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COMMENTARY

Infectious Disease Threats: A Rebound To Resilience

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ABSTRACT The US has experienced a series of epidemics during the past five decades. None has tested the nation's resilience like the coronavirus disease 2019 (COVID-19) pandemic, which has laid bare critical weaknesses in US pandemic preparedness and domestic leadership and the nation's decline in global standing in public health. Pandemic response has been politicized, proven public health measures undermined, and public confidence in a science-based public health system reduced. This has been compounded by the large number of citizens without ready access to health care, who are overrepresented among infected, hospitalized, and fatal cases. Here, as part of the National Academy of Medicine's Vital Directions for Health and Health Care: Priorities for 2021 initiative, we review the US approach to pandemic preparedness and its impact on the response to COVID-19. We identify six steps that should be taken to strengthen US pandemic resilience, strengthen and modernize the US health care system, regain public confidence in government leadership in public health, and restore US engagement and leadership in global partnerships to address future pandemic threats domestically and around the world.

Emerging infectious diseases have been increasing in frequency during the past five decades.¹ These include recurring outbreaks caused by influenza and Ebola viruses; diseases that have dramatically increased their range and impact such as Chikungunya and Zika viruses; and outbreaks caused by novel pathogens (so-called Disease X), such as severe acute respiratory syndrome coronavirus-1 (SARS-CoV-1) in 2002 and SARS-CoV-2 in 2019–20, the virus responsible for the current coronavirus disease 2019 (COVID-19) pandemic. (The online appendix contains more details on these and other infectious disease outbreaks.)² From 2010 to 2020 annual outbreaks of influenza A and B in the US resulted in 9–45 million illnesses, 140,000–810,000 hospitalizations, and 12,000–61,000 deaths per year.³ Between January 21,

2020, and January 11, 2021, SARS-CoV-2 caused more than 22.3 million documented infections and more than 373,000 deaths from COVID-19 in the US.⁴ With just 4 percent of the global population, the US accounted for almost 25 percent of the world's reported cases and tied with Hungary for the fourth-highest per capita COVID-19 confirmed death rate of any western high-income country as of January 11, 2021.⁵ This novel virus has revealed the US to be unprepared, overconfident, and inept in pandemic control. In this wealthy country with globally respected agencies for infectious disease research (the National Institute of Allergy and Infectious Diseases [NIAID]), public health (the Centers for Disease Control and Prevention [CDC]), evaluation and licensing of drugs and vaccines (the Food and Drug Administration [FDA]), and unparalleled academic and pharmaceutical capacity, the na-

tion's failure to contain the outbreak must be thoroughly examined, to avoid similar failures in the future.⁶

This article is part of the National Academy of Medicine's Vital Directions for Health and Health Care: Priorities for 2021 initiative, which critically assesses public health issues of the past five years to provide guidance for the incoming US administration. Although there will likely be other major infectious disease challenges in the future (for example, antimicrobial drug resistance), addressing the shortcomings of the US response to COVID-19 is of the highest priority to improve preparedness for the next pandemic. We discuss how the pandemic has laid bare the impact of health inequity, the need to strengthen public health policy, and the wisdom of adopting a One Health approach. We then lay out six policy options that we believe will be essential to improving the US response to pandemic threats, helping the country regain international standing as a global health leader, and supporting a rebound in resilience to meet the challenges of a post-COVID-19 world.

Pandemic Preparedness In The US

Federal agencies, together with state and local governments, collaborate in protecting the nation from infectious disease epidemics. During previous outbreaks, states, cities, and entry port authorities have worked with the CDC and the Department of Homeland Security (DHS) to prepare for infectious disease introductions and to develop quarantine and control measures. CDC epidemiologists bolster outbreak response and disease control, identify unusual clusters of disease, enact travel and trade restrictions, and identify tainted food products. The CDC can develop and manufacture diagnostic tests and supply them to states and localities, and it can support research on drugs and vaccines to combat diseases. Collaborations among the CDC, FDA, Department of Agriculture (USDA), and states to tackle foodborne infections and antimicrobial drug resistance have led to the FDA ending the use of medically important antibiotics for growth promotion in food animals and requiring veterinary oversight to prescribe such antibiotics for animal use.

The US supports pandemic prevention strategies with an international focus. Some strategies are focused on biosecurity—for example, the Department of Defense Biothreat Reduction Program and Global Emerging Infection Surveillance and Response System and the Department of State Biosecurity Engagement Program. Others are research based—for example, the NIAID at the National Institutes of Health

(NIH) funds international partnerships to analyze the origins of pandemics, risk for future emergence, and development of vaccines and therapeutics. The US Agency for International Development (USAID) Emerging Pandemic Threats initiative and the NIH Fogarty International Center programs aim to build capacity globally, whereas the Global Health Security Agenda (GHSA) and CDC Global Disease Detection programs involve monitoring of health threats and preparedness capacity. Before 2017 the US took part in successful international interventions around influenza, Ebola, Zika, and many other infectious diseases. However, the US capacity to tackle infectious diseases on the global stage and domestically has never been tested as severely as it has by the COVID-19 pandemic.

Critical Deficiencies In Current Pandemic Preparedness

The US response to outbreaks has evolved and improved over time. The 2014–15 Ebola outbreak in West Africa revealed weaknesses in global capacity for rapid outbreak detection and containment in resource-poor settings. US involvement in the launch of the GHSA by the G7 came about partly in response to these perceived weaknesses.⁷ Since 2017, however, pandemic prevention research and emergency response structures have been underfunded, sidelined, or removed. This includes an almost two-year absence of leadership at the White House Office of Science and Technology Policy, cuts to pandemic preparedness staff and funding at NIH and USAID, and removal of the global health security team responsible for pandemic strategy within the National Security Council.⁸ Domestic capacity to manufacture personal protective equipment (PPE) had dwindled in the US as a result of a lack of federal contracting and an emphasis on biodefense therapeutics over PPE and clinical care equipment (such as ventilators) in the Strategic National Stockpile. The dominance of the international supply chain for active pharmaceutical ingredients for drugs was underestimated, and warning signs were ignored.

Notably, the US was ranked first in the 2019 Global Health Security Index, yet it scored poorly in facility and community care capacity, political and security risks, and socioeconomic resilience and was ranked 175th in the world for health care access.⁹ Moreover, it received a score of zero for public confidence in government—a critical requirement for an effective public response. Assessments of US engagement in the Ebola outbreak response in West Africa highlighted deficits in the country's commitment to the World Health Organization (WHO) and identified crit-

ical improvement efforts, most of which have been ignored.⁷ Most emerging infectious diseases originate outside the US, and in the past few years US and international scientists raised the specter of a pandemic due to a novel Asian-origin respiratory virus, specifically a bat-origin SARS-related coronavirus.¹⁰ However, reductions in health and science staff at US embassies in China and elsewhere, disengagement with the WHO, and the increasingly fractious nature of US relationships with its global partners undermined the ability to act effectively on these forecasts, or even to obtain early knowledge of the COVID-19 outbreak.

Once SARS-CoV-2 spread beyond China, its origins and control became politicized rather than informed by science.¹¹ Although a federal Coronavirus Task Force was established January 29, 2020, it proved ineffective in its communication and overly influenced by politics. The significance of COVID-19 and the high likelihood of its spread in the US were minimized, leading to initial complacency within government leadership and the public. Similar responses occurred in some European countries (for example, Sweden and the United Kingdom), but the impact in the US was greater. The US enacted travel restrictions in March to prevent COVID-19 entering the country but left procedural gaps that allowed large numbers of potentially infected people to return to or enter the US without sufficient planning for safe processing at the airports, including quarantine, testing, or contact tracing. Guidance for Americans traveling overseas and on cruise ships was lacking, confusing, or poorly communicated. Testing for the virus failed, initially because of faulty reagents in the CDC kit originally distributed to states, then because of inflexibility in the FDA's rules to certify tests, and later perhaps primarily as a result of the executive branch's dismissal of expanded testing capacity.¹² Isolation of the US from the global health community began before the outbreak and grew throughout the initial surge, culminating in the widely criticized decision for the US to leave the WHO.¹³

The politicization of public health decisions has led to public confusion over the value of nonpharmaceutical interventions. The removal or silencing of key scientific staff at federal and state agencies (for example, the Biomedical Advanced Research and Development Authority [BARDA] and the CDC) and interference in agency decisions on therapeutics and vaccines (for example, the FDA decision to authorize emergency use of hydroxychloroquine for COVID-19, or FDA criteria and decision-making protocols for emergency approval of a vaccine) have eroded public confidence in government decisions

on COVID-19.¹⁴ Antiscience statements from the Trump administration, conflicting public messages, support by government officials for conspiracy theories on the origin of SARS-CoV-2, and accusations that China is responsible for the pandemic have limited US involvement in determining the origins of SARS-CoV-2, will likely undermine vaccine uptake, and have already blocked relevant scientific collaborations between scientists in the US and China. Repeated efforts to open the economy rapidly in advance of adequate testing capacity, coupled with the relaxation of CDC guidelines on mitigation, have led to subsequent rises in cases and deaths. Abrupt changes to federal surveillance reporting protocols undermined confidence in the objectivity and validity of reported caseloads and hindered understanding of epidemic trends.

The combination of missteps and disregard of science-based policies has resulted in rates of infection and mortality in the US that are orders of magnitude higher than those in countries with comparable economic and medical capacity (for example, South Korea, China, and Germany). These rates of infection and mortality in turn have had major social, educational, political, and economic ramifications. The rise in cases was accelerated by systemic inequities within the US population, representing a particular threat to minorities and those living in poverty.

Systemic Disparities And Epidemic Disease In The US

Epidemic diseases do not occur in a vacuum. They exploit the connectivity within societies, and their impacts may be exacerbated by social divides, economic disparities, and injustices that lead to inequities in health care. As a result, the impacts of epidemic diseases are disproportionately experienced by already vulnerable population groups. In the US, centuries of ongoing racial injustice founded in slavery and post-Civil War disenfranchisement have led to systemwide disparities in income, safe and adequate housing, access to health care, high-quality education, healthy and sufficient food, clean water, and employment security, as well as targeted excessive policing.

The impacts of these underlying disparities have been well documented by the significantly higher hospitalization and death rates from COVID-19 in the African American and Latinx communities. The reasons for these disparities are deep and complex. There is a higher prevalence of predisposing conditions that increase COVID-19 severity, including obesity, diabetes, and cardiovascular and pulmonary diseases, in these populations. The stringent measures im-

posed in response to COVID-19, without appropriate supportive social and economic policies (such as support payments, sick leave, eviction pauses, and universal access to health care) have magnified existing inequalities, made compliance difficult, and undermined the social compact and trust necessary for public health measures to succeed. Discrimination in health care and the inequitable allocation of resources compounded these injustices, particularly affecting communities of color, people with disabilities, people in detention, and the elderly. COVID-19 has demonstrated that health care inequity in the US is a public health threat to the whole population.

Policy Challenges In Addressing Epidemic Threats

DOMESTIC LEGAL BARRIERS AND OPPORTUNITIES

COVID-19 has also revealed critical barriers in national policy and governance that hinder US pandemic preparedness and response. Although states bear primary responsibility for public health, the federal government is the key funder of pandemic response. The benefits of federalism in giving states flexibility to tailor responses to their populations' needs while capitalizing on the federal government's power to coordinate were not harnessed during the COVID-19 pandemic. A cohesive national plan to contain and control COVID-19 has not been released; therefore, states have been driven to develop individual control measures, resulting in disparate responses, patchy suppression of cases, competition for PPE and ventilators, and continued disease spread. Other countries with similar federal structures (for example, Germany and Australia) responded significantly better to COVID-19, suggesting that federalism per se was not to blame in the US. Of more significance was a lack of national leadership and coordination among state and federal entities on data sharing and research and fair distribution of and access to PPE, ventilators, testing, and treatments—and ultimately vaccines. The emergency declaration powers vested in the president and in the secretary of HHS were used to release funding to states and remove some regulatory barriers. However, decades of underfunding of state, territory, and local public health departments, resulting in outdated information technology for data sharing and contact tracing (even at the CDC), led states to compete with the federal government when purchasing PPE, ventilators, and test kits. Ultimately, some states replicated the benefits of federalism, collaborating regionally on such measures as cross-border quarantine requirements and supply procurement through

multistate cooperation agreements.

Measures to protect public health have long been seen to be necessary, reasonably designed to prevent or ameliorate the threat, proportional, not harmful, and nondiscriminatory (*Jacobson v. Massachusetts*, 197 US 11 [1905]; and *Ho v. Williamson*, 103 F. 10, 26 [C.C.N.D. Cal. 1900]). The COVID-19 pandemic has demonstrated that the nation's long history of racism and economic inequality can accentuate the impacts of epidemic disease on already vulnerable and marginalized communities. The pandemic also demonstrates the role of broader policies that move beyond health to ensure a broad range of social, economic, and political protections to promote equity and foster a healthier US population.

ROLE IN INTERNATIONAL PANDEMIC PREPARED-

NESS The International Health Regulations of 2005 are the primary legal global instrument for preventing, detecting, and responding to cross-border health threats. Problems in their implementation have spurred calls to revise them, including the need to enforce the obligation to rapidly report public health events to the WHO; provide relevant clinical, epidemiological, and laboratory data and pathogen samples; revise the classification system to allow international response to expanding outbreaks before the declaration of a Public Health Emergency of International Concern; and require cooperation with the WHO and international partners to monitor the impact of resulting interventions. If the US carries out the Trump administration's stated intent to leave the WHO, the nation will not add its input to critical decisions around proposals that would empower the WHO's Health Emergencies Programme or the World Health Assembly to enforce recommendations or investigatory powers or to amend existing emergency declaration powers. Proposals may also seek to require countries to provide genetic sequence data and pathogen samples of outbreak pathogens. The latter is currently covered by the Nagoya Protocol; however, the US is not a party to the Nagoya Protocol and is therefore unable to formally participate in any negotiations in that forum as well. International Health Regulations reform—or any new piece of international law—may also address legal barriers and gaps in the equitable distribution of diagnostics, treatments, vaccines, and other medical goods, including PPE. The ability of the US to participate and represent its interests will be significantly affected by the country's future approach to multilateralism, engagement with the WHO, and global collaborative responses to the COVID-19 pandemic.

The Role Of A One Health Strategy To Tackle Pandemics

Most emerging infectious diseases, and almost all known pandemics, are classified as zoonotic diseases (zoonoses)—that is, they involve microbial transmission among animals (wildlife or livestock) that ultimately “spills over” to humans.¹⁵ One Health is defined as a breaking down of public health siloes among livestock, domestic animal, wildlife, and human health and the environment to better address health threats that include infectious diseases.¹⁶ One Health is a particularly pertinent approach for pandemics, given their predominantly animal origins. The rate at which novel microbes spill over and spread has risen in step with exponential increases in environmental and land use changes, disruption of wildlife habitats, global travel and trade, and increased human-animal contact.¹⁵ For example, expansion of poultry and pig production in Southeast Asia led to repeated influenza outbreaks and the initial emergence of Nipah virus in Malaysia, whereas the spillover of bat-origin coronavirus diseases such as SARS, Middle East respiratory syndrome (MERS), and COVID-19 has been driven by expansion of human settlements into wildlife habitats and by the hunting, consuming, and exploitation of wildlife. Coordinated and cooperative action across human, animal, and environmental sectors (One Health) is recognized as an essential strategy to tackle this rising threat.¹⁵

Within the US, public health response to outbreaks of animal-origin microbes is hindered by jurisdictional boundaries among the CDC, FDA, US Fish and Wildlife Service, USDA, and US Geological Survey’s National Wildlife Health Center and between these agencies and their state and local counterparts. Coordination among these agencies would speed up identification of microbial threats and mitigation strategies to address them. For example, the US is the biggest importer of wildlife on the planet, with 10–20 million individual animals imported legally each year¹⁷—and countless more illegally. Zoonotic diseases have emerged in the US through this pathway (for example, monkeypox). Disease surveillance at ports of entry is currently mandatory for just a handful of known pathogens but is completely lacking for novel pathogens and potential zoonoses, so the international wildlife trade remains especially at high risk for the importation of diseases affecting people, livestock, and wildlife. Broader surveillance and meaningful regulation of disease risk in the wildlife trade are needed to mitigate these emergence threats.¹⁸

Transitioning to a One Health approach can be an important tactic to ensure public health resilience because of the high proportion of emerg-

ing diseases that are zoonotic. The adoption of this approach in the US’s international health efforts would also help address the global nature of pandemic emergence. Emerging infectious diseases originate mainly in tropical and subtropical regions that have high biodiversity of wildlife and the microbes they harbor. Because of the limited resources available in many regions, spillover to humans often goes unrecognized or unreported for long periods.^{19,20} The causes of disease emergence are rooted in patterns of socioeconomic growth and environmental change (for example, deforestation, land use change, and wildlife trade), often driven by consumption patterns in the US and other countries at all income levels (for example, global consumption of palm oil). Programs have been proposed to conduct better surveillance for new emerging infectious diseases and to mitigate consumption to reduce pandemic risk and provide collateral benefits to conservation.²¹ Multisectoral One Health surveillance systems integrated across animal, human, and environmental health can vastly improve early detection, control, and ultimately prevention of future threats.

Six Steps To Strengthen US Pandemic Resilience

We have reviewed the US capacity for preparedness to address future pandemics and have identified inadequacies in its response to COVID-19 and policy and equity challenges that this and future pandemics will present. Here we offer policy options for structural changes at the national level that will help build depth and resilience into future US pandemic preparedness. Given the chaotic response of the executive branch of the US government to COVID-19, which stands in contrast to often strong leadership at the state level, these options focus on policies affecting federal agencies and the executive branch, with the goals of better mobilizing resources, communicating transparently and consistently, restoring US respect for science- and evidence-based policy making, fostering independence between public health and politics, and repairing fractured international alliances and collaborations. To achieve these goals, we believe that the following six steps should be considered by US policy makers, and in particular by the Biden administration.

LAUNCH A COMMISSION The US should rapidly launch an independent expert Pandemic Preparedness and Response Commission to review US performance in preparing for and responding to COVID-19. The commission should be led by the established independent body mandated

to advise the US government on health and science issues: the National Academies of Science, Engineering, and Medicine. This review should be nonpartisan, be constructively critical of short- and long-term failings and gaps in US public health systems, have a One Health perspective, produce forward-looking strategies to deal with these issues, and identify what worked well to build on successes. The commission should have multidisciplinary science, policy, and communication expertise and transparent governance, with a focus on fact finding and accountability to the public so that the US does not fail in its response to the next Disease X.

STRENGTHEN AND MODERNIZE HEALTH AND PUBLIC HEALTH SYSTEMS The US should reinstate, strengthen, and institutionalize the Directorate for Global Health Security and Biodefense at the White House and create a permanent position for a global health security and pandemic preparedness representative at the National Security Council. In addition, funding should be guaranteed through congressional action to restore effective public health capacity at the federal, state, and local levels and to continually modernize and improve the agencies involved.

A comprehensive, multisectoral strategy should be developed to address the challenges posed by zoonotic infectious diseases via One Health systems and capacities coordinated across federal agencies and a One Health task force at the White House. Also, a federally led, multipronged science- and evidence-based communication and governance campaign should be created and launched to deal with scientific misinformation and disinformation, including vaccine hesitancy among the public.

The US should strengthen access to health care by expanding the number of people with a social safety net of health insurance coverage as a first step in dealing with current inequities in access. The nation should establish a sound scientific and public health foundation to underpin health insurance policy and should make equitable and universal health care a strategic priority, recognizing it as a critical public health goal.

Data sharing should be enabled across human, livestock, and wildlife health platforms that include environmental indicators and planning to inform policy. This should include revision of the CDC's public health information systems to better align local, state, and federal data.

Finally, the US should adopt the recommendations on research and development for pandemic preparedness laid out in the recent National Academy of Medicine report to the Global Preparedness Monitoring Board.²²

RENEW STATUS AS GLOBAL PUBLIC HEALTH LEADER AND PARTNER Because infectious disease

threats anywhere are threats everywhere, US health security is dependent on engagement in the global system, particularly in the post-COVID-19 pandemic period, when the US risks being excluded from having a voice at the table in crucial global reforms. The US should ensure its long-term commitment to the WHO by immediately reversing the decision to leave the organization, fully meeting US funding responsibilities, and actively engaging with partners to support and improve the WHO's capacity to deal effectively with pandemic threats before they become globalized. The US should also support revision of the International Health Regulations (and companion evaluation tools developed by the GHSA) to reflect a more comprehensive and inclusive multisectoral approach to early detection across animal and human health threats and early reporting of suspected spillover of animal microbes to humans to control and limit national, regional, and international spread.

A formal commitment should be made to efforts under International Health Regulations and the GHSA to build essential core capacities in all nations, coupled with reforms including the following: improve compliance through country agreements and independent measures of performance, highlighting where nations have succeeded at reducing risk related to travel and trade and gaps in operationalizing the International Health Regulations; strengthen the Joint External Evaluation of countries' International Health Regulations core capacities and provide resources and collaboration to address the shortcomings identified in the process; and introduce One Health and governance metrics directly into the Joint External Evaluation.

In addition, support should be increased for international research collaborations on emerging infectious diseases and research capacity building in emerging infectious disease hotspots through increased funding to NIAID, the CDC, and USAID for collaborative programs. Efforts should include strengthening US presence via laboratories in emerging disease hotspots (for example, international laboratories in the Navy Medical Research and Development Enterprise Laboratories network and the Walter Reed Army Institute of Research). The American Association for the Advancement of Science fellowship program should be expanded to build a larger cohort of science and diplomacy fellows and to encourage scientists to work with HHS, USAID, the State Department, and DHS on critical disease threats and public health issues around the world.

The US also should commit to the equitable global sharing of diagnostics, therapeutics, vaccines, and nonpharmaceutical supplies (for ex-

ample, PPE and ventilators). One key action would be immediately joining more than 190 high-, middle-, and low-income countries in the global COVID-19 Vaccine (COVAX) initiative.

REINFORCE A SCIENCE-BASED APPROACH TO PUBLIC HEALTH POLICY At the level of the White House, the importance and role of objective science in decision making should be actively promoted. The National Academies' Standing Committee on Emerging Infectious Diseases and 21st Century Health Threats should be advising the White House as a permanent committee, convening regular meetings with agency heads and the executive branch to provide an independent second tier of scientific advice distinct from agency staff.

Information campaigns by HHS directed at—and designed for—all segments of the US population, including children, adolescents, and minority communities, should be introduced and sustained to reduce vaccine hesitancy, and additional resources should be provided to the CDC to counter misinformation and conspiracy theories promulgated on social media and by the press. STEM (science, technology, engineering, and mathematics) education should be reviewed, and the Department of Education should be challenged to develop and ensure adequate financial support for STEM programs, focusing on science and public health education in middle and high schools across the country.

Working with Congress, the White House also should promote cultural diversity and opportunity for all communities to engage at all levels of science: education, policy, academia, media, and civil society.

FEDERAL FUNDING AND POLITICAL INDEPENDENCE FOR PANDEMIC AGENCIES Pandemic agencies should aim to enhance or develop a robust, resilient system to predict, prevent, prepare for, and contain pandemics. Long-term support should be provided to NIAID for the development of vaccine platforms and broad-acting therapeutics to target both known and potential future disease threats, including virus families prone to host-shifting and spillover and novel viruses representing high emerging disease risk.

Collaboration between BARDA and the Coalition for Epidemic Preparedness Innovations (CEPI) should be enhanced, including financial investments to design and trial vaccines for potentially pandemic viral pathogens. An initiative similar to CEPI should be established to address additional groups of important microbial pathogens and extend the vision to diagnostics and therapeutics in addition to vaccines. In addition, well-trained science attachés should be assigned to US embassies in critical emerging infectious disease hotspots to facilitate both surveillance

and collaborative capacity strengthening of local health and public health surveillance and research.

Funding of NIH's domestic and internationally focused emerging infectious disease research should be ensured, both for individual researchers and at an institutional level, including for NIAID's Centers for Research on Emerging Infectious Diseases Network; the Fogarty International Center's Global Health Program for Fellows and Scholars; research sponsored by NIAID, the National Institute of Environmental Health Science, and the Fogarty International Center on the origins and spread of novel emerging infectious diseases; and the National Science Foundation–NIH Ecology and Evolution of Infectious Diseases program. Funding for USAID's Emerging Pandemic Threats program also should be renewed and expanded, including for the PREDICT initiative and for support for discovery of novel viruses in wildlife that could become future pandemics.

Finally, the ability of the US to guarantee purchase orders and other economic incentives for successful products to combat pandemic infectious diseases should be expanded.

SUPPORT ONE HEALTH AND EFFORTS TO MITIGATE UNDERLYING DRIVERS OF PANDEMICS The One Health approach has gained traction in many countries because it recognizes the connections among human, animal, and environmental health. However, the US lags behind, with an aging public health infrastructure that remains siloed despite US academic leadership.

We recommend the following actions. First, an interagency One Health task force should be formed to coordinate activities under a White House director of pandemic preparedness. Second, One Health leadership should be promoted across federal agencies in collaboration with leading US universities and nonprofit organizations. Third, the role of the US Fish and Wildlife Service in addressing health risks from imported live wildlife and their products should be expanded. It should build a cadre of veterinary and public health staff to investigate and mitigate microbial threats from trade in wildlife. Fourth, USAID's commitment to pandemic prevention strategies in emerging infectious disease hotspot countries should be expanded, including interagency One Health collaborations with the ministries of health, agriculture, and environment in developing countries. Fifth, broad collaboration on pandemic prevention strategies should take place with the World Bank; the tripartite initiative of the Food and Agriculture Organization, the World Organization for Animal Health, and the WHO; and the United Nations Environment Programme and Intergov-

ernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Global Environment Facility, US Fish and Wildlife Service, and conservation nongovernmental organizations, trade groups, and private-sector initiatives. These initiatives should target key drivers of disease emergence, including climate and global environmental changes. Finally, the US should enter into agreements with the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services to support the proposed High-Level Intergovernmental Council on Pandemic Prevention.

Conclusion

We believe that serious consideration and implementation of these six steps to strengthen US public health pandemic resilience would greatly improve US capacity to anticipate and respond to pandemic threats, build end-to-end programs for preparedness and response including research and development of medical countermeasures before the next pandemic occurs, and begin to correct deficiencies and improve equity in the US health care and public health systems. COVID-19 demonstrates that US preparedness and response to pandemic diseases should be revised and upgraded to protect the US population from grave consequences for health and social, political, and economic stability. ■

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