Establish a Global Emerging Pathogen Surveillance System for Early Pandemic Detection

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Biological incidents, whether in the form of natural outbreaks, accidents, or deliberate attacks, pose complex and growing threats to our nation. The global response to the COVID-19 pandemic has starkly illustrated systemic weaknesses in our pandemic preparedness. In addition to an urgent, robust, and professional federal response to COVID-19, the federal government should immediately take strategic actions to establish an advanced analytics-driven global emerging pathogen surveillance system. This system should integrate targeted screening of natural reservoirs of disease, multiple data streams (e.g., existing surveillance programs, social media indicators, etc.), and predictive modeling. Such a system would maximize the value of existing surveillance programs, empower early outbreak sensing, warning, and threat forecasting, and increase the security and resilience of our nation to emerging biological threats.

The need for a global pathogen surveillance system has been expressed by multiple leaders in academia, government, the nonprofit sector, and private industry, including the Atlantic Council[1] and the Nuclear Threat Initiative.[2] The Bipartisan Commission on Biodefense has repeatedly noted that the U.S. remains underprepared for a catastrophic intentional biothreat or a global pandemic and has called out the critical need for coordination between government entities in biodefense.[3] Addressing these challenges will require greater coordination across the interagency to assess gaps and align programmatic resources.

Successful biothreat mitigation requires a coordinated USG effort to recognize early warning signatures and understand the event lifecycle for effective forecasting, detection, response, and recovery efforts. Through such a coordinated effort, we can leverage the vast resources of both the public and private sector to create a truly sustainable, long-term solution that addresses the challenges we face in detecting and responding to emerging biological threats.

Establishing a whole-of-government global pathogen surveillance system requires several targeted actions:

Recommendation #1: Establish an integrated global biosurveillance program to identify early signatures of pathogen emergence from natural reservoirs.

Each biothreat event has detectable scientific indicators (signatures), whether traditional (e.g., health or food sources) or nontraditional (e.g., news feeds, animal outbreaks). However, existing surveillance programs fall short of reliably identifying these signatures due to poor access to existing data and the need for additional research to collect the right data.[4] The federal government should build upon high quality programs such as USAID's PREDICT program, which collects and catalogues viruses globally, by leveraging technologies beyond traditional biological information (e.g., sequencing) to better predict mutations and spillover events. Further, the government should establish better information flow between entities involved in preparedness and response activities and existing biosurveillance programs. Innovative sensing platforms that provide accurate data over extended periods of time are essential to identify changes in

[1] David Bray, "We Can Build an Immune System for the Planet," *GeoTech Cues*, The Atlantic Council, April 6, 2020, https://www.atlanticcouncil.org/blogs/geotech-cues/we-can-build-an-immune-system-for-the-planet/.

[2] Nuclear Threat Initiative, *Preventing the Next Global Biological Catastrophe,* 2020, https://www.nti.org/analysis/reports/nti-releases-transition-papers-nuclear-and-biological-threats/.

[3] Bipartisan Commission on Biodefense, *A National Blueprint for Biodefense: Leadership and Major Reform Needed to Optimize Efforts*, 2015, https://biodefensecommission.org/reports/a-national-blueprint-for-biodefense/.

[4] Jennifer B. Nuzzo, "Improving Biosurveillance Systems to Enable Situational Awareness During Public Health Emergencies," *Health Security* 15, no. 1 (February 2017): 17–19, https://doi.org/10.1089/hs.2016.0097.

pathogens that indicate a species jump or increased mortality upon infection.

An effective global biosurveillance program would leverage many existing data streams (e.g., goods movement, animal outbreaks, geospatial analysis, forensics, risk analysis, etc.) as well as establish real-time standardized data collection to integrate the analysis of multiple signals across data streams to facilitate the biothreat event early warning. Partnerships spanning global to local levels are needed to collect samples at the scale required and could serve to raise public awareness and understanding of the ways in which biothreats may emerge.

Recommendation #2: Establish a global advanced analytics system to support data-driven pathogen surveillance, which informs national pandemic planning efforts and contributes to a global health security agenda.

Although we live in the age of big data, sustainable and practical data stewardship approaches remain a challenge. New approaches to facilitate secure data sharing and archiving protocols among diverse parties will be key to a global advanced analytics system for pathogen surveillance. This system should include traditional epidemiologic data and more advanced surveillance data described in Recommendation #1, but also social media data, demographic information, climatic data, and more. This system must also be informed by an understanding of the biodefense landscape, including policies in place, policy gaps that may require legislative action, key actors in the public and private sectors, and models for sustainable interoperability and coordination between all stakeholders.

Recommendation #3: Strengthen interagency partnerships between DOE, HHS, DOD, DOS, DHS, and other federal stakeholders to coordinate pandemic preparedness efforts and provide guidance to key stakeholders.

The roles and responsibilities of each agency should be clearly defined, and all relevant research capabilities across the interagency – biomedical, computational, engineering, and physical science – should be brought to bear on detecting and mitigating future pandemics. The U.S. Department of Energy (DOE) national laboratories, as federally funded research and development centers, perform biomedical and biodefense RD&D for all of these and other federal agencies, making them natural points of integration for a whole-of-government pathogen surveillance initiative. In response to COVID-19, DOE rallied the national laboratories to establish a National Virtual Biotechnology Laboratory (NVBL) to perform epidemiological modeling, pursue therapeutics development, understand viral fate and transport, execute testing R&D, and support advanced manufacturing research to address critical shortages in the supply chain. As a result, the labs are well-positioned to provide unbiased technical coordination, support, and integration by working with agencies and key stakeholders (e.g., the National Security Council and Office of Science and Technology Policy) to align intramural and extramural programs into the larger national and even international landscape.

Recommendation #4: Use the convening power of the White House to build public–private partnerships that increase U.S. pandemic preparedness.

The White House should establish a working group of public and private leaders to develop and execute a strategy across relevant sectors to enhance U.S. pandemic preparedness, similar to efforts to secure the bioeconomy. This partnership could also facilitate timely bidirectional sharing of unclassified and classified threat information to enhance private industry's ability to identify, prioritize, and coordinate the defense of people, infrastructure and resources. Investment in new data stewardship approaches in Recommendation #2 would also address private industry concerns regarding data sharing. This partnership could further inform long-term R&D performed by academia, the DOE national laboratories, and other research partners.

If we seize this opportunity to improve our ability to detect and mitigate the threat posed by emerging pathogens, we can better secure our nation and ensure resilience to catastrophe. These four targeted efforts will deliver significant benefits to U.S. pandemic preparedness today and into the future.

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