 2016].)

Global Public Health Intelligence Network (GPHIN): A secure Internet-based multilingual early-warning tool that continuously searches global media sources such as news wires and websites to identify information about disease outbreaks and other events of potential international public health concern. Developed by Health Canada in collaboration with WHO.

Globalization: The increased interconnectedness and interdependence of peoples and countries. It is generally understood to include two interrelated elements: the opening of borders to increasingly fast flows of goods, services, finance, people, and ideas across international borders; and the changes in institutional and policy regimes at the international and national levels that facilitate or promote such flows. (See http://www.who.int/trade/glossary/story043/en/index.html [accessed April 18, 2016].)

Hantavirus: Any of a genus (*Hantavirus*) of bunyaviruses (as the Hantaan virus) that are transmitted by rodent feces and urine and cause hantavirus pulmonary syndrome and hemorrhagic fevers marked by renal necrosis.

Health security: Public health security. (1) The provision and maintenance of measures aimed at preserving and protecting the health of the population. (2) The policy areas in which national security and public health concerns overlap. (See http://www.who.int/trade/glossary/story030/en [accessed April 18, 2016].)

Herd immunity: A reduction in the probability of infection that is held to apply to susceptible members of a population in which a significant proportion of the individuals are immune because the chance of coming in contact with an infected individual is less.

Host (disease): Person or other living animal that affords subsistence or lodgment to an infectious agent under natural conditions.

Immune-competence: The ability of the immune system to respond appropriately to an antigenic stimulation.

Immunoassay: A technique or test (as the enzyme-linked immunosorbent assay) used to detect the presence or quantity of a substance (as a protein) based on its capacity to act as an antigen or antibody.

Immunocompromised: A condition (caused, for example, by the administration of immunosuppressive drugs or irradiation, malnutrition, aging, or a condition such as cancer or HIV disease) in which an individual's immune system is unable to respond adequately to a foreign substance.

Incidence: Number of cases of a disease commencing, or of persons falling ill, during a given period of time in a specified population. Incidence rate is the number of new cases of a specific disease diagnosed or reported during a defined interval of time divided by the number of all persons in a defined population during the same time.

Index case: An instance of a disease or a genetically determined condition that is discovered first and leads to the discovery of others in a family or population.

Infection: The invasion of the body or a part of the body by a pathogenic agent, such as a microorganism or virus. Under favorable conditions the agent develops or multiplies, the results of which may produce injurious effects. Infection should not be confused with disease.

Influenza: An acute highly contagious virus disease that is caused by various strains of orthomyxoviruses belonging to three major types now considered as three separate genera and that is characterized by sudden onset fever, prostration, severe aches and pains, and progressive inflammation of the respiratory mucous membrane—often used with the letter *A*, *B*, or *C* to denote disease caused by a virus of a specific one of the three genera; any human respiratory infection of undetermined cause—not used technically; any of numerous febrile, usually virus, diseases of domestic animals (as shipping fever of horses and swine influenza) marked by respiratory symptoms, inflammation of mucous membranes, and often systemic involvement.

Inter-Agency Standing Committee (IASC): The primary mechanism for inter-agency coordination of humanitarian assistance. It is a unique forum involving the key UN and non-UN humanitarian partners. The IASC was established in June 1992 in response to United Nations General Assembly Resolution 46/182 on the strengthening of humanitarian assistance.

Intermediate host: A host that is normally used by a parasite in the course of its life cycle and in which it may multiply asexually but not sexually.

International Health Regulations (IHR): An international legal instrument that is binding on 194 countries across the globe, including all the member states of WHO. Their aim is to help the international community prevent and respond to acute public health risks that have the potential to cross borders and threaten people worldwide. The IHR, which entered into force on June 15, 2007, requires countries to report certain disease outbreaks and public health events to WHO. Building on the unique experience of WHO in global disease surveillance, alert, and response, the IHR defines

the rights and obligations of countries to report public health events, and establishes a number of procedures that WHO must follow in its work to uphold global public health security.

Lassa: A disease especially of Africa that is caused by the Lassa virus and is characterized by a high fever, headaches, mouth ulcers, muscle aches, small hemorrhages under the skin, heart and kidney failure, and a high mortality rate.

Microbe: A microorganism or biologic agent that can replicate in humans (including bacteria, viruses, protozoa, fungi, and prions).

Microbial threat: Microbes that lead to disease in humans.

Microbiology: A branch of biology dealing especially with microscopic forms of life.

Migration: The regular, usually seasonal, movement of all or part of an animal population to and from a given area.

Millennium Development Goals: Eight international development goals that were established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration. These goals—which range from halving extreme poverty rates to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015—form a blueprint agreed to by all the world's countries and all the world's leading development institutions. They have galvanized unprecedented efforts to meet the needs of the world's poorest.

Mitigation: Initiatives that reduce the risk from natural and man-made hazards. With respect to climate change, mitigation usually refers to actions taken to reduce the emissions or enhance the sinks of greenhouse gases.

Morbidity: Diseased condition or state.

Mortality: The number of deaths in a given time or place; the proportion of deaths to population.

Mutation: Genetic change that can occur either randomly or at an accelerated rate through exposure to radiation or certain chemicals (mutagens) and may lead to change in structure of the protein coded by the mutated gene.

Nipah virus infection: A newly emerging zoonosis that causes severe disease in both animals and humans. The natural host of the virus are fruit bats of the Pteropodidae family, *Pteropus* genus. (See http://www.who.int/csr/disease/nipah/en [accessed April 18, 2016].)

OECD countries: The Organisation for Economic Co-operation and Development member countries. On December 14, 1960, 20 countries originally signed the Convention on the Organisation for Economic Co-operation and Development. Since then, 14 countries have become members of the Organisation. (See http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm [accessed April 18, 2016].)

One Health: The collaborative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, and our environment.

Outbreak: Localized occurrence as opposed to a generalized epidemic.

Pandemic: Epidemic occurring over a wide geographic area and affecting an exceptionally high proportion of the population.

Pathogen: Organism capable of causing disease.

Pathogenic: Capable of causing disease.

Pathology: The branch of medicine concerned with disease, especially its structure and its functional effects on the body.

Phylogeny: The connections between all groups of organisms as understood by ancestor/descendant relationships.

Physiochemical: Of or relating to physiological chemistry.

Prevalence: Proportion of persons in a population currently affected by a particular disease. Prevalence rate is the number of cases of a specific disease at a particular time divided by the population at that time living in the same region.

Program for Monitoring Emerging Diseases (ProMED): An Internet-based reporting system dedicated to rapid global dissemination of information on outbreaks of infectious diseases and acute exposures to toxins that affect human health, including those in animals and in plants grown for food or animal feed.

Prophylaxis: Measures designed to preserve health (as of an individual or of society) and prevent the spread of disease.

Public health: The art and science of dealing with the protection and improvement of community health by organized community effort and including preventive medicine and sanitary and social health.

Public health emergency of international concern (PHEIC): An extraordinary event that is determined: (1) to constitute a public health risk to other states through the international spread of disease; and (2) to potentially require a coordinated international response. This definition implies a situation that is serious, unusual, or unexpected; carries implications for public health beyond the affected state's national border; and may require immediate international action.

Quarantine: The enforced isolation or restriction of free movement imposed to prevent the spread of a contagious disease.

Retrovirus: Any of large family of RNA viruses that includes lentiviruses and oncoviruses, so called because they carry reverse transcriptase.

Risk: Probability that an event will occur; a measure of the degree of loss expected by the occurrence of a loss.

Species barrier: Difficulty or impossibility for an infectious agent to pass from one species to another (due to differences between species).

Surveillance: Used in this workshop summary to refer to data collection and record keeping to track the emergence and spread of disease-causing organisms such as antibiotic-resistant bacteria.

Sustainable Development Goals: A new agenda for 2030, building off of the Millenium Development Goals, consisting of 17 goals and 169 targets to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are designed to stimulate action over the next 15 years in areas of critical importance for humanity and the planet.

Syndrome: A group or recognizable pattern of symptoms or abnormalities that indicate a particular trait or disease. (See http://www.genome.gov/glossary.cfm?key=syndrome [accessed April 18, 2016].)

Transmission: Process by which a pathogen passes from a source of infection to a new host.

Vaccine: A preparation of living, attenuated, or killed bacteria or viruses, fractions thereof, or synthesized or recombinant antigens identical or similar to those found in the disease-causing organism that is administered to raise immunity to a particular microorganism.

Vector: An organism, such as an insect, that transmits a pathogen from one host to another.

Vector-borne: Transmitted from one host to another by a vector.

Vector-borne disease: (1) *Mechanical*: This includes simple mechanical carriage by a crawling or flying insect through soiling of its feet or proboscis or by passage of organisms through its gastrointestinal tract. This does not require multiplication or development of the organism. (2) *Biological*: Propagation (multiplication), cyclic development, or a combination of these (cyclopropagative) is required before the arthropod can transmit the infective form of the agent to humans. An incubation period (extrinsic) is required following infection before the arthropod becomes infective. The infectious agent may be passed vertically to succeeding generations (transovarian transmission); transstadial transmission indicates its passage from one stage of the life cycle to another, as nymph to adult. Transmission may be by injection of salivary gland fluid during biting, or by regurgitation or deposition on the skin of feces or other material capable of penetrating the bite wound or an area of trauma from scratching or rubbing. This transmission is by an infected nonvertebrate host and not simple mechanical carriage by a vector or vehicle. However, an arthropod in either role is termed a vector.

Viremia: The presence of virus in the blood of a host.

Virulence: The ability of any infectious agent to produce disease. The virulence of a microorganism (such as a bacterium or virus) is a measure of the severity of the disease it is capable of causing.

West Nile virus: A flavivirus (genus *Flavivirus*) that causes an illness marked by fever, headache, muscle ache, skin rash, and sometimes encephalitis or meningitis that is spread chiefly by mosquitoes and that is closely related to the viruses causing Japanese B encephalitis and Saint Louis encephalitis.

World Bank: The World Bank Group. One of the world's largest sources of funding and knowledge for developing countries, consisting of five institutions with a common commitment to reducing poverty, increasing shared prosperity, and promoting sustainable development

Zoonotic infection: Infection that causes disease in human populations but can be perpetuated solely in nonhuman host animals (e.g., bubonic plague); may be enzootic.

C

Statement of Task

GLOBAL HEALTH RISK FRAMEWORK TASK FORCE: GLOBAL GOVERNANCE FOR HEALTH—A WORKSHOP

Background:

The current Ebola epidemic in West Africa underscores the strengths and challenges of the global public health governance structures established, ostensibly, to be mobilized in an instant to detect and respond to such public health epidemics anywhere in the world. On August 8, 2014, the World Health Organization (WHO) declared the West Africa Ebola crisis a "public health emergency of international concern," triggering powers under the 2005 International Health Regulations (IHR). The IHR requires countries to develop national preparedness capacities, including the duty to report internationally significant events, conduct surveillance, and exercise public health powers, while balancing human rights and international trade. The IHR are legally binding regulations (forming international law) that aim to (a) assist countries to work together to save lives and livelihoods endangered by the spread of diseases and other health risks, and (b) avoid unnecessary interference with international trade and travel. The purpose and scope of the IHR 2005 are to prevent, protect against, control, and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade (Art. 2, IHR 2005).

Beyond the near-term challenge of ending the Ebola outbreak, this

public health event has demonstrated that the international framework for managing global public health events falls far short of the need. Governance structures, intra- and interinstitutional and across sectors, have been dysfunctional. Partly as a result of this, the Ebola outbreak grew for months before being recognized as a global threat. This has had a catastrophic health, economic, and social impact on Guinea, Liberia, and Sierra Leone, and it has threatened nations far beyond. Financial and human resources to end the outbreak have been slow in arriving and insufficient. Surveillance and other information systems have not been up to the task. Potentially life-saving products have also been delayed. Over the past 40 years globally significant outbreaks of HIV/AIDS, influenza, severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and other infections have also identified many of these weaknesses, but the political will to provide the systems needed to implement a robust global public health framework has failed. As a result, countless lives have been lost, and billions of dollars in economic damage has been incurred.

Statement of Task

Building on earlier workshops on SARS in 2002, the H1N1 influenza pandemic of 2009, the emergence of MERS coronavirus in the Arabian Peninsula (2014), and the Ebola epidemic in West Africa (2015), an ad hoc committee will host a 2-day public workshop to inform the Forum on Microbial Threats and other participants about challenges and opportunities regarding global governance for health during infectious disease emergencies. The public workshop will feature invited presentations and discussions that may address such potential topics as

- Who is primarily responsible for the surveillance, detection, and reporting of a zoonotic infectious disease (ID) outbreak?
- Who is primarily responsible for assembling and deploying the materials and resources for responding to an ID outbreak before it is declared to be a public health emergency of international concern (PHEIC)?
- Where will these resources come from?
- Who will be responsible and accountable for ensuring that the right resources reach the areas most in need at the right time?
- Who will be responsible for the technical training of health care workers—both in-country and external to the affected area—regarding the appropriate care and treatment of the ill, the worried well, and the survivors of an epidemic of a dread disease?
- What is the role(s) of civil society organizations in responding to an ID outbreak?

- Are existing legal authorities for the surveillance, detection, reporting, and response adequate to address infectious disease emergencies?
- What reforms might be needed to improve the efficiency and effectiveness of the global response(s) to future ID epidemics/pandemics?

An ad hoc committee will plan and conduct the 2-day public workshop and an individually authored summary of the workshop will be prepared by a designated rapporteur in accordance with institutional policy and procedures.

D

Workshop Agenda

GLOBAL HEALTH RISK FRAMEWORK: GOVERNANCE FOR GLOBAL HEALTH

WORKSHOP SESSION GUIDE

September 1-2, 2015

Wellcome Trust - Gibbs Building, 6th Floor - London, UK

BACKGROUND

Contracted Statement of Task for the Commission's Governance Workstream

"The governance for global health workstream will explore global, national, and local capabilities, to include those required by the International Health Regulations (2005), to facilitate the collective action of the governmental, intergovernmental, corporate, and non-profit sectors as they contribute to preparedness and response. . . . The Commission will deliberate and evaluate options to strengthen global, regional, national, and local systems to better prepare, detect, and respond to epidemic diseases. Interrelations between sectors will be studied."

Overarching Objectives for Governance for Global Health Workshop

- Mobilize for the Global Health Risk Framework Commission suitable evidence and expert opinion to inform their deliberations around the pros and cons of alternative approaches to improved governance for global health.
- Illuminate the definition of governance for global health and its scope.
- Consider the key elements of "good" governance, such as targets and benchmarks, monitoring, transparency, honesty, civil society engagement, and accountability.

- Document key successes and lessons learned from past global infectious disease outbreaks and other public health emergencies and how they may inform preparation and response to future outbreaks and emergencies.
- Characterize needs, gaps, and barriers in current approaches to addressing global infectious disease outbreaks and other public health threats.
- Consider compliance-enhancing mechanisms to drive good governance and implementation of existing international norms, such as measures of compliance and monitoring for compliance, incentives for compliance, identifying and working with key actors to improve compliance, and "shadow" reports such as by independent experts and civil society.
- Consider indicators and metrics that may be used to guide and assess the resilience of the global health infrastructure to future outbreaks and emergencies.

Working Definition of Governance for Global Infectious Disease Control

In the context of infectious disease outbreaks of global significance, governance encompasses a range of integrated policy, information management, command, and control mechanisms for facilitating collective action to achieve the objectives of prevention, detection, and response. Of necessity, these mechanisms integrate actions across intergovernmental organizations, sovereign nations, communities, the corporate sector, humanitarian agencies, and civil society. They operate in not only the realm of health, but also to a variable extent in collateral spheres to include agriculture/food security, diplomacy, education, finance, migration/refugee care, security, and transportation.

DAY 1
Tuesday, September 1, 2015

Compiling Evidence About Governance for Global Infectious Disease Control

8:00 – 8:30 AM Registration and Continental Breakfast

8:30 – 8:40 AM Welcome

Jeremy Farrar, Director, Wellcome Trust

David Relman, Chair of the Forum on Microbial Threats, Institute of Medicine (IOM); Professor of Microbiology and Immunology, Stanford University

8:40 – 8:55 AM **Victor Dzau,** President, National Academy of Medicine: "Developing a Global Health Risk Framework"

8:55 – 9:00 AM Keynote Introduction

David Relman, Chair of the Forum on Microbial Threats, IOM; Professor of Microbiology and Immunology, Stanford University

9:00 – 9:30 AM Keynote Remarks

Keizo Takemi, Member of Japanese Parliament: "Governance for Global Health: Engaging Intergovernmental Organizations to Achieve Collective Action"

Session 1: Definition of Governance for Global Health and Lessons Learned from Outbreaks of the Past

Session Moderator: Ximena Aguilera, Director, Center of Epidemiology and Public Health Policies, Universidad del Desarrollo, Chile

Goals of Session

- Illuminate key elements of "good" governance for global health
- Examine compliance enhancing mechanisms to drive good governance and implementation of existing international norms
- Synthesize lessons learned from recent infectious disease outbreaks and opportunities to strengthen governance for global health
- Identify ways in which the International Health Regulations (IHR) can be modified to achieve its intended purpose

Part 1: Elements of Good Governance for Global Health

9:30 – 10:10 AM Presentations

David Fidler, Professor of Law, Indiana University: "What is Global Health Governance in the Context of Recognizing and Mitigating the Threat of Epidemic Infectious Diseases?"

Alejandro Thiermann, President, Terrestrial Animal Health Code Commission, World Organisation for Animal Health (OIE): "Global Health Security Begins by Assessing and Assisting National Capacities at the Animal-Human Interface"

10:10 – 10:30 AM Discussion

10:30 – 10:45 AM Break

Part 2: Lessons Learned from Outbreaks of the Past

10:45 – 11:45 AM Case Study Panel

David Heymann, Head/Chair, Public Health England/Chatham House: "SARS and the 2005 Revisions to the IHRs"

Harvey Fineberg, President, Moore Foundation: "How Well Did the IHRs Work During the H1N1 Pandemic and Why Were the Recommendations for Strengthening the IHRs Not Implemented?"

Joanne Liu, President, Médecins Sans Frontières (MSF): "Ebola as a Humanitarian and Health Care Crisis: Governance Challenges as Seen from the View of a Key Nongovernmental Organization"

11:45 AM – 12:45 PM Discussion

12:45 – 1:30 PM Lunch

Session 2: Challenges in Governance for Global Health for Fragile States

Session Moderator: Oyewale Tomori, President, Nigerian Academy of Science

Goals of Session

- Compare and contrast different governance approaches for fragile health systems vs. other areas and identify where new approaches are relevant
- Identify how to measure and define success of governance for global health for areas with weak political systems and economies

1:30 – 2:10 PM Presentations

Paul Wise, Professor of Pediatrics and Health Policy, Stanford University School of Medicine; Senior Fellow, Freeman-Spogli Institute for International Studies, Stanford University: "The Challenge of Strengthening Health Systems in Areas of Political Instability and Weak Governance"

Mark Heywood, Executive Director, Section27 (South Africa): "An African Perspective on the Challenge of Strengthening Health Systems in Areas of Political Instability and Weak Governance"

2:10 – 2:40 PM Discussion

Session 3: Challenges in Current Design of Global Health Governance

Session Moderator: Margaret A. Hamburg, Former Commissioner, U.S. Food and Drug Administration

Goals of Session

- Highlight ways the World Health Organization (WHO) and member states can be better equipped to address global outbreaks
- Discuss recent proposals made to enhance global preparedness and response
- Identify how global security initiatives and frameworks can work together to boost preparedness and response

2:40 – 4:30 PM Presentations

Margaret Chan, Director General, World Health Organization: "WHO Headquarters Views 18 Months After the Outbreak Was Reported"

Charles Clift, Senior Consulting Fellow, Center on Global Health Security, Chatham House: "Form Should Follow Function: What's the World Health Organization for?"

Colin McIff, Senior Health Attaché, U.S. Mission, Geneva: "U.S. Government Perspectives on Ways to Make the WHO/UN Health Governance System More Effective and Efficient During Health Emergencies"

Dame Barbara Stocking, Murray Edwards College: "Findings, Conclusions, and Recommendations of the Recently Released 'Report of the Ebola Interim Assessment Panel' (July 2015)"

4:30 – 4:50 PM Break

4:50 – 6:00 PM Panel Discussion

6:00 – 6:15 PM	Concluding Remarks **David Relman,** Chair of the Forum on Microbial Threats, IOM; Professor of Microbiology and Immunology, Stanford University
6:15 PM	Meeting Adjourns
6:30 – 7:30 PM	Reception, Wellcome Trust Museum Speakers, event organizers, and staff
7:30 – 9:30 PM	Conference Dinner, Wellcome Trust Museum Speakers, event organizers, and staff

DAY 2
Wednesday, September 2, 2015

Illuminating Potential Future Mechanisms for Improved Governance

8:30 – 9:00 AM	Registration and Continental Breakfast
9:00 – 9:15 AM	Summary of Day One **David Relman,** Chair of the Forum on Microbial Threats, IOM; Professor of Microbiology and Immunology, Stanford University

Session 4: Models of Governance for Global Health

Moderator: Larry Gostin, University Professor of Global Health Law, Georgetown University

Goals of Session

- Illuminate goals of governance systems considering domains from the international, national, regional, and local levels
- Compare and contrast four potential models of governance for global health, including key features of organizational structure, funding, legitimacy, authority, and accountability

- Identify a broad array of stakeholders and effective methods for integrating and leveraging partner engagements for strong governance for global health

Part 1: Systems for Governance: How Should They Fit Together?

9:15 – 10:05 AM	Presentations
	Claude de Ville de Goyet, Consultant to UN and Former WHO/Pan American Health Organization Emergency Preparedness Director: "How Should the Governance Roles of WHO Regional Offices Be Made Fit for Purpose?"
	Ron St. John, WHO Consultant: "Observations on Governance in the Provision of WHO Assistance at the National Level"
10:05 – 10:20 AM	Break
10:20 – 11:10 AM	Presentations
	Ben Anyene, Health Reform Foundation of Nigeria: "Governance and the Role of Local Humanitarian Organizations During an Outbreak"
	Rebecca Marmot, Global Partnerships, Unilever: "Governance and the Role of Public–Private Partnerships During an Outbreak"
11:10 AM – 12:10 PM	Panel Discussion
12:10 – 1:00 PM	Lunch

Part 2: Laying Out Some Governance Options: The Work of Concurrent Panels and Debate

1:00 – 1:40 PM	Insights from Concurrent Initiatives
	Peter Piot, London School of Hygiene & Tropical Medicine: Insights from the Lancet Commission – Harvard–LSHTM Study

Joy Phumaphi, African Leaders Malaria Alliance: "Observations on the UN Secretary General's Commission on the Ebola Response"

1:40 – 1:50 PM The Debate: Introduction [10 min for presentation; 10 min for discussion]

Larry Gostin (moderator), University Professor of Global Health Law, Georgetown University

1:50 – 2:10 PM **Model 1: A Reformed WHO**

- **Charles Clift**

2:10 – 2:30 PM **Model 2: "WHO Plus."** The WHO with an attached center for humanitarian and outbreak management under the line authority of the WHO Director-General and with strategic, operational, and tactical roles. It combines both strategic and operational missions within the WHO-Geneva culture.

- **Ilona Kickbusch**

2:30 – 2:50 PM **Model 3: The Executive Agency Model.** The WHO as the host for a center for humanitarian and outbreak management operating under the authorities of the UN Secretary-General and executing strategic, operational, and tactical roles. (This taps the expertise of WHO but draws from a higher level of authority for command and control and political support.) It would insulate the center from the WHO culture and the politics of the WHA but derive vast technical benefits.

- **Dr. Yasushi Katsuma, Dean and Professor, Graduate School of Asia-Pacific Studies; Waseda University**

2:50 – 3:10 PM **Model 4: Independent Entity with Interagency Composition under the Authority of the UN Secretary General.**

- **Daniel López-Acuña**

3:10 – 4:00 PM Panel and General Discussion

Harvey Fineberg (moderator):
Each reactor would have 5 minutes to reflect on the model they favor based on the presentations.

Featured Reactors:

1. **Kenji Shibuya, University of Tokyo**
2. **Ann Marie Kimball, Chatham House**
3. **Kumanan Rasanathan, United Nations Children's Fund**

4:00 – 4:15 PM Break

Session 5: Other Considerations in Governance for Global Health

Moderator: Chris Elias, President, Global Development, The Bill & Melinda Gates Foundation

Goals of Session

- Synthesize best practices for translating research and lessons learned into actions for governance for global health
- Identify financing mechanisms that help mobilize and maintain good governance and steer policy directions

4:15 – 5:15 PM Panel Discussion

Tim Evans, Senior Director, Health, Nutrition and Population Global Practice, World Bank: "The Essential Connection Between Governance and Finance"

Jeremy Farrar, Director, Wellcome Trust: "Governance for Health Research in the Context of Rapidly Emerging Infectious Disease Threats"

Daniel López-Acuña, Former WHO Senior Adviser to the Director-General**:** "Ensuring Health Security as a Function of Governance"

5:15 – 5:45 PM Open Discussion

5:45 – 6:00 PM Concluding Remarks and Adjournment

Eileen Choffnes, Scholar, Board on Global Health, IOM

Ceci Mundaca-Shah, Senior Program Officer, Board on Global Health, IOM

David Relman, Chair of the Forum on Microbial Threats, IOM; Professor of Microbiology and Immunology, Stanford University

E

Workshop Speaker Biographies

Speaker and Moderator Bios
Global Health Risk Framework: Governance for Global Health
September 1-2, 2015

Ximena Aguilera, M.D., is Director of the Centre of Epidemiology and Public Health Policies at the Faculty of Medicine Universidad del Desarrollo in Chile. She was Senior Advisor in Communicable Diseases at the World Health Organization (WHO) Regional Office for the Americas (2008-2010), where among other duties she coordinated the technical response to the influenza A (H1N1) pandemic. Previously she was the Chief of Health Planning Division at the Ministry of Health in Chile (2005-2008) and Head of the Department of Epidemiology at the same institution (1999-2005). Dr. Aguilera was the Chilean representative during the negotiations on the revision of the International Health Regulations, and official delegate for Asia-Pacific Economic Forum Health Working Group, and for MERCOSUR sub-working group on health. In addition, she was primarily responsible for pandemic preparedness and for the implementation of the International Health Regulations (2005) at the Ministry of Health of Chile. Dr. Aguilera has worked as consultant for the WHO Regional Office for the Americas, the United Nations Development Fund, the Inter-American Development Bank, and the World Bank in several countries in Latin America and participated in the WHO mission in response to the severe acute respiratory syndrome (SARS) outbreak in China (2003). She has been a member of the Advisory Committee of the Global Outbreak Alert and Response Network of WHO.

Benjamin Chukwudum Anyene, M.D., is trained as a medical doctor and a microbiologist. He attended courses including the World Bank Institute course in health sector reform, health economics, and financing. His areas of interest are health and development with primary focus on primary

health care and immunization systems reforms. He has broad experience as a public, private, and nonstate actor in health. He was Health Commissioner in Anambra State, Nigeria; UK Department for International Development (DFID) health programmes consultant to Health Ministers on Policy, Plans and Systems Development; and Coordinator of the DFID-supported Federal Ministry of Health Health Sector Reform/Health Millennium Development Goals Technical Team. He was a Board member and Chairman Board Technical Committee, National Primary Health Care Development Agency, 2001-2003 and 2013-2015. He led the development, advocacy for, and passage by the National Assembly and presidential assent of the National Health Bill (2004-2014). He was the National Policy/Immunization Advisor (2008-2014), DFID and Norwegian Government program (PRRINN-MNCH) for Revitalizing Routine Immunization and Maternal Newborn and Child Health in Northern Nigeria, Chairman of the National Health Sector Reform Coalition, Chairman of the Board Health Reform Foundation of Nigeria (HERFON), Vice Chairman of the White Ribbon Alliance Nigeria for Safe Motherhood, member of the Nigeria Academy of Science Vaccines and Immunization Committee, and Chairman of the National Vaccine Financing Task Team.

Margaret Chan, M.D., is the Director-General of WHO and was first appointed by the World Health Assembly (WHA) on November 9, 2006. The Assembly appointed Dr. Chan for a second 5-year term at its 65th session in May 2012. Dr Chan's current term began on July 1, 2012, and will continue until June 30, 2017. Before being elected Director-General, Dr. Chan was WHO Assistant Director-General for Communicable Diseases as well as Representative of the Director-General for Pandemic Influenza.

Prior to joining WHO, she was Director of Health in Hong Kong. During her 9-year tenure as director, Dr. Chan confronted the first human outbreak of H5N1 avian influenza in 1997. She successfully defeated the spate of SARS in Hong Kong in 2003. She also launched new services to prevent disease and promote better health.

Charles Clift, Ph.D., is a Senior Consulting Fellow in the Centre on Global Health Security at Chatham House. He was responsible for coordinating the work of Chatham House's high-level working group on governance and writing the report arising from the working group: *What's the World Health Organization For?* Previously he was an economist at the UK Department for International Development. In addition to his work for Chatham House, he has been a consultant to UNITAID, the World Intellectual Property Organization, the Access to Medicine Foundation, and the World Health Organization. He is also chair of the board of the Medicines Patent Pool Foundation.

Claude de Ville de Goyet, M.D., a Belgian medical doctor, was the first director of the Centre for Research on the Epidemiology of Disasters (CRED) in Belgium (1974-1977). As director of the Pan American Health Organization (PAHO/WHO) Disaster Management Programme from 1977 to 2002, he coordinated the international health response to major outbreaks, natural disasters, and conflicts in Latin America and the Caribbean during 25 years.

He was team leader in many evaluations in earthquakes in Iran (2003), Pakistan (2005), and Haiti (2010); tsunamis (2004), hurricanes, and floods in the Caribbean and Latin America; and conflicts in Europe (Kosovo, Bosnia), Africa (Darfur), and the Middle East (Gaza). Acting temporarily as WHO Representative during the peak of the cholera outbreak in Haiti, he launched an external evaluation. More recently, he advised the European Union on the Ebola Recovery Assessment through field visits and close coordination with the national health authorities in the affected countries.

His career in the UN and missions for The Red Cross System, nongovernmental organizations (NGOs), or bilateral donors gave him an in-depth knowledge of the complex interplay of humanitarian actors and local health authorities in all types of major crises. He wrote numerous articles and chapters in books on disaster health management.

Chris Elias, M.D., is the President of the Global Development Program at The Bill & Melinda Gates Foundation, where he leads the foundation's efforts in a diverse range of program areas aimed at finding creative new ways to ensure solutions and products get into the hands of people in poor countries who need them most. Focusing on areas with the potential for high-impact, sustainable solutions that can reach hundreds of millions of people, Dr. Elias oversees Global Development's portfolio in agriculture development; emergency response; family planning; financial services for the poor; maternal, newborn, and child health; nutrition; polio eradication; vaccine delivery; and water, sanitation, and hygiene. A common theme of these programs is innovative and integrated delivery, including an emphasis on strengthening of primary health care systems.

Dr. Elias's professional background is in public health and medicine. Prior to joining the Gates Foundation in February 2012, he worked in various positions and countries for international nonprofit organizations, most recently serving as the president and CEO of PATH, an international, nonprofit organization dedicated to improving the health of people around the world by advancing technologies, strengthening systems, and encouraging healthy behaviors.

Dr. Elias holds an M.D. from Creighton University, having completed postgraduate training in internal medicine at the University of California, San Francisco, and an M.P.H. from the University of Washington, where he

was a fellow in the Robert Wood Johnson Clinical Scholars Program. He is a member of the National Academy of Medicine.

Tim Evans, D.Phil., is the Senior Director of Health, Nutrition and Population at the World Bank Group. From 2010 to 2013, Dr. Evans was Dean of the James P. Grant School of Public Health at BRAC University in Dhaka, Bangladesh, and Senior Advisor to the BRAC Health Program. From 2003 to 2010, he was Assistant Director-General at WHO. Prior to this, he served as Director of the Health Equity Theme at The Rockefeller Foundation. Earlier in his career he was an attending physician of internal medicine at Brigham and Women's Hospital in Boston and was Assistant Professor in International Health Economics at the Harvard School of Public Health. He is a board member of a number of international health alliances.

Dr. Evans has been at the forefront of advancing global health equity and strengthening health systems delivery for more than 20 years. At WHO, he led the Commission on Social Determinants of Health and oversaw the production of the annual World Health Report. He has been a co-founder of many partnerships including the Global Alliance on Vaccines and Immunization as well as efforts to increase access to HIV treatment for mothers and innovative approaches to training community-based midwives in Bangladesh.

Dr. Evans received his medical degree from McMaster University in Canada and was a research and internal medicine resident at Brigham and Women's Hospital. He earned a D.Phil. in agricultural economics from University of Oxford, where he was a Rhodes Scholar.

Jeremy Farrar, D.Phil., is Director of the Wellcome Trust, a global charitable foundation dedicated to achieving extraordinary improvements in health by supporting the brightest minds. Before joining the Trust he was Director of the Oxford University Clinical Research Unit in Vietnam, where his research interests were in infectious diseases, tropical health, and emerging infections. He has contributed to 500 peer-reviewed scientific papers, and has served on several World Health Organization advisory committees.

Dr. Farrar was appointed OBE in 2005 for services to tropical medicine, and he has been awarded the Memorial Medal and Ho Chi Minh City Medal from the government of Vietnam, the Frederick Murgatroyd Prize for Tropical Medicine by the Royal College Physicians, and the Bailey Ashford Award by the American Society for Tropical Medicine and Hygiene. He is a Fellow of the Academy of Medical Sciences and a Fellow of The Royal Society.

David P. Fidler, J.D., is one of the world's leading experts on international law and global health. He is the James Louis Calamaras Professor at the

Indiana University Maurer School of Law, an associate fellow at the Centre on Global Health Security at Chatham House, and a distinguished visitor at the O'Neill Institute for National and Global Health Law at Georgetown University. He is a member of the Harvard University–London School of Hygiene & Tropical Medicine Independent Panel on the Global Response to the Ebola Outbreak. Fidler has served as an international legal consultant to WHO and the U.S. Centers for Disease Control and Prevention (CDC). He has twice been appointed by WHO's Director-General as a member of the International Health Regulations (IHR) Roster of Experts, which advises the director general on matters relating to the IHR (2005). He holds degrees from Harvard Law School and the University of Oxford.

Harvey Fineberg, M.D., Ph.D., is the President of the Gordon and Betty Moore Foundation and interim chief program officer for its Patient Care Program. He previously held the Presidential Chair for 2014-2015 as visiting professor at the University of California, San Francisco. Prior to that, he served as president of the Institute of Medicine from 2002 to 2014 and as provost of Harvard University from 1997 to 2001, following 13 years as dean of the Harvard School of Public Health. He has devoted most of his academic career to the fields of health policy and medical decision making. His past research has focused on the process of policy development and implementation, assessment of medical technology, evaluation and use of vaccines, and dissemination of medical innovations.

Dr. Fineberg chairs the board of the Carnegie Endowment for International Peace and serves on the boards of the William and Flora Hewlett Foundation and the China Medical Board. He helped found and served as president of the Society for Medical Decision Making and also served as consultant to the World Health Organization.

Dr. Fineberg is co-author of the books *Clinical Decision Analysis*, *Innovators in Physician Education*, and *The Epidemic That Never Was*, an analysis of the controversial federal immunization program against swine flu in 1976. He has co-edited several books on such diverse topics as AIDS prevention, vaccine safety, understanding risk in society, and global health. He has also authored numerous articles published in professional journals. Dr. Fineberg is the recipient of several honorary degrees—the Frank A. Calderone Prize in Public Health, the Henry G. Friesen International Prize in Health Research, and the Harvard Medal, awarded by the alumni association of the university from which he earned his bachelor's and doctoral degrees.

Lawrence O. Gostin, J.D., is University Professor (Georgetown University's highest academic rank), O'Neill Chair in Global Health Law, and Director of the O'Neill Institute for National and Global Health Law. Professor

Gostin holds international professorial appointments at Oxford University, University of Witwatersrand, and Melbourne University. He is Director of the WHO Collaborating Center on Public Health Law & Human Rights, and serves on expert WHO advisory committees mental health, International Health Regulations, and Pandemic Influenza Preparedness. Professor Gostin holds editorial appointments, notably for the *Journal of the American Medical Association*.

Professor Gostin holds honorary doctoral degrees from the State University of New York, Cardiff University, Sydney University, and the Royal Institute of Public Health. He is a member of the National Academy of Sciences, Council of Foreign Relations, and Hastings Center. The National Academy awarded Professor Gostin the Yarmolinsky Medal for distinguished service to further its mission of science and health. He received the Public Health Law Association's Distinguished Lifetime Achievement Award.

Professor Gostin received the Delbridge Memorial Award in the United Kingdom as the person "who has most influenced Parliament and government to act for the welfare of society." His latest book is *Global Health Law* (Harvard University Press, 2014).

Margaret A. Hamburg, M.D., is the former Commissioner of the U.S. Food and Drug Administration, having stepped down from that role in April 2015 after almost 6 years of service. Dr. Hamburg earned her B.A. from Harvard College and her M.D. from Harvard Medical School and completed her medical residency at Weill Cornell Medical Center.

In 1991, Dr. Hamburg was named Commissioner of the New York City Department of Health. During her 6-year tenure there, she implemented rigorous public health initiatives that tackled the city's most pressing crises head-on, including improved services for women and children, an internationally recognized tuberculosis control program, a needle-exchange program to combat HIV transmission, and the nation's first public health bioterrorism defense program. In 1997, President Clinton named Dr. Hamburg Assistant Secretary for Planning and Evaluation in the U.S. Department of Health and Human Services. She later became founding Vice President for Biological Programs at the Nuclear Threat Initiative, a foundation dedicated to reducing the threat to public safety from nuclear, chemical, and biological weapons.

In March 2009, President Obama nominated Dr. Hamburg for the post of U.S. Food and Drug Administration Commissioner. In that role, Dr. Hamburg emphasized the critical need for innovation in meeting medical care and public health needs. As Commissioner, she provided leadership on many groundbreaking activities, including implementation of new authorities to regulate tobacco products, new legislation designed to transform our nation's food safety system to one based on prevention rather than

simply responding when outbreaks occur, and modernization of the system for the evaluation and approval of medical products.

Dr. Hamburg is a Fellow of the American Association for the Advancement of Science and the American College of Physicians, as well as a member of the Council on Foreign Relations and the National Academy of Medicine, where she serves as Foreign Secretary.

David L. Heymann, M.D. (CBE), is Professor of Infectious Disease Epidemiology, London School of Hygiene & Tropical Medicine; Head of the Centre on Global Health Security at Chatham House, London; and Chairman of Public Health England, United Kingdom. Previously he was the World Health Organization's Assistant Director-General for Health Security and Environment, and Representative of the Director-General for polio eradication. From 1998 to 2003 he was Executive Director of the WHO Communicable Diseases Cluster, during which he headed the global response to SARS. Before joining WHO, Professor Heymann worked for 13 years as a medical epidemiologist in sub-Saharan Africa on assignment from CDC where, as well as supporting ministries of health in research, he participated in the first and second outbreaks of Ebola hemorrhagic fever. Prior to joining CDC, Professor Heymann worked in India for 2 years in the WHO Smallpox Eradication Programme. He is an elected fellow of the National Academy of Medicine (United States) and the Academy of Medical Sciences (United Kingdom) and has been awarded several public health awards. In 2009 Professor Heymann was appointed an honorary Commander of the Most Excellent Order of the British Empire (CBE) for service to global public health.

Mark Heywood is the Executive Director of Section27. Section27 was established in May 2010. It incorporates the AIDS Law Project (ALP), one of South Africa's most successful post-apartheid human rights organizations. Section27 is a public interest law center that seeks to influence, develop, and use the law to protect, promote, and advance human rights. Mr. Heywood grew up in Botswana, England, Ghana, and Nigeria. He holds a B.A. (Hons) in English Language and Literature from Balliol College, Oxford University. After graduating from Oxford in 1986, he worked for the Marxist Workers Tendency of the African National Congress, first in London and then from 1989 to 1994 in South Africa. During this time he was instrumental in setting up campaigns such as the Philemon Mauku Defence Campaign, the Leeukop Political Prisoners Support Committee, and the Johannesburg Inner City Community Forum. He also researched and wrote a dissertation for an M.A. in African literature at the University of the Witwatersrand, Johannesburg, and lectured and wrote on the influences of Shakespeare on African writing and politics in South Africa.

Mr. Heywood joined the ALP in 1994, becoming its head in 1997 and executive director in 2006. In 1998, he was one of the founders of the Treatment Action Campaign (TAC). In 2007, he was elected as deputy chairperson of the South African National AIDS Council, a position he held until 2012. From 2006 to 2012 he was the chairperson of the Joint United Nations Programme on HIV/AIDS (UNAIDS) Reference Group on HIV/AIDS and Human Rights. In 2009, Mr. Heywood was appointed as a member of the Ministerial Advisory Committee on National Health Insurance. Mr. Heywood has written extensively on HIV, human rights, and the law, including co-editing the *AIDS and the Law Resource Manual* and *Health & Democracy: A Guide to Human Rights, Health Law and Policy in Post-Apartheid South Africa*. He has been part of the legal teams of the ALP and TAC that have been involved in all the major litigation around HIV and human rights.

Ilona Kickbusch, Ph.D., is currently the Director of the Global Health Programme at the Graduate Institute of International and Development Studies in Geneva, and director of Kickbusch Health Consult. Professor Kickbusch has had a distinguished career with the World Health Organization. Most recently she was a member of the Ebola Interim Assessment Panel, to undertake an assessment on all aspects of WHO's response in the Ebola outbreak. The panel presented its first progress report to the 68th WHA in May 2015 and the second report in July 2015. She was also responsible for the Ottawa Charter for Health Promotion, a seminal document in public health. She developed the "settings" approach and initiated programs such as Healthy Cities, health-promoting schools, healthy workplaces, health-promoting hospitals, and health in prisons. She also initiated WHO's Health Behavior in School-aged Children Study. Professor Kickbusch has published and advised widely on health in all policies (HIAP) approaches. Most recently, she conducted a study on governance for health for WHO/Europe and has been deeply involved in the development of Health 2020, the European health policy framework. She is developing training materials for WHO on HIAP and was engaged in the global HIAP conference in Finland in 2013. She is also a member of a commission that advises on the future health of Portugal and serves on the boards of the Careum Foundation and the Foundation for Innovative New Diagnostics.

Ann Marie Kimball, M.D., is a physician and epidemiologist. A strategic advisor for The Rockefeller Foundation, she served as technical and strategic lead for The Bill & Melinda Gates Foundation surveillance strategy formation. This 3-year process resulted in the first approved surveillance strategy in the history of that Foundation. Prior to her recruitment as Senior Program Officer, Surveillance and Epidemiology for the Foundation, she

served as Professor of Epidemiology for the University of Washington (UW) School of Public Health with adjunct appointments in medicine (bioinformatics and infectious diseases) and the Jackson School of Foreign Affairs. She attended clinically at Harborview Medical Center. She is emerita at this time. During her tenure at UW, Dr. Kimball founded and directed the APEC Emerging Infections Network, and led research and training programs in Surveillance and Informatics in Peru and Thailand. Her research focus on global trade and emerging infections earned her a Fulbright New Century Scholars award and a Guggenheim Scholars award. She is the author of *Risky Trade: Infectious Diseases in an Era of Global Trade* (Ashgate, 2006), which was highly reviewed by the *New England Journal of Medicine*, *Emerging Infections*, and *Lancet*. She has authored numerous scientific publications, and served on numerous Institute of Medicine panels. Most recently she led The Rockefeller Foundation evaluation of their global Disease Surveillance Network portfolio. She is a fellow in the American College of Preventive Medicine and member of the National Biosurveillance Advisory Subcommittee (NBAS) from the Centers for Disease Control and Prevention.

A former Epidemic Intelligence Service Officer for the CDC in Atlanta, prior to joining UW she worked and lived in the Yemen Arab Republic, Ivory Coast, and Senegal. She served as Director of National Program Support for PAHO, directing the elaboration and implementation of medium-term AIDS plans in member countries throughout Latin America and the Caribbean. She has served as Director of HIV/AIDS for Washington State, and was the founding Chair of the National Alliance of State and Territorial AIDS Directors in the United States.

Joanne Liu, M.D., has been the Médecins Sans Frontières (MSF) International President since October 1, 2013. She first started with MSF in 1996, when she worked with Malian refugees in Mauritania. She subsequently provided support in Indonesia after the tsunami, assisted people affected by the earthquake and cholera epidemic in Haiti, and worked with Somali refugees in Kenya. She also helped develop one of the first programs offering comprehensive medical care for survivors of sexual violence in the Republic of the Congo. She has worked in many conflict zones, including in Palestine, Democratic Republic of the Congo, Central African Republic, and Sudan's Darfur region. Dr. Liu helped create the telemedicine project, which connects MSF physicians in 150 remote sites with a pool of more than 300 medical specialists across the globe.

Born in Quebec City, Canada, Dr. Liu decided to become a pediatrician at an early age. She trained at McGill University, School of Medicine, specializing in pediatrics at Montreal's Sainte-Justine Hospital. She has a fellowship in pediatric emergency medicine from New York University,

School of Medicine, a diploma in tropical medicine from Cayeto Heredia University in Lima, Peru, and an international master's degree in health leadership from McGill University. She is an associate professor at the Université de Montréal and a professor of practice at McGill University.

Daniel López-Acuña, M.D., born in Mexico City in 1954, is both a Mexican and Spanish national. He graduated as a Medical Doctor from the National Autonomous University of Mexico in 1978 and did both his master's and doctoral studies in public health at the Johns Hopkins University School of Hygiene and Public Health in Baltimore, Maryland. He has been a faculty member of the School of Medicine at the National Autonomous University of Mexico and at the School of Public Health of Mexico, and visiting professor at several universities in the United States, Spain, and Latin America in fields such as epidemiology, health systems, health planning, and health economics.

Between 1986 and 2005, he worked for the Pan American Health Organization WHO Regional Office for the Americas in different capacities, including the positions of Director of Health Systems and Director of Program Management. Since 2006 until May 2011 he worked as Director Health Action in Crisis in the World Health Organization headquarters in Geneva. In June 2011 he was appointed Adviser to the Director-General of the World Health Organization. In this capacity he has been supporting the design and implementation of WHO's Reform. In August 2013 he was appointed Director of Country Cooperation and Collaboration with the United Nations System at the World Health Organization.

Dr. López-Acuña was responsible for organizing the discussions on migrants health during the 2008 WHA and of coordinating the WHO work for implementing the resolution approved to that effect. He also coordinated the Global Consultation on Migrant's Health that took place in 2010 in Madrid, Spain. He represented WHO at the Global Migration Group. In his last assignment in WHO he represented WHO in the United Nations Development Group Assistant Secretary-General Advisory Group, in the High-Level Committee on Programmes (HLCP) and occasionally in the High-Level Committee on Management (HLCM), all of them subsidiary mechanisms of coordination of the Chief Executives Board for Coordination of United Nations (UN) System. As part of this he has been involved in the discussions on repositioning the UN System in light of the post-2015 agenda.

Dr. López-Acuña has published several books and specialized papers. He is a member of the editorial boards of a number of technical and periodical journals. Among the books published, two of them have had wide dissemination: *La Salud Desigual en México*, originally published in 1980 and currently in its ninth edition, and *La Salud Ambiental en México*, published in 1986. He coordinated the publication titled *Public Health in*

the Americas, launched by PAHO/WHO in 2002. He retired from WHO in November 2014 and since then has been an independent public health and health systems consultant residing in Gijon, Spain.

Rebecca Marmot heads Unilever's Global Partnerships team including setting up and now running the inaugural Unilever Foundation. Through building global partnerships and the Foundation, Rebecca has created programs that focus on the core areas of Unilever's value chain from sustainable sourcing through to consumer access (particularly focusing on women's economic empowerment) to drinking water, hygiene, sanitation, basic nutrition, and self-esteem. The Unilever Foundation seeks to maximize the positive social impact Unilever can make, as the business continues to grow. She is also a Board Director for Water and Sanitation for the Urban Poor.

Colin McIff, M.P.I.A., currently serves as the Senior Health Attaché at the U.S. Mission in Geneva. Since his 2010 arrival in Geneva, Mr. McIff has chaired or co-chaired negotiations on some of the most sensitive issues facing the global health community. In the context of the World Health Organization, Mr. McIff has negotiated resolutions on noncommunicable diseases, on the role of the health sector in addressing interpersonal violence, and on strengthening the International Health Regulations, and, most recently, with South Africa he co-chaired the negotiations on the Ebola resolution during the WHO Special Session. Before his posting as Health Attaché at the U.S. Mission in Geneva, Mr. McIff was the Acting Director for Multilateral Affairs at the Office of Global Affairs at the U.S. Department of Health and Human Services, leading U.S. negotiations on the Code of Practice on the International Recruitment of Health Personnel adopted by consensus at the 63rd WHA. Mr. McIff served as Multilateral Organizations Officer for the President's Emergency Plan for AIDS Relief (PEPFAR) at the Office of the U.S. Global AIDS Coordinator. While with PEPFAR, Mr. McIff led coordination efforts with multilateral organization partners such as UNAIDS, the UN Office of Drugs and Crime, and the UN Children's Fund (UNICEF). Prior to joining PEPFAR, Mr. McIff served with the Bureau of Oceans and International Environmental and Scientific Affairs, and the Office of Japan Affairs at the U.S. Department of State and with the U.S. Agency for International Development. During his State Department career Mr. McIff covered a wide range of multilateral organizations, among them, the UN General Assembly, UN Food and Agriculture Organization (FAO), and Convention on International Trade in Endangered Species.

Joy Phumaphi is the Executive Secretary of the African Leaders Malaria Alliance, a member of the UN Secretary General's High-Level Panel on

the Global Response to Health Crises, and Chair of the Global Leaders Council for Reproductive Health. She served as Member of Parliament in Botswana, holding portfolio responsibility in the cabinet, first for Lands and Housing (1995-1999), and then for Health (1999-2003). She joined WHO as Assistant Director-General for Family and Community Health (2003-2007) and later served as Vice President for Human Development at the World Bank (2007-2009). She has served on a number of commissions and expert groups and sits on the boards of several international nonprofit organizations working on global health.

Peter Piot, M.D., Ph.D., is the Director of the London School of Hygiene & Tropical Medicine. He was the founding Executive Director of UNAIDS and UN Under Secretary-General. Dr. Piot co-discovered the Ebola virus in 1976, and led research on HIV/AIDS, sexually transmitted diseases, and women's health in Africa. He was a professor at the Institute of Tropical Medicine, Antwerp, University of Nairobi, and College de Frances, Paris, and a Senior Fellow at the University of Washington, and The Bill & Melinda Gates Foundation. He is a member of the U.S. National Academy of Medicine, the Royal Academy of Medicine of his native Belgium, and the Academy of Medical Sciences, United Kingdom. He was the President of the International AIDS Society and was knighted as a baron. He has published more than 550 scientific articles and 16 books, including *No Time to Lose*. He was the recipient of the Calderone Prize, the Hideyo Noguchi Africa Prize for Medical Research, the Prince Mahidol Award, the Canada Gairdner Global Health Award, and the Robert Koch Gold Medal.

Kumanan Rasanathan, M.P.H., is a public health physician and Senior Health Specialist at UNICEF in New York. He works on district health system strengthening to improve the delivery of maternal and child health services, with a particular focus in South and East Asia, and including links to universal health coverage. Dr. Rasanathan is also the UNICEF focal point for health in the post-2015 development agenda and for social determinants of child health. He has commissioned and overseen a number of pieces of research for UNICEF in health systems strengthening and social determinants, and leads UNICEF's partnerships with TDR (the Special Programme for Research and Training in Tropical Diseases) and the Alliance for Health Policy and Systems Research.

Kenji Shibuya, M.D., Dr.PH., is Professor and Chair of Global Health Policy at the University of Tokyo's Graduate School of Medicine and President of the Japan Institute for Global Health. He obtained his M.D. at the University of Tokyo and his doctorate in international health economics at Harvard University. After teaching at Teikyo University in Tokyo, he joined

WHO's Global Programme on Evidence for Health Policy in 2001 and was chief of the Health Statistics and Evidence Unit from 2005 until 2008. He has published widely on mortality, causes of death, burden of disease, risk factors, cost effectiveness, priority setting, health system performance assessment, and health diplomacy. He has been an advisor to both central and local governments. He spearheaded the future strategic directions of the Japanese global health policy agenda after the Hokkaido Toyako G8 Summit in 2008. He led the *Lancet* Series on Japan, published in 2011 in an effort to jump-start debates on Japanese domestic and global health policy reform. This year he chaired the landmark Advisory Panel on Health Care 2035 for the Minister of Health, Labour and Welfare. He is currently the Executive Advisor on Global Health for the Ministry of Health, Labour and Welfare.

Ronald K. St. John, M.D., M.P.H., has had a 35-year career in public health and infectious disease control in the United States and Canada, and at the World Health Organization, Regional Office for the Americas. With undergraduate, medical, and public health degrees from Yale, Columbia University, College of Physicians and Surgeons, and Harvard, his career has included the planning, management, and policy review of international and national infectious disease control programs, quarantine and migration health, travel medicine, the Global Public Health Intelligence Network, travel medicine, and counter-terrorism. As the first Director-General for the Centre for Emergency Preparedness and Response in the Public Health Agency of Canada, he was the national manager for Canada's response to 9/11, and SARS. The Centre serves as the country's single coordinating point for public health security in Canada.

In the past, he worked and lived in Bolivia and the Philippines. From 1989 to 1992 he was Deputy Director of the National AIDS Program Office in the Office of the Secretary, U.S. Department of Health and Human Services. Most recently, he was the Ebola Incident Manager at PAHO responsible for assessing and improving member states' response to the possible importation of a case of Ebola.

Dame Barbara Stocking became the fifth President of Murray Edwards College (New Hall) in July 2013. From May 2001 until February 2013 Dame Stocking was Chief Executive of Oxfam GB. During this time she led major humanitarian responses. In March 2015, Dame Stocking was appointed Chair of the Independent Panel to Assess WHO's Response in the Ebola outbreak. The final report was published in July 2015. Previously, Dame Stocking was a member of the top management team of the National Health Service, and for 8 years worked as Regional Director for the South East of England, and then as the founding Director of the NHS

Modernisation Agency. She was awarded a CBE for health services in 2000, and a Dame Commander of the British Empire (DBE) for humanitarian services, in 2008.

Keizo Takemi is a Liberal Democratic Party (LDP) member of the Japanese House of Councilors. He has also served as State Secretary for Foreign Affairs in the Obuchi Cabinet in 1999, and the Senior Vice Minister of Health, Labor and Welfare in the first Abe cabinet. Within LDP, he serves as the Chairman of the Special Mission Committee on Global Health Strategy of the Policy Research Council. He is a Senior Fellow at the Japan Center for International Exchange. He was involved in various global initiatives, including the Commission on Information and Accountability for Women's and Children's Health, Global Health Workforce Alliance, WHO Expert Working Group on R&D Financing, and the International Organizing Committee of the Prince Mahidol Award Conference. Since March 2013, he has served as the Chair of the Parliamentary Caucus on Stop TB Partnership and, since October 2013, as the Chair of the Asian Forum of Parliamentarians on Population and Development.

Alejandro Thiermann, Ph.D., has been President of the World Organisation for Animal Health's (OIE's) international standard setting committee, the Terrestrial Animal Health Code Commission, since 2000. He has been seconded by the U.S. Department of Agriculture (USDA)-Animal and Plant Health Inspection Service (APHIS) to the OIE in Paris to devote full time to the work of this Commission as well as to serve as the senior advisor to the Director-General. During 1997 to 1999 he was twice elected Chairman of the World Trade Organisation (WTO), Sanitary and Phytosanitary Committee. He was an active member of U.S. delegations to the negotiation of the Uruguay Round of the WTO, the drafting of the new International Plant Protection Convention, also served for 2 years as the U.S. Coordinator for the Codex Alimentarius. Dr. Thiermann joined USDA-APHIS in 1989 as the Deputy Administrator for International Services. In this capacity, he promoted APHIS' role in trade facilitation. Before joining APHIS, he was the National Program Leader for animal health research under the USDA Agriculture Research Service. A native of Chile, he received his doctorate of veterinary medicine degree from the University of Chile at Santiago, and a Ph.D. degree in medical microbiology and immunology from the School of Medicine at Wayne State University in Michigan.

Oyewale Tomori, D.V.M., Ph.D., F.A.S.T.M.H., is currently the President of the Nigerian Academy of Science. He was pioneer Vice-Chancellor at the Redeemer's University, Nigeria. He is a recipient of the NNOM, Nigeria's highest award for academic and intellectual attainment. At the University

of Ibadan, Nigeria, as Professor of Virology, he led research into study of viral infections, and elucidated the properties of Orungo virus, registered with the ICVT. In 1981, he received the U.S. Public Health Service Certificate for contribution to Lassa fever research. At the WHO Africa Region, as Regional Virologist from 1994 to 2004, he set up the African Regional Polio Laboratory Network, which provided laboratory diagnostic support for polio eradication, and became the forerunner of regional diagnostic laboratory networks for other diseases. He has been involved in the investigations of outbreaks of viral hemorrhagic fevers (yellow fever, Ebola virus disease, etc.) infections in many African countries. Tomori serves on several national and international advisory bodies, including the Nigeria Expert Review Committee (ERC) on Poliomyelitis Eradication and Routine Immunization, and as a member of the U.S. Institute of Medicine (IOM) Committee on Sustainable Global Surveillance of Zoonotic Diseases, the IOM Committee on Identifying and Prioritizing New Preventive Vaccines for Development, the WHO Strategic Advisory Group of Experts (SAGE), and Co-Chairman of the ASADI/USNAS/NASAC Study Team on Country Ownership of Africa's Development, SAGE Working Group on Ebola.

Paul Wise, M.D., is the Richard E. Behrman Professor of Child Health and Society and Professor of Pediatrics and Health Policy at Stanford University School of Medicine. Dr. Wise is also a Senior Fellow in the Center for Democracy, Development and the Rule of Law and the Center for International Security and Cooperation, in the Freeman-Spogli Institute for International Studies, Stanford University. He is also Co-director of the March of Dimes Center for Prematurity Research at Stanford University.

Dr. Wise received his A.B. degree summa cum laude in Latin American studies, his M.D. degree from Cornell University, and a master of public health degree from the Harvard School of Public Health and did his pediatric training at the Children's Hospital in Boston. His former positions include Director of Emergency and Primary Care Services at Boston Children's Hospital, Director of the Harvard Institute for Reproductive and Child Health, and Vice-Chief of the Division of Social Medicine and Health Inequalities at the Brigham and Women's Hospital and Harvard Medical School. He served as Special Assistant to the U.S. Surgeon General, Chair of the Steering Committee of the National Institutes of Health Global Network for Women's and Children's Health Research, and currently is a member of the Advisory Council of the National Institute of Child Health and Human Development, National Institutes of Health.

Dr. Wise's research focuses on health inequalities, child health policy, and global child health. He leads a multidisciplinary initiative, Children in Crisis, which is directed at integrating expertise in political science, security, and health services in areas of civil conflict and unstable governance.

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Forum on Microbial Threats Member Biographies

David A. Relman, M.D. (*Chair*), is the Thomas C. and Joan M. Merigan Professor in the Departments of Medicine, and of Microbiology and Immunology at Stanford University, and Chief of Infectious Diseases at the Veterans Affairs (VA) Palo Alto Health Care System in Palo Alto, California. He received an S.B. (biology) from the Massachusetts Institute of Technology (1977) and M.D. (magna cum laude) from Harvard Medical School (1982), completed his clinical training in internal medicine and infectious diseases at Massachusetts General Hospital, served as a postdoctoral fellow in microbiology at Stanford University, and joined the faculty at Stanford in 1994.

Dr. Relman's current research focus is the human indigenous microbiota (microbiome), and in particular, the nature and mechanisms of variation in patterns of microbial diversity within the human body as a function of time (microbial succession), space (biogeography within the host landscape), and in response to perturbation, e.g., antibiotics (community robustness and resilience). One of the goals of this work is to define the role of the human microbiome in health and disease. This research integrates theory and methods from ecology, population biology, environmental microbiology, genomics, and clinical medicine. During the past few decades, his research directions have also included pathogen discovery and the development of new strategies for identifying previously unrecognized microbial agents of disease. This work helped to spearhead the application of molecular methods to the diagnosis of infectious diseases in the 1990s. His research has emphasized the use of genomic approaches for exploring host-microbe relationships. Past scientific achievements include the description of a novel approach for identifying previously unknown pathogens, the identification

of a number of new human microbial pathogens, including the agent of Whipple's disease, and some of the first broad, molecular analyses of the composition of the human indigenous microbiota.

Dr. Relman advises the U.S. government, as well as nongovernmental organizations, in matters pertaining to microbiology, emerging infectious diseases, and biosecurity. He is a member of the National Science Advisory Board for Biosecurity, is a member of the Defense Advanced Research Projects Agency Synthetic Biology Panel, and advises several U.S. government departments and agencies on matters related to pathogen diversity, the future life sciences landscape, and the nature of present and future biological threats. He has served as Chair of the Board of Scientific Counselors of the National Institute of Dental and Craniofacial Research at the National Institutes of Health (NIH) and as President of the Infectious Diseases Society of America (IDSA) (2012-2013). Dr. Relman was vice-chair of a National Academy of Sciences (NAS) committee that studied the science underlying the FBI investigation of the 2001 anthrax mailings, and co-chaired a 3-year NAS study that produced a widely cited report titled "Globalization, Biosecurity, and the Future of the Life Sciences" (2006). He is a Fellow of the American Academy of Microbiology, a Fellow of the American Association for the Advancement of Science (AAAS), and a member of the Association of American Physicians. Dr. Relman received the Squibb Award from the IDSA in 2001, and was the recipient of both the NIH Director's Pioneer Award and the Distinguished Clinical Scientist Award from the Doris Duke Charitable Foundation in 2006, and a Transformative R01 Award from NIH in 2013. He was elected a member of the National Academy of Medicine in 2011.

James M. Hughes, M.D. (*Vice-Chair*), is professor of medicine (infectious diseases) and public health (global health) at Emory University's School of Medicine and Rollins School of Public Health, and serves as senior advisor to the Emory Center for Global Safe Water. Prior to joining Emory in June 2005, Dr. Hughes served as director of the National Center for Infectious Diseases (NCID) at the U.S. Centers for Disease Control and Prevention (CDC). Dr. Hughes received his B.A. and M.D. degrees from Stanford University and completed postgraduate training in internal medicine at the University of Washington, infectious diseases at the University of Virginia, and preventive medicine at CDC. After joining CDC as an Epidemic Intelligence Service officer in 1973, Dr. Hughes worked initially on foodborne and water-related diseases and subsequently on infection control in health care settings. He served as director of CDC's Hospital Infections Program from 1983 to 1988, as deputy director of NCID from 1988 to 1992, and as director of NCID from 1992 to 2005. A major focus of Dr. Hughes' career is on building partnerships among the clinical, research, public health,

and veterinary communities to prevent, detect, and respond to infectious diseases and improve health at the local, national, and global levels. His research interests include emerging and reemerging infectious diseases, antimicrobial resistance, foodborne diseases, health care–associated infections, vectorborne and zoonotic diseases, rapid detection of and response to infectious diseases and bioterrorism, strengthening public health capacity at the local, national, and global levels, improving immunization coverage, and preventing water-related diseases in the developing world. Dr. Hughes is a fellow of the American Academy of Microbiology (AAM), the American Association for the Advancement of Science, the American College of Physicians, the American Society of Tropical Medicine and Hygiene, and the IDSA, a past president of IDSA, and a member of the International Board and the Communications Committee of the American Society for Microbiology, the Board of Governors of the AAM, the Board of Directors of the EcoHealth Alliance, and the Board of Directors of the One Health Commission. He is a member of the National Academy of Medicine.

Lonnie J. King, D.V.M. (*Vice-Chair*), is the 10th dean of the College of Veterinary Medicine at the Ohio State University (OSU). In addition to leading this college, Dr. King is also a professor of preventive medicine and holds the Ruth Stanton Endowed Chair in Veterinary Medicine. He also serves as the Executive Dean for the seven Health Science Colleges at OSU. Before becoming dean at OSU, he was the director of CDC's new National Center for Zoonotic, Vector-Borne, and Enteric Diseases (NCZVED). In this new position, Dr. King leads the Center's activities for surveillance, diagnostics, disease investigations, epidemiology, research, public education, policy development, and disease prevention and control programs. NCZVED also focuses on waterborne, foodborne, vectorborne, and zoonotic diseases of public health concern, which also include most of CDC's select and bioterrorism agents, neglected tropical diseases, and emerging zoonoses. Before serving as director, he was the first chief of the agency's Office of Strategy and Innovation.

Dr. King served as dean of the College of Veterinary Medicine, Michigan State University, from 1996 to 2006. As at OSU, he served as the CEO for academic programs, research, the teaching hospital, the diagnostic center for population and animal health, basic and clinical science departments, and the outreach and continuing education programs. As dean and professor of large-animal clinical sciences, Dr. King was instrumental in obtaining funds for the construction of a $60 million Diagnostic Center for Population and Animal Health; he initiated the Center for Emerging Infectious Diseases in the college, he served as the campus leader in food safety, and he had oversight for the National Food Safety and Toxicology Center.

In 1992, Dr. King was appointed administrator for the Animal and Plant Health Inspection Service (APHIS), U.S. Department of Agriculture

(USDA), in Washington, DC. In this role, he provided executive leadership and direction for ensuring the health and care of animals and plants, to improve agricultural productivity and competitiveness, and to contribute to the national economy and public health. Dr. King also served as the country's chief veterinary officer for 5 years, worked extensively in global trade agreements within the North American Free Trade Agreement and the World Trade Organization (WTO), and worked extensively with the World Animal Health Association. During this time he was the Deputy Administrator for Veterinary Services of APHIS, USDA, where he led national efforts in disease eradication, imports and exports, and diagnostics in both Ames, Iowa, and Plum Island. He spent 5 years in Hyattsville, Maryland, in staff assignments in Emergency Programs, as well as Animal Health Information. While in Hyattsville, Dr. King directed the development of the agency's National Animal Health Monitoring System. He left APHIS briefly to serve as the director of the Governmental Relations Division of the American Veterinary Medical Association (AVMA) in Washington, DC, and served as the lobbyist for the AVMA on Capitol Hill.

Dr. King was in private veterinary practice for 7 years in Dayton, Ohio, and Atlanta, Georgia. As a native of Wooster, Ohio, Dr. King received his bachelor of science and doctor of veterinary medicine degrees from OSU in 1966 and 1970, respectively. He earned his master of science degree in epidemiology from the University of Minnesota and received his master's degree in public administration from American University in Washington, DC, in 1991. Dr. King is a board-certified member of the American College of Veterinary Preventive Medicine and has completed the Senior Executive Fellowship program at Harvard University. He served as president of the Association of American Veterinary Medical Colleges from 1999 to 2000 and was the vice-chair for the National Commission on Veterinary Economic Issues from 2000 to 2004. He has served on six NAS committees, including chairing the National Academies' Committee on Assessing the Nation's Framework for Addressing Animal Diseases. He was also Chair of the Institute of Medicine (IOM) Committee on Lyme Disease and Other Tick-Borne Diseases and for State of the Science, and he has chaired the AVMA's Commission for AVMA Vision 2020. In addition, he now serves as Chair for the IOM's Committee on Identifying and Prioritizing New Preventive vaccines and served on CDC's National Bio-surveillance Advisory Committee. Dr. King is currently Vice-Chair of the National Academies of Sciences, Engineering, and Medicine Committee on Microbial Threats to Health, is a past member of the U.S. Food and Drug Administration's (FDA's) Board of Scientific Advisors, and is past president of the American Veterinary Epidemiology Society. He served as the chair for the national One Medicine Task Force for the AVMA, which helped start the country's One Health Initiative. Dr. King was elected as a member of the National Academy of Medicine in 2004.

Kevin Anderson, Ph.D., serves as a Senior Program Manager in the U.S. Department of Homeland Security's (DHS's) Science and Technology Directorate, providing oversight and requirements for biodetection and biodiagnostics systems development for government-wide customers and stakeholders. Since joining DHS in 2003, Dr. Anderson has provided leadership for science program development, laboratory design, and strategic planning; served as a subject-matter expert and advisor to the Bioterrorism Risk Assessment and Biological Threat Characterization programs; and has participated in interagency working groups and assessments which provide guidance to medical countermeasure development, a key component of the nation's biodefense strategy. Prior to joining DHS, Dr. Anderson was a Principal Investigator at the U.S. Army Medical Research Institute of Infectious Diseases, leading research focused on understanding basic mechanisms of viral diseases causing hemorrhagic fever and development of medical countermeasures. He received postdoctoral training in molecular virology at the University of Alabama at Birmingham and the University of North Carolina at Chapel Hill, performing basic research on human respiratory syncytial viruses, and earned Ph.D. and B.S. degrees in microbiology from Montana State University and the University of Maryland, College Park, respectively.

COL Michael Bell, M.D., joined the Armed Forces Health Surveillance Center as the director in April 2015. Prior to joining the agency, COL Bell served as the Global Health Engagement Officer for the U.S. Army Assistant Surgeon General for Force Projection, where he was a public health subject-matter expert on multiple working groups to develop Army policy for personal protective equipment, medical evacuation, training, force protection, and post-deployment monitoring and reintegration for the response to the Ebola outbreak in West Africa. He also coordinated a memorandum of agreement between the U.S. Army Medical Command and the World Health Organization (WHO) to establish a framework for their respective roles for joint cooperation on global health issues. As the commander of the U.S. Army Public Health Region–North from August 2012 to July 2014, COL Bell managed more than 500 military and civilian scientists, veterinarians, engineers, and administrative support personnel in a region that comprised 20 states and Azores. He was the U.S. Army Surgeon General's Consultant for Occupational Health and Environmental Medicine from July 2012 to February 2015. He managed the strategies for Occupational Medicine, and ensured that all critical positions were filled. As an associate director, COL Bell managed the National Capital Consortium Occupational and Environmental Medicine Residency at the Uniformed Services University of the Health Sciences from July 2010 to July 2012. As the manager of the U.S. Army Behavioral and Social Health Outcomes Program, COL Bell established a multidisciplinary team of 28

public health physicians, epidemiologists, psychologists, social workers, and medical operations professionals from July 2008 to July 2010. COL Bell graduated from the F. Edward Herbert School of Medicine at the Uniformed Services University of the Health Sciences (USUHS) in 1997, and completed an internship in Internal Medicine at the Madigan Army Medical Center. He followed that up with residency in occupational and environmental medicine at USUHS. He also earned a master's in public health from USHUS. He received two undergraduate degrees: a bachelor of arts in biology from Syracuse University and a bachelor of general management at the University of Alabama.

Enriqueta C. Bond, Ph.D., retired in August 2008 as President of the Burroughs Wellcome Fund (BWF), a private foundation whose mission is to advance the medical sciences through the support of research and education. Dr. Bond is a founding partner of QE Philanthropic Advisors and now consults with philanthropic and nonprofit organizations on program development and governance. Previously Dr. Bond served for nearly 20 years as staff officer and division director at the Institute of Medicine, serving as executive officer from 1989 to 1994.

Dr. Bond serves on numerous board and advisory groups such as the Council of the National Institute of Allergy and Infectious Diseases; the National Academies of Sciences, Engineering, and Medicine Board on Life Sciences and Committee on Developing a Framework for an International Faculty Development Project on Education About Research in the Life Sciences with Dual Use; the Burroughs Wellcome Fund Career Award for Science and Mathematics Advisory Committee; the Board of the Health Effects Institute; and the James B. Hunt Jr. Institute for Educational Leadership.

Dr. Bond currently chairs an Academies Board on Developing the Capacity of African Academies of Science, serves as a member of the Academies Forum on Microbial Threats to Health, and serves as a frequent reviewer of Academy reports. Dr. Bond is a member of the National Academy of Medicine and is a fellow of the Association for the Advancement of Science. She was educated at Wellesley College (A.B.), the University of Virginia (M.A.), and Georgetown University (Ph.D. in genetics and molecular biology).

Luciana Borio, M.D., serves as the Assistant Commissioner for Counterterrorism Policy and Director of the Office of Counterterrorism and Emerging Threats in the Office of the Chief Scientist, FDA. In this capacity, Dr. Borio is responsible for providing leadership, coordination, and oversight for FDA's national and global health security, counterterrorism, and emerging threat portfolios. She serves as FDA's point of entry on policy and planning

matters concerning counterterrorism and emerging threats, including Ebola, and collaborates across the U.S. government and internationally on actions to advance global health security and U.S. national security. She also serves as FDA's Acting Deputy Chief Scientist, responsible for providing leadership and coordination for FDA's crosscutting scientific and public health efforts. Prior to joining FDA as a medical reviewer in 2008, Dr. Borio served as a Senior Associate at the UPMC Center for Biosecurity, Assistant Professor of Medicine at the University of Pittsburgh, and Advisor on Biodefense Programs for the U.S. Department of Health and Human Services. Dr. Borio received her M.D. from the George Washington University and continues to practice medicine at Johns Hopkins Hospital.

Roger G. Breeze, BVMS, Ph.D., MRCVS, is currently Bio-Security Deputy Program Director, Global Security Directorate, Office of Strategic Outcomes, Lawrence Livermore National Laboratory and serves on the senior management team of the Defense Threat Reduction Agency's Chemical and Biological Defense Directorate. He received his veterinary degree in 1968 and his Ph.D. in veterinary pathology in 1973, both from the University of Glasgow, Scotland. He was engaged in teaching, diagnostic pathology, and research on respiratory and cardiovascular diseases at the University of Glasgow Veterinary School from 1968 to 1977 and at Washington State University College of Veterinary Medicine from 1977 to 1987, where he was professor and chair of the Department of Microbiology and Pathology. From 1984 to 1987 he was deputy director of the Washington Technology Center, the state's high-technology sciences initiative, based in the College of Engineering at the University of Washington. In 1987, he was appointed director of the USDA's Plum Island Animal Disease Center, a Biosafety Level 3 facility for research and diagnosis of the world's most dangerous livestock diseases. In that role he initiated research into the genomic and functional genomic basis of disease pathogenesis, diagnosis, and control of livestock RNA and DNA virus infections. This work became the basis of U.S. defense against natural and deliberate infection with these agents and led to his involvement in the early 1990s in biological weapons defense and proliferation prevention. From 1995 to 1998, he was South Atlantic Area Director for USDA's Agricultural Research Service before going to Washington, DC, to establish biological weapons defense programs for USDA. He received the Distinguished Executive Award from President Clinton in 1998 for his work at Plum Island and in biodefense. Since 2004 he has been CEO of Centaur Science Group where his main commitment is to the Defense Threat Reduction Agency's Global Bioengagement Program.

Arturo Casadevall, M.D., Ph.D., is professor and chair of the Department of Molecular Microbiology and Immunology at the Johns Hopkins

Bloomberg School of Public Health. Previously he served as director of the Division of Infectious Diseases at Montefiore Medical Center, the University Hospital and Academic Medical Center for Einstein, from 2000 to 2006 and as chair of the Department of Microbiology and Immunology from 2006 to 2014. Dr. Casadevall received both his M.D. and Ph.D. (biochemistry) degrees from New York University. Subsequently, he completed his internship and residency in internal medicine at Bellevue Hospital in New York. He then completed subspecialty training in infectious diseases at Montefiore and Einstein. The author of more than 620 scientific papers, Dr. Casadevall's major research interests are in fungal pathogenesis and the mechanism of antibody action. In the area of biodefense, he has an active research program to understand the mechanisms of antibody-mediated neutralization of *Bacillus anthracis* toxins. In recent years Dr. Casadevall has become interested in problems with the scientific enterprise and with his collaborators has shown that misconduct accounts for the majority of retracted publications. Dr. Casadevall has suggested a variety of reforms to the way science is done. Dr. Casadevall is the editor-in-chief of *mBio*, the first open-access general journal of the American Society of Microbiology, and is on the editorial board of the *Journal of Clinical Investigation* and the *Journal of Experimental Medicine*. He has also served on numerous NIH committees, including those that drafted the National Institute of Allergy and Infectious Diseases (NIAID) Strategic Plan and the Blue Ribbon Panel on Biodefense Research. He is currently a member of the National Science Advisory Board for Biosecurity and co-chairs the NIAID Board of Scientific Counselors. In 2008, he was recognized by the American Society of Microbiology with the William Hinton Award for mentoring scientists from underrepresented groups. He has been elected to AAAS Fellowship, the American Society for Clinical Investigation, the American Academy of Microbiology, the American Association of Physicians, and the National Academy of Medicine.

Andrew Clements, Ph.D., is the Deputy Director of the Pandemic Influenza and Other Emerging Threats Unit in the U.S. Agency for International Development's (USAID's) Bureau for Global Health. He received his doctorate in anaerobic microbiology from Virginia Tech and completed his post-doctoral training in biochemistry at the National Institutes of Health's National Cancer Institute. Including his Diplomacy Fellowship through the American Association for the Advancement of Science, he has served as an infectious disease advisor at USAID for the past 17 years focusing on the development, management, and monitoring of programs to address tuberculosis, malaria, avian influenza, antimicrobial resistance, and disease surveillance. He is currently the manager of a grant with the UN Food and Agriculture Organization (FAO) to monitor influenzas in animals and the

PREDICT project, part of USAID's Emerging Pandemic Threats program, which monitors wildlife for new zoonotic threats, characterizes the spillover risk associated with specific interfaces between wild animals and humans, and improves models for predicting geographic "hot spots" for emergence of new public health threats. He also analyzes trends for avian influenza and other emerging public health threats and serves as a liaison to USAID missions in the Asia and Near East regions for programs related to avian influenza and emerging pandemic threats.

Peter Daszak, Ph.D., is President of EcoHealth Alliance, a U.S.-based organization which conducts research and outreach programs on global health, conservation, and international development. Dr. Daszak's research has been instrumental in identifying and predicting the impact of emerging diseases across the globe. His achievements include identifying the bat origin of severe acute respiratory syndrome (SARS), identifying the causes of Nipah and Hendra virus emergence, producing the first ever global emerging disease "hot spots" map, identifying the first case of a species extinction due to disease, coining the term "pathogen pollution," and the discovery of the disease chytridiomycosis as the cause global amphibian declines. Dr. Daszak is a member of the National Academies of Sciences, Engineering, and Medicine Forum on Microbial Threats and served on the IOM Committee on Global Surveillance for Emerging Zoonoses, the NRC Committee on the Future of Veterinary Research, and the International Standing Advisory Board of the Australian Biosecurity CRC, and he has advised the Director for Medical Preparedness Policy on the White House National Security Staff on global health issues. Dr. Daszak won the 2000 Commonwealth Scientific and Industrial Research Organisation medal for collaborative research on the discovery of amphibian chytridiomycosis and is Editor-in-Chief of the journal *Ecohealth*. He has authored more than 200 scientific papers, and his work has been the focus of extensive media coverage, ranging from popular press articles to television appearances.

Jeffrey Scott Duchin, M.D., is Chief of the Communicable Disease Epidemiology & Immunization Section for Public Health–Seattle & King County, Washington, and Professor of Medicine, Division of Infectious Diseases and adjunct professor in the School of Public Health at the University of Washington. Dr. Duchin trained in internal medicine at Thomas Jefferson University Hospital. He completed a fellowship in general internal medicine and emergency medicine at the Hospital of the University of Pennsylvania and infectious disease subspecialty training at the University of Washington. After several years on the faculty at the University of Pennsylvania, he joined the CDC's Epidemic Intelligence Service program where he was assigned to the National Center for Infectious Diseases, and the CDC's

Preventive Medicine Residency program. He worked for CDC as a medical epidemiologist in the Divisions of Tuberculosis Elimination and HIV/AIDS Special Studies Branch before assuming his current position.

Dr. Duchin is a member of the CDC's Advisory Committee on Immunization Practices (ACIP). He is a Fellow of the IDSA and is current Chair of the IDSA's Public Health Committee and past-Chair of the IDSA's Bioemergencies Task Force. Dr. Duchin serves on the Editorial Board and Technical Advisory Group for Communicable Disease Alert and Response to Mass Gatherings for the World Health Organization and previously served as a member of the U.S. Department of Health and Human Services (HHS) 2004 Tiger Team consulting with the government of Greece on health preparations for the 2004 Olympics, in Athens, Greece. Dr. Duchin's peer-review publications and research interests focus on communicable diseases of public health significance, and he has authored textbook chapters on outbreak investigations, bioterrorism, and the epidemiology of HIV/AIDS.

Mark B. Feinberg, M.D., Ph.D., is Vice President and Chief Public Health and Science Officer, Merck Vaccines at Merck & Co., Inc. In this role, he is responsible for developing initiatives and partnerships that accelerate the development and global availability of Merck's vaccines, and that maximize their public health impact. In addition, he has led a number of significant initiatives to enable Merck's research and development (R&D) expertise to help address public health challenges impacting resource-poor countries—including the creation of the MSD-Wellcome Trust Hilleman Laboratories and, most recently, coordinating Merck's multisector collaborative Ebola vaccine development effort. Prior to joining Merck in 2004, Dr. Feinberg worked for more than 20 years in both academia and government where he was actively engaged in basic and clinical research, patient care, and health care policy—with a primary focus on HIV/AIDS pathogenesis, treatment, and prevention research and on the biology of emerging infectious diseases.

Dr. Feinberg received his undergraduate degrees in biology and anthropology from the University of Pennsylvania and his M.D. and Ph.D. degrees from Stanford University School of Medicine. He pursued a post-graduate medical training in internal medicine at the Brigham and Women's Hospital and postdoctoral fellowship training in the laboratory of Dr. David Baltimore at the Whitehead Institute for Biomedical Research. Dr. Feinberg has served on the faculty of the University of California, San Francisco, and the Emory University School of Medicine, and as a Medical Officer in the Office of AIDS Research at the National Institutes of Health. He was a Fellow in the Advanced Leadership Initiative at Harvard University in 2012, and a Senior Fellow in this program in 2013. Dr. Feinberg is a Fellow of the American College of Physicians, a member of the Council on Foreign Relations and the Association of

American Physicians, and the recipient of an Elizabeth Glaser Scientist Award from the Pediatric AIDS Foundation.

Aaron M. Firoved, Ph.D., serves as the Senior Biodefense Advisor to the Assistant Secretary for Health Affairs and Chief Medical Officer of DHS. In this position, Dr. Firoved provides scientific and technical expertise to the department's biodefense and pandemic preparedness activities.

Prior to joining the Office of Health Affairs (OHA) in April 2012, Dr. Firoved worked for the U.S. Senate Homeland Security and Governmental Affairs Committee, where he was responsible for a biodefense, disaster medical response, and medical countermeasure portfolio as well as the Committee's programmatic and budgetary oversight of OHA and the department's Science and Technology Directorate.

He served his first year with the Committee as the 2007 American Society for Microbiology Congressional Science Policy Fellow. Previously, Dr. Firoved conducted post-doctoral research studying anthrax pathology at the National Institutes of Health. Dr. Firoved received his Ph.D. in microbiology and immunology from the University of Michigan and his B.S. in microbiology from the University of Washington.

Jacqueline Fletcher, Ph.D., Regents Professor of Plant Pathology at Oklahoma State University, received a B.S. in biology from Emory University, Atlanta, Georgia, an M.S. in botany from the University of Montana, and a Ph.D. in plant pathology from Texas A&M University. She served as a postdoctoral associate at the University of Illinois before joining OSU in 1984, where she was appointed Sarkeys Distinguished Professor in 2001 and Regents Professor in 2008. She was named a Fellow of the American Phytopathological Society (APS) in 2005 and a Fellow of AAAS in 2007.

Dr. Fletcher is Director of the National Institute for Microbial Forensics and Food and Agricultural Biosecurity (NIMFFAB), a multidisciplinary OSU initiative that addresses high-priority national issues in research, teaching/education, and outreach with emphases in microbial forensics applications in plant pathology and produce safety. The NIMFFAB serves as a spoke laboratory for the DHS-affiliated National Bioforensic Analysis Center, in the area of plant pathogen forensics. Dr. Fletcher's research focuses on mechanisms of virulence and insect transmission of plant pathogenic bacteria; on the relationships between human pathogens, such as *Salmonella* and *Escherichia coli*, and plants; and on the emerging disciplines of microbial forensics and agricultural biosecurity.

Dr. Fletcher served on the APS Council for 10 years, including the 4-year APS presidential sequence. In the months following September 11, 2001, Dr. Fletcher led APS responses and input to new national biosecurity initiatives. She served for 9 years on the APS Public Policy Board (4 years

as chair) and is currently on the APS Threatening Pathogens Advisory Committee. She is currently the Chair of the Gordon Research Conference on Chemical and Biological Terrorism Defense for 2015, and serves on several federal biosecurity advisory panels.

Claire Fraser, Ph.D., is Director of the Institute for Genome Sciences at the University of Maryland School of Medicine in Baltimore, Maryland. She has joint faculty appointments at the University of Maryland, School of Medicine, in the Department of Medicine and Microbiology/Immunology. Until 2007, she was President and Director of The Institute for Genomic Research (TIGR) in Rockville, Maryland, and led the teams that sequenced the genomes of several microbial organisms, including important human and animal pathogens. She helped launch the new field of microbial genomics and revolutionized the way microbiology has been studied. In a 1995 landmark publication, a group of TIGR investigators reported on the first complete genome sequence of a free-living organism, *Haemophilus influenzae*. This new approach has, to date, produced DNA sequence data from nearly 1,000 different species across the phylogenetic tree.

Her work on the Amerithrax investigation led to the identification of four genetic mutations in the anthrax spores that allowed the FBI to trace the material back to its original source. She is one of the world's experts in microbial forensics and the growing concern about dual uses—research that can provide knowledge and technologies that could be misapplied.

Dr. Fraser has authored more than 200 publications, edited 3 books, and served on the editorial boards of 9 scientific journals. For the past 10 years, she has been the most highly cited investigator in the field of microbiology. Her list of awards includes the E.O. Lawrence Award, the highest honor bestowed on research scientists by the Department of Energy; the Promega Biotechnology Award from the American Society of Microbiology; and the Charles Thom Award from the Society for Industrial Microbiology. She has been selected as one of Maryland's Top 100 Women Circle of Excellence, and in 2010, was named to the Maryland Women's Hall of Fame.

She has served on many advisory panels for all of the major federal funding agencies, the National Research Council, the U.S. Department of Defense, and the intelligence community. In addition, she has contributed her time as a board member for universities, research institutes, and other nonprofit groups because of her commitment to the education of our next generation of scientists.

Jesse L. Goodman, M.D., M.P.H., is Professor of Medicine at Georgetown University, where he directs a new Center on Medical Product Access, Safety and Stewardship (COMPASS), which focuses on informing science-based policy to address emerging public health needs, including product

development and access, the supply chain, and antimicrobial resistance. He is also Attending Physician in Infectious Diseases at the Georgetown University and Washington, DC, VA Hospitals and the Walter Reed National Military Medical Center. Until February 2014 he was the Chief Scientist of FDA, a position he assumed in 2009 along with Deputy Commissioner for Science and Public Health (2009-2012). As Chief Scientist he had broad responsibility for strategic leadership of FDA's crosscutting scientific and public health efforts, including public health preparedness and medical countermeasures. In that role, he led the 2009 H1N1 pandemic response and medical countermeasure review for FDA, also serving as a member of the HHS Senior Leadership team. From 2003 to 2009 Dr. Goodman was director of FDA's Center for Biologics Evaluation and Research (CBER), overseeing activities critical to U.S. and global preparedness and the development, evaluation, safety, quality, and availability of blood, vaccines, cell and gene therapies, and other biologics. As Senior Advisor to the Commissioner in 1998-1999, he initiated and co-chaired the United States Task Force on Antimicrobial Resistance, which produced the first Public Health Action Plan to Combat Antimicrobial Resistance. He has served on numerous CDC, NIH, U.S. Department of Defense (DoD), and WHO Advisory and Review Committees, and was a member of the Decade of Vaccines Research and Development Group. Prior to his service at FDA, he was Professor of Medicine and Chief of Infectious Diseases at the University of Minnesota, where his NIH-funded laboratory first isolated and characterized the biology of *Anaplasma phagocytophilum*, an emerging tick-borne infection. A graduate of Harvard, Dr. Goodman received his M.D. from the Albert Einstein College of Medicine and did residency and fellowship training at the Hospital of the University of Pennsylvania and at the University of California, Los Angeles, where he was also Chief Medical Resident. Dr. Goodman is board certified in medicine, infectious diseases, and oncology and has authored numerous scientific papers and edited the book *Tick Borne Diseases of Humans* (ASM Press). He has been elected to the American Society for Clinical Investigation and to the National Academy of Medicine.

Eduardo Gotuzzo, M.D., is principal professor of the Department of Medicine and Director of the "Alexander von Humboldt" Institute of Tropical Medicine and Infectious Diseases, Peruvian University Cayetano Heredia in Lima, Peru, and head of the Department of Transmissible Diseases at the Cayetano Heredia Hospital. He is also an adjunct professor of medicine at the University of Alabama, Birmingham, School of Public Health. He is Director of the International Gorgas Course in Clinical Tropical Medicine, Peruvian University Cayetano Heredia, taught jointly with the University of Alabama at Birmingham. He is an adjunct faculty member of the William

J. Harrington Training Programs for Latin America, University of Miami School of Medicine (since 1983); is associate to the International Health Department of the Johns Hopkins University (1986-2005); and was a Fellow of the Center for the Americas at Vanderbilt, Vanderbilt University. Dr. Gotuzzo is an active member in numerous international societies and has been a member of the IDSA Scientific Program (2000-2003) and the International Organizing Committee of the International Congress of Infectious Diseases (1994), and president of the International Society for Infectious Diseases (1998-2000), the Pan American Infectious Diseases Association, the International Federation for Tropical Medicine (2005-2008), and the Peruvian Society of Internal Medicine (1991-1992). He works on several research areas and teaches on subjects including emerging diseases, TB, HTLV-1, free-living amoebas, brucellosis, typhoid fever, cholera, and parasites. He has published more than 400 articles and 50 chapters as well as 6 manuals and 2 books. Recent honors and awards include being named an honorary member of the American Society of Tropical Medicine and Hygiene in 2002; an honorary member of the Peruvian Society of Internal Medicine in 2000; and a distinguished visitor at the Faculty of Medical Sciences, University of Cordoba, Argentina (1999). In 1998 Dr. Gotuzzo received the Golden Medal for Outstanding Contribution in the Field of Infectious Diseases awarded by Trnava University, Slovakia. In 2007, Dr. Gotuzzo received the Society Citation Award from the IDSA. He is an honorary member of the Australian Society for Infectious Diseases (2008), the American Society of Tropical Medicine and Hygiene (2002), Sociedad Venezolana de Infectología (1997), Sociedad Paraguaya de Infectología (2009), and the National Academy of Medicine of Mexico (2010). He is also member of the Steering Committee of Zoonosis Diseases of WHO (2009-2011), member of the Strategic and Technical Advisory Group on Neglected Diseases of WHO (2010-2015), and international member of Texas Medical Branch's Center for Tropical Diseases (2012).

Dr. Gotuzzo also received the "XI Annual Esteban Campodónico Figallo Prize" (2005) and the Award Southern Peru Medal "Cristóbal de Losada y Puga" by Pontificia Universidad Católica del Perú (2010), and he is Doctor Honoris Causa, Universidad "San Luis Gonzaga" (Ica-Perú) (2011). The Peruvian talent award in recognition of the research performed, given by the Committee on Science and Technology of Peruvian Congress (2013), the "Carlos Slim" award in 2013 for his performance on the investigation, México, and finally the "Abraham Valdelomar" medal given by Ica Region, Peru.

Jennifer Grady, Ph.D., is both a scientist and a science communicator. As an assistant professor in the School of Population and Public Health at the University of British Columbia (UBC), Dr. Grady holds a Tier 2

Canada Research Chair in Public Health Genomics. Situated at the British Columbia Centre for Disease Control (BCCDC), her laboratory uses microbial genomics, phylogenetics, and bioinformatics to understand the transmission and epidemiology of infectious diseases, including tuberculosis, influenza, and measles. Her group was the first to use genome sequencing to reconstruct a large outbreak of tuberculosis, and she is continuing to apply this novel technique to other outbreak scenarios. She is also involved in other genomics-related research, including metagenomic surveys of human and environmental samples. She completed a Ph.D. in microbial genomics and bioinformatics at Simon Fraser University in 2006 under Dr. Fiona Brinkman, as well as a post-doctoral fellowship in the systems biology of innate immunity with Dr. R. E. W. Hancock at UBC, before joining BCCDC in 2009.

Outside of academia, Dr. Grady works in science communication. She's hosted an eight-part science series for CBC Television, multiple episodes of CBC's long-running documentary series *The Nature of Things*, and is a regular guest host on Discovery Channel Canada's flagship science newsmagazine, *Daily Planet*. She's also blogged and written for Canadian newspaper *The Globe & Mail*, recently published a children's book called *It's Catching! The Infectious World of Germs and Microbes*, and runs a series of workshops for graduate students and postdoctorals on how to communicate science effectively.

Carole A. Heilman, Ph.D., serves as Director of the Division of Microbiology and Infectious Diseases (DMID) of NIAID, a component of NIH. DMID supports research to prevent and control diseases caused by virtually all human infectious agents (except HIV), including bacterial, viral, parasitic, and fungal diseases. The Division supports a wide variety of projects spanning the spectrum from basic biology of human pathogens and their interaction with human hosts, through translational and clinical research, toward the development of new and improved diagnostics, drugs, and vaccines for infectious diseases. As Director, Dr. Heilman provides scientific direction, oversight, and management for an extramural research portfolio that encompasses approximately 300 different organisms.

DMID supports the nation's biodefense as well as a solid research infrastructure that readily responds to public health challenges, such as emerging diseases. These resources were mobilized to respond to the emergence of 2009 H1N1 influenza by providing the first in-depth characterization of the H1N1 pandemic virus and conducting nine clinical trials that provided safety and efficacy data to inform public health practice.

Dr. Heilman has a Ph.D. in microbiology from Rutgers University. She did her post-doctoral work in molecular virology at the National Cancer Institute (NCI) and continued at the NCI as a senior staff fellow in molecu-

lar oncology. She later moved into health science administration, where she focused on respiratory pathogens, particularly vaccine development. Dr. Heilman has received numerous awards for scientific management and leadership, including three HHS Secretary's Awards for Distinguished Service recognizing her efforts on development of acellular pertussis vaccines, AIDS vaccines, and on accelerating R&D in biodefense and emerging infectious diseases. In 2010, she received the Distinguished Alumni Award from the Boston University College and Graduate School of Arts and Sciences and in 2011 she received the Distinguished Alumni Award from the University of Medicine and Dentistry of New Jersey Graduate School of Biomedical Sciences.

Dr. Heilman serves as an infectious disease expert on the Board of Scientific Counselors for CDC. She also serves on the scientific board of the Fondation Mérieux's annual Advanced Course of Vaccinology. Throughout her career, Dr. Heilman has been a pioneer supporting the advancement of women in biomedical careers and serves as a mentor to a number of women within and outside of NIAID.

David Heymann, M.D., CBE, is currently Head of the Centre on Global Health Security at Chatham House, London, Professor of Infectious Disease Epidemiology at the London School of Hygiene & Tropical Medicine, and Chairman of Public Health England, United Kingdom. Previously he was the World Health Organization's Assistant Director-General for Health Security and Environment and the representative of the Director-General for polio eradication. From 1998 to 2003 he was Executive Director of the WHO Communicable Diseases Cluster and from October 1995 to July 1998 he was Director of the WHO Programme on Emerging and other Communicable Diseases. Prior to that, he was the Chief of research activities in the WHO Global Programme on AIDS.

Before joining WHO, Dr. Heymann worked for 13 years as a medical epidemiologist in sub-Saharan Africa on assignment from CDC. In this capacity he supported ministries of health in designing and implementing programs in infectious disease prevention and control, with emphasis on childhood diseases, malaria, and the African hemorrhagic fevers. Prior to that, he worked in India for 2 years as a medical epidemiologist in the WHO Smallpox Eradication Programme.

He is a member of the National Academy of Medicine and Fellow of the Academy of Medical Sciences (UK); he has been awarded the 2004 Award for Excellence of American Public Health Association, the 2005 Donald Mackay Award from the American Society for Tropical Medicine and Hygiene, and the 2007 Heinz Award on the Human Condition. In 2009 he was appointed an honorary Commander of the Most Excellent Order of the British Empire (CBE) for services to global public health. He

is currently the editor of the 19th edition of the *Control of Communicable Diseases Manual*, a joint publication of the American Public Health Association and WHO.

Stephen Albert Johnston, Ph.D., is currently co-director of the Center for Innovations in Medicine (CIM) in the Biodesign Institute at Arizona State University. CIM focuses on inventing and implementing disruptive technologies for basic problems in health care. CIM currently has three major projects: developing a universal prophylactic cancer vaccine, creating a simple method for continuous health monitoring through immunosignatures, and improving synbody therapeutics for treatment of chronic diseases and infections. Dr. Johnston founded the Center for Biomedical Inventions (also known as the Center for Translation Research) at the University of Texas, Southwestern, the first center of its kind in the medical arena. He and his colleagues have developed numerous inventions and innovations, including the gene gun, genetic immunization, TEV protease system, organelle transformation, digital optical chemistry arrays, expression library immunization, linear expression elements, synbodies, immunosignature diagnosis, and others. He also was involved in transcription research for years, first cloning *Gal4* and later discovering functional domains in transcription factors and the connection of the proteasome to transcription. He has been professor at the University of Texas Southwestern Medical Center at Dallas and associate and assistant professor at Duke University. He has been involved in several capacities as an adviser on biosecurity since 1996 and is a founding member of BioChem 20/20.

Gerald T. Keusch, M.D., is Professor of Medicine and International Health at Boston University where he serves as an Associate Director of the National Emerging Infectious Diseases Laboratory. He is a graduate of Columbia College and Harvard Medical School, trained in internal medicine and infectious diseases. His research has focused on tropical infectious diseases and their impact in developing countries, ranging from molecular pathogenesis to field research on diarrheal disease, nutrition-infection interactions, and HIV/AIDS. He is the author of over 300 original publications, reviews, and book chapters, and the editor of eight scientific books. Dr. Keusch is the recipient of the Oswald Avery and Alexander Fleming Awards and delivered the Society's Maxwell Finland Lecture from the Infectious Diseases Society of America and the Distinguished Leadership in Global Health Award from the Consortium of Universities for Global Health. He is a member of the American Society for Clinical Investigation, the Association of American Physicians, the National Academy of Medicine, and a Fellow of the American Society for Microbiology. Prior to his present appointments, he was Associate Director for International Research in the

Office of the Director, and Director of the Fogarty International Center, both at the National Institutes of Health (1998-2004); Chief of the Division of Geographic Medicine and Infectious Diseases at Tufts Medical Center (1979-1998); and a faculty member at Mount Sinai School of Medicine (1970-1978).

Rima F. Khabbaz, M.D., is Deputy Director for Infectious Diseases and Director of the Office of Infectious Diseases at CDC. Prior to her current position, she served as Director of CDC's National Center for Preparedness, Detection, and Control of Infectious Diseases and held other leadership positions across the agency's infectious disease national centers. She is a graduate of the American University of Beirut, Lebanon, where she obtained both her bachelor's degree in science and her medical doctorate degree. She trained in internal medicine and completed a fellowship in infectious diseases at the University of Maryland, Baltimore. She joined CDC in 1980 as an epidemic intelligence service officer, working in the Hospital Infections Program. During her CDC career, she has made major contributions to advance infectious disease prevention, including leadership in defining the epidemiology of non-HIV retroviruses (HTLV-I and II) in the United States and developing guidance for counseling HTLV-infected persons, establishing national surveillance for hantavirus pulmonary syndrome following the 1993 U.S. outbreak, and developing CDC's blood safety and food safety programs related to viral diseases. She has also played key roles in CDC's responses to outbreaks of new and/or reemerging viral infections, including Nipah, Ebola, West Nile, SARS, and monkey pox, as well as the 2001 anthrax attacks. She is a fellow of the IDSA and member of the American Epidemiologic Society, the ASM, the Council of State and Territorial Epidemiologists, and the American Society for Tropical Medicine and Hygiene. She served on IDSA's Annual Meeting Scientific Program Committee and currently serves on the society's Public Health Committee. In addition to her CDC position, she serves as adjunct professor of medicine (infectious diseases) at Emory University. She is a graduate of the National Preparedness Leadership Initiative at Harvard University and of the Public Health Leadership Institute at the University of North Carolina.

COL Mark G. Kortepeter, M.D., M.P.H., is Associate Dean for Research at the School of Medicine, USUHS. He recently served as the Director of the Infectious Disease Clinical Research Program (IDCRP) at USUHS from August 2010 to March 2014. The IDCRP conducts clinical research on militarily relevant infectious diseases at 10 medical treatment facilities across the country. An Associate Professor of Medicine and Preventive Medicine and Biodefense Consultant for the Army Surgeon General, Dr. Kortepeter is board certified in infectious diseases and preventive medicine. Dr. Kortepeter

received his B.A. from Harvard College, his M.D. from New Jersey Medical School, and his M.P.H. from Harvard School of Public Health. He spent seven and a half years at the U.S. Army Medical Research Institute of Infectious Diseases, where he served in several roles, including Deputy Commander (equivalent to Chief Operations Officer), Deputy Chief of the Virology Division, and Chief of the Medical Division. His deployments include Chief of Preventive Medicine for the U.S. forces in Bosnia in 1997 and the Special Medical Augmentation/Response Team for Investigational New Drugs, Operations Enduring and Iraqi Freedom, Kuwait, in 2003. His other prior assignments include staff internist at Fort Bragg, North Carolina, and Chief of Preventive Medicine at Fort Sill, Oklahoma. COL Kortepeter has specific expertise and interest in the pathophysiology of Ebola virus infection and investigational vaccines and treatments as well as management of laboratory exposures to potential biological weapons threats.

Stanley M. Lemon, M.D., is Professor of Medicine and Microbiology and Immunology within the School of Medicine at the University of North Carolina at Chapel Hill,. He received his undergraduate A.B. degree in biochemical sciences from Princeton University summa cum laude and his M.D. with honors from the University of Rochester. He completed post-graduate training in internal medicine and infectious diseases at the University of North Carolina at Chapel Hill, and is board certified in both. From 1977 to 1983 he served with the U.S. Army Medical Research and Development Command, followed by a 14-year period on the faculty of the University of North Carolina where he was Chief of the Division of Infectious Diseases. He moved to the University of Texas Medical Branch in 1997, serving first as chair of the Department of Microbiology & Immunology, then as dean of the School of Medicine from 1999 to 2004, returning to Chapel Hill in 2010. Dr. Lemon's research interests focus on the molecular virology and pathogenesis of hepatitis viruses, particularly hepatitis C, and the role of innate immunity protection against viral hepatitis. He has had a longstanding interest in antiviral and vaccine development and has served as chair of both the Anti-Infective Drugs Advisory Committee and the Vaccines and Related Biologics Advisory Committee of the FDA. He is the past chair of the Steering Committee on Hepatitis and Poliomyelitis of the WHO Programme on Vaccine Development, and the NCID-CDC Board of Scientific Counselors and currently a member of the National Science Advisory Board on Biosecurity and the U.S. Delegation to the U.S.–Japan Cooperative Medical Sciences Program. He has served as chair of the National Academies of Sciences, Engineering, and Medicine's Forum on Microbial Threats, was chair of the IOM study committee on a Strategy for Minimizing the Impact of Naturally Occurring Infectious Diseases of Military Importance: Vaccine Issues in the U.S. Military, co-chair of the

NAS Committee on Advances in Technology and the Prevention of Their Application to Next Generation Biowarfare Threats, and is a past member of the Academies Board on the Health of Select Populations.

COL Emil P. Lesho, D.O., is originally from White Haven, Pennsylvania. He is a 1990 graduate of the Philadelphia College of Osteopathic Medicine and is board certified in internal medicine and infectious diseases. He has been an active-duty Army physician for over 20 years and is currently assigned to the Walter Reed Army Institute of Research in Silver Spring, Maryland, where he co-founded and is the Director of the Multidrug-resistant Organism Repository and Surveillance Network (MRSN).

The MRSN is the DoD's flagship agency for conducting epidemiologic surveillance and in-depth whole-genome characterization of multidrug-resistant organisms. Dr. Lesho also serves as an attending physician in both internal medicine and infectious diseases at the Walter Reed National Military Medical Center in Bethesda, Maryland, and as a staff infectious diseases physician at the University of Maryland's R. Adams Cowley Shock Trauma Center in Baltimore, Maryland. While serving as the Director of the MRSN, he won the 2010 and 2013 Military Health System's Award for Healthcare Innovations in Infection Control.

Prior to this assignment, COL Lesho was the Brigade Surgeon 214th Fires Brigade, Forward Operating Base Delta, Iraq, and the Senior Medical Officer/Officer in Charge, U.S. Military Hospital, al-Kut, Iraq (2007-2008). While there, he led and published two separate studies in antibiotic resistance: one in newly constructed hospitals and one in evacuation vehicles involved in explosions. He currently holds appointment as an Associate Professor of Medicine at the Uniformed Services University of the Health Sciences, Bethesda, Maryland, as a Clinical Assistant Professor of Medicine at the University of Maryland, School of Medicine, Baltimore, Maryland, and as an Adjunct Clinical Associate Professor in the Department of Clinical Medicine at Pacific Northwest University of Health Sciences College of Osteopathic Medicine, Yakima, Washington.

Dr. Lesho has been awarded the "A" Proficiency Designator in both internal medicine and in infectious diseases, the Army's highest award for clinical excellence. He has 106 publications in peer-reviewed journals (57 as first author), including *Lancet Infectious Diseases*, *Clinical Infectious Diseases*, the *Journal of Infectious Diseases*, and *Infections Control and Hospital Epidemiology*, and he has lectured extensively both nationally and internationally on various internal medicine and infectious diseases topics, and most recently on the escalating crisis of antibiotic resistance.

Margaret McFall-Ngai, Ph.D., is a professor in the Department of Medical Microbiology and Immunology at the University of Wisconsin–Madison.

Her research program has combined her training experiences in both organismal and molecular biology, resulting in the development of two major focuses: (1) host-bacterial symbiosis; and (2) the "design" of tissues that interact with light. The experimental strategy for both areas of research relies on methods that have emerged from the study of the squid-vibrio symbiotic association over the past 20 years. In addition, she has had a longstanding interest in the history and development of the field of microbial symbiosis and its impact on biology. A focused effort in this area promises to drive an unprecedented integration across biology as a whole, and will revolutionize the way we think about all aspects of the biosphere.

Dr. McFall-Nagi received her Ph.D. degree from the University of California, Los Angeles (UCLA), in 1983. In recognition of her contributions during her graduate career, she was named Graduate Woman of the Year at UCLA in 1983. Her postdoctoral work at Jules Stein Eye Institute (UCLA Medical Center) and Scripps Institution of Oceanography (UC San Diego) focused on protein biochemistry and biophysics. Combining the training from these experiences, she accepted a faculty position in Biological Sciences at the University of Southern California (USC), where she began studies on the role of beneficial bacteria in the promotion of health in animals using the squid-vibrio model. For these efforts and for excellence in teaching, she received the Albert S. Raubenheimer Award for Outstanding Junior Faculty at USC in 1994. After receiving tenure at USC, she was recruited to the Kewalo Marine Laboratory at the University of Hawaii (UH) in 1996. While at UH, she received a grant from the WM Keck Foundation to develop genomic tools for the study of her model, and from The Rockefeller Foundation to organize an international meeting on symbiosis at the Rockefeller Conference Center in Bellagio, Italy. For her contributions to the field of microbiology, she was elected to the American Academy of Microbiology in 2002. In the same year, she received the Regents' Medal for Excellence in Research in recognition of her scholarship at UH. She was also involved in several leadership positions while in Hawaii, including serving as the Chair of the Rhodes Scholar Committee for the State of Hawaii. In 2004, Dr. McFall-Ngai accepted a position at the University of Wisconsin–Madison in the Department of Medical Microbiology and Immunology. Dr. McFall-Ngai was awarded a Guggenheim fellowship for the academic year 2009-2010 to investigate the role of symbiosis in shaping evolutionary selection on the form and function of animal systems. In addition, she recently served as a member of the Board of Life Sciences of the National Academy of Sciences.

Dr. McFall-Nagi is currently serving as the Chair of the national meeting of the American Society for Microbiology. She also serves on the Scientific Advisory Board of the Global Health Institute (EPFL, Switzerland). In addition to her professorship at UW-Madison, she currently holds several

additional academic positions. The year 2010-present, she is an EU/Marie Curie ITN Professor of the Max Planck Institute. For the academic year of 2011-2012, she holds a Gordon and Betty Moore Visiting Professorship at California Institute of Technology. She also holds an A.D. White Professorship-at-Large (2011-2016) at Cornell University. She was elected as a member of the American Academy of Arts and Sciences in 2012.

Edward McSweegan, Ph.D., is a program officer at NIAID. He graduated from Boston College in 1978 (B.S.) and has degrees in microbiology from the University of New Hampshire (M.S.) and the University of Rhode Island (Ph.D.). He was a National Research Council Associate (1984-1986) and did post-doctoral research at the Naval Medical Research Institute in Bethesda, Maryland. Dr. McSweegan then served as an AAAS Diplomacy Fellow in the U.S. State Department (1986-1988), helping to negotiate science and technology agreements with Poland, Hungary, and the former Soviet Union. After moving to the Office of Tropical Medicine and International Research at NIAID, he continued to work on international health and science projects in Egypt, India, Israel, and Russia. Dr. McSweegan also served as a guest scientist at the National Institute of Diabetes and Digestive and Kidney Diseases, helped write technical guidance for electronic versions of FDA drug applications at CBER, and assisted the President's Emergency Plan for AIDS Relief under the CDC's International Experience and Technical Assistance Program in Swaziland, Africa. Dr. McSweegan manages the Indo-U.S. Vaccine Action Program at NIAID, and represented NIAID in the HHS Biotechnology Engagement Program with Russia and related countries. He is a member of AAAS, the American Society for Microbiology, and the National Science Writers Association. He is the author of numerous journal articles and freelance science articles, and was a columnist for the Annapolis, Maryland newspaper, *The Capital*. He has won a number of local and national awards for his writing.

Paula J. Olsiewski, Ph.D., joined the Alfred P. Sloan Foundation as a Program Director in 2000 to spearhead the Foundation's program to reduce the threat of bioterrorism. Dr. Olsiewski now directs the Microbiology of the Built Environment program and the Synthetic Biology Initiative. She oversees the Sloan Public Service Awards and the Sloan Awards for Excellence in Teaching Science and Mathematics. She is also developing a new program in chemistry.

Dr. Olsiewski serves on numerous advisory committees and boards. She was recently elected to the board of the Spondylitis Association of America. From 2005 to 2012 she was a member of the advisory board for the National Consortium for the Study of Terrorism and Responses to Terrorism, a Center of Excellence of the U.S. Department of Homeland

Security based at the University of Maryland. She served as a member of the MIT Corporation (2003-2009), was President of the MIT Alumni Association (2003-2004), and served on the MIT Initiative on Faculty Race and Diversity Advisory Committee (2008-2009). She was a member of the NRC/IOM Committee on Advances in Technology and the Prevention of Their Application to Next Generation Biowarfare Threats, which produced the 2006 report *Globalization, Biosecurity, and the Future of Life Sciences*.

Prior to joining the Foundation, Dr. Olsiewski served in many capacities in the biotech and biomedical community. She directed the New York City Biotechnology Initiative, a state-funded program under the auspices of the New York Biotechnology Association, to improve the region's ability to grow biotechnology companies by fostering relationships between academia and industry. She established and directed the technology licensing office at the Hospital for Special Surgery, an affiliate of Weill Medical College of Cornell University. Dr. Olsiewski has served as a consultant on numerous projects, providing technical analysis of biomedical companies and technologies for investment banking groups and state economic development agencies. She worked for 9 years at Enzo Biochem, Inc., a publicly traded biotechnology company, where she directed commercial development activities for a variety of in vitro diagnostic products.

Dr. Olsiewski received a bachelor of science in chemistry from Yale College in 1975 and a doctorate in biological chemistry from MIT in 1979.

Julie Pavlin, M.D., Ph.D., M.P.H., is the Deputy Director of the Armed Forces Health Surveillance Center and a retired Colonel in the U.S. Army. Prior to her current position, she was the director of the Epidemiology and Biostatistics Division at the Uniformed Services University. She also served as Chief of the Global Emerging Infections Department at the Armed Forces Research Institute of Medical Sciences in Bangkok, Thailand, where she developed surveillance programs for infectious diseases in Asia and the Chief of the Field Studies Department at the Walter Reed Army Institute of Research where she played a pivotal role in developing the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE), the Department of Defense real-time surveillance system. Dr. Pavlin received her A.B. from Cornell University, her M.D. from Loyola University her M.P.H. from Harvard University, and her Ph.D. in Emerging Infectious Diseases at the Uniformed Services University. She completed her residency at Madigan Army Medical Center and is board certified in General Preventive Medicine and Public Health. Her current research interests include innovative disease surveillance methods and infectious disease epidemiology in developing countries.

George Poste, Ph.D., D.V.M., is chief scientist, Complex Adaptive Systems Initiative, and Del E. Webb Professor of Health Innovation at Arizona State University (ASU). He assumed this post in 2009. From 2003 to 2009 he directed and built the Biodesign Institute at ASU. In addition to his academic post, he serves on the Board of Directors of Monsanto, Exelixis, Caris Life Sciences, LGC, and the Scientific Advisory Board of Synthetic Genomics. From 1992 to 1999 he was Chief Science and Technology Officer and President, R&D, of SmithKline Beecham (SB). During his tenure at SB he was associated with the successful registration of 31 drug, vaccine, and diagnostic products. In 2004 he was named "R&D Scientist of the Year" by *R&D Magazine*, in 2006 he received the Einstein award from the Global Business Leadership Council, and in 2009 he received the Scrip Lifetime Achievement award voted by the leadership of the global pharmaceutical industry.

He has published more than 350 research papers and edited 14 books on pharmaceutical technologies and oncology. He has received honorary degrees in science, law, and medicine for his research contributions and was honored in 1999 by Her Majesty Queen Elizabeth II as a Commander of the British Empire for his contributions to international security. He is a Fellow of the Royal Society, the Royal College of Pathologists, the UK Academy of Medicine; a member of the Council on Foreign Relations; and a former Distinguished Fellow at the Hoover Institution, Stanford University. He has served on numerous government panels related to biosecurity and national competitiveness.

David Rizzo, Ph.D., received his doctorate in plant pathology from the University of Minnesota and subsequently joined the faculty of the University of California Davis, Department of Plant Pathology and the Graduate Group in Ecology in 1995. In 2013, Dr. Rizzo became chair of the Department of Plant Pathology. Research in his laboratory focuses on the ecology and management of forest tree diseases, including diseases caused by both native and introduced pathogens. Research in the laboratory takes a multiscale approach ranging from experimental studies on the basic biology of organisms to field studies across forest landscapes. Active collaborations include projects with landscape ecologists, epidemiologists, molecular biologists, entomologists, and forest managers. The primary research effort in the laboratory is currently *Phytophthora* species in California coastal forests, with an emphasis on Sudden Oak Death. As part of his research on Sudden Oak Death, Dr. Rizzo also serves as the scientific advisor for the California Oak Mortality Task Force. In conifer forests of the Sierra Nevada Mountains, the laboratory studies a variety of diseases and their relationship to past and present forest management and conservation issues. In addition to research, Dr. Rizzo teaches undergraduate and

graduate courses in mycology as well as introductory biology. Since 2004, he has been director of the Science and Society program in the College of Agricultural and Environmental Sciences. Science and Society is an academic program designed to offer students the opportunity to discover the interdisciplinary connections that link the biological, physical, and social sciences with societal issues and cultural discourses.

Gary A. Roselle, M.D., FACP, is the Director of the National Infectious Diseases Service for VA Central Office in Washington, DC, as well as the Chief of the Medical Service at the Cincinnati VA Medical Center. He is a professor of medicine in the Department of Internal Medicine, Division of Infectious Diseases, at the University of Cincinnati College of Medicine and Associate Chairman of the University of Cincinnati's Department of Internal Medicine. Dr. Roselle serves on several national advisory groups including the Advisory Council for the Elimination of Tuberculosis, the Federal TB Task Force, the Interagency Task Force on Antimicrobial Resistance, the Health and Human Services Steering Committee to Prevent Healthcare-Associated Infections, the White House's Sub-Interagency Policy Committee for Biosurveillance, and the Centers for Disease Control and Prevention Healthcare Infection Control Practices Advisory Committee. He has received commendations from the Under Secretary for Health for VA and the Secretary of VA for his work in the Infectious Diseases Program for VA. He has been an invited speaker at national and international meetings and has published more than 100 papers and several book chapters, and is a reviewer for numerous scientific and medical journals. Dr. Roselle received his medical degree from The Ohio State University School of Medicine. He served his residency at the Northwestern University School of Medicine and his infectious diseases fellowship at the University of Cincinnati, College of Medicine.

Janet Shoemaker is Director of the ASM's Public Affairs Office, a position she has held since 1989. She is responsible for managing the legislative and regulatory affairs of this 37,400-member organization, the largest single life science society in the world. Previously, she held positions as assistant director of public affairs for the ASM and as ASM coordinator of the U.S.–U.S.S.R. Exchange Program in Microbiology. She received her baccalaureate, cum laude, from the University of Massachusetts and graduate studies at the George Washington University programs in public policy and in editing and publications. She is a member of Women in Government Relations, the American Society of Association Executives, and AAAS. She has co-authored articles on research funding, biotechnology, biodefense, and public policy issues related to microbiology, and she has participated in advisory committees for the U.S. government on policy issues related to microbiology.

Jay Siegel, M.D., is Chief Biotechnology Officer and Head of Scientific Strategy and Policy for Johnson & Johnson. In these roles, he is actively engaged in R&D leadership and in policy development at the national and international levels with regard to scientific and regulatory issues. He currently serves on the Executive Committees and the Boards of Directors of the Biotechnology Industry Organization and the Alliance for Regenerative Medicine. Dr. Siegel joined Johnson & Johnson in 2003 as President of Centocor Research & Development, Inc., and subsequently served as Group President of R&D with oversight of research and development in biotechnology, immunology and oncology. Dr. Siegel later served as Head of Global Regulatory Affairs for Janssen, the pharmaceutical companies of Johnson & Johnson, and led the company's Biotechnology Center of Excellence. Before joining Johnson & Johnson, Dr. Siegel spent 20 years at the FDA Center for Biologics Evaluation and Research in positions of increasing responsibility regulating the biotechnology industry. Dr. Siegel received a B.S. in biology from the California Institute of Technology and an M.D. from Stanford University. He trained in internal medicine at the University of California, San Francisco, and in infectious diseases and immunology at Stanford University. Dr. Siegel is recipient of numerous honors including the U.S. Public Health Service's highest honor, the Distinguished Service Medal and, twice, the HHS Secretary's Award for Distinguished Service. He has been elected to fellowship in the American College of Physicians and the Society for Clinical Trials and has authored numerous publications in the areas of clinical trial design, biotechnology, immunology, and drug development policy.

Mary E. Wilson, M.D., is Adjunct Professor of Global Health and Population at the Harvard School of Public Health. For 2014-2015 she is Visiting Professor of Epidemiology and Biostatistics, School of Medicine, University of California, San Francisco. Her academic interests include the ecology of infections and emergence of microbial threats, travel medicine, tuberculosis, and vaccines. She received her M.D. from the University of Wisconsin and completed an internal medicine residency and infectious disease fellowship at the Beth Israel Hospital in Boston. She was Chief of Infectious Diseases at Mount Auburn Hospital, a Harvard-affiliated community teaching hospital in Cambridge, Massachusetts, for more than 20 years. She is a Fellow in the IDSA, the American College of Physicians, and the American Society of Tropical Medicine and Hygiene. She has served on ACIP of CDC, the Academic Advisory Committee for the National Institute of Public Health in Mexico, and on five committees for the IOM of the National Academies of Sciences, Engineering, and Medicine. She has worked in Haiti at the Albert Schweitzer Hospital and led the Harvard-Brazil Collaborative Course on Infectious Diseases, taught in Brazil. In 1996 she was a resident

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Edward You is a Supervisory Special Agent in the FBI's Weapons of Mass Destruction Directorate, Biological Countermeasures Unit. Mr. You is responsible for creating programs and activities to coordinate and improve FBI and interagency efforts to identify, assess, and respond to potential intentional biological threats or incidents. These efforts include expanding FBI engagement with the life sciences community to address biosecurity. Before transferring to the Weapons of Mass Destruction Directorate, Mr. You was a member of the FBI Joint Terrorism Task Force in Los Angeles for 4 years. Mr. You has also been directly involved in policy-making efforts with a focus on biosecurity. He holds ex officio positions on the NIH National Science Advisory Board for Biosecurity, and the Synthetic Biology and Engineering Research Center Strategic Advisory Board. He also serves as an active Working Group member of the National Security Council Interagency Policy Committee on Countering Biological Threats; was the FBI representative on the Executive Order 13546 Select Agent Program Federal Experts Security Advisory Panel; and presented, on behalf of the FBI, to the Presidential Commission for the Study of Bioethical Issues regarding biosecurity and synthetic biology. Prior to joining the FBI, Mr. You worked for 5 years in graduate research on human gene therapy and retrovirology at the University of Southern California, Keck School of Medicine. He subsequently worked for 3 years at the biotechnology firm Amgen Inc. developing cancer therapeutics.