Public Private Partnership Responses to COVID-19 and Future Pandemics: Proceedings of a Workshop in Brief (2020)

DETAILS

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Proceedings of a Workshop
IN BRIEF

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Public–Private Partnership Responses to COVID-19 and Future Pandemics

Proceedings of a Workshop—in Brief

The National Academies of Sciences, Engineering, and Medicine's Forum on Public–Private Partnerships (PPPs) for Global Health and Safety convened a virtual workshop on June 25–26, 2020,[1,2] to review best practices from past PPP epidemic and pandemic responses to determine if those frameworks have applications to the coronavirus disease 2019 (COVID-19) pandemic, as well as to explore PPP innovations that are addressing COVID-19 in other countries, to examine PPP pandemic responses that expand the distribution of global public goods, and to discuss PPP pandemic responses that enable the development of a global health security agenda. On June 25, Victor Dzau, president of the National Academy of Medicine, said that globally there are 9.4 million cases of COVID-19 and 480,000 deaths from the disease, with 2.4 million cases and 134,000 deaths in the United States. An "all-society response" could begin to address concerns about testing, containing the spread, providing countermeasures, and maintaining the supply chain. Previous health crises gave rise to several PPPs, such as the Ebola Private Sector Mobilization Group (EPSMG) and the Coalition for Epidemic Preparedness Innovations (CEPI).

Dzau also provided examples of PPPs that have emerged during COVID-19. The Accelerating COVID-19 Therapeutic Interventions and Vaccines initiative unites government agencies with pharmaceutical companies to develop vaccines, treatments, and diagnostics. The Biomedical Advanced Research and Development Authority supports partnerships with Johnson & Johnson and AstraZeneca to develop a global vaccine plan. The Access to COVID-19 Tools (ACT) Accelerator connects the European Commission with the Bill & Melinda Gates Foundation (the Gates Foundation); CEPI; Gavi, the Vaccine Alliance (Gavi); The Global Fund to Fight AIDS, Tuberculosis and Malaria (The Global Fund); Unitaid, Wellcome Trust, and the World Health Organization (WHO) to craft a global pandemic response.

KEYNOTE PRESENTATIONS: DAY 1

Peter Sands, executive director of The Global Fund, emphasized that PPPs enabled The Global Fund to save approximately 32 million lives and reduce the annual death toll from HIV, malaria, and tuberculosis by half during the past 18 years. Sustainable PPPs require careful construction of appropriate governance mechanisms, conflict-of-interest procedures, and investment of time to understand stakeholder perspectives and constraints. He provided examples of private-sector interventions during COVID-19 such as those by Microsoft and Orange, which are helping civil society operate online and providing capacity to shift medical services to a digital environment; and by Coca-Cola, which is developing a tool for a bottleneck analysis on supply chains. The next step is for different sectors to consider how to

[1] For more information about the forum, see https://www.nationalacademies.org/our-work/forum-on-public-private-partnerships-for-global-health-and-safety (accessed September 30, 2020).
[2] To view videos from the workshop, see https://www.nationalacademies.org/event/06-25-2020/public-private-partnership-responses-to-covid-19-and-future-pandemics-a-workshop (accessed September 30, 2020).

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sustain the appropriate mobilization of resources and capabilities. The broader business and finance sectors need to understand how infectious diseases affect the economy; according to Sands, only 9 percent of Fortune 500 companies have an explicit strategy for global health. Greater understanding from the public sector could help to build trust and achieve more effective partnerships with the private sector. According to Sands, COVID-19 could be the impetus to improving the relationship between the global health sphere and private-sector companies.

John Nkengasong, director of the Africa Centres for Disease Control and Prevention (CDC), emphasized the role that the public sector plays in enabling response; for example, the African Union partnered with the Africa CDC and member states to open air space for the transport of pandemic responders. He noted that cases in Africa have been steadily increasing: from June 19 to June 25, 2020, northern Africa's weekly COVID-19 cases increased by 17 percent and southern Africa's increased by 27 percent, resulting in 336,000 cases and nearly 9,000 deaths in Africa. Although these numbers are rising, the increase appears to be mostly happening within 10 countries, while approximately 40 countries still have less than 5,000 documented cases.

In particular, testing is a challenge—4.3 million tests have been conducted, which is only approximately 3,000 tests per 1 million people. As lockdowns begin to lift and cases begin to increase, Nkengasong said it is important for both the public and private sectors to develop innovative strategies. For example, the Africa CDC launched the Partnership to Accelerate COVID-19 Testing in Africa to conduct 10 million tests, deploy 1 million health workers to support contact tracing, and train 100,000 health care workers. A diagnostic and personal protective equipment (PPE) procurement platform for this effort has already been launched with the aid of an individual in Africa. Nkengasong explained that vaccines can end transmission, prevent deaths, and minimize social and economic harm. The Africa CDC will help coordinate the COVID-19 Africa Vaccine Clinical Trial Network, which will initiate a vaccine regulatory working group, strengthen systems to vaccinate target populations, and launch a vaccine advocacy campaign.

Forum member Jo Ivey Boufford, clinical professor at the New York University School of Global Public Health, asked about the characteristics of sustainable partnerships. Nkengasong replied that common interest and a shared vision are key, and Sands emphasized the value of communication and mutual understanding. For a company to engage in a long-term partnership, the work has to align with its commitment to its shareholders—companies need to incorporate corporate social responsibility into their core missions. He pointed out that non–United Nations (UN) entities (e.g., Gavi, CEPI, and The Global Fund) have the flexibility to create governance structures, with members of the private sector and civil society directly involved in decision making. Forum member Clarion Johnson, past consultant for ExxonMobil, wondered about the configuration of PPPs. Sands said that a variety of skills is needed to address the scientific, clinical, logistical, community, human rights, behavioral, and communication facets of global health problems. Boufford asked if companies are building capacity for local private-sector partners to solve problems. Sands commented that the ACT Accelerator stimulates the local production of diagnostics and builds public and private capabilities in laboratory networks. He suggested that PPE be manufactured where it will be used, because the design should vary by environment for greatest effectiveness and may mitigate global supply chain issues.

PUBLIC–PRIVATE PARTNERSHIP AND PRIVATE-SECTOR LESSONS LEARNED FROM PAST EPIDEMIC AND PANDEMIC RESPONSES

Alan Knight, corporate responsibility general manager of ArcelorMittal and secretariat/chair of the EPSMG, observed that although the epidemiology and medical interventions for Ebola, HIV, and COVID-19 are not the same, private responses are similar: address behavior, fear, and stigma; limit travel within and between countries; inform and aid employees; and lessen economic impacts. He noted that the potential for private-sector contribution has been both undervalued and poorly leveraged. In preparation for the Ebola outbreak in 2014, ArcelorMittal employed medical experts, provided screening, educated employees, and prepared for the worst-case scenario. This enabled the company to better protect its staff and the local community, and continue to support the local economy by keeping its mining operations in Liberia open. However, he explained that there was a significant difference between company resilience and collective action to fight Ebola.

ArcelorMittal worked with other companies and nongovernmental organizations (NGOs) to develop a unified private-sector voice via the EPSMG. Three country groups focused on problem solving, with a regional platform for shared learning. A similar body, the West Africa Private Sector Coronavirus Platform, has emerged in response to COVID-19, with groups in Ghana and Liberia working on capacity for testing, procurement platforms, and communication campaigns. Knight's vision for the future includes creating a long-term, pandemic-resilient private sector with in-company risk management plans, identifying regional business leaders ready to mobilize when a pandemic is predicted, and discussing best practices on a continuous basis with experts and global medical networks.

Michael Osterholm, director of the Center for Infectious Disease Research and Policy (CIDRAP) at the University of Minnesota, defined an epidemic as the occurrence in a community or region of cases of an illness clearly in excess

of normal expectancy. The number of cases indicating the presence of an epidemic varies according to the agent, the size of the outbreak, and the type of population exposed. Epidemics affect regional manufacturing and supply chains. He further explained that a pandemic is an epidemic that occurs over a wide area across international borders, typically affecting a large number of people. Severity assessment of a pandemic is based on mode of transmission as well as agent pathogenicity and virulence. Pandemics affect global just-in-time manufacturing and supply chains. He explained that 63,000 ships move goods around the world every hour, creating a global just-in-time delivery system for critical supplies.

As COVID-19 continues to disrupt this system, the CIDRAP Resilient Drug Supply Project is mapping the entire supply chain for U.S. drug products in partnership with Medsafe, the New Zealand Medicines and Medical Devices Safety Authority. Funded by the Walton Family Foundation, this effort aims to improve the health care system's ability to maintain a steady supply of critical treatments. In the United States, 156 drugs have been identified as critical acute drugs, 63 of which were in shortage before COVID-19. This number is increasing rapidly, he continued, causing concern about the ability to provide routine medical care in low-, medium-, and high-income countries. For example, the United States depends on foreign sources for 18 of the 21 critical antibiotics used to treat secondary infections from COVID-19. He emphasized that this crisis is unprecedented and that preparation for an epidemic does not indicate readiness for a pandemic. Pandemics present challenges that global governance and business resiliency plans are not prepared to navigate efficiently, jeopardizing vital products and services.

Workshop planning committee member John Monahan, senior advisor for global health to the president, senior fellow at the McCourt School of Public Policy, and senior scholar at the O'Neill Institute for National and Global Health Law at Georgetown University, wondered what immediate steps should be taken by companies and governments. Osterholm said that the United States has to reconsider how it does business, as it currently depends heavily on global supply chains. He is engaged in discussions with the European Union about the implications of concentrating manufacturing in certain parts of the world as well as contingency plans to continue supply chains when areas are shut down—decentralization is likely needed. He suggested that the private sector address security issues around the drug supply and related collateral damage outcomes as the pandemic worsens. Knight added that because a central part of the private sector's current business model involves global travel, the movement of people also needs to be reconsidered to decrease illness transmission.

GLOBAL PUBLIC–PRIVATE PARTNERSHIP AND PRIVATE-SECTOR RESPONSES TO COVID-19 IN OTHER COUNTRIES: CHALLENGES AND OPPORTUNITIES

Brenda Colatrella, associate vice president of corporate responsibility at Merck & Co., Inc., said that Merck is dedicated to protecting the physical and emotional well-being of employees and families, ensuring that its supply of medicines and vaccines reaches its patients and customers, contributing its scientific expertise to the development of antivirals and vaccines, and supporting health care providers and communities during the COVID-19 pandemic. Merck is engaged in a number of collaborative efforts with key coalitions, private-sector partners, and foundations, including (1) the International AIDS Vaccine Initiative to develop an investigational vaccine; (2) Themis Bioscience, a recent acquisition, to accelerate the development of its vaccine candidate; (3) Ridgeback Biotherapeutics to develop an orally available, novel antiviral candidate; and (4) the Gates Foundation CEO Roundtable on issues of access and equitable deployment of pandemic vaccines.

Merck is supporting global communities through its work with Project ECHO (Extension for Community Healthcare Outcomes) in India and Vietnam (training providers and public health professionals), as well as a regional grants program to enable its subsidiaries to support local needs and the development of the Global Medical Volunteers Program, which enables medically trained Merck employees to volunteer in their communities while maintaining their base pay. In addition to creating new programs, Merck has modified existing PPPs in response to COVID-19. For example, when WHO recommended that mass treatment programs for neglected tropical diseases be postponed, Merck worked with several stakeholders to continue to ship donated Mectizan so that it is available when distribution programs resume.

Merck also worked with disease modelers to understand the effects of stopped treatment, including a range of scenario planning efforts to mitigate long-term community impacts. Colatrella emphasized that Merck's approach is always evidence based and scientific, and she highlighted the danger of proposing medical solutions that have not been fully proven. She explained that Merck's experience during the Ebola crisis informed its response to COVID-19. It demonstrated the challenge of enabling speed without sacrificing quality and safety, as well as the value of continued partnership and innovation. This experience also illuminated the critical role of communities in identifying needs, increasing communication, and establishing trust among the private sector, governments, and the global community. According to Colatrella, success requires shared purpose, cooperation, and compromise.

Elhadj As Sy, former secretary general of the International Federation of Red Cross and Red Crescent Societies and chair of the Kofi Annan Foundation, noted that partnership is a long-term, joint commitment to problem solving with mutually beneficial outcomes. He referenced *A World at Risk*, the 2019 WHO Global Preparedness Monitoring Board (GPMB) report that emphasized the need to escape the "cycle of panic and neglect," which he described as rushing to partner during a crisis, and when the crisis recedes, disappearing—only to "start from scratch again" the next time a crisis occurs. The goal is to build trust within partnerships to ensure sustainability in order to better respond to the next crisis and avoid the need to start anew each time. Although many effective partnerships exist, COVID-19 has prompted more competition (e.g., for commodities such as PPE) than solidarity.

As Sy explained that countries need to realize that none are safe in a pandemic until all are safe. He expressed concern about high-priced commodities and people who will be left behind when therapeutics or vaccines emerge. The southern hemisphere, in particular, has a severe shortage of tests, PPE, and respirators. This indicates a lack of effective partnerships prior to the pandemic and demonstrates why people may mistrust private-sector engagement. As Sy emphasized that an enabling environment composed of the government, the corporate sector, and various private actors that is driven by humility and flexibility is needed to more effectively address global health issues. A platform of global solidarity, with strong leadership and governance, could begin to address issues of equitable access to goods and commodities.

Trevor Gunn, vice president of international relations at Medtronic, explained that Medtronic publicly released its PB560 ventilator design specifications, providing manufacturers around the world with the ability to accelerate ventilator production during COVID-19. Approximately 250,000 organizations downloaded this intellectual property. Medtronic has also been engaged in several partnerships to respond to COVID-19, including identifying biomedical technologies with WHO and the UN, reducing health care workers' exposure by remotely managing ventilators at the Javits Center with Intel, and producing critical ventilator components with other manufacturers. Medtronic committed to maintaining current ventilator prices during the pandemic and founded the Ventilator Training Alliance, which developed a training app for health care workers.

As of January 2020, 60 percent of the global supply of ventilators was outside of the United States, and ventilator component supply chains depended on the United States, the European Union, and Asia, Gunn said. Thus, Medtronic is increasing limited supply, fighting trade restrictions, expanding human capacity, and engaging with global organizations (e.g., development banks, unilateral donors such as the United States Agency for International Development, nonprofit organizations, and governments) to fight COVID-19. A better understanding of private-sector contributions has emerged, and PPPs are moving from the tactical to the strategic, from hard infrastructure multispecialty hospitals to asset-light investments (i.e., information technology driven), from complicated negotiations to rapid movement, and from high-touch to remote capabilities (e.g., education, monitoring).

Malick Diara, public health manager in the Department of Medicine and Occupational Health at ExxonMobil, said the company's response to COVID-19 is based on a global health approach with local solutions for the protection of its employees. To support local communities and COVID-19 interventions, ExxonMobil temporarily shifted select manufacturing lines to the production of oil and gas products to make isopropyl alcohol for hand sanitizer donations. Diara noted that a single sector or entity cannot tackle a major health crisis on its own: the public sector, the private sector, and local communities need to work together within the framework of the International Health Regulations and global health security for effective pandemic readiness and response. ExxonMobil's internal preparedness and response infrastructure is built on a corporate-level emergency support group, with similar mechanisms at the country and regional levels; infectious disease outbreak management; and a metrics-driven business continuity plan for sites.

ExxonMobil's strategy is to prevent workplace transmission and mitigate disease consequences in health, safety, operations, cost, and reputation. This includes prevention safeguards (e.g., hazard identification and disease surveillance; awareness and environmental measures; personal preventative actions; and site preparedness with drills, screening, and supplies) and mitigation safeguards (e.g., early diagnosis and treatment, isolation and contact tracing with environmental and other response measures). He described a successful response as one that includes public- and private-sector synergies with communities, engagement with business executives, consideration of local health system capabilities in worksite plans, use of internal and external systems for site preparedness and response, and frequent communication with intended audiences using multiple channels while applying a global approach with local solutions.

Workshop planning committee member Allison Goldberg, executive director of the AB InBev Foundation, wondered about additional features of successful pandemic response. Colatrella reiterated that it is difficult, but critical, to resist the urge to act without thinking, especially given external pressures. As Sy reaffirmed the value of long-term engagement. Gunn noted that guts and humility are crucial, and Diara said that agility is key. An audience member asked about the private sector's role in sustainable health systems strengthening in the context of a pandemic. Colatrella pointed out that the private sector can help the government and communities by supporting activities on

the ground, enhancing preparedness, building capacity, implementing appropriate policies and practices, and contributing resources. Diara commented that the private sector first needs to understand how the public sector works, what plans are in place, and what needs exist—then the two sectors can work together to define common objectives. Colatrella suggested that private-sector companies consider adding people to their teams who have public-sector or government experience to deepen that level of understanding. Johnson highlighted the courage, discipline, thoughtfulness, wisdom, and selflessness in each entity's response to COVID-19.

KEYNOTE PRESENTATION: DAY 2

Chris Elias, president of global development at the Gates Foundation, explained that the 2019 GPMB report described the world as ill prepared for a fast-moving respiratory outbreak. Noting that "an outbreak anywhere threatens people everywhere," he emphasized that such a threat requires solidarity and a global response. He expressed urgency in strengthening the capacities of low- and middle-income countries (LMICs) in particular, whose health systems can be quickly overwhelmed by a pathogen such as COVID-19. To date, the Gates Foundation has committed more than $300 million to the COVID-19 response. Most of this funding will support the development of diagnostics, therapeutics, and vaccines, as well as the efforts to provide partners in Africa and south Asia with resources to scale up their COVID-19 detection, treatment, and isolation efforts while strengthening social safety nets affected by the pandemic.

The Gates Foundation has also committed $100 million to Gavi to support its future efforts to deliver COVID-19 vaccines in LMICs. COVID-19 has prompted the formation of new partnerships—for example, the COVID-19 Therapeutics Accelerator (CTA), launched with funding from the Gates Foundation, Wellcome Trust, and MasterCard, will identify, assess, develop, and scale up the production of treatments. The CTA is committed, with nine additional partners, to making therapeutics available and affordable in low-resource settings. Initial funding has supported, among other things, three clinical trials to identify immunotherapies, and capacity has been reserved with Fujifilm to scale up the manufacturing of future COVID-19 monoclonal antibodies. The Gates Foundation and a consortium of life sciences companies announced a collaboration to accelerate the development, manufacture, and delivery of vaccines, diagnostics, and treatments for COVID-19, and through "The Fight Is in Us" campaign, the Gates Foundation is working with an array of public- and private-sector partners to stimulate plasma donations from COVID-19 survivors in an effort to find new plasma-derived therapies.

Elias suggested that effective PPPs in low-resource settings require strengthening primary health care, investing in surveillance, building agile research and development systems, collaborating internationally, funding global public goods, and investing in procurement and delivery. According to Elias, COVID-19 underscores the fact that a nation's health security is inseparable from global health security. To effectively prepare and respond to infectious disease threats, governments can align their aid programs, prioritize public health, and collaborate in data sharing and the global distribution of vaccines, therapeutics, and diagnostics. The innovative private sector can work closely with the government to facilitate regulatory responses and manage liability risks, and philanthropy can enable swift investment and engagement.

CHALLENGES OF SUCCESS: MANAGING GLOBAL PUBLIC GOODS

Arnaud Bernaert, head of global health and health care industries and system initiatives at the World Economic Forum (WEF), explained that WEF is committed to PPPs that advance common goods. In March 2020, it launched the COVID Action Platform, which builds on the work of its Epidemics Readiness Accelerator. The COVID Action Platform's priorities are to stimulate the global business community for collective action, protect livelihoods and facilitate business continuity, and marshal cooperation and business support for the COVID-19 response. More than 1,200 organizations have been mobilized, and 39 projects have begun on more than 12 platforms. WEF also drafted six stakeholder principles for COVID-19, one of which encourages businesses to commit to fair pricing.

More than 1,600 ministers from 174 countries have been engaged in this discussion, and 65 civil society leaders have convened as part of the COVID Action Platform. WEF has several other response efforts under way, Bernaert said. The first is the development of workforce principles for human resource offices to connect essential workers to mobility operators. Another is a COVID-19 education and prevention program for Hispanic youth in the United States and Latin America, in collaboration with Univision. WEF is working with several partners, including the Resolve to Save Lives project, on an effort that reshaped social distancing guidelines that were not feasible in many African countries. It also helped industry scale up capacity for medical supplies, forming an alliance with the 3D Printing COVID-19 Rapid Response Initiative as well as creating the Manufacturers Alliance for Global Equitable Access to Coronavirus Vaccines.

Frederik Kristensen, deputy chief executive officer at CEPI, described CEPI as a PPP that accelerates the development of, and enables equitable access to, vaccines for emerging infectious diseases. CEPI was launched with

the support of WEF, the Gates Foundation, the governments of India and Norway, and Wellcome Trust, and it is now supported by several other governments and private-sector entities. All CEPI investments in response to COVID-19 have been guided by the principles of speed, scale, and access. In its first 3.5 years, CEPI initiated more than 20 programs that focused on 5 target pathogens and 3 rapid response platforms. Some of these rapid response platforms were leveraged at the onset of COVID-19: six projects are testing vaccine response in human subjects, and three more projects will soon enter clinical trials.

These projects are diverse across vaccine platforms and geographic locations. However, Kristensen explained the need for a new paradigm for vaccine development. During the COVID-19 pandemic, it has been necessary to produce early doses of vaccine candidates to support clinical studies, and there has also been a need to begin the process of scaling them up to the industrial level before the clinical trials are complete in order to provide a vaccine within 12 to 18 months. In addition to the need to scale up, there is a need to scale out—to ensure manufacturing capacity in several geographic locations.

Spurred by the ACT Accelerator, CEPI, Gavi, and WHO have a goal of 2 billion doses of vaccines by the end of 2021 through COVAX—the vaccine pillar of the ACT Accelerator. The CTA, co-chaired by Unitaid and Wellcome Trust, has committed to provide 245 million courses of therapeutics to LMICs by mid-2021. The Global Fund and the Foundation for Innovative New Diagnostics have committed 500 million COVID-19 tests to LMICs by mid-2021 in the diagnostics arm of the ACT Accelerator. He concluded by discussing the COVAX Facility advanced marketing commitment from Gavi that will channel eligible monies for subsidized vaccine doses to 92 low-income countries and Gavi-eligible countries. Partners are inviting other governments to join the COVAX Facility to create financial instruments to ensure globally fair distribution of vaccine doses to participating countries. Having one channel to procure vaccine doses and to pool risk for countries will also further strengthen global solidarity.

Andreas Seiter, global lead of the private sector at the World Bank, described the World Bank's interest in providing funds to governments—concessional financing for low-income countries and market-based financing for middle-income countries. It also has donor trust funds that are distributed as grant funds. The World Bank is providing approximately $3.7 billion to 72 countries—more than half of which are in Africa—to help finance the COVID-19 response, from procuring PPE and medical equipment to implementing disease surveillance, introducing distancing measures, and educating the population. He noted that each country has its own internal bureaucracy, which creates bottlenecks in the distribution of World Bank funds. The World Bank has offered the option of bank-facilitated procurement instead, but translating a global mechanism into local action continues to be challenging.

The International Finance Corporation (IFC), the private-sector financing arm of the World Bank, engages by injecting money into the banking system to create loans for small health care facilities. A second method of IFC engagement has been proposed to invite investment capital for the manufacturers that want to increase capacity for vaccines, therapeutics, or diagnostics. The World Bank's Multilateral Investment Guarantee Agency (MIGA) insures political risk and compensates the private sector if a country's government does not fulfill its obligations. MIGA is also considering its role in the work on indemnification of vaccine manufacturers because of the potential for side effects that may not be discovered in the clinical trials. Seiter expressed hope that the products being developed to control the pandemic and prevent future outbreaks will become public goods: available, accessible, and affordable to all.

Workshop planning committee member Regina Rabinovich, ExxonMobil Malaria Scholar in Residence at the Harvard T.H. Chan School of Public Health, asked the panelists about a country's voice in decision making. Elias explained that WHO is consulting with its member states and defining principles for the equitable and effective allocation of scarce countermeasures. Seiter noted that a government might not always effectively represent all of the disenfranchised portions of its population. A standardized tool to assess a country's readiness to fairly distribute vaccine doses for its population could be useful.

Bernaert stated that the COVAX construct is sound because it places WHO at the center; his greater concern is a lack of preparedness to provide an adequate vaccine supply in LMICs. Instead of manufacturers pledging to support a limited number of vaccine innovators now, Bernaert emphasized that a "push mechanism" could be implemented to provide funding for manufacturers to scale up and pair with the right vaccine when there is clinical evidence of its effectiveness.

Rabinovich inquired about maximizing the vaccine supply, and Kristensen replied that considerations are being made to first vaccinate health care workers, people over the age of 65, and adults with comorbidities, which would begin to reduce the mortality rate. He added that discussions have begun about manufacturing vaccines in developing countries. Elias noted that because scaling up vaccine manufacturing is expensive and time consuming, it is best to repurpose existing facilities instead of building new ones. He added that participation in COVAX is an opportunity for countries to ensure access to whichever vaccine succeeds.

Rabinovich asked how to balance collaboration with competition. Elias observed that COVID-19 exposed vulnerabilities in systems; there is a need to strengthen existing multilateral procurement systems and to create innovative procurement systems. If systems could not handle the procurement of PPE, he continued, they are not ready for a vaccine or a life-saving therapeutic. Based on WHO's initial consultations with its member states, global allocation will occur first via COVAX or the CTA and then countries will allocate within (for which civil society will need to hold them accountable).

In response to a question about preparation for the next pandemic, Kristensen championed a global financing mechanism supported by national agreements. Seiter said that countries need an emergency funding route that bypasses traditional bureaucracy. A mechanism that would allow nonpandemic patients and pandemic patients to have access to separate medical facilities would also be useful to maintain routine health care. Elias suggested investing in preparedness for fast-moving respiratory pandemics and added that leadership matters: the lowest death counts are in countries with strong, scientifically-backed leadership.

PUBLIC–PRIVATE PARTNERSHIP TEMPLATES FOR THE FUTURE

Workshop planning committee member John Lange, senior fellow for global health diplomacy at the United Nations Foundation, expressed hope that COVID-19 will lead to permanent funding increases that could be allocated toward all-hazards preparedness. He mentioned that the private sector and individuals have committed more than $223 million to the COVID-19 Solidarity Response Fund. Jeffrey Sturchio, chief executive officer at Rabin Martin, emphasized that even countries with sophisticated health systems have been paralyzed by COVID-19, and that health and economic burdens continue to fall disproportionately on vulnerable populations. No nation is immune, nor can any one nation address the pandemic on its own. He said that leveraging diverse expertise and technical capabilities accelerates immediate actions and lays the foundation for long-term health care systems strengthening. An all-society response that incorporates the private sector's expertise—particularly in health research and development, procurement and supply chain management, data analytics, and manufacturing—is essential.

He shared seven lessons about pandemic preparedness and response: (1) plan now, not when the next crisis hits; (2) focus on risk mitigation and planning for future global disruptions; (3) invest in multisectoral responses; (4) build resilient health systems for sustainability; (5) work with communities to bridge the gap between plans and action; (6) prioritize collaboration to ensure a timely, effective, equitable, and sustainable response; and (7) invest in transparency, governance, and accountability mechanisms to build trust and enable long-term engagement.

Reflecting on a potential vision for the future, Sturchio quoted WHO's director-general, Tedros Adhanom Ghebreyesus: "Universal health coverage and global health security are two sides of the same coin." He added that in an effort to preserve business continuity and protect employees, their families, and their communities in the event of a global crisis, corporations are beginning to frame sustainability strategies around global health security, with investments in disease prevention, surveillance, and health infrastructure at global, national, and local levels. Sturchio also noted that the Global Health Security Agenda's (GHSA's) Private Sector Roundtable (PSRT) offers a new model of preparedness. PSRT is a diverse coalition designed to catalyze PPPs to enhance global response by providing expertise, training, and online learning platforms to build local capacity. According to Sturchio, this sustained collaboration and engagement in addressing emerging health crises augurs well for the future of global health security.

Beth Cameron, vice president of global biological policy and programs at the Nuclear Threat Initiative (NTI), noted the importance of defending against pathogens and risks as well as creating sustainable architecture for global health security. She explained that GHSA brought together countries to strengthen capabilities for epidemic and pandemic preparedness. Those targets were launched with the support of WHO, which conducts joint external evaluations that allow national action plans with benchmarks to be developed. The next step, Cameron continued, is to use those national action plans to better target resources from the public and private sectors, track and account for measurable progress, and provide surge financing to break the cycle of panic and neglect.

The Global Health Security (GHS) Index from the Johns Hopkins Center for Health Security and NTI assessed 195 countries in 2019 and found that national health security was weak around the world. Cameron said the purpose of the index is to motivate capability and political will, encourage collaborative work across the public and private sectors, and hold countries and donors accountable for financing global health security. The index also revealed a lack of functional health systems. Given the accidents or deliberate events that could occur in this era of biotechnology, she suggested that biosafety and biosecurity be prioritized, with public- and private-sector leaders partnering to reduce risks.

Several other proposals emerged from the GHS Index, including one for the formation of new financing mechanisms such as a multilateral global health security matching fund and the expansion of World Bank International

Development Association allocations to include preparedness. UN systems could be used more effectively, and the pandemic preparedness architecture could align with the global health architecture. As the World Bank launches its new multidonor trust fund, Cameron advised that the private sector incentivize countries to better leverage financial mechanisms and prioritize global health security.

Rebecca Martin, director of the Center for Global Health at the U.S. CDC, noted that although the U.S. CDC's natural partnerships are government–government, it also collaborates with in-country and international NGOs, bilateral partners and multilateral organizations, academic institutions, and the private sector. The goal of these partnerships is to strengthen public health infrastructure by identifying resources needed to prepare for and respond to public health threats. One way to do this is by establishing national public health institutes that include surveillance, laboratories, the public health workforce, incident management systems, and implementation science. Martin described joint strategic planning efforts in six countries to strengthen preparedness and response efforts and mentioned that U.S. CDC technical experts have an in-country presence in more than 60 countries.

In its response to COVID-19, the U.S. CDC has leveraged several previous global health efforts, including platforms used for The President's Emergency Plan for AIDS Relief, the Field Epidemiology Training Program, global tuberculosis programs, and global health protection efforts, such as infection prevention and control, contact tracing, and operationalizing effective emergency operations centers in priority countries. She concluded that continuing to deliver essential health services while moving forward with vaccines, diagnostics, and mitigation efforts for COVID-19 still presents substantial challenges.

Judith Monroe, president and chief executive officer of the CDC Foundation, works to extend the life-saving work of the U.S. CDC through partnerships with philanthropies and other organizations. The CDC Foundation's agility during crises is a direct result of the trust built with partners involved in long-term relationships. In its 25-year operation, Monroe said, the CDC Foundation has launched more than 1,000 programs, and it manages programs in 140 countries annually. During an emergency, the CDC Foundation activates its emergency response fund, which is raised, not endowed, after the U.S. CDC has activated its Emergency Operations Center. The CDC Foundation's board of directors created priorities around global health security and data modernization, and Monroe remarked that COVID-19 has accelerated its efforts to establish new networks, funding, and partnership opportunities.

Lange asked panelists about the link between (1) global health security and pandemic preparedness and response, and (2) the broader effort to create strong health systems, especially when funding is limited. Sturchio said that when health ministers make the right investments to strengthen primary care and build the health workforce, the system is better prepared for a new pandemic. Cameron added that the GHS Index intentionally added a category with broader health system–related indicators so leaders could see the data, understand the relationships between broader access to care and health security, and make better decisions. Lange inquired about possible governance structures for pandemic preparedness and response. Sturchio mentioned that guidelines are needed to engage the private sector and civil society in financing and programmatic interventions. He added that it is important for existing institutions to be fit for purpose.

Cameron noted that in addition to strengthening institutions already in place, new public–private organizations are needed, such as an international organization to review public and private biosurveillance data. She highlighted the importance of developing mechanisms that can readily pivot production capability instead of relying on stockpiles or on a specific country. Martin added that it is important to build capacity for testing and manufacturing that can be expanded when needed, and Monroe emphasized that all organizations need to align with local culture as well as harness data for predictive analytics for pandemic readiness. ◆◆◆

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REVIEWERS: To ensure that it meets institutional standards for quality and objectivity, this Proceedings of a Workshop—in Brief was reviewed by **Allison Goldberg**, Anheuser-Busch InBev Foundation, and **Thomas Mampilly**, U.S. Centers for Disease Control and Prevention. **Lauren Shern**, National Academies of Sciences, Engineering, and Medicine, served as the review coordinator.

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For additional information regarding the workshop, visit https://www.nationalacademies.org/event/06-25-2020/public-private-partnership-responses-to-covid-19-and-future-pandemics-a-workshop.

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