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COVID-19 and World Order

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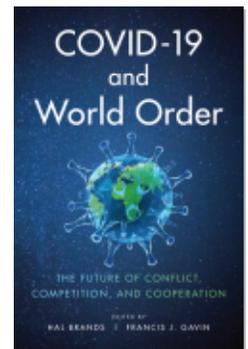
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PART II / Global Public Health
and Mitigation Strategies

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Make Pandemics Lose Their Power

Tom Inglesby

COVID-19 has had the power to do what few other international shocks could have done. It has sickened millions around the world in a matter of months, killed hundreds of thousands, and created a global economic crisis unprecedented in modern times. People around the world have been directed to stay at home for months to avoid catching the disease or contributing to its rapid spread. Massive job losses and economic ruin have occurred globally. Most schools around the world closed for a prolonged period, or they are still out. At least one national leader appears to have died from COVID-19,¹ and other national leaders who are either older or have certain underlying medical conditions run the risk of having a severe outcome should they become ill. Travel around the world has diminished to a fraction of what it was. While the disease has unified some countries in their collective effort to pursue a vaccine and to assist lower-income countries, it has deepened international fissures between others. It has underscored the importance and limits of international organizations in this kind of crisis. In the big picture, COVID-19 has shown the extraordinary power of pandemics to do harm.

Pandemics are in a small category of events that have destructive power on a global scale, posing risks that have been called global catastrophic risks.² The risks

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of future pandemics and biological threats are going to continue to grow. The next one could arise without warning or lead time at any point, just as SARS-CoV-2 appeared with no notice at the end of 2019. Even as the world continues its struggle to cope with this pandemic, it is critical to consider how to prevent something like this from happening again. Doing so will require a major re-envisioning of our effort to prevent and prepare for biological threats. Given its capabilities in science, medicine, health, technology, and manufacturing, the United States must be a central part of all these efforts. In US foreign policy, there has been a long-standing debate about US unilateralism versus multilateralism and the benefits and risks of those paths. The effort to drastically diminish the impact and consequence of pandemics in the future will require a strong combination of the two.

In the time ahead, the project for the United States will be to do what it can to prevent a new pandemic threat from emerging, to prepare a strong national program to respond to the next event, and to be a driver of international partnerships needed to solve critical global problems that emerge in this kind of crisis. If we can accomplish the necessary work within the United States and in partnerships internationally, we can give ourselves more warning about new outbreaks, diminish the risk that science will create new pandemics, accelerate the development of vaccines and therapies, and prepare our national and international systems for rapid, strong, and effective response that would limit illness and economic impact. This is how the United States can make pandemics lose their power.

Anticipate Biological Threats on the Horizon

There has been a series of acute infectious disease crises in the last twenty years, including the anthrax mailed letters in 2001, SARS in 2002–4, H5N1 bird flu in 2005, H1N1 influenza pandemic, MERS, Zika, and Ebola in West Africa and in the Democratic Republic of the Congo, to name just some. If you go back to the 20th century there were three major influenza pandemics, the most serious of which by far was in 1918. National and global systems for preparing and responding to these crises have evolved and improved over time, though progress waxes and then wanes as time passes after these events occur. The World Health Organization (WHO) has helped lead an effort to improve nations' capacity to prepare and respond to regionally serious epidemics and pandemics by measuring national capabilities to respond to infectious disease crises using an assessment tool called the Joint External Evaluation. The majority of countries in the world have voluntarily engaged in that transparent evaluation process, and scores from the

assessment have helped drive government and philanthropic funding to improve preparedness.

It might be imagined that the COVID-19 pandemic is a once-in-a-century event, and that since it has now happened, we are safe from another such event until far off into the future. Some might also believe that the severity of this virus, with its ability to sicken and kill so many, cannot be matched or exceeded by future pandemics. Neither of these notions is true. There are no natural waiting periods after a pandemic, and no certain limits to how lethal a future pandemic might be. Future pandemics could have higher lethality and/or a greater capacity to spread. One of the few comparatively silver linings of COVID-19 has been that it has caused substantially less serious illness in children compared to adults. Tragically it has caused death in some children but at a rate that is orders of magnitude less than older adults or those with certain underlying conditions. Future pandemics may not follow that pattern, however. If children were to get sick and die at rates similar to adults, that would create major global shocks beyond even the ones we are experiencing now as countries would consider drastic actions to protect young people.

At the high end, future natural, accidental, or deliberately initiated pandemics could lead to global catastrophe on the scale we are suffering now or even worse. At the highest end, these risks have been called global catastrophic biological risks, defined in this way: “Global Catastrophic Biological Risks are those events in which biological agents—whether naturally emerging or reemerging, deliberately created and released, or laboratory engineered and escaped—could lead to sudden, extraordinary, widespread disaster beyond the collective capability of national and international governments and the private sector to control. If unchecked, GCBRs would lead to great suffering, loss of life, and sustained damage to national governments, international relationships, economies, societal stability, or global security.”³

In addition to severe naturally occurring pandemics, there are other kinds of biological risks that need to be considered. The deliberate or accidental release of smallpox from its known global repositories could result in a smallpox pandemic in a world with very little immunity and enough vaccine to cover only a small minority of the world’s population.⁴ The scientific manipulation of a bird flu virus to turn it into a more transmissible variant could start a pandemic with high lethality in the event of laboratory accident or misuse. Science may also develop the capability of creating organisms using artificial genetic code that would be harmful to humanity on a large scale.⁵

Countries will need to improve the way they consider and plan for these kinds of risks. Special efforts will need to be made to prevent these kinds of events from occurring, but governments have not been particularly attentive to these kinds of potential harmful consequences of life science research or technological developments. If efforts to prevent pandemics or other global catastrophic biological risks fail, then there will need to be extraordinary national and global action in response. Preparing those systems will take a United States that is far more capable of responding, combined with an international pandemic response effort that is far stronger than what exists now.

Scale Up the Efforts to Prevent New Pandemics

Efforts to prevent pandemic threats from emerging will take a combination of surveillance and early-warning systems, better governance of science that could create new pandemic risks, and strong international diplomatic effort and agreement.

New viruses emerge from nature on a regular basis, with the jump from animals to humans being the most common way that novel epidemics appears.⁶ Existing viruses may also evolve new properties and so change in ways that make them more transmissible, lethal, or resistant to existing therapies. There are many conditions that are increasing the risks of big epidemics or pandemics.⁷ Humans are continuing to encroach on animal ecosystems that were previously undisturbed. Megacities continue to grow with people living more densely, in some places without access to good sanitation. The climate is warming, increasing the range of the animal vectors that carry diseases. Rising numbers of large, concentrated livestock operations around the world provide conditions for the rapid spread and amplification of pathogens within animal populations that could increase the risks of contraction for the humans working with and around them. People can travel around the world rapidly, incubating and spreading the disease, a means of spread that contributed to the rapid global spread of COVID-19.

Prevention efforts around natural pandemics should include improving early disease surveillance, both in the animals that are a frequent source of disease spread, but also in humans hospitalized with serious febrile illness, a substantial portion of whom are never definitively diagnosed. To build our understanding of the global baseline of human viral infections causing serious illness, we should increase the effort to identify specific viral causes of serious human illness.⁸ Science now provides the tools for that, but cost concerns and widespread access to technologies has limited their use. On the animal side, we need to build the sci-

ence around animal virus discovery, geographic range, and rate of evolution, with a special focus on viral families that have already caused serious outbreaks in humans. Other key capacities related to the prevention of natural epidemics are a country's ability to make rapid laboratory diagnoses and to mobilize public health and communicate with doctors and nurses at the earliest signs of a new outbreak. We should build these rapid systems aimed at the earliest possible recognition of a new outbreak so that we can move to contain it before it spreads.

Prevention efforts also need to be focused on preventing the misuse of science. Biotechnology, and the life sciences more broadly, while they do bring enormous benefits to the world, could also be misused in ways that increase the risk of accidentally or deliberately starting a new pandemic. Scientific tools and approaches now exist that allow scientists to increase the lethality or transmissibility of a pathogen, creating a novel strain not before seen in nature. If laboratory accidents were to occur while working on a novel pathogen that is highly transmissible and lethal—either through engineering failures, administrative mistakes, human errors, or subversion of safety systems—then that strain could start spreading in a community with the possibility of generating a large outbreak, even a pandemic.⁹ Similarly, if scientists with the skills to create these kinds of novel strains decided to create and release them deliberately into the world, they could themselves start an outbreak, perhaps leading to a pandemic. Such scientists could conceivably be working with a country's biological weapons program, a terrorist organization, a cult, or even be working by themselves or with small numbers of others.

Governments should have strong policies in place for the governance and funding of biotechnology and life science research that could generate novel pathogens that are transmissible and injurious,¹⁰ but most countries do not at this point. Any work that could result in pathogens with these characteristics should require very clear justification, senior government approval, public transparency, and with benefits determined to exceed the serious risks. If work is to be permitted to create such pathogens, then the highest possible biosafety and biosecurity systems should be in place to prevent possible accidental escape or deliberate dispersion from the laboratory. Viruses with pandemic potential that are no longer circulating, most notably SARS-CoV-1 and smallpox, should also be handled with the highest possible level of global biosafety and biosecurity. The current plan to hold all smallpox reserves and allow research in only two places in the world, and only after WHO approval, is one strong global model for noncirculating viruses with pandemic potential. Now that viruses can be created *de novo*, it is also possible to synthesize viruses from nonliving parts. Efforts need to be made to improve

screening and impose interdiction for those trying to order, without authorization, the parts of those viruses with epidemic and pandemic potential from DNA synthesis companies.

Given that biological weapons could be created that had the capacity to start epidemic or pandemic disease, the United States and other countries should also be fully committed to the terms of the Biological Weapons Convention (BWC),¹¹ the only treaty that bans an entire class of weapons. Most countries of the world have signed the convention, but there are no practical verification measures that are in place. It is critical to build confidence and assurance that countries are in compliance with the treaty in order to preserve the norm against biological weapons, with particular importance given to stopping the development, trade, and use of biological weapons that could start epidemics or pandemics. If a country is proven to be out of compliance with the BWC, the United States should work closely with the signatories of the BWC to impose sanctions, with particularly serious consequences for a country that has developed, acquired, or used a biological weapon with the capacity to cause serious and highly transmissible human illness.

Transform US Preparedness for Future Pandemics

To consider what the United States needs to build in order to stop future pandemics, it is important to consider our current response to COVID-19. While some parts of the world have had success in their efforts to control this disease, including New Zealand, Thailand, Taiwan, Iceland, the Czech Republic, and Australia, the United States has not done well. The United States was slow to transition diagnostic testing to public health labs, hospitals, and private-sector diagnostic companies. It also placed confidence in a strategy of trying to keep the disease entirely out of the country by focusing initially on banning incoming flights from China. The result was a delayed recognition that the United States was confronting pandemic spread of the disease, a delayed start to testing around the country, and the discovery of an extraordinary amount of COVID-19 infections in places around the country in March 2020. The United States also has had far too little personal protective equipment to safeguard its health care workers, essential businesses, or the public. Other countries provided medical masks for the general public,¹² but the United States did not even have enough for its own health care workers.¹³ The US Centers for Disease Control and Prevention (CDC), usually a highly visible pillar of public health response during infectious disease emergencies in the country, was restricted in its communications with the American pub-

lic.¹⁴ New York City was one of the hardest hit cities in the world, with as many as one in four hundred New Yorkers dying from this disease in the first three months of the pandemic there.¹⁵ Widespread state-level imposition of social distancing, public mask use, and expanded diagnostic testing worked to flatten the epidemic curve and slow the spread nationally. However, many states continued to have daily rises in the rate of new infections through at least June, at the time of writing this commentary. Communication from the top of government was confused, inconsistent, and too infrequent to continue broadcasting the message throughout the country. So, even as other developed countries have had major improvements in their epidemics, the United States continues to struggle.

The reasons for these mistakes are many. There seemed to be a political decision to minimize the virus at the start of the pandemic so as to avoid economic setbacks. There were also decisions to reopen economies in states around the country too quickly and fully, even for some of the higher-risk activities. In addition, in the years leading up to the pandemic, there has been waxing and waning support in the presidential administration and in Congress for pandemic-preparedness activities. In the setting of an acute infectious disease shock, there would, for a time, be a period of activity and funding. As time moved on, though, the attention paid to the threat would diminish.

Strong preparation for a future pandemic will require that the United States become highly capable on its own. The country will need to have the ability to rapidly develop and mass-manufacture vaccines. It should have the ability to manufacture personal protective equipment and ventilators on a large scale, sufficient for all the needs of the health care system, the public, and the many organizations that require or want this equipment for their operations. It will need the capacity to scale up diagnostic testing right from the start of a major new epidemic or pandemic. It also will require changes to medical and public health systems to make them much better prepared, as well as a plan to deal with long-standing racial inequities that have deepened the impact of this crisis.

Preparedness for a naturally occurring pandemic would resemble in most ways preparedness for one deliberately started by a biological weapon capable of pandemic spread, or accidentally initiated by a laboratory accident with a pathogen that was both lethal and highly transmissible. All of these would appear as an epidemic requiring early detection, rapid surveillance to understand the extent of disease, analysis of risk factors, health care for the sick, and development of medical countermeasures. And all of these parts of the response would require basically the same workforce.

If it were deliberate biological weapon use, there would be the additional concerns related to national security, law enforcement, and government intelligence, which would require their own careful response. But the public health and medical response for all would be similar. It should be said that efforts to prevent biological weapons development or use would be quite distinct from efforts to prevent a natural pandemic from emerging. Preventing deliberate efforts requires strong diplomatic initiative, strong law enforcement coordination, and interdiction work. It would also require good governance of the life sciences to avoid funding and supporting research that could be used to create novel pathogens capable of causing a pandemic.

Faster Development and Manufacturing of Vaccines, Therapeutics, and Diagnostics

With an extraordinary number of COVID-19 vaccine projects under way,¹⁶ this is the biggest and fastest vaccine development project in history. The major lines of effort are being funded by the United States, China, and an international collaboration run by the Coalition for Epidemic Preparedness Innovations in a partnership with WHO—all working in partnership with biotech or leading global vaccine companies. Some leading vaccine experts have said there is the possibility of having a safe and effective COVID-19 vaccine approved by the US Food and Drug Administration (FDA) by the end of 2020, with production starting at the end of this year or the beginning of next year.¹⁷ If so, that would be faster development by far than ever before for a new vaccine. Other leading experts believe it will take much longer to develop and produce on large scale a safe and effective vaccine. In any event, it is not fast enough to head off incredible sickness, death, and economic catastrophe around the world.

The United States will need to invest much more in preparing to make vaccines for unknown threats that emerge without warning. Given that there is no private-sector market for such investment between crises, readiness will require a dedicated government effort aimed at preparing for the emergency development of a vaccine for the next pandemic.¹⁸ That kind of program would fund the development and optimization of new vaccine platforms and technologies, as well as acceleration and optimization of proven vaccine development approaches. It would have the necessary contractual mechanisms in place for speed. It would have agreements with leading vaccine companies to initiate development at the earliest indication of an emerging pandemic. It would prepare for new manufacturing operations that could rapidly produce vaccine on a great scale, and it would have

worked through as many regulatory issues and as was feasible with the FDA in advance to identify the most efficient path to approval. We should resolve to do what it takes never to be in the position of waiting twelve to eighteen months, or possibly much longer, to have a vaccine to fight a new pandemic.

The rapid development and manufacture of a safe and effective vaccine should be the highest-order goal. A vaccine would change almost everything related to the response for the better. But because it will remain uncertain whether even a substantial new effort to prepare to make vaccine for unknown emerging infections will succeed, we also need to press forward with the capability to accelerate therapeutic development for the next pandemic. In the earliest days of a new therapeutic, there needs to be a rapid effort to assess whether existing medications can be repurposed with any effectiveness. These medications are already approved for other purposes, so they do not need to be developed. The case of hydroxychloroquine has shown us again that randomized clinical trials are crucial before therapies are recommended by leaders. Even if a medication seems to have promise in early treatment efforts, a randomized trial can show it causes more harm than good, as a series of trials have now shown for hydroxychloroquine.

New antiviral medications, monoclonal antibodies, and immune system modulators are all being developed now for COVID-19. Given the way trials work for these products, it may be possible to develop and demonstrate the safety and efficacy of these medications faster than is possible for a new vaccine. The United States and other countries have been moving along at a good pace with many of these trials, helped in part by an emerging infectious disease clinical trial network developed in the aftermath of the Ebola outbreaks in Africa. But this process could get faster and produce more information that could help with the approval process and decisions around use, and we should work to streamline and accelerate these clinical trial efforts. The large and fast-moving UK trial called Randomised Evaluation of COVID-19 Therapy recently announced the results of a study showing that a commonly used medical steroid reduced mortality in the sickest COVID-19 patients.¹⁹ This is an example of what we should aspire to do in the United States. That is the kind of speed and scale for a trial that is needed in pandemic conditions.

Diagnostics have been critical in this pandemic for identifying people infected with COVID-19 and for getting them isolated and properly treated as needed. Diagnostics will be crucial in future pandemics as well. They are key in monitoring disease control efforts within a state or country, and they are critical to assessing the overall course of an outbreak. In the COVID-19 response in the United States,

the process of transitioning the initially developed diagnostic test into a widely available one was seriously delayed by technical challenges and policy decisions. We need to be prepared in future pandemics to bring in the full diagnostic power of the leading US companies in clinical diagnostics and the health care system laboratories of the United States at the earliest sign of pandemic spread. Earlier widespread diagnostic testing could have limited the early spread of the disease and diminished the impact of COVID-19 in the United States.

Greater Supply of Personal Protective Equipment and Ventilators

When epidemics are local or regional in one part of the world, the emergency supply chain can pivot toward helping that region. But in a pandemic, all countries need the same critical materials at the same time. The United States had woefully too few N95 masks, too few surgical masks, too few gowns, and inadequate eye protection and face shields to cope with the COVID-19 pandemic. All countries were dependent on the same small number of global suppliers, some located in the United States but a substantial portion of them overseas. If we do not change that situation, we will again see in a future pandemic our doctors and nurses having to care for patients without the right protective equipment, high numbers of infections for health care workers, and too small a supply to give to businesses and organizations that need them. The United States needs to create the right incentives to develop its own robust manufacturing base for the personal protective equipment it will need. Some emergency supply should be stockpiled for immediate need in a crisis, but in addition we need the capability to emergently ramp up through increased US industrial supply. In the Strategic National Stockpile, a similar kind of arrangement is called keeping a warm base. If a supplier makes X number of masks in a year, the US government should establish a contract to pay the supplier to scale up rapidly to perhaps five times X or ten times X above their usual annual capacity in a time of national emergency. We need to build in this kind of surge capacity.

Another concern in the early months of the COVID-19 pandemic was the potential for ventilator shortages around the country. While social distancing measures and stay-at-home orders diminished the rate of new hospitalized cases in New York City in time to avert ventilator shortages overall, there were some hospitals in the city that reported having come extremely close to running out of ventilators given the rapid peak in COVID-19 patients. Future pandemic planning will need to plan appropriately both for the number of ventilators that should be

stockpiled and for rapid ramping up of production of low-cost ventilators should our national stockpile of ventilators not be sufficient.

Strengthen US Health Care and the Public Health Response and End Racial Health Inequities

Health care workers and hospitals will need to be better prepared for future pandemic events. A big part of that preparation relates to having the right protective equipment and material assets. COVID-19 has shown that many health care workers were not trained to manage these kinds of events. Many hospitals had not sufficiently prepared staff or acquired the needed facilities. Health care workers around the country stepped up to provide outstanding care for COVID-19 patients, despite the uncertainties. In the aftermath of this pandemic, it will be critical to go back to identify how some health care systems were able to succeed whereas other systems struggled to cope.

Public health agencies have been critical to state and local responses to COVID-19. They have a central role in advising political leaders, communicating with the public, running their state laboratories, identifying the highest risks and sources of transmission, establishing diagnostic strategies, and running contact tracing and quarantine efforts, among other key responsibilities. They are chronically underfunded in between times of epidemic crisis, and this needs to change. Our public health system should be built to rival any in the world, but it is clear that public health agencies such as those in Hong Kong, Singapore, Taiwan, New Zealand, and Iceland, to name a few, have capabilities that exceed ours in important ways. There are public health data management systems, outbreak investigation capabilities, crisis communication, and contact tracing efforts that are far stronger in countries around the world than they are in the United States. We should learn from others by emulating them and turning our public health systems into ones that can cope with the challenge of future pandemics.

Federal health agencies are also an important part of our health care and public health systems. The CDC provides some of the best technical advice in the world, both to the public and to local health agencies, and that has for the most part been true during the COVID-19 pandemic. The CDC has expertise across a range of disciplines that are key to pandemic preparedness and response. In major infectious disease crises of the past, the CDC was allowed to explain and guide the public and medical and public health leaders. Unfortunately, the CDC has not been allowed to serve in that role for COVID-19; the CDC has been permitted to

make relatively few public announcements as the pandemic progressed. That should change. The country needs the CDC to regain its advisory role.

The Department of Health and Human Services also has the Office of the Assistant Secretary for Preparedness and Response (ASPR), which is responsible for preparing hospital systems for crises. The hospital preparedness effort needs to be substantially expanded from where it stood before the pandemic. The ASPR should also be prepared to take on major responsibility for logistics in future pandemics, centrally coordinating the distribution of scarce resources to states and hospitals as needed. The ASPR has control of the Strategic National Stockpile and so can deploy those resources,²⁰ but it also must be ready to contract with companies to make products or assets that are in short supply or that might not have been anticipated. If the ASPR is unable to fill that kind of national logistics role, then the Department of Defense or the Federal Emergency Management Agency could also serve in that role, or do it jointly with the ASPR, as came to happen over time in the US response to COVID-19.

One more priority in building the nation's response is to correct gross inequities in the health care and public health response that has resulted in people of color being disproportionately sickened and killed by COVID-19.²¹ This population of people is more likely to have jobs categorized as essential and so would be unable to telecommute, which puts this population at higher risk of catching the disease on the job. People in essential jobs need to be better protected, with masks, spacing, and changes to work operations that decrease their risks. People of color also have less access to health care and more difficulty overall in getting a diagnostic test in many parts of the country. Those things would need to be addressed with urgency at the start of a future pandemic. It is also known that people of color have more underlying medical conditions that place them at a higher risk of having severe outcomes with COVID-19, and these medical conditions themselves are often determined by social factors including less access to healthy food and good outpatient care, higher environmental risks to health, and other challenges. Those are the kinds of issues that should be dealt with and changed now as part of improving the quality of and access to health care in the United States, well in advance of any future pandemic.

One particularly important task for strengthening US preparedness for pandemics is to rebuild public trust in public health and the interventions we will need to rely on in the future. Substantial portions of the public have concerns about vaccines or will refuse to get them. During the COVID-19 response, a sizable portion of the national population has resisted wearing masks, social distanc-

ing, or otherwise changing their lives to slow down the spread of the virus. That kind of reaction has been rare elsewhere in the world. For the United States to develop a strong preparedness program, we have much work to do to understand the root causes of public mistrust of these public health tools and recommendations. We will need the public to be strong and full partners in efforts to prepare the country for infectious disease crises of the future.

Strengthen the Multilateral System of Response

Even while the United States is doing all that it can to build up its own capacities to respond vigorously and successfully to future pandemics, it also needs to prepare and plan effectively and intensely with other governments, international organizations, and the private sector. Together with these partners around the world, the United States needs to anticipate and address problems that can only be solved through multinational efforts, public-private partnerships, and international approaches. Even if the United States should become largely able to solve its own challenges in a future pandemic, it will be in the country's clear interest to help the international community get through a global pandemic crisis as quickly as it can, whether that is a pandemic with the severity of COVID-19 or something even worse. Not only would it be the morally right approach for a strong United States to help the rest of the world cope with and recover from a future pandemic, it would also be in the national and economic interest of the United States to do so. There are some who may say that preparing for and responding to a pandemic is a zero-sum game that requires us to go our own path and compete with other countries over scarce resources. And, in fact, that is to some extent how the United States has operated in response to COVID-19. Not having developed its own manufacturing infrastructure for masks, for example, the United States has tried to muscle its way past others to get scarce resources. However, in the future, were the United States to operate with a longer-term strategy and seek synergy with partners around the world, pandemic planning would then not be a zero-sum matter. We do better when other countries do better. If much of the rest of the world remains badly disrupted, economically failing, fragmented in its trade efforts, overwhelmed with sickness and mortality—and perhaps unstable politically, unable to fulfill international obligations, and no longer capable of sending its students abroad or having its businesspeople and travelers come to the United States—then the United States will suffer.

The United States should be helping to build systems to manufacture and provide on vast scale what the United States will need to be making for itself: vaccines

and therapeutics, personal protective equipment, and necessary medical equipment. For example, vaccines will need to be manufactured quickly at sites around the world. A global system of distribution that relies on international organizations and private-sector distributors will be needed. How this is all accomplished could produce greater solidarity or long-term fissures between countries.

While some countries in the world can and will increase their domestic manufacturing base for these products, there are many that will not be able to, either financially or technically or both. The United States, working with other governments, international organizations, and the private sector, should increase the stockpile of vaccines, therapeutics, diagnostics, and personal protective equipment at WHO. There are important products for known infectious diseases (e.g., yellow fever, Ebola, influenza) that can be stored now for anticipated emergencies, and this will help create the logistics and decision-making processes needed when new vaccines and therapeutics for previously unknown pandemics are created and require a process of global dissemination. In the COVID-19 pandemic, the process of distributing vaccine, when one becomes available, will likely rely in part on the WHO stockpile system as it exists now. We should learn from this process and strengthen and expand it going forward.

Governments should incentivize major biopharmaceutical companies to invest in distributed-manufacturing approaches so that the same critical vaccine and therapeutic products can be made in many parts of the world concurrently. This will require navigating legal and regulatory issues ahead of time. Without a widely distributed manufacturing process, lifesaving products may become restricted to the countries where they are created or to their close allies. We need to create a system that does not lead to that.

Global business should be a strong part of these efforts. It is very clear now what the economic toll of pandemics may be in the future. So global businesses should be fighting for much more robust national planning efforts, stronger international organizations, and better preparedness within their own organizations. COVID-19 has shown that a severe pandemic greatly interferes with workforce health, business operations, and the movement of goods and services, with potentially long-lasting effects on whole industries and national and global economies. It has also become clear that economies will not be able to fully recover without strong COVID-19 disease control efforts. The public is unlikely to go out and engage with the economy, buy things in the way they used to, go to entertainment venues, or travel, until they feel safe doing those things.

Governments and the private sector should also focus on establishing better processes for sharing scientifically and medically correct and useful information with the public and better coping with misinformation in the setting of a pandemic. Governments rely on traditional and social media companies to communicate with the public. Establishing partnerships in advance of future pandemics will help increase the spread of information that is reliable and scientifically valid, amid a flood of stories that are inadvertently or deliberately incorrect. The more that people get reliable and accurate information, the better societies will do at making good decisions and taking wise action.

To cope effectively with future pandemics will require strong international organizations that have the political and financial support of countries around the world. Of these organizations, WHO is particularly vital. In this pandemic, WHO sounded an early warning about COVID-19 at the start of January and started sending out technical reports from that time forward. It has been criticized for moving too slowly because of political interference. But if one looks at the timeline of WHO's actions and decisions in early January, it is clear that it was quickly communicating what it was learning to the public, and it was rapidly developing and publishing guidance. It is true that WHO did not declare a public health emergency of international concern until the end of January, and many in the public health community were arguing that a declaration should have happened sooner. WHO later said it had worried that declaring a public health emergency too soon might lead China to let up on its containment efforts. As a point of comparison in terms of timing, at the end of February, President Donald J. Trump was still saying that the virus was going to disappear and was under good control in the United States.

WHO has been providing guidance to countries around the world since the pandemic began, and it has sent technical assistance teams and medical assets to places with the greatest need.²² WHO got a public health assessment team into China early on, when other countries could not on their own. It helped rally the world around a new approach to vaccine and therapeutic trial design that should accelerate results. It helped create a coalition of countries from around the world to donate to vaccine development efforts. The United States should be doing all that it can to strengthen WHO by enabling it to provide more technical and material assistance to countries that need it.

Instead of doing that, however, the United States is currently in the process of withdrawing from the organization. When the COVID-19 crisis subsides in the

world, there should be an assessment of the overall WHO response to COVID-19, with an aim of strengthening its response in advance of the next global pandemic crisis. No doubt there are things that it can do to improve its response, decisions that it may have made differently given what we know now. But in the midst of this crisis, WHO needs to be strongly supported. It is a critical international institution and has the confidence of most countries around the world on technical and health matters. We should help work to strengthen it. In a substantial portion of the US public, though, there is an antipathy to international organizations, including WHO. This public antipathy has been fostered by a number of political leaders over the years. It will require strong leadership to counter that narrative going forward. It will require that presidential administrations and Congressional leaders make the case for international engagement, particularly for WHO engagement. In the case of WHO, it will be important to convey what the world would look like without WHO in a pandemic. It will also be key to offer a vision of how US leaders want WHO to evolve. Effective leadership can and should make the case for WHO's high value and paint a picture of how the United States will support it and help it move forward with strong multilateral partnerships to be better prepared for future pandemics.

Pandemic Resilience

COVID-19 has established that pandemics are a terrible source of global upheaval and destruction, a form of catastrophe that has to be clearly reckoned with in humanity's future. Unlike some other potential global catastrophic risks, the path to take for averting or mitigating pandemics is relatively clear, even if it is not easy or fast to carry out. The United States needs to understand the risks of natural and manmade epidemics and pandemics. It needs to plan for and invest in large-scale innovations, technologies, programs, and strategies that will transform its national ability to prevent and prepare for pandemics in the future. At the same time, it needs to be a strong partner with other countries in the world, working to create a post-COVID-19 system that is far more capable of anticipating and responding to future pandemics. International organizations, especially WHO, as well as the private sector will need to be key partners in that global effort. If and when we do all these things, we will strengthen our medical and public health systems in ways that make the United States more resilient to infectious disease threats. We will also diminish the power of pandemics to wreak havoc on the world.

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