



COVID-19 and Beyond

US Policies for Global Health Security R&D

September 2020

advancing **innovation** to save lives

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About the Global Health Technologies Coalition

The Global Health Technologies Coalition (GHTC) works to save and improve lives by encouraging the research and development of essential health technologies. We bring together more than 30 nonprofit organizations, academic institutions, and aligned businesses to advance policies to accelerate the creation of new drugs, vaccines, diagnostics, and other tools that bring healthy lives within reach for all people.

Acknowledgments

This report was authored by Julien Rashid and Emily Conron in consultation with the staff and members of GHTC.

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Introduction

With the generosity of American taxpayers and the leadership of Congress and many administrations, the United States has played a leading role in developing new technologies to combat global health challenges. A [range of US agencies](#) has supported this work, which has led to products such as the Ervebo Ebola vaccine, a phase 2 MERS-CoV vaccine, and remdesivir, an antiviral drug initially developed for Ebola now being used to treat severe cases of COVID-19.

The COVID-19 pandemic has demonstrated that our preparedness for any health emergency is fundamentally determined by the medical countermeasures (MCMs) we have available, such as diagnostics to rapidly identify and isolate infected people, therapeutics to treat those who have been infected, and vaccines to prevent new infections or mitigate severity. Since the beginning of the pandemic, testimonies from the leaders of our federal health and research agencies have made clear that research and development (R&D) is foundational to our preparedness and response to global health emergencies and is our best exit strategy from the economic and social challenges caused by this unprecedented crisis.

The US government has the most robust scientific infrastructure in the world and has made forward-thinking investments to build our R&D capacity and resource our scientists to develop the tools we and our global partners need to be healthy and safe. In fact, in the first [Global Health Security Index](#), released in 2019, the United States was rated as the country best equipped for a global catastrophic biological risk (GCBR). The COVID-19 pandemic, however, has demonstrated that there is more we must do. It is critical to sustain and build on the progress we have made on many global health challenges and strengthen our preparedness for the next pandemic by investing in science and innovation.

Our coalition offers the following policy recommendations to Congress and the Administration to strengthen global health security R&D to respond to COVID-19 and prepare for the next global health security threat:

- Increase investment in diagnostics and surveillance technologies: CDC (NCEZID, CGH).
- Continue investing in early stage research: NIH (NIAID).
- Strengthen bridges across the research valley of death: BARDA, NIH (NIAID, NCATS).
- Design MCMs for low-resource settings: USAID, DOD.
- Invest in nimble production, distribution, and administration technologies: FDA, BARDA, NIH, USAID.
- Lead and align with international partners: NIH (FIC), FDA, CDC, HHS, State Department, USAID.
- Strengthen US government R&D coordination and collaboration: cross agency.

Increase investment in diagnostics and surveillance technologies

Key agencies: CDC (NCEZID, CGH)

Key policy recommendations

- The US government must increase investments in diagnostic development and validation while continuing to strengthen partnerships with the private and nonprofit sectors.
- New resources should be appropriated across the Centers for Disease Control and Prevention (CDC) for the development and rollout of new diagnostic tools, especially to centers that contribute to global health security and pandemic preparedness, such as the National Center for Emerging Zoonotic Diseases (NCEZID) and the Center for Global Health (CGH).

Fundamental role of diagnostics

Diagnostic tools are fundamental to our ability to detect and respond to pandemic threats, but diagnostic development has typically been one of the most underfunded segments of biomedical research and product development. The COVID-19 pandemic has thrust diagnostics into a long-deserved spotlight, illuminating in stark relief the importance of the timely development and rollout of diagnostic tools for novel health threats. An [article](#) published in BMJ Global Health in January 2019, prophetically titled “Importance of diagnostics in epidemic and pandemic preparedness,” begins, “Diagnostic tests are a fundamental component of a successful outbreak containment strategy, being involved at every stage of an outbreak, from initial detection to eventual resolution.” The article then warns, “Development of diagnostic tests suitable for epidemic prevention and containment is technically challenging, and processes for development, validation and implementation are complex and time consuming.” These challenges have been especially evident in the COVID-19 response, in which delayed and insufficient testing in both the United States and around the world has let slip new outbreaks and uncontrollable spread.

“Diagnostic tests are a fundamental component of successful outbreak containment strategy, being involved at every stage of an outbreak, from initial detection to eventual resolution.”

CDC leadership in diagnostic development

In the first few months of COVID-19, it has been reinforced that to best prepare for the next pandemic the US government needs **greater investment in key federal government agencies that contribute to diagnostic development and validation. Specifically, appropriations to CDC, particularly NCEZID, must rise to the level of the ever-growing global threat of emerging and zoonotic infectious diseases.** These investments should complement strengthened partnerships with the private and nonprofit sectors, who play a critical role in diagnostic rollout and scale-up.

CDC is a leader in the development and validation of diagnostic tools for novel health threats, often translating basic research generated by the National Institutes of Health (NIH) into public health recommendations and usable tools. While NIH has received significant new funding over the last decade to support infectious disease research, CDC’s capacity for translational research has not been equally prioritized. Americans are now facing the consequences of the decades-long underfunding of CDC. In fact, CDC received more emergency funding in the first three COVID-19 emergency supplemental funding bills than its entire fiscal year 2020 (FY20) appropriated budget, which covered every public health threat the

agency has been tasked with tracking, preventing, and responding to both domestically and internationally. **GHTC recommends that significant new resources be appropriated across the CDC centers that contribute to global health security and pandemic preparedness—in particular, NCEZID and CGH, especially for research, development, and distribution of new diagnostic tools.**

NCEZID provides advanced laboratory services, including biosafety labs and advanced molecular detection technologies that CDC scientists use to study hazardous pathogens and identify infectious diseases of unknown origin—capabilities critical to responding to biological threats. NCEZID also leads R&D of new diagnostic tests for emerging and enduring health threats, such as the bubonic plague, rabies, Zika, Ebola, Lyme disease, parasites, and potential pandemic threats. NCEZID’s expertise has made it an international reference hub for vector-borne viral and bacterial diseases. These functions are essential for strengthening our capacity to detect and respond to the next pandemic, are unique to NCEZID, and require increased investment.

Continue investing in early stage research

Key agencies: NIH (NIAID)

Key policy recommendations

- Additional investment in NIH today will strengthen our ability to prevent and respond to pandemics tomorrow.

NIH leadership in basic research

NIH is the heart of the United States’ biomedical research enterprise and a world leader in global health R&D. Focusing primarily on basic and early-stage R&D, NIH supports researchers around the country and the world to better understand pathogens and health conditions and unlock scientific discoveries. Within NIH, the National Institute of Allergy and Infectious Diseases (NIAID) leads work in basic and applied research to better understand, treat, and ultimately prevent infectious diseases. Forward-thinking investment by Congress over the past decade has significantly strengthened NIH’s capacity to advance research for a wide range of infectious disease threats—investments that have paid incredible dividends in the rapid advancement of products to combat COVID-19.

There are only two other known coronaviruses that cause fatal diseases: SARS-CoV (SARS), which appeared in 2002, and MERS-CoV (MERS), which appeared in 2012. In the wake of the SARS and MERS outbreaks, NIAID funded and conducted extensive research on both coronaviruses, developing animal models, treatments, and a DNA vaccine candidate for SARS at the NIAID Vaccine Research Center. These two decades of past investments in response to the SARS and MERS epidemics put NIH researchers and scientists around the world in a much stronger position to rapidly assess and immediately respond to COVID-19 with focused R&D on diagnostics, therapeutics, and vaccine candidates. Because of this investment in research on coronaviruses, NIH scientists were able to determine within two weeks of discovery how the COVID-19 virus enters cells; within two months begin phase 1 clinical trials of both a treatment (remdesivir) and the world’s first COVID-19 vaccine to enter human trials (mRNA-1273); and within five months devise a comprehensive strategic research plan and distribute more than 310 research grants averaging US\$1.5 million each. Additional investment today in NIAID will strengthen our ability to prevent and respond to pandemics tomorrow. We can and should use the COVID-19 crisis to impel bold increases in funding for research into a wide range of infectious disease threats so that we can swiftly respond to the next pandemic.

Strengthen bridges across the research valley of death

Key agencies: BARDA, NIH (NIAID, NCATS)

Key policy recommendations

- US government agencies should continue leveraging public-private partnerships to amplify their work.
- The Biomedical Advanced Research and Development Authority (BARDA) needs increased base appropriations to address naturally occurring threats and needs to provide greater clarity into the use of its existing funding streams and prioritization of disease threats.
- NIAID should be maximally resourced to continue advancing translational research for global health threats.
- The National Center for Advancing Translational Science (NCATS) at NIH should be empowered and resourced to play a larger role in advancing the science of translational research for emerging infectious diseases (EIDs).
- The US government needs to amplify mechanisms for incentivizing research on naturally occurring global health threats, including EIDs, antimicrobial resistance (AMR), and pandemic influenza.

The vital role of public-private partnerships

The research valley of death refers to the gap in funding that is needed to translate basic lab research into successful health innovations. This valley exists because of high financial risk for companies, limited funding, and a lack of coordination among stakeholders. Ideally, the development of new MCMs occurs before threats appear, but for this to happen developers would have to risk upfront investment in technologies that may never have markets. This high risk plows an especially large valley for global health security innovations. If developers are not supported with adequate push and pull mechanisms, innovations are unlikely to ever be fully developed until they are needed, which is likely too late. Over the last two decades, the US government, academia, and the private sector have found a way to bridge this valley: public-private partnerships. These partnerships, which can align funding and coordination behind promising products, have become critical for developing MCMs against current and future global health threats.

By continuing to make high-impact investments in public-private partnerships, US agencies can amplify their own work in pandemic preparedness and global health security R&D. BARDA, NIH, and the US Agency for International Development (USAID), in particular, are agencies that operate well regarded public-private partnership models.

Strengthening BARDA's mandate for naturally occurring health threats

As perhaps the world's lead public institution for developing MCMs through public-private partnerships, BARDA is critical for preparing and responding to EIDs both domestically and abroad. BARDA, however, has historically been under-resourced for this work. Since its founding in 2006, BARDA has been authorized to engage in the development of MCMs for naturally occurring threats. This work was bolstered by the [Pandemic and All-Hazards Preparedness and Advancing Innovation Act of 2019](#), which specifically authorized BARDA to implement "strategic initiatives" to develop MCMs against EIDs, pandemic influenza, and antimicrobial-resistant pathogens. BARDA, however, was established in response to the anthrax attacks and historically has focused more on developing MCMs against man-made rather than naturally occurring threats.

BARDA's work on naturally occurring threats, including Ebola, Zika, and COVID-19, has been advanced through one-off emergency supplemental appropriations. **Increased funding for the full range of health threats, along with a specific, protected funding line for EIDs at BARDA, could have supported a larger portfolio of MCMs for pandemic threats like coronaviruses.** Indeed, at the outset of the COVID-19 outbreak, as agencies like NIH announced large investments in

COVID-19 research, former BARDA Director Dr. Rick Bright publicly stated that his agency did not have the resources on hand to contribute to COVID-19 R&D. Several weeks passed before BARDA announced a market research initiative to identify MCMs with the potential to help address the outbreak. The first supplemental funding to support the advancement of products did not arrive until the Coronavirus Preparedness and Response Supplemental Appropriations Act was passed in March. **Delays in utilizing the full capability of partners like BARDA because of insufficient funding for naturally occurring global health threats cost lives in the COVID-19 pandemic, and, if not addressed by Congress, will cost lives in the next pandemic.**

Among these needs for naturally occurring threats, **BARDA needs dedicated funding for AMR initiatives**, including to support the broad spectrum antimicrobials program and the CARB-X effort to leverage public-private partnerships to develop new products that directly support the government-wide National Action Plan for Combating Antibiotic-Resistant Bacteria. Increased dedicated AMR funding is needed to prevent a post-antibiotic era that would threaten global health security and reverse modern medical advances that depend upon available antibiotics, such as cancer chemotherapy, organ transplants, and many routine surgeries. Tuberculosis (TB) is already the leading cause of deaths globally from AMR, and our progress against TB is at risk as drug resistance intensifies. Illness from respiratory viruses, like COVID-19 and influenza, brings significant risk of bacterial co-infections or secondary infections, particularly for patients with severe disease. These co-infections can worsen outcomes and increase the risk of death. These concerning trends are evidence of the need for increased dedicated funding for BARDA's AMR initiatives.

Today, we are at a peak of the boom-and-bust cycle of pandemic preparedness investments, with BARDA, as of August 2020, having been appropriated \$6.5 billion in emergency funding to advance MCMs for COVID-19 across the first four supplemental funding packages. This amount is more than elevenfold BARDA's base annual FY20 appropriation, and more emergency appropriations are expected. A more consistent and proactive investment by Congress in BARDA's capabilities to advance products for EIDs and other naturally occurring threats might have blunted the current need for this unsustainable spike in funding.

The next step is clear: **Congress should increase BARDA's base appropriations and compel BARDA to clarify its funding streams and prioritization of disease threats.** This will enable BARDA to continue bridging the research valley of death for the full spectrum of naturally occurring threats, including EIDs, pandemic influenza, and antimicrobial-resistant pathogens.

Advancing translational research at NIH

To prepare for the next pandemic, Congress needs to provide greater investment and policy guidance on translational research through NIH, specifically NIAID and NCATS. NIAID is the premier US agency for infectious disease research. The agency conducts basic and applied research and has a strong record of fostering new innovations from labs into clinical trials. **NIAID must continue to be strongly resourced for this critical translational research work for global health security.**

NCATS was established in 2011 and aims to advance the science of translational research and enable developers to translate innovations more efficiently from the lab bench to the bedside. NCATS is authorized to support clinical trial research through phase 2B for all health products and through phase 3 for rare disease products. Congress should expand NCATS' capability to support phase 3 clinical trials for all health products, which could strengthen the center's role in global health and pandemic preparedness. By advancing the science of translational research for EIDs, NCATS could help create new platforms that enable developers to develop new MCMs to EIDs more quickly and efficiently. NCATS is authorized to do research on global health conditions and has supported some research on HIV, malaria, Chagas disease, and other neglected diseases. NCATS has recently begun work on evaluating a potentially overlooked treatment for COVID-19, but prior to this, EIDs have not been part of NCATS' portfolio. **GHTC recommends that NCATS be empowered and resourced to advance the science of translational research for EIDs**, conditions which—with their potentially sudden impact on society—require quick translation of basic research into new MCMs.

Other mechanisms for bridging the valley of death

Beyond funding federal agencies and public-private partnerships, the US government has other mechanisms for advancing translational research for MCMs. For example, since 2016, companies that develop material threat MCMs have been eligible to receive priority review vouchers through the US Food and Drug Administration (FDA). These vouchers can be sold or submitted to FDA to expedite regulatory review of new medical products. Other valid proposals for incentive mechanisms exist. For example, to incentivize the creation of new antibiotics—which face market failures similar to MCMs—experts have proposed that the US government, through the Centers for Medicare and Medicaid Services, use a population-based payment system to contract with companies to have those antibiotics available when needed. This ensures that companies are recompensed for their research contributions and remain solvent to produce their products when needed in the future.

The US government needs to consider more robust, specific incentive programs for naturally occurring global health threats, including EIDs. One opportunity would be to reassess how EIDs are factored into the threat determination process, which could enable BARDA, the Department of Defense (DOD), and other agencies to invest more in EID R&D. Through Project BioShield, the Department of Homeland Security, in consultation with the Department of Health and Human Services, already has a Material Threat Determination process, which includes chemical, biological, radiological, and nuclear agents that can be weaponized—but Congress should consider expanding this process to include naturally occurring biological threats.

Design MCMs for low-resource settings

Key agencies: USAID, DOD

Key policy recommendations

- Congress can better leverage diverse public-private partnerships by investing in global health R&D through USAID.
- In the near-term, the next emergency supplemental funding package for COVID-19 should include funding for USAID to launch a Grand Challenge program to advance COVID-19 innovations designed for use in low- and middle-income countries (LMICs).
- DOD programs have created game-changing global health innovations; DOD should continue being resourced to develop MCMs for low-resource settings for global health security.

The power of PDPs

One type of public-private partnership, the product development partnership (PDP), has had demonstrated success since the 1990s. PDPs are designed specifically to develop new medical products that lack commercial viability. PDPs work by facilitating partnerships that convene expertise, resources, and investments from the public, philanthropic, and private sectors to target defined public health goals. Through the PDP model, partners share financial risk and focus on affordability and access. Private-sector companies alone are unlikely to assume the full risks and costs of developing products for poverty-related, neglected, or emerging diseases, so PDPs bear this risk by covering costs throughout the product development life cycle. In exchange, PDPs receive licensing agreements and intellectual property rights to ensure the resulting products are affordable and available in adequate supply in the places they are needed most. This model creates incentives for the pharmaceutical and biotechnology industries to take on R&D for diseases with less viable commercial markets. PDPs typically manage a portfolio of candidates at various stages of development and work across the product development process—from basic research through product development and market introduction.

In addition to advancing lifesaving products, PDPs also contribute to building a stronger global infrastructure for R&D. For instance, they help strengthen the capacity of research and manufacturing partners in LMICs through their partnerships with research institutes in those countries and facilitation of clinical trials. They also work closely with regional and national regulatory authorities, as well as other regulatory stakeholders, to develop and clarify regulatory pathways for global health products and improve the alignment of regulatory requirements.

By channeling investments through PDPs, the US government’s support for global health R&D can have a multiplier effect by leveraging inputs from the philanthropic sector and the pharmaceutical and biotechnology industries. GHTC recommends that US government agencies increase funding to and participation in PDPs to fully capitalize on their strengths in research toward a variety of global health goals, including pandemic preparedness and global health security. Historically, USAID and NIH have been the two agencies offering the largest support for PDPs for global health products, and these same models can be used for global health security.

Leveraging USAID expertise in R&D

One way the US government can better leverage diverse partnerships like PDPs is by investing in global health R&D at USAID. Increasing funding for Global Health Programs at USAID to advance and deliver innovations to help LMICs prevent, prepare for, and respond to future pandemic threats is key to preparing for the next pandemic. As the only US agency with a mission focused exclusively on global development, USAID has a long history of supporting the profiling, design, development, and delivery of global health tools. USAID should be better resourced to advance a range of MCMs tailored to the constraints of low-resource settings—including vaccine candidates and vaccine delivery systems; diagnostics; therapeutics; medical devices; personal protective equipment for frontline health workers; health facility innovations; and the financing, manufacturing, and distribution systems these MCMs require.

USAID has a demonstrated record of advancing these kinds of innovations for EIDs through PDPs and other partnership models. For example, the agency has effectively used the Grand Challenge open innovation model during the Ebola and Zika emergencies, and this model should also be used to identify and develop new innovations for COVID-19. The Grand Challenge model works by mobilizing governments, companies, and foundations to source new solutions, test new ideas, and scale what works. All Grand Challenges offer challenge grants, but many use additional tools depending on the problem they intend to solve, including prizes, hack-a-thons, and capacity-building services. Through ten challenges over the past decade, USAID and Grand Challenges partners have funded more than 450 innovations in 60 countries.

In 2014, as the largest Ebola epidemic in history unfolded in West Africa, USAID, working with the White House Office of Science and Technology Policy (OSTP), CDC, and DOD, issued the [Fighting Ebola Grand Challenge](#) to identify innovations to address barriers faced by health care workers in combating the epidemic. International experts reviewed more than 1,500 ideas and rapidly selected 14 promising innovations to support, including a low-cost battery-powered infusion monitor to deliver IV fluids in settings without reliable electricity and the STAMPS Sensor, a disposable, Bluetooth-enabled vital signs sensor which goes on like a band-aid and remotely monitors key vital signs including heart rate, respiratory rate, temperature, and oxygen saturation of Ebola patients in Ebola Treatment Units.

In 2016, faced with the growing threat of the Zika virus across Latin America, USAID launched the [Combating Zika and Future Threats Grand Challenge](#) to crowdsource and advance innovative approaches to fight the outbreak and prevent other infectious disease outbreaks, including a multiplex point-of-care diagnostic test that uses Blu-ray technology to diagnose Zika and dengue from a single drop of blood. In just nine weeks, USAID received nearly 900 submissions from across the globe in response to the Grand Challenge. Following a rigorous review process, 21 potentially game-changing solutions that covered vector control, personal and household protection, vector and disease surveillance, diagnostics, and community engagement were selected for funding for accelerated development, testing, and deployment. Five additional awards have been announced, including unmanned aerial vehicles that deliver critical medical supplies to remote areas and the use of big data and machine learning to prevent future disease outbreaks.

In response to the growing global reach of the COVID-19 pandemic, USAID issued a Request for Information on March 30, 2020, seeking proposals for low-cost, scalable products; service innovations; and information channels that could support the international COVID-19 response. In just nine days, USAID received 230 responses. **USAID leadership is very supportive of launching a Grand Challenge to advance these innovations, but funding is needed to make this happen.** Several innovations from previous USAID Grand Challenges might also be readapted for COVID-19. Two examples include DripAssist, a low-cost, battery-powered tool that manages the flow rate of IV treatments in low-resource settings, and Simprints’ biometric patient ID system, which uses fingerprints to track patients and aid in disease surveillance and contact tracing in places that lack robust medical records.

The Saving Lives at Birth (SL@B) Grand Challenge was coordinated by USAID to find and scale innovations that could reduce maternal and newborn mortality in low-resource settings. SL@B was an annual event designed to address a perennial issue, and as such, it offers a model for how **USAID could create an annual Grand Challenge for global health security innovations for low-resource settings.** Innovations developed in the Ebola and Zika Grand Challenges that are now being applied to COVID-19 have demonstrated that **an annual global health security Grand Challenge could lead to new innovations for use against future biothreats in low-resource settings.** Such a program would require additional dedicated funding and should not subtract from USAID’s current appropriations.

Leveraging DOD expertise on technologies for low-resource settings

DOD has a long history of responding to biothreats and infectious diseases uncommon in the United States—including Ebola, malaria, leishmaniasis, and cholera—but which military service personnel in low-resource settings are exposed to alongside local communities.

Indeed, DOD research institutes and centers—including the Walter Reed Army Institute of Research (WRAIR), the Naval Medical Research Center (NMRC), and DOD’s Joint Program Executive Office for Chemical, Biological, Radiological, and Nuclear Defense (JPEO-CBRND)—have already begun working on innovations that could counter COVID-19 in low-resource settings: JPEO-CBRND is backing INOVIO Pharmaceutical’s INO-4800 DNA-based COVID-19 vaccine candidate, which can be rapidly manufactured, remain effective for up to one year in room-temperature storage, and can be delivered with a needleless device. WRAIR is developing the Spike Ferritin Nanoparticle (SpFN) COVID-19 vaccine candidate which will begin clinical trials in September 2020. DOD provided seed funding for the UCSD MADVent Mark V emergency ventilator, which can be fabricated rapidly for \$500 per unit and assembled in 15 minutes. JPEO-CBRND also began research on a rapid point-of-care diagnostic test that could be used in settings without access to lab equipment.

COVID-19 is just the latest in a series of pandemic threats DOD has addressed through R&D. WRAIR supported the clinical development of the Ervebo Ebola Vaccine, which became FDA approved in 2019, and led the first clinical trials for a Marburg vaccine developed by NIH. Marburg—a deadly cousin of Ebola—is listed by the World Health Organization (WHO) as the top emerging disease likely to cause a major epidemic. A Marburg vaccine will make it possible to prevent future Marburg outbreaks from becoming epidemics, whether in the United States or abroad.

DOD’s ability to develop health tools designed for low-resource settings and its unique ability to sponsor the development of new innovations from the lab bench to the field make it an invaluable part of the global health security R&D ecosystem. Increasing investment in DOD’s health R&D efforts, especially at WRAIR, NMRC, JPEO-CBRND, and the Congressionally Directed Medical Research Program (CDMRP; which has in the past been authorized for funding EID research), would lead to better MCMs suited for low-resource settings.

Invest in nimble production, distribution, and administration technologies

Key agencies: FDA, BARDA, NIH, USAID

Key policy recommendations

- The US government should increase its investment in research on advanced manufacturing for diagnostics, therapeutics, and vaccines at FDA, BARDA, and DOD.
- The US government should expand its national contract manufacturing capacity for vaccines, invest in the capacity of partner countries, and invest in vaccine platforms that enable faster, cheaper production and more nimble distribution and administration.
- The US government should invest in vaccine technologies that lower the cost of distribution and administration.

The promise of advanced manufacturing

When the next outbreak capable of exponential growth occurs, society must be commensurately capable of deploying MCMs at speed and scale. One of the tightest bottlenecks for deploying new MCMs is manufacturing. Investments in *advanced manufacturing*—or the development of new technologies to make the manufacturing of medical products faster, more efficient, more adaptive, and higher quality—can eliminate these bottlenecks and have strong potential for helping society respond to the next biological threat.

While medical product developers have made remarkable progress in new therapeutics, diagnostics, and vaccines over the past half century, many of these technologies are still manufactured through processes that are largely unchanged. For example, drugs are still often synthesized in batches that must undergo quality checks, storage, and shipment between each step of production. This is inefficient and exposes supply chains to contamination and delay—especially large risks in the context of a global health emergency.

On the near horizon, or in some cases just reaching us, are technologies that could make therapeutic manufacturing faster, nimbler, and higher quality. These include continuous manufacturing, in which drugs are manufactured through a perpetual and uninterrupted process instead of in batches and steps, and single-use or plug-and-play modular systems that allow facilities to quickly and cheaply shift from producing one kind of product to another.

While developers are investing in advanced manufacturing technologies, there is a lack of incentives to invest in technologies that are not commercially viable but that offer the speed and adaptiveness that global health security requires. This dynamic, between societal need and lack of commercial opportunity, has created a gap that needs public investment. US agencies have made headway. As the agency responsible for regulating medical product manufacturing, FDA has led efforts in advanced manufacturing, issuing guidance for industry, funding academic research, advancing regulatory science, and working closely with BARDA and DOD on advanced manufacturing for MCMs. **There have been promising results—FDA was the first regulatory agency in the world to create a technical framework for medical product manufacturers using 3D printing, which has been used for the emergency production of nasal swabs for COVID-19 diagnostic tests—but sustained funding and support is needed for advanced manufacturing research at FDA, BARDA, and DOD.**

Investing in vaccine manufacturing partnerships and platforms

Vaccine manufacturing is exceptionally complex compared to other medical products. Most vaccine manufacturing facilities are purpose-built for specific vaccines and must be individually approved by FDA, making it difficult and costly to repurpose those facilities. Because the startup costs of building a facility, sourcing raw materials, and hiring personnel for a single product is so high, a developer usually does not invest in building a new facility until it has confidence that its vaccine will

be successful. This creates delays in market entry ranging from several months to several years, depending on the complexity of the vaccine, and because vaccines have low commercial potential, **there has been relatively little private investment in advanced manufacturing for vaccines despite being perhaps the most powerful tools for tackling disease.**

To eliminate delays for the next pandemic, the **US government needs greater investment in public-private manufacturing models for vaccines.** The US government has advanced such efforts through BARDA and Operation Warp Speed, which have provided funding to scale the manufacturing capacity of at least six COVID-19 vaccine candidates with Moderna, Janssen (Johnson & Johnson), AstraZeneca, Novavax, Inovio, and Sanofi as of August 2020. Prior to this, BARDA has provided funding over the past decade to increase the nation’s capacity to fill and finish vaccines, establishing a program for direct manufacturing capabilities. But it is becoming clear that these investments alone are insufficient to support COVID-19 vaccine manufacturing to meet the full need for protection in the United States and around the world.

To prepare for the next pandemic, **the US government needs more emergency funding available and contracts in place to proactively build or repurpose vaccine production facilities.** This will give future leaders sufficient capacity to respond to the next pandemic threat by making early bets on enough vaccine candidates, so that once a candidate is successfully approved, there will be sufficient supply and capacity to address the threat. **In addition, the US government should invest in the capacity of partner countries to support quality-assured vaccine manufacturing to ensure that the development and approval of a successful vaccine does not initiate a race for access** but rather a collaborative effort to meet global needs.

Various proposals have been made for meeting these public health capacity needs, such as a Health Defense Operations (HDO) fund. Similar to the Overseas Contingency Operations (OCO) fund, an HDO fund—which would be established to protect public health—would be removed from yearly budget caps and would provide Congress with a bypass budget that reflects the needs of the nation in preparing for the infectious disease and public health threats of the future. Unlike OCO, which has been criticized as a slush fund, an HDO could include measures for better accountability and oversight from Congress.

Funding for vaccine manufacturing can be stretched further if the US government **invests in research on vaccine manufacturing platforms for EIDs and other global health threats that enable faster production and more flexible facilities.** These efforts should expand on the president’s executive order to modernize influenza vaccines through government investment in faster, more flexible flu vaccine manufacturing platforms. Having these manufacturing platforms available for additional global health threats would make it easier to repurpose manufacturing facilities and more quickly begin production on new vaccines. For example, mRNA-1273, the COVID-19 vaccine candidate developed by NIAID scientists in partnership with Moderna, only needs one bioreactor for production—a first-of-its-kind vaccine manufacturing process that lowers the capital costs for large-scale production.

Because the cost of vaccine R&D is high and profit margins are low relative to other health products, creating these new technologies will require direct government investment and incentives to encourage public-private partnerships—such as with the IAVI-Merck PDP, an effort to develop a COVID-19 vaccine using the same rVSV platform that was used to develop the highly effective Ervebo Ebola vaccine.

Platform technologies can accelerate production of the biological vaccine product, but there also remains serious limitations to filling, finishing, transporting, and distributing vaccines on such an unprecedented scale. With the global scope of COVID-19, however, there are serious concerns that the need to vaccinate the entire global population will lead to a shortage of syringes, needles, and other delivery tools. This will only be exacerbated if a successful vaccine candidate requires multiple doses.

Improving vaccine distribution and administration technologies

To address these anticipated shortages for COVID-19 and future pandemics, **the US government should invest in new technologies that make it easier and less resource intensive to distribute and administer vaccines.** One example of a historic innovation developed by PATH and USAID is Uniject, a low-cost, auto-disable, single-injection syringe that can be used with minimal training. Other promising high-volume, low-cost delivery designs include:

- A thermo-stable, stamp-sized skin patch—in development at the University of Pittsburgh with support from NIH—which could vaccinate individuals through hundreds of invisible microneedles. These patches are created through a scalable printing process and are easily applied to the skin like a bandage to vaccinate the recipient. Preclinical research is happening on a COVID-19 vaccine patch.
- Collectra, a DOD-backed AA battery-powered device that uses a brief electrical pulse to deliver a vaccine through skin pores. Collectra was developed by INOVIO Pharmaceuticals and is designed to deliver INOVIO’s DOD-backed COVID-19 vaccine candidate, INO-4800. According to the company, the device is designed to “function reliably in challenging environments and can be stockpiled in large quantities without maintenance.”
- A BARDA-funded partnership between Merck and GHTC member IAVI is attempting to develop a single-dose, oral vaccine for COVID-19.

Such low-cost, high-volume manufacturing and delivery systems will be essential for mass production and distribution of a vaccine for COVID-19, and **US government investment to advance these innovative technologies beyond COVID-19 would significantly lower the cost of producing, transporting, and administering vaccines for the next global health crisis.**

Lead and align with international partners

Key agencies: NIH (FIC), FDA, CDC, HHS, State Department, USAID

Key policy recommendations

- To support global health research capacity, regulatory harmonization, and normative standard setting, the United States should reaffirm its support of WHO. Congress should continue to fund the multilateral institution and ensure that it has the resources to carry out its mandate.
- Congress should authorize US participation in and funding for the Access to COVID-19 Tools (ACT) Accelerator and the Coalition for Epidemic Preparedness Innovations (CEPI).
- The US government should support and join multilateral partnerships to expand our capacity to develop and then distribute diagnostic tests and technologies to LMICs, complementing and leveraging efforts led by WHO.
- To better support international research capacity and partnerships, Congress should appropriate an additional \$10 million to the Fogarty International Center (FIC) in each of the next five fiscal years.
- The United States should reaffirm its commitment to the Global Health Security Agenda (GHS) and support building toward the 2024 targets. The United States should push to strengthen the existing framework through the inclusion of R&D of diagnostics and MCMs in the Action Package governance structure.
- FDA’s global leadership, coordinated with other federal agencies and initiatives and global partners, should be strengthened to speed the deployment of life-saving new health products.

Reaffirm support for WHO and multilateralism

The US government should work closely with multilateral institutions like WHO and other mechanisms for global health R&D collaboration to expand its capacity for developing tools to combat health threats. Global institutions like WHO can reach places the United States cannot and receive key scientific data, health intelligence, and insights globally to advance MCMs against borderless diseases. As of September 2020, the United States is not participating in the WHO Solidarity Trial, the world’s largest clinical trial for COVID-19 treatments. According to WHO, compared to normal drug trials, the Solidarity Trial will reduce the time it takes to determine effectiveness of treatments by 80 percent. The combined size and geographic breadth of the trial will provide a strong evidence base for specific therapies that can be then utilized quickly by countries’ health systems. WHO—with its broad membership, global reach, and international legitimacy—is the only organization positioned to accomplish such feats. When the United States helped found WHO in 1948, it did so with the understanding that collective efforts to combat shared health threats are more effective than any individual country’s efforts. No matter how strong the United States is scientifically, politically, economically, or militarily, it will not fare better alone against global health threats. It is imperative that the US government maintain a strong partnership with WHO to tackle this pandemic and better prepare for future global health threats.

Fund CEPI and support the ACT Accelerator

In April 2020, WHO, in partnership with a number of member states, nonprofits, and private-sector partners, came together to launch the ACT Accelerator, an effort to speed up the development and production of vaccines, diagnostics, and therapeutics for COVID-19 and ensure their equitable global distribution. **The US government should participate in the ACT Accelerator, which could benefit those living in the United States and around the world.**

The lead organization of the vaccine arm of the ACT Accelerator is CEPI, an international organization advancing nine vaccine candidates for COVID-19 that has put forward a \$5 billion global ask to advance its portfolio. The United States has not yet made a commitment to CEPI, which could limit the world’s access to any vaccine developed by the partnership, costing valuable time especially if a CEPI-supported candidate is more promising than a US-supported candidate. **Congress should authorize and fund CEPI:** a relatively modest US investment in CEPI is a smart way to diversify and strengthen the US government’s COVID-19 vaccine portfolio and ensure that a COVID-19 vaccine is designed with global access in mind.

The diagnostics arm of the ACT Accelerator is co-led by the Global Fund and GHTC member FIND, which is [tracking efforts to develop COVID diagnostics](#). As FIND [elaborates](#), “Without mass testing—which relies on availability of high-performing, rapid tests—[COVID-19] will continue to spread. Innovation and scale up of these tests must be accelerated for deployment in all countries. For low- and middle-income countries, this investment would contribute to saving 9 million lives and strengthen health systems to overcome the COVID-19 pandemic. An investment of US\$6 billion is required to harness innovation and secure access to vital diagnostic tests over the next 12 months for low- and middle-income countries. US\$2 billion of this is required immediately to expedite development, manufacturing and scale-up of the rapid tests that will enable mass testing to be introduced globally—as well as procurement of tests to fill critical short-term gaps in low-income countries.” **The US government should support efforts to develop and scale up COVID-19 diagnostic tests in LMICs**—while considering global and equitable access, transparency, oversight, and accountability—to ensure that the progress made in combatting the pandemic in the United States remains durable.

Strengthen international research through FIC

FIC at NIH has a unique and important role in advancing new technologies for pressing global health challenges. FIC serves as a critical link between researchers in the United States and researchers in more than 100 countries. With less than one-quarter of one percent of the total NIH budget, FIC strengthens international research and laboratory capacity, facilitates global research partnerships, improves surveillance of EIDs, and trains scientists who make critical contributions to long-standing global public health challenges such as HIV/AIDS and emerging threats like AMR, Zika, Ebola, and COVID-19. FIC-

trained scientists are embedded in scientific research agencies and ministries of health worldwide on the frontlines of the COVID-19 response. Progressively increasing FIC’s base budget would allow them to pursue a wider range of research priorities with extramural partners around the world. **GHTC joins other advocacy organizations in calling for an additional \$10 million to be appropriated to FIC’s modest budget in each of the next five fiscal years.** This would support sustainable growth and long-term planning in pursuit of FIC’s mission to build research capacity in partner countries.

Bolster R&D in GHSA

When it comes to global threats, no country stands alone. For global health security, countries must work together to prevent and respond to disease threats that do not recognize borders. Launched in 2014, one such collaboration has been GHSA, a multilateral initiative of nearly 70 countries, international organizations, civil society, and private-sector partners working to build countries’ capacities to prevent, detect, and respond to infectious disease threats whether naturally occurring, deliberate, or accidental. A world without continued focus on global health security is a world more vulnerable to the dangerous and harmful impacts of outbreaks and epidemics. GHSA 2024 positions member countries to develop the leadership, technical knowledge, and collaborative foundation to sustain health security in the long term. It is vital that the United States, with engagement and leadership from several US agencies, continues to play a leadership role in GHSA and work with global partners in this multisectoral initiative to strengthen country capacity to respond to current and future health threats. **The US government should strengthen the current GHSA framework to include a greater focus on R&D for MCMs as part of the current GHSA priorities and expand the scope of the current Action Packages to explicitly include R&D for drugs, vaccines, diagnostics, and other health technologies as part of the core strategic capacity building initiatives.**

Leverage FDA expertise to improve the global regulatory landscape

Strong regulatory systems play a critical role in global epidemic preparedness. FDA is a global leader in the safety, efficacy, and security review of biomedical products with a priority focus on interventions that serve US public health—but FDA has also had a major role in global health through initiatives such as its tentative approval process for antiretroviral drugs for use by the President’s Emergency Plan for AIDS Relief (PEPFAR).

As new innovations to respond to EIDs come through the pipeline, regulatory bodies will be required to ensure they are safe and effective and ultimately approve them for use in a timely manner to ensure populations have access to new tools as soon as possible. FDA leads the world in regulatory expertise and can play a stronger role in providing more technical support to less developed regulatory bodies, particularly in an epidemic setting where novel innovations are being developed and require fast-track approval. A more coordinated international regulatory environment, supported by FDA leadership, could save lives.

GHTC encourages legislative provisions that promote FDA’s global leadership, coordinated with other federal agencies and initiatives and global partners, such as by encouraging FDA to provide technical support and maximize transparency and work-product sharing with international partners; promoting international interagency capacity-building, convergence, and information sharing, such as through improved clinical data interoperability and evidence sharing; promoting the formation and scope-expansion of mutual recognition agreements (MRAs) between international regulatory agencies; and promoting FDA coordination with WHO on its prequalification (PQ) process through initiatives like the recently launched pilot program to share minimally redacted FDA reviews of HIV antiretrovirals with WHO to speed up PQ decision-making.

These provisions would support a more cohesive global regulatory environment, lowering the burden for product developers and speeding the deployment of lifesaving new health products.

Strengthen US government R&D coordination and collaboration

Cross agency

Key policy recommendations

- Congress should require the public release of the Global Health Innovation Act report to improve transparency on the scope of USAID’s collaboration and coordination with other federal agencies and external partners engaged in global health innovation activities.
- Congress should instruct leaders at the State Department and USAID to work together with other US agencies to develop a whole-of-government global health R&D strategy to ensure that US investments in global health research—including for the prevention of and response to public health emergencies—are efficient, coordinated, and streamlined.

Improving collaboration and transparency

Many US government departments, agencies, and programs contribute to global health R&D. To maximize our capacity to respond to both enduring and emerging health threats, including public health emergencies such as the COVID-19 pandemic, GHTC has long advocated for increased coordination and collaboration between US federal agencies, including USAID, the State Department, DOD, CDC, NIH, BARDA, and FDA. Coordination and collaboration are critical to ensuring that US investments in global health R&D are efficient, coordinated, and streamlined.

The Global Health Innovation Act (P.L. 115-411) requires USAID, for five years, to annually report on the development and use of global health innovations in the programs, projects, and activities of USAID and to provide a description of the agency’s collaboration and coordination with other US departments and agencies, including CDC, in support of global health product development. **Congress should require the public release of this report to improve transparency on the scope of USAID’s collaboration and coordination with other federal agencies and external partners engaged in global health innovation activities.**

Creating a whole-of-government strategy

Congress should instruct leaders at the State Department and USAID to work together with other US agencies to develop a whole-of-government global health R&D strategy to ensure that US investments in global health research—including for the prevention of and response to public health emergencies—are efficient, coordinated, and streamlined. Each federal agency engaged in health research offers unique capabilities, but effective coordination is essential to maximize our ability to respond to public health emergencies through accelerated R&D activities. The National Biodefense Strategy released in 2018 explicitly calls for increased federal alignment and prioritization of R&D funding focused on global health security, including sub-goal 3.1.2 to “establish procedures for prioritizing, funding, and coordinating R&D efforts during bioincidents.” In the wake of COVID-19, Congress should support efforts to better delineate the role of each research agency—and the norms and procedures for coordination between them—during future health emergencies.



The Global Health Technologies Coalition (GHTC) works to save and improve lives by encouraging the research and development of essential health technologies. We bring together more than 30 nonprofit organizations, academic institutions, and aligned businesses to advance policies to accelerate the creation of new drugs, vaccines, diagnostics, and other tools that bring healthy lives within reach for all people.

www.ghtcoalition.org

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