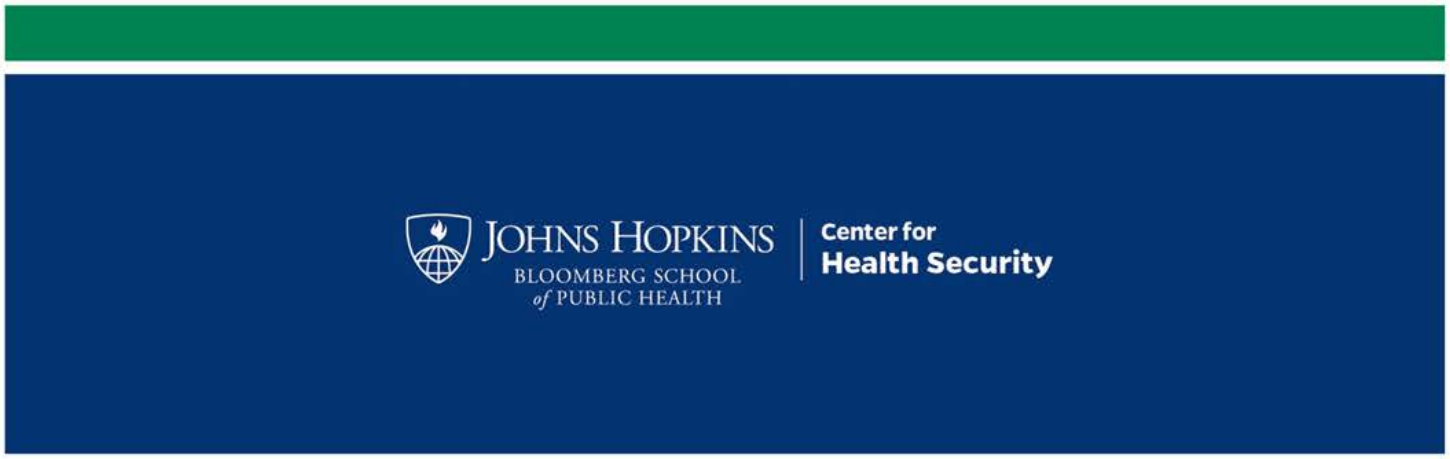
Global Health Security in South Asia

Johns Hopkins Center for Health Security
Report from the July 10, 2018, meeting in Washington, DC

September 2018



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This meeting was sponsored by the Project on Advanced Systems and Concepts for Countering WMD (PASCC; sponsored by the Defense Threat Reduction Agency, DTRA) of the US Air Force Institute for National Security Studies.

Table of Contents

Executive Summary

On July 10, 2018, in Washington, DC, the Johns Hopkins Center for Health Security hosted a meeting on global health security in South Asia. The goal of the meeting was to discuss health security challenges in South Asia and to identify opportunities for implementation of health security initiatives. The meeting was sponsored by the Project on Advanced Systems and Concepts for Countering WMD (PASCC; sponsored by the Defense Threat Reduction Agency, DTRA) of the US Air Force Institute for National Security Studies.

Invited speakers provided insights about the progress on the Global Health Security Agenda (GHSA), financing and investment challenges and opportunities, and the importance of both scientific and biosafety engagement between the US and South Asian nations. The speakers included high-level participants from the government of Pakistan, the World Bank, the US Centers for Disease Control and Prevention, the US Department of Health and Human Services, the US National Academies of Science, and from other academic, nonprofit, and government organizations. The meeting agenda can be found in **Appendix B** and speaker biographies in **Appendix C**.

South Asian countries face shared challenges, including populations with similar biological disease risks, health surveillance limitations, and concerns about emerging or reemerging infectious diseases. South Asia is a densely populated region—it accounts for around 20% of the global population, approximately 1.8 billion people—and is vulnerable to changes in climate and weather patterns, which increase the risk for vector-borne disease transmission.[1,2] The World Bank estimates that by 2050, changes in weather patterns will decrease living standards in Bangladesh, India, Pakistan, and Sri Lanka, adding to current societal and environmental pressures.[2] South Asian countries also have one of the highest disease burdens for typhoid fever, there remains endemic polio transmission in Pakistan and Afghanistan, and the region accounts for approximately 40% of total tuberculosis cases.[3-5] In addition, zoonotic diseases such as Nipah, Crimean-Congo hemorrhagic fever, and chikungunya are present; in May 2018, a Nipah virus outbreak in India had a fatality rate of almost 90%.[6]

Despite these health security challenges, a major theme for the meeting was optimism: Positive steps are being taken across South Asia to acknowledge health security threats, proactively identify gaps in the healthcare system, and develop the workforce required to respond. It was highlighted that countries are increasingly open to pursuing measures to identify and evaluate gaps to improve preparedness and disease surveillance programs. For example, Afghanistan, Pakistan, India, and Bangladesh are all part of the GHSA, and, as of July 2018, 6 South Asian governments had completed Joint Evaluation Exercises

(JEEs), a process that measures countries' individual status and progress toward developing the requisite capacities to prevent, detect, and respond to infectious disease threats.[7]

Other major themes included the outlook for continued implementation of the GHSA, leveraging international institutions to advance health security efforts in South Asia, the importance of workforce development, and the use of scientific and biosafety engagement initiatives to train the next generation of public health officials.

The highly interactive meeting presented an important opportunity to focus on the health security challenges facing South Asia and to identify paths forward, and it emphasized the importance of dialogue in bringing together multiple disciplines, sectors, and countries, extending even beyond the region. As one participant noted, "A health risk anywhere is a health risk everywhere."

Introduction

On July 10, 2018, the Johns Hopkins Center for Health Security hosted a meeting on global health security in South Asia, bringing together experts from across the region and the United States to discuss key scientific and policy issues related to health security. Held in Washington, DC, the meeting included presenters and participants from academia, nongovernmental institutions, multilateral organizations, the private sector, and government representation from Pakistan, India, and the United States. The meeting was sponsored by the Project on Advanced Systems and Concepts for Countering WMD (PASCC; sponsored by the Defense Threat Reduction Agency, DTRA) of the US Air Force Institute for National Security Studies.

The goal of this 1-day meeting was to discuss health security challenges in South Asia and to identify opportunities for implementation of health security initiatives. Invited speakers drew from a breadth of expertise in medicine, biosafety, public health, bioscience, government, and geopolitics. They provided insights about the progress on the Global Health Security Agenda (GHSA), financing and investment challenges and opportunities, and the importance of both scientific and biosafety engagement between the United States and South Asian nations. The speakers included high-level participants from the government of Pakistan, the World Bank, the US Centers for Disease Control and Prevention, the US Department of Health and Human Services, and the US National Academies of Science, and from other academic, nonprofit, and government organizations. The meeting agenda can be found in **Appendix B** and speaker biographies in **Appendix C**.

South Asian countries face a number of shared challenges, including populations with similar biological disease risks, health surveillance limitations, and concerns about emerging or reemerging infectious diseases. A densely populated region—South Asia accounts for around 20% of the global population, approximately 1.8 billion people—the region is vulnerable to changes in climate and weather patterns, which increase the risk for vector-borne disease transmission.[1,2] The World Bank estimates that by 2050, changes in weather patterns will decrease living standards in Bangladesh, India, Pakistan, and Sri Lanka, adding to current societal and environmental pressures.[2] South Asian countries also account for one of the highest disease burdens for typhoid fever, there remains endemic polio transmission in Pakistan and Afghanistan, and the region accounts for approximately 40% of total tuberculosis cases.[3] In addition, zoonotic diseases such as Nipah, Crimean-Congo hemorrhagic fever, and chikungunya are present; in May 2018, a Nipah virus outbreak in India had a fatality rate of almost 90%.[6]

One speaker noted that "a health threat anywhere is a health threat everywhere" and that globalization has greatly increased the pace and severity of infectious disease outbreaks. The 2003 SARS epidemic spread to more than 37 countries and 3 continents in only 4 months, with an economic impact of $40 billion; from 1997 to 2009, 6 major zoonotic outbreaks caused a total economic loss of over $80 billion.[8] Major outbreaks can have other significant economic impacts as well, including loss of workforce and loss of travel and trade, as well as an impact on supply chains that have global effects.

One participant stated that ecologic factors allow for rapid pathogen mutation and host adaptation, and these are often worse in areas of disorder, insecurity, and conflict. These factors are immense challenges when coupled with population movement. There are important lessons being learned for the region from experiences in Pakistan and Afghanistan on how to deliver health interventions during conflict, such as conducting polio eradication programs in highly insecure areas.

In South Asia, there is both the emergence and reemergence of infectious diseases such as avian flu, MRSA, and MDR/XDR tuberculosis. One participant noted that for tuberculosis in particular, "we remain to be frogs in a beaker" and provided the HIV epidemic as a good historical example of a disease that raged for over a decade and with tremendous human life and economic losses before necessary preventive measures and funding and resources were allocated. In response, a participant specified that in Pakistan, TB, AIDS, and malaria are all vertical programs that require additional technical resources from the international community to both strengthen laboratory systems and better integrate these vertical programs under one umbrella. Integration could help reduce duplication of effort and would leverage existing resources to improve TB surveillance systems.

To prepare and counter emerging health security threats across South Asia, one speaker highlighted that there is already international consensus on the importance of preparedness. However, in 2012 only 20% of countries had met the International Health Regulations (IHR 2005) goals, and by 2014, only about 30% of countries were fully prepared to detect and respond to an outbreak. This demonstrates that there are still significant actions to be taken for health security. The next iteration of the GHSA may present an opportunity to further catalyze action; the GHSA steering group has developed a draft strategic framework for this next phase, which will run from 2019 to 2024.[9] Components of the next phase include promoting and supporting health security at the country level, developing tools and sharing lessons to strengthen country health security capacities, promoting a multisectoral and multi-stakeholder approach to health security, and strengthening accountability for global health security.

As part of the day's discussion, participants drew out several additional recommendations to respond to growing health security risks in the region. Countries need to start prioritizing public health measures such as immunization, surveillance of zoonotic diseases, and control of microbial resistance to prevent avoidable catastrophes. There is also a need to improve early disease detection mechanisms, using well-networked surveillance systems, strong laboratory practices, and information systems that enable timely and relevant information to be shared rapidly. And finally, countries need to develop systems to respond by establishing emergency operations centers (EOCs), acquiring and stockpiling medical countermeasures, and creating better coordination between public health and law enforcement efforts.

On-the-Ground Implementation of the Global Health Security Agenda

The first session highlighted “on-the-ground” implementation of the GHSA in South Asia. The GHSA, created in February 2014, has a vision to create a “world safe and secure from global health threats posed by infectious diseases.”[10] In October 2017, the Kampala Declaration extended the GHSA commitment through 2024. As of January 2018, more than 50 countries had signed up and committed to the GHSA, including 4 countries in South Asia.[11]

The GHSA focuses on 4 crosscutting aspects of public health capabilities: disease and event surveillance and outbreak response; emergency management; laboratory diagnostics and systems; and public health workforce development. One speaker provided some examples of implementation from the South Asia context, noting that in Pakistan local experts were trained to lead Disease Surveillance and Response Units (DSRUs), located across Pakistan, and that those units responded to 190 disease outbreaks between January 2016 and July 2017. India, in response to growing antimicrobial resistance, led the establishment of 2 national antimicrobial resistance and healthcare-associated infection surveillance networks.

While there are increasing initiatives related to the 4 cross-cutting areas for GHSA, speakers and participants also pointed to the slow progress on the implementation of the IHR, which stipulated that all countries should focus on establishing mechanisms and planning for all facets of health security.[12] At the first milestone in 2012, only 20% of countries were compliant. At the second milestone in 2014, only 33% of countries were compliant. Speakers and participants highlighted several challenges that could be driving such low percentages, particularly resource mobilization. Fulfilling national obligations requires having the resources to build and strengthen capacities, and resources may be limited. While it has often been the ministry of health that has been given responsibility for IHR implementation, broader multiagency support is needed, as well as broader political support to fund these deficits.

The GHSA was set up to catalyze action to enhance basic public health capacities. One participant pointed out the positive effect of focusing on tangible and measurable targets. It was also described how the JEEs led to progress. Initially, there were doubts about whether an external evaluation process would be acceptable to countries, but since its inception, there have been 79 JEEs completed, with 21 more expected by the end of 2018.[13]

In South Asia, Bhutan, Sri Lanka, Afghanistan, Bangladesh, Pakistan, and Maldives have all completed JEEs, but not all countries in the region have embraced the concept.[14] Speakers and participants described how JEEs have changed the conversation globally on why it is important to be transparent, highlighted the importance of a multisector One Health approach, and used gap analysis to develop plans that donors can more easily finance.

In 2017, Pakistan volunteered for a JEE. Pakistan was the fourth country in the world, and the first in South Asia, to use newly developed JEE tools. This external evaluation aimed to provide baseline information on existing capacity and identify gaps, and it recommended development of a 5-year road map. A major takeaway for Pakistan from the JEE was a realization that there was a lack of sensitization surrounding both the GHSA and IHR across the government, and an effort was identified to enhance collaboration on both the IHR and GHSA at all levels of the government and throughout the country. Other recommendations included a need for a legislative framework to implement and enforce surveillance, response and outbreak detection capacities, and a need for a network of laboratories to carry out surveillance and detection efforts.

Speakers described how Pakistan is working to develop a national framework for biosafety, expanding a network of disease surveillance systems in all provinces to carry out outbreak investigations, and initiating efforts to establish integrated disease surveillance and response systems. To address growing biological threats, Pakistan has developed a strategic framework for antimicrobial resistance, as well as training programs on epidemiology and surveillance. Their national public health laboratories are providing support for surveillance and outbreak response.

This discussion concluded by highlighting that the GHSA has developed action packages to achieve specific targets and that one of the most important pillars of that is workforce development. There is a need for personnel training and development of public health expertise in key disciplines, such as laboratory research, emergency operations, and surveillance. Other ideas suggested included establishing specimen referral networks, preparing the workforce to effectively activate EOCs when needed, improving the workforce capacity to analyze and link data for a functional real-time biosurveillance system, and increased training of field epidemiologists.

Global Perspectives in Health and Security

Participants examined the intersection of health, regional security, and investment in South Asia. Participants and speakers discussed how political stability, regional conflicts, and environmental crises need to be considered when conducting health planning and programming. One speaker explained that the strategic landscape across the Asian continent is being redrawn as regional classifications (Southeast, South Asia, East Asia) are not consistent; the reason Asia was originally partitioned into different regions was an artifact of the Cold War. Several other speakers mentioned that the region is classified differently by international organizations, with the World Health Organization (WHO) placing several countries in the South East Asia region (Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka) and others in the Eastern Mediterranean Regional Office (Afghanistan and Pakistan), while the World Bank definition of South Asia includes Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.[1,15]

From a political perspective, one speaker described how there are 2 aspects to a biosecurity threat: The first is determining the origin and attribution of a threat, and the second is the ability to cope with the consequences of the threat. It is often the security agencies that are charged with dealing with the first part, but the latter falls on different institutions across both the government and private sector and increasingly requires cooperation across borders. This requires much closer working relationships between countries. For some countries, having conversations at a bilateral level can be a challenge because of political pressures and tensions. The use of multilateral platforms (WHO, World Bank, etc) to coordinate cross-border issues presents an opportunity to open communications on preparing for biosecurity and health security threats.

The session also focused on what drives countries to invest sufficiently in health security. One speaker noted that investments in financial, economic, and military security are acceptable to countries, but countries do not typically invest in health security. The key question posed was, “Why is it, when we all know what the problem is, that we don’t invest in health security?” The speaker described misperceptions that could be driving countries to not invest financially in health security, such as its being too complicated or extremely expensive or that countries are unable to find international funding.[16] The use of the JEE has demonstrated that these perceptions are false and provided a mechanism for demystifying the investment process. Following the JEE, both Tanzania and Pakistan conducted post-JEE preparedness costing exercises and found that government per capita investment as low as 50 cents to 1 dollar per year could be sufficient for investing in health security preparedness capacities.

Another challenge cited by the participants was that funding often arrives "when the urgent becomes more important than the important." For many countries, there are more pressing immediate threats in the health field and other societal needs, so that it is often difficult to sell investing in strengthening preparedness for epidemics or other health security threats. The discussion then shifted to the topic of pandemic preparedness and the human and economic costs they bring. Several examples provided were the 2013-2015 West Africa Ebola crisis, which caused more than 11,000 deaths, cost $2 billion in lost GDP across the 3 primarily affected countries, and required $7 billion in donor money pledged.[17,18] The World Bank also estimates that globally a moderately severe to severe pandemic could cost as much as $570 billion annually, further underscoring the importance of understanding the true economic costs and impacts of pandemics.[19] The speaker stressed that the world needs to be better prepared to respond to potential pandemics; fragmented and slow response means that thousands die needlessly and economic losses escalate.

Several opportunities discussed throughout the meeting included creating more direct incentives for investment in preparedness to ensure that the risks inherent in disease outbreaks are reflected in financial markets and businesses' investment decisions. If a country's economic vulnerability to disease outbreaks was incorporated in mainstream macroeconomic analyses, investment in pandemic preparedness would no longer be solely the concern of the health minister and central governments would take a more holistic approach to and understanding of funding health security. One participant noted that investment in health security is not an investment in health; it is an investment in a country's security.

Another opportunity described was the Pandemic Emergency Financing facility (PEF), which provides surge financing to countries in the event of an outbreak.[20] It is a mechanism to insure the world's poorest countries against pandemic threats and provides a mechanism to release funds quickly to help accelerate a response to stop, or at the least slow down, an outbreak from becoming a pandemic. There are 2 primary mechanisms the PEF uses to initiate this rapid response: an insurance window, which covers specific diseases and disease families with pandemic potential (6 outbreaks: influenza, coronavirus, filovirus, Lassa fever, RFV, CCHF), and a cash window, which complements the insurance window and provides more flexibility to respond to emerging pathogens or situations that may not meet insurance activation criteria.[21]

The discussion concluded with a speaker emphasizing the importance of investing in pandemic preparedness by reminding participants that "infectious disease outbreaks are inevitable, pandemics are optional."

Scientific and Biosafety Engagement in South Asia

Participants considered the importance and role that international scientific engagement has played throughout their careers as public health professionals, applying lessons learned and case studies to evaluate the opportunities and challenges to scientific engagement in South Asia. One area of focus was regional cooperation initiatives and how they could be best applied in South Asia. A speaker provided examples of regional cooperation from the Middle East, Southeast Asia, and Africa that have potential application to South Asia.

The Middle East Consortium for Infectious Disease Surveillance (MECIDS) is a cooperative effort among governments, universities, and nongovernmental organizations from Israel, Jordan, and the Palestine territories. The consortium demonstrates that, even in an area where politics are complex, there is a confluence of interests among the countries regarding monitoring food and waterborne disease outbreaks and sharing information.

Another example is the Mekong Basin Disease Surveillance Network (MBDS), which consists of 6 countries along the Mekong River and focuses on surveillance efforts for diseases in the surrounding area.[22] As part of the initiative, the countries conducted a tabletop exercise to identify gaps in the health system prior to the occurrence of an outbreak. A major finding was that the different visa processes severely hindered the countries' ability to respond and share information in an outbreak. As a result of the exercise, participants established that health officials needed to be able to carry a pre-cleared document to respond during an outbreak.

The last example discussed was the Southern Africa Centre for Infectious Disease Surveillance (SACIDS), which focuses on surveillance sharing of timely information related to zoonotic disease infections and outbreaks.[23] Relevant for South Asia, this example demonstrated the importance of having health care and government authorities on the ground "own" the process and establishing trust between the participating countries.

Participants concluded the day by emphasizing the importance of workforce development as a foundational principle for health security in South Asia. Investing in the training of frontline workers provides rapid returns on investment for disease surveillance programs, as they are often the first to identify and spot an outbreak. In addition to investing in the workforce, other participants mentioned that efficient and deliberate resource investment is also critical. Ensuring that laboratory equipment is properly allocated across national, district, and local levels labs is a critical component of the speed and success of a

surveillance system, with one participant describing how high-technology machines might be sitting at district-level laboratories, whereas ELISA machines are being distributed to national-level labs. Having a strategic process to identify which diagnostic tools and capabilities belong at which level of government will improve the efficiency and accuracy of disease surveillance programs.

Appendix A: References

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Appendix B: Meeting Agenda

Global Health Security in South Asia
Johns Hopkins Center for Health Security

10 July 2018
St. Regis Hotel, Washington, DC

9:00-9:15 **Welcome and Introductory Remarks**
Tom Inglesby, Director, Johns Hopkins Center for Health Security

9:15-9:30 **A South Asian View: Global Health Security Agenda**
Muhammad Ali Shahzada, Additional Secretary, National Health Services, Regulations, and Coordination Division (Pakistan)

9:30-10:30 **On the Ground Implementation of the Global Health Security Agenda**
Progress in Pakistan on the Global Health Security Agenda
Aamer Ikram, Executive Director at National Institute of Health, Pakistan

New Viruses, Old Viruses—Working with South Asia on the GHSA
Hamid Jafari, Principal Deputy Director, Center for Global Health, US Centers for Disease Control and Prevention

Evaluating Progress in the GHSA and Beyond
Jose Fernandez, Deputy Director, Global Health Security Office of Pandemics and Emerging Threats, Office of Global Affairs, US Department of Health and Human Services

11:00-11:15 Coffee Break

11:15-12:15 **Global Perspectives in Health and Security**
Charting the Course for Security in South Asia—An Indian Perspective
Amb. Rakesh Sood, Distinguished Fellow at the Observer Research Foundation

Thinking Globally: The World Bank's Approach to Health Security"
Mukesh Chawla, The World Bank

12:15-1:15 Lunch

1:15-2:15 **Lessons from a Lifetime of Scientific Engagement:**
A conversation between Col. (ret) David Franz and Gigi Gronvall

2:15-2:30 Coffee Break

2:30-4:00 **Scientific and Biosafety Engagement Panel Discussion**
Terry Taylor, President of the International Council for the Life Sciences
Fahim Tahir, Principal Scientific Officer, National Institute of Health (Pakistan)
Rita Guenther, Senior Program Officer, National Academies of Science, Engineering, Medicine
Aamer Khan, National Institute of Health, Pakistan
Gigi Gronvall, Senior Scholar, Center for Health Security (moderator)

4:00 **Closing**

Appendix C: Speaker Biographies

Anita Cicero, JD

Anita Cicero directs operations and is the deputy director at the Johns Hopkins Center for Health Security. She is a lawyer with over 25 years of experience. Ms. Cicero works closely with the CEO to lead strategic and budget planning and program development at the Center. She is also an associate editor of the journal *Health Security*, the leading peer-reviewed journal in this field.

Ms. Cicero has greatly expanded the Center's efforts in epidemic preparedness, nuclear resilience, and international programs and has provided leadership on the Center's health security preparedness work for the country of Taiwan. In working to engage the Center in valuable new exchanges, Ms. Cicero has also launched a number of initiatives to improve mutual understanding and collaboration with countries including China, Kuwait, the Kingdom of Saudi Arabia, Singapore, Malaysia, and Indonesia.

Ms. Cicero has authored or co-authored a number of widely cited articles and reports on biosecurity policy, pandemic preparedness, nuclear and radiological consequence management, biosurveillance, international disease surveillance, and public health law.

Before joining the Center, Ms. Cicero spent nearly 2 decades as a practicing attorney in both the US federal government and the private sector. She was Managing Partner in charge of the Washington, DC, office of Drinker, Biddle & Reath, LLP, where she was responsible for more than 300 lawyers and staff. In her legal work, she created and managed a number of pharmaceutical consortia, with a particular focus on clinical research and regulatory compliance. Ms. Cicero's work required constructive engagement with members of Congress; the World Health Organization; the European Commission; the US Food and Drug Administration; the US Departments of State, Defense, and Health and Human Services; and the Environmental Protection Agency.

Before entering private practice, Ms. Cicero focused on environmental litigation and counseling. She began her career as a trial attorney in the honors program at the US Department of Justice, Environmental Enforcement Section. Ms. Cicero is a graduate of the Yale Law School and Oberlin College.

Mukesh Chawla, PhD

Mukesh Chawla, PhD, is an adviser, Global Health Security, World Bank, and coordinator, Pandemic Emergency Financing facility; he has worked for over 20 years with governments and international development partners in Europe, Asia, and Africa on a variety of health sector issues, including insurance solutions for global public goods, design and diffusion of complex innovations in health, identification of innovative business solutions to address systemic and process issues in the health sector, and economics of health. His current area of interest and responsibility is helping countries get better prepared to respond immediately and effectively to disease outbreaks that have the potential to assume pandemic proportions. He has written

extensively on the role of markets and market-like institutions in the creation of incentives that strengthen health systems, fiscal space for health, innovations in health financing, design of health sector reforms, and economics of aging populations. Prior to joining the Bank, he held a research faculty position at Harvard University. He attended St. Stephen's College and Delhi School of Economics, Delhi, India, and Boston University.

Jose Fernandez, PhD

Jose A. Fernandez is the deputy director for Global Health Security in the Office of Pandemics and Emerging Threats in the Office of Global Affairs (OGA) at the Department of Health and Human Services (HHS). Dr. Fernandez leads and manages a policy portfolio that includes the International Health Regulations (IHR), the Global Health Security Agenda (GHSA), and related global health security issues. In this role, he serves as a key advisor on global health security issues for senior leadership at HHS and leads a broad array of strategy and policy development and health diplomacy efforts, in coordination with US government interagency partners.

Before joining OGA, Dr. Fernandez was the deputy director for the Division of International Health Security in the HHS Office of the Assistant Secretary for Preparedness and Response, overseeing a broad portfolio of IHR and global health security issues. From 2006 to 2007, Dr. Fernandez worked at HHS as a global security fellow, co-sponsored by the American Association for the Advancement of Science and the Nuclear Threat Initiative. During this time, he led US government implementation of the IHR, in coordination with the White House Homeland and National Security Councils. Prior to his fellowship, Dr. Fernandez worked as a consultant on biological and small molecule databases and as a postdoctoral fellow in cell biology. He has a BS in biology from Walsh College, an MS in biology from the University of Akron, and a PhD in biochemistry from Purdue University.

David Franz, DVM, PhD

David Franz served in the US Army Medical Research and Materiel Command for 23 of 27 years on active duty and retired as a colonel. He served as commander of the US Army Medical Research Institute of Infectious Diseases (USAMRIID) and as deputy commander of the Medical Research and Materiel Command. Prior to joining the command, he served as group veterinarian for the 10th Special Forces Group (Airborne).

Dr. Franz served as a committee member for the National Academy of Sciences study *Biotechnology Research in an Age of Terrorism* (the Fink Report) and as a charter member of the National Science Advisory Board for Biosecurity (NSABB). He co-chaired the NAS study Global Security Engagement (CTR 2.0) in 2009 and continues to chair the bio subgroup of the NAS Committee for International Security and Arms Control (CISAC). He holds an adjunct professorship, Department of Diagnostic Medicine and Pathobiology, College of Veterinary Medicine, Kansas State University. The current focus of his interest relates to the role of international engagement in public health and the life sciences as a component of global biosecurity policy. Domestically, he continues to encourage thoughtfulness when regulating research in the name of security, thereby minimizing negative impacts on progress in the life

sciences. Dr. Franz holds a DVM from Kansas State University and a PhD in physiology from Baylor College of Medicine.

Gigi Kwik Gronvall, PhD

Gigi Gronvall is a senior scholar at the Johns Hopkins Center for Health Security and an associate professor in the Department of Environmental Health and Engineering at the Johns Hopkins Bloomberg School of Public Health. She is an immunologist by training.

Dr. Gronvall's work at the Center addresses the role of scientists in health security—how they can contribute to an effective technical response against a biological weapon or a natural epidemic. She is particularly interested in developing policies that will boost the safety and security of biological science activities while allowing beneficial research to flourish.

Dr. Gronvall is a member of the Threat Reduction Advisory Committee (TRAC), which provides the Secretary of Defense with independent advice and recommendations on reducing the risk to the United States, its military forces, and its allies and partners posed by nuclear, biological, chemical, and conventional threats. In 2014-15, she led a preparatory group that examined the US government response to the Ebola outbreak in West Africa as a case study for DoD's strategic role in health security and that made recommendations for future DoD actions in response to disease outbreaks.

She served as the science advisor for the Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism from April 2009 until the Commission ended in February 2010. She has testified before Congress about the safety and security of high-containment biological laboratories in the United States and served on several task forces related to laboratory and pathogen security, most recently the National Institutes of Health Blue Ribbon Panel to Review the 2014 Variola Virus Incident on the NIH Campus (2016) and the Committee for Comprehensive Review of DoD Laboratory Procedures, Processes, and Protocols Associated with Inactivating Bacillus anthracis Spores, formed in response to the Dugway anthrax shipments (2015). Dr. Gronvall has investigated and presented policy recommendations on the governance of science to the Biological Weapons Convention (BWC) in Geneva, Switzerland.

Dr. Gronvall is the author of the book *Synthetic Biology: Safety, Security, and Promise*, published in fall 2016 (Health Security Press), and the book *Preparing for Bioterrorism: The Alfred P. Sloan Foundation's Leadership in Biosecurity.* She is an associate editor of the journal *Health Security*. She is a founding member of the Center, and, prior to joining the faculty, she worked at the Johns Hopkins University Center for Civilian Biodefense Strategies. She was a National Research Council Postdoctoral Associate at the US Army Medical Research Institute of Infectious Diseases (USAMRIID) in Fort Detrick, Maryland.

Dr. Gronvall received a BS in biology from Indiana University, Bloomington. She subsequently worked as a protein chemist at the Memorial Sloan-Kettering Cancer Center and received a PhD from Johns Hopkins University for work on T-cell receptor/MHC I interactions.

Rita Guenther, PhD

Rita Guenther is a senior program officer for the Committee on International Security and Arms Control of the US National Academies of Sciences, Engineering, and Medicine. Recipient of a Fulbright-Hayes Graduate Fellowship, Dr. Guenther has worked on or led several cooperative projects with counterparts in Pakistan, India, and Russia. These projects include a series of workshops with the Pakistan Academy of Sciences on strengthening clinical laboratories for human and animal health, based on cooperation that began in 2011. Dr. Guenther received the National Academies distinguished service award in 2007. She speaks Russian fluently and holds an MA degree in Russian studies and a PhD in history from Georgetown University.

Prof Brig Aamer Ikram, SI(M)

Aamer Ikram graduated in 1987; he earned a diploma in pathology (1990), qualified MCPS (1991), and completed a fellowship (clinical microbiology) in 1998. He received clinical training from the UK (2005) and earned a PhD (microbiology) in 2014. He qualified for a diploma in occupational health & safety (National University of Science & Technology), followed by a diploma in disaster management. Prof. Ikram has excelled in the fields of biosafety, biosecurity, dual-use safety, and infection control, completing a wide range of courses from renowned universities like Harvard, Oxford, South Florida, Iowa, Chester, and Bradford and workshops from UN, WHO, CDC, ASM, and ABSA. In 2009-10, he completed a 1-year certificate course from the University of Iowa; he later completed a master trainer course in dual-use biosecurity from Bradford University. He was the first Pakistani to be a registered biosafety professional (RBP) from ABSA (US); a biosafety level 2 professional from the Institute of Safety in Technology & Research (UK); and an IFBA certified professional. He was awarded FRCP by the Royal College Edinburgh in 2012, FRCPath from the Royal College of Pathologists London in 2014, and recently received a fellowship in public health.

Prof. Ikram has been chief editor of the *Infectious Diseases Journal Pakistan* and is on the editorial boards of renowned national and international journals. He has more than 170 publications.

Prof. Ikram holds multiple national and international portfolios, including president of the Medical Microbiology & Infectious Diseases Society of Pakistan; president of the Pakistan Biological Safety Association; HEC Focal Point of Expertise under National Research Programme for Universities; Convener, Microbiology PHRC; and member of several national working groups. He was selected as an international ambassador by the Society for Healthcare Epidemiology of America; Global Health Delivery Faculty at Harvard, and recently Council of ICID. He was awarded the Biosafety Heroes Award by the International Federation of Biosafety Associations in 2011 and Sitara-e-Imtiaz (Military) in 2014. Currently, he is executive director of the National Institute of Health (Pakistan), administrator of HOTA, and national coordinator for the Global Fund.

Tom Inglesby, MD

Tom Inglesby is the director of the Center for Health Security of the Johns Hopkins Bloomberg School of Public Health and a professor in the Department of Environmental Health and Engineering in the Johns Hopkins Bloomberg School of Public Health with a joint appointment in the Johns Hopkins School of Medicine.

Dr. Inglesby's work is internationally recognized in the fields of public health preparedness, pandemic and emerging infectious disease, and prevention of and response to biological threats. He is chair of the Board of Scientific Counselors, Office of Public Health Preparedness and Response, US Centers for Disease Control and Prevention (CDC). He is also chair of the National Advisory Council of the Robert Wood Johnson Foundation's National Health Security Preparedness Index. He was a member of the CDC Director's External Laboratory Safety Workgroup that examined biosafety practices of the CDC, the National Institutes of Health (NIH), and the Food and Drug Administration (FDA) following high-profile laboratory incidents in federal agencies. He was on the 2016 Working Group assessing US biosecurity on behalf of the President's Council of Advisors on Science and Technology (PCAST). He has served on committees of the Defense Science Board, the National Academies of Sciences, the Institute of Medicine, and in an advisory capacity to NIH, BARDA, DHS, and DARPA.

Dr. Inglesby has authored or co-authored more than 115 publications, including peer-reviewed research, reports, and commentaries on issues related to health security and preparedness for epidemics, biological threats, and disasters. He is editor-in-chief of the peer-reviewed journal *Health Security*, which he helped establish in 2003. He was a principal editor of the *JAMA* book *Bioterrorism: Guidelines for Medical and Public Health Management.* He has been invited to brief White House officials from the past 4 presidential administrations on national biosecurity challenges and priorities, and he has delivered congressional testimony on a number of issues related to public health preparedness and biosecurity. He is regularly consulted by major news outlets for his expertise. He is a member of the board of directors of PurThread, a company dedicated to developing antimicrobial textiles.

Dr. Inglesby completed his internal medicine and infectious diseases training at Johns Hopkins University School of Medicine, where he also served as assistant chief of service in 1996-97. Dr. Inglesby received his MD from Columbia University College of Physicians and Surgeons and his BA from Georgetown University. He sees patients in a weekly infectious disease clinic.

Hamid Jafari, MBBS

Hamid Jafari currently serves as the principal deputy director, Center for Global Health, at the Centers for Disease Control and Prevention (CDC).

Until February 2016, Dr. Jafari was the director of Global Polio Eradication at World Health Organization headquarters, Geneva, and the overall leader of the Global Polio Eradication Initiative. Before this appointment, Dr. Jafari served as the project manager of WHO's National Polio Surveillance Project in India (2007-2012), where he was the main technical advisor to the government of India on the implementation of the nation's large-scale polio eradication,

measles control, and routine immunization activities and directed WHO's extensive network of more than 2,000 field staff.

Previously, Dr. Jafari served as director of the Global Immunization Division at the CDC, Atlanta. He has also served as the medical officer for polio eradication in the regional office of WHO for Eastern Mediterranean in Egypt on assignment from CDC.

Dr. Jafari is a graduate of CDC's Epidemic Intelligence Service (EIS) program, class of 1992. He obtained his MBBS degree from Sind Medical College, Karachi University. He completed his residency training in pediatrics at Dartmouth Medical School and his pediatric infectious disease fellowship training at the University of Texas Southwestern Medical Center, Dallas. Dr. Jafari completed a research fellowship at Harvard Medical School. He has been certified by the American Board of Pediatrics in the subspecialty of pediatric infectious diseases. Dr. Jafari has published more than 70 scientific papers and book chapters on pathogenesis of infectious diseases, polio eradication, and other vaccine-preventable diseases.

Muhammad Ali Shahzada

Muhammad Ali Shahzada is additional secretary, National Health Services, Regulations and Coordination Division, Pakistan.

Ambassador Rakesh Sood

Rakesh Sood is a distinguished fellow at ORF. He has over 38 years of experience in the field of foreign affairs, economic diplomacy, and international security issues. He has a postgraduate degree in physics and in economics and defense studies.

Ambassador Sood has served in the Indian missions in Brussels, Dakar, Geneva, and Islamabad in different capacities and as deputy chief of mission in Washington, DC. He set up the Disarmament and International Security Affairs Division in the foreign ministry, which he led for 8 years until the end of 2000. During this period, Ambassador Sood was in charge of multilateral disarmament negotiations, bilateral dialogues with Pakistan, and strategic dialogues with other countries, including the US, the UK, France, and Israel.

Ambassador Sood then served as India's first ambassador–permanent representative to the Conference on Disarmament at the United Nations in Geneva. He also chaired a number of international working groups, including those relating to negotiations on landmines and cluster munitions, and was a member of the UN Secretary General's Disarmament Advisory Board from 2002 to 2003. Ambassador Sood has served as special envoy of the prime minister for Disarmament and Non-proliferation Issues, Indian ambassador to France, Indian ambassador to Nepal, and Indian ambassador to Afghanistan.

Since his retirement, he has been writing and commenting regularly in both print and audiovisual media on India's foreign policy, its economic dimensions, and regional and international security issues. He is a frequent speaker and contributor at various policy planning groups and think tanks in India and overseas.

Faheem Tahir, PhD

Faheem Tahir is currently the chief, Public Health Laboratories Division, National Institute of Health in Pakistan. Dr.Tahir majored in microbiology and biochemistry and received his MPhil in molecular biology from Quaid-i-Azam University, Islamabad. He began his career in the domain of human fertility in 1992 and worked on various aspects of male infertility at the National Institute of Health, Islamabad, Pakistan, to earn a PhD. After completion of his PhD, his research domain was expanded to include other areas of endocrinology as well. He has spent a year of postdoctoral research on hepatic insulin transcription factors at the Department of Molecular Medicine and Surgery, Karolinska Institute, Stockholm, Sweden.

Dr. Tahir became involved in the area of public health laboratories, and specifically biosafety and biosecurity, while representing the NIH Pakistan at national and international fora, including the United Nations. Having started work as a scientific officer, over the years he has reached his current position. He is the national focal point for European Union Chemical Biological Radiological and Nuclear (CBRN) Centres of Excellence Initiative. He has more than 100 research publications in national and international indexed journals and a similar number of research presentations at various national and international conferences. Professionally, he is a member of ASM, the Pakistan Physiological Society, the Pakistan Society for Biochemistry and Molecular Biology, the Population Association of Pakistan, and the Pakistan Biological Safety Association.

Terence Taylor

Terence Taylor is the founding president of the International Council for the Life Sciences (ICLS). From 2012 to 2017 he was the coordinator of the UN Security Council's Committee that oversees the implementation of its resolution 1540 (2001), which is designed to prevent non-state actors from obtaining and using weapons of mass destruction. Previously, he was vice president, Global Health and Security, at the Nuclear Threat Initiative (NTI) and earlier was assistant director at the International Institute for Strategic Studies (IISS) in London, and executive director of IISS-US in Washington, DC. He has substantial experience in international security policy matters as a UK government official (both military and diplomatic) and for the United Nations, both in the field and at UN headquarters, including, from 1993 to 1997, as a commissioner and a chief inspector in Iraq. His experience is related to both military field operations and to the development and implementation of policies in relation to arms control and nonproliferation treaties and agreements for both conventional and weapons of mass destruction and law of armed conflict aspects of international humanitarian law. He has also conducted consulting work for private companies on the defense industry, new military and dual-use technologies, political risk assessment, and studies of the private biotechnology industry, particularly in relation to biological safety and security at life science facilities. For 6 years he was a member of the US Institute of Medicine's Standing Forum on Microbial Threats. He was a career officer in the British Army with experience in many parts of the world, including UN peacekeeping and counter-insurgency and counter-terrorism operations.