Nine Urgent Priorities for Science, Medicine, & Public Health Based on Lessons Learned from COVID-19

In March 2021, the National Academy of Medicine (NAM) established a Working Group on Priorities for Science, Medicine, & Public Health After COVID-19 to develop guidance for consideration by U.S. government agencies and other stakeholders. While the priorities are wide-ranging, they are also interconnected and overlapping. There is a need for a coordinated, strategic approach to make progress in all priority areas.

While many organizations and policy makers are working in these areas, progress has not been sufficient to realize the transformative change that will be necessary to rebuild American society to be more resilient after the COVID-19 pandemic. It is imperative to capitalize on the current moment, when the pandemic has heightened motivation to address systemic challenges for health, to catalyze the critical actions described below.

PRIORITY 1: Transform the Public Health Infrastructure

America needs equitable, world-class public health systems that effectively promote health and protect all people in the country, no matter their neighborhood. In 2012, Institute of Medicine (IOM) report *For the Public’s Health: Investing in a Healthier Future* defined the vision for idealized U.S. public health and offered a framework for ensuring that all governmental health departments have the resources needed to promote and protect the public’s health. Such a public health system should have measurable, accountable foundational capabilities. These include the ability to longitudinally monitor the health of a community through data, case findings, and laboratory capacity; respond to emergencies of all kinds; translate public health science into policy and regulation; communicate effectively with the public with timely, science-based information; and harness and align community resources and actors to advance the health of the entire community.

Yet, the public health system in America remains severely underdeveloped and under-resourced. One could even say that it isn’t really a system, instead being a patchwork of local, state, and federal entities with overlapping responsibilities but without effective coordination. Variation in health department capabilities across the country contributes to health inequities and undermines readiness for public health emergencies. Even where resources exist, departments do not always distribute them efficiently due to

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NAM Working Group on Priorities for Science, Medicine, & Public Health After COVID-19

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gaps in governance. The current system is characterized by inadequate funding (public health represents approximately 2.4 percent of total U.S. health expenditures), workforce shortages (56,000 public health jobs have been lost over the past decade), and outdated technological infrastructure (in some places, public health departments still rely on fax machines).

In addition, life expectancy in America has been declining since 2014, with the elevated mortality burden disproportionately affecting Black, Indigenous, and people of color (BIPOC) and low-income individuals. The consequences of this fragmented system were exposed during the COVID-19 pandemic and are further evidenced by the ongoing epidemics of opioid misuse, obesity, and firearm violence in the United States. Due to these shortcomings, America is inadequately prepared to meet health challenges during and after COVID-19.

Bold and aggressive intervention from national leaders is required to build the high-performing, equitable, and rational public health system we need. There is consensus among public health and policy makers that securing sustainable, equitable, and robust public health infrastructure starts with the right financing model, which requires a departure from the primarily grant-based, “boom or bust” approaches that characterize current funding streams. The new financing model should be anchored on individuals and populations, not institutions, to ensure equitable public health protection, and should incentivize shared services, regional coordination, and consolidation of local public health where applicable. Current research indicates that an annual investment of $32 per person could secure the public health services needed to support equitable health in the United States. The system also needs governance models that eliminate redundancies and allow rapid response to crises, as well as investments in a modern workforce.

A number of key public health organizations, stakeholders, and thought leaders have proposed pathways that can provide a foundation for the establishment of a strategic, actionable plan. Examples include the Association of State and Territorial Health Officials (ASTHO) and the deBeaumont Foundation’s Public Health Workforce Interests and Needs Survey and the Council of State and Territorial Epidemiologists’ report Driving Public Health in the Fast Lane: The Urgent Need for a 21st Century Data Superhighway. Numerous IOM/NAM publications have explored the state of the nation’s public health systems and have made pertinent recommendations, including most recently the “Public Health COVID-19 Impact Assessment: Lessons Learned and Compelling Needs.”

**PRIORITY #2: Rebuild the Health & Health Care Data System**

Transforming the public health system requires the establishment of an interoperable data system with timely, granular, and actionable data for both health and health care (including data integration across traditional health care, public health, mental health, and social services). The current system abounds with data deficiencies that make it difficult to gain timely, actionable insights from both existing and accumulating data. An overall system architecture, modular components, and supportive infrastructure are required. Privacy and cybersecurity must be a guiding principle for system design, along with coordinated implementation and continuous feedback. Broader access to high-capacity computing infrastructure, which is currently accessible only in government labs, industrial labs, and commercial clouds, is required to transform health data. Similarly, artificial intelligence and machine learning tools should be built and leveraged for data-intensive public health projects. The health data system also requires a modular approach to support various components and foster innovation.

Despite digitization-focused legislation, such as the HITECH Act, during the first 9 months of the pandemic in the U.S., adequate pandemic data was not readily available to leaders and decision makers – whether for health systems trying to forecast personal protective equipment (PPE) needs, public health departments attempting testing and contact tracing, or local policy makers determining guidance on public activities. Access to electronic health records was impeded by institutional barriers. Key data, such as
contact tracing numbers, were almost always disconnected from and non-interoperable with other health technology systems. Medical researchers making critical discoveries lacked access to coordinated data infrastructure at scale to accelerate clinical research needs and often lacked formal channels to share their observations.

Hundreds of new data systems were rapidly created and deployed to enable hospitals and health systems to forecast COVID-19 capacity and utilization, track consumables such as PPE, improve connectivity between health care and public health, create evidence, and share vital information on successful treatment of the disease. While locally impactful, these efforts created even more data silos and had the same or even worse interoperability issues as past systems. Going forward, it will be necessary to develop a universal data repository at the federal level that allows public health, social services, and health care delivery systems to share information during public health emergencies (as described further under Priority #7).

Evolving the current digital health ecosystem to one that supports innovation will require public-private partnerships, with federal government playing a central role in coordinating and enabling this effort. A focus on foundational elements such as technical infrastructure, data architecture, and modularity is necessary. As a first step, a new federal Office of Health and Health Care Data Integration could be formed, with both operational and spending authority. Alternatively, an existing organization such as the Office of the National Coordinator for Health IT (ONC) could be leveraged to take on this role, which may accelerate the timeline for action. (ONC’s Health Information Technology Committee has already formed a Task Force on Public Health Data Systems.) Additionally, it would be worth looking at the National Institute of Standards and Technology’s successful track record of serving multiple industries and industry partners in order to glean insights on how to evade industry capture that may stall this critical progress.

Most importantly, important clinical and logistics data have to flow to responsible parties, even if there are adverse trust relationships among some of the parties involved. For example, health systems compete with each other, and thus are not incentivized to share data with competitors, even in a pandemic. County management competes with state management (in large states), and several states may not want to fully share data with the federal government. Future governance over data interchange must be designed to be resilient to such political issues.

**PRIORITY #3: Track and Evaluate Virus Strains**

There has been an increasing emergence of pathogenic diseases over the past several years with significant outbreak or pandemic potential. The latest of these, SARS-CoV-2, has proven to be both a health security and national security issue, and serves as a tragic example of the inadequacy of our basic public health capacity to use the current level of knowledge around advanced molecular and genomic sciences to respond to these types of health threats. Protecting and improving the health of the public requires a robust system capable of rapidly identifying any new infectious health threat that enters the community and providing an effective public health response. This response must include the ability to identify these threats; track them throughout the population over time; understand the disease patterns they cause, as well as their prevalence and impact; and subsequently control outbreaks both in the United States and globally. Current capabilities to leverage genomic epidemiology and genetic tools to do so are inadequate and must be enhanced.

This concept is not limited to COVID-19 or future emergent viral threats, since genomic epidemiology is also a powerful tool in the fight against antimicrobial resistance (AMR), for which there is a specific federal advisory committee—the Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria. However, there is no real proactive focus in the U.S. government, nor a clear agency-level...
mandate, for the establishment of comprehensive genomic epidemiology utilizing and continually advancing the best-available technology for different types of disease threats such as COVID-19 or AMR (although interoperability efforts like SHIELD [Standardization of Lab Data to Enhance Patient-Centered Outcomes Research and Value-Based Care] at the Office of the Assistant Secretary for Planning and Evaluation should be noted).

It is essential that a comprehensive nationwide system be built to track pathogenic organisms. It must utilize cutting-edge genomic techniques for pathogen identification in ways that allow for rapid pathogen testing and genetic variant identification, surveillance, and tracking – fueled by rapid data and sample sharing. It must have capacity to utilize these tests to diagnose disease, evaluate clinical impact, and enhance disease control, which must then aid therapeutic and vaccine development (through formal linkage to the best available science on antigen structure and design). The technology should be easily available through a network of laboratories including the public health laboratory response network and appropriate private-sector academic and research laboratories (see Genomic Epidemiology Data Infrastructure Needs for SARS-CoV-2: Modernizing Pandemic Response Strategies).

The nation’s academic medical centers (AMCs) are well-positioned to be leveraged in this way, in what might be called Centers of Excellence for Pandemic Sequencing and Surveillance (CEPSAS), which could provide the speed, expertise, capacity, and local knowledge for a sustainable national pandemic sequencing platform. These regional CEPSAS could be focused on integrating patient-level outcomes with specimen sequences to reveal the clinical importance of new variants, as well as the forces driving the evolution of pathogens, including prevention and treatment exposures such as vaccines, drugs, and neutralizing antibodies; social determinants; germline DNA variation; and more. CEPSAS could provide the infectious disease, public health, epidemiologic, and related expertise to identify and rapidly address sources of emergence, either in hospitals, neighborhoods, or regional “hot zones” of activity. Though many AMCs have the core resources to perform the viral and other pathogen sequencing, CEPSAS would likely require assistance in the form of hardware and bioinformatics personnel to expand these resources to manage the anticipated sample volumes.

Regional CEPSAS would require support from an extensive and robust network of pandemic sample collection sites for sample acquisition and processing across all regions. Once again, key to this overarching CEPSAS framework would be the interoperability of data and the establishment of connectivity among federal, state, territorial, tribal, and local and regional public health departments and associated laboratories engaged in testing and contact tracing. Existing data platforms, like AIMS - APHL Informatics Messaging Services, or new platforms supporting genome sequence information could be further developed to have interoperability with CEPSAS, public health entities, and pandemic sample collection sites, with a renewed commitment to standardization and adoption of a single federal data exchange system that all public health and health system components would use. However, to facilitate this needed data exchange, data protection policies such as the Health Insurance Portability and Accountability Act (HIPAA) would need to be amended.

PRIORITY #4: Develop a Robust System to Prevent and Forecast Disease

Public safety, security, and well-being are protected by the ability to forecast, prevent, and contain existential threats like hurricanes, earthquakes, and terrorist attacks. However, for pandemics, we have neglected such an approach. Instead, we wait for them to happen, then scramble to contain them with emergency funding and the rapid development of vaccines and therapeutics. In what is likely to be at least a 2-year interval between the beginnings of COVID-19 in Wuhan, China, and adequate global vaccine coverage, we have experienced crushing mortality, morbidity, and economic loss.
Forecasting and prevention of pandemics either at their first “spillover” into people, or even before this happens, would provide substantial return on investment (ROI) by allowing us to disrupt the infectious process at an early stage. While the annual cost of such a system is estimated to be in the billions per year, investments in these capabilities would yield one to two orders of magnitude in return if epidemics were prevented or contained more early in their spread. Many of the pieces for such a system have been designed and trialed. Now is the moment for a coordinated effort to go the last mile and build models to scale, incorporate pandemic forecasting into our public health system, and build the international science diplomacy to gather and rapidly share on-the-ground data.

Investment in disease prevention and forecasting can be thought of as an insurance policy. For example, people pay insurance premiums for vehicles, dwellings, and possessions, yet most do not need to exercise these policies for losses. Similarly, government agencies fund fire departments, a service that most taxpayers never utilize. Yet, if needed, this essential service is available. Fortunately, as we slowly move out of the most severe part of the COVID-19 pandemic, the need for more effective public health processes to forecast and prevent infectious diseases is better understood, by both politicians and the public.

To predict pandemics will require a coordinated system, which starts with two bold steps. The first is developing and maintaining a Disease X database of global viral threats. A Global Virome Project would work collaboratively with other countries to collect and analyze wildlife samples, identify novel viruses, and get their genetic sequences safely in the scientific domain so that we can work on new drugs and vaccines against them, expand the capacity of current therapeutics, and work with local communities to reduce risk of emergence. This will require international engagement, such as building on the U.S. Agency for International Development’s PREDICT program, and coordinated international outreach to reduce risk. Internationally, an initiative like this would require support from U.S. embassies in critical emerging infectious disease hotspots within southeast Asia, central and west Africa, and Latin America, and could act as a vehicle for science diplomacy with countries already engaging in similar work, like China. It would require advances in scientific understanding of viral risk, so that we can identify and target the novel viruses that are most likely to infect people and predict their ability to cause pandemics through a triage method. This would involve analyzing their genome for signals of high risk, like the ability to bind to human cells, and conducting the basic virology research that is the current remit of the National Institute of Allergy and Infectious Diseases. The triage method would also involve looking at where the animal carrying the virus came from, since a virus that came from an animal that is hunted, traded, lives on a farm, lives in a densely populated place, or has other potential for close human contact would require more attention in the triage system. This information would feed into private-sector initiatives, like the Coalition for Epidemic Preparedness Innovations (CEPI) and others, to develop broadly acting vaccines, antiviral drugs, monoclonal antibodies, and other therapeutics that work against all known threats from each viral group. It should be noted that, although viruses are much more likely to be associated with pandemic spread than other pathogens, we should not neglect other etiologic agents that can and do impact our population, including AMR bacteria or highly-resistant fungal pathogens (like Candida auris), etc.

The second step is developing a big-data-driven pandemic forecasting system. Diseases like COVID-19 begin as single human infections, spread in early clusters, and eventually travel globally via road and air traffic systems. Each stage involves complex interactions of environmental changes (e.g., wildlife trade, deforestation, livestock production), human behaviors (e.g., hunting, urbanization, travel), and socioeconomic factors (e.g., poverty, economic development). All of these have measurable indicators that can be used to forecast the frequency of spillover and spreading events and help prevent pandemics. These include human movement patterns, gathered, for example, through cellphone data, syndromic surveillance based on internet search data ground-truthed by “fevers of unknown origin” disease surveillance in rural clinics, blood bank surveys, travel, and trade data. A One Health approach involving
collaboration among field teams investigating disease outbreaks, big data digital science, machine learning tools, and input from medical epidemiologists, wildlife health experts, and meteorologists would rapidly crystallize outbreak forecasting capacity.

A key scientific policy goal is to tap into the substantial resources of the federal agencies and build a comprehensive public health data management system, rather than the patchwork that currently exists. This could be coordinated by the White House Office of Science and Technology Policy (OSTP) through an inter-agency taskforce (e.g., the Pandemic Prediction and Forecasting Science and Technology [PPFST] working group) that includes the National Security Council, CDC, the U.S. Department of Health and Human Services (HHS), and others, working side-by-side with private-sector development in digital modeling and prediction technologies to allow public health threats to be identified early, thereby enabling timely decision making on the part of the U.S. government. Incentives to report new outbreaks in people and livestock could be enforced by policies, such as an international pandemic treaty or strengthened World Health Organization (WHO)/International Health Regulations, and/or by decoupling country sovereignty from outbreak indicators using novel surveillance mechanisms, such as satellite imagery for environmental drivers and unusual human activity and environmental sampling.

**PRIORITY #5: Implement an All-Hazards Science Preparedness and Response Leadership Program for the United States**

In addition to pandemics, predictable but unanticipated crises like climate events, nuclear accidents, oil spills, and technology-based-threats are frequent and often require science to respond, recover, promote resilience, and generate new knowledge so as never to be in the same situation with the same knowledge gaps twice. Yet, our ability to mount a full research response is often so delayed that we miss the window for data collection or action. Timely research informs immediate response, often facilitates recovery, and generates new knowledge that is useful to mitigating the impacts of future crises. Strategy, coordination, and infrastructure for innovation will accelerate effective response. Maintaining scientific leadership is also critical to the political and economic stature of the United States.

OSTP should lead an effort, working with relevant agencies, to ensure that the basic questions that will arise in a crisis are outlined in advance, and that the capabilities that exist to rapidly answer those questions are prepositioned, both nationally and globally. When a crisis occurs, OSTP should work with government agencies, academia, and the private sector to rapidly convene and develop a prioritized research agenda, revisiting that agenda as needed in a prolonged crisis. OSTP should work with research entities to enable rapid jumpstart funding and eliminate other barriers to rapid research initiation.

One related area of opportunity is a National Artificial Intelligence and Machine Learning infrastructure to support development of “open source” tools for basic science, public health, and social care practice (potentially building on the work of the National Laboratories). This need was clear during the pandemic as critical data on SARS-CoV-2 were inaccessible to basic scientists, academics, and public health and social care professionals. Further, CDC and other agencies were overwhelmed by the sheer volume of data and were unable to adequately process and analyze it.

The value of such data is realized only if there is adequate computing infrastructure to analyze and process it. Extremely large computing infrastructure in government labs, industrial labs, and commercial clouds were used to accelerate our detailed understanding of the biology of SARS-CoV-2 and hasten the discovery of ways to diagnose, treat, and immunize against COVID-19. Yet much of that infrastructure is inaccessible to basic scientists, academics, and those at the front line of public health and social care. Access to this capacity and the tools that derive from it serve to democratize and make accessible critical information and analytic capacity and puts relevant tools in the hands of users in the scientific and public
health communities. Such tools should be considered public goods and support the precompetitive space for product development and more effective and efficient government services.

The United States can build this system for “non-defense, non-intel community” access to computing resources through public-private partnerships, by using incentives to leverage and expand the current, largely commercial capacity, and through financing to develop next-generation infrastructure. A light governance structure should be built in to these partnerships so that, in a crisis, the computing resources can be fully utilized, similar to manufacturing resources under the Defense Production Act. These partnerships would be required to support the set of core needs for the scientific and public health response described above. In this way, they could be conceived of as the supercomputing analog to the Centers for Innovation in Advanced Development and Manufacturing, which were built in part to surge-manufacture vaccines in the event of an influenza pandemic. It is likely that following an initial investment, much of the costs could be financed through savings and ROI.

PRIORITY #6: Advance Global and National R&D Strategy

One of the clear findings of the COVID-19 pandemic is that there is not an end-to-end, strategic, coordinated, sustainable mechanism for U.S. and global research and development that would enable swift future pandemic response time, including for diagnostics. Although Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) and the Biomedical Advanced Research and Development Authority (BARDA) have done well, there are gaps in other areas of R&D and the end-to-end R&D ecosystem.

In order to build this end-to-end system, inter-pandemic public-private partnerships (PPPs) on drug, vaccine, and diagnostics discovery must be enhanced. As has been seen in the U.S. government response to the COVID-19 pandemic, the rapid development of a PPP approach to vaccines, drugs, and diagnostics led to dramatic advances, both in modality and timing, especially in the area of vaccines. This work should continue, but go well beyond vaccines alone to support the development of diagnostics, therapeutics, and other potential interventions with broad public health impact for which commercial markets are either unattractive or uncertain.

The establishment of a “PPP medical countermeasures incubator” would be a highly impactful investment against future infectious disease threats. To effect this, the United States could augment the current CARB-X PPP, which is presently directed toward antimicrobial resistance, with support from BARDA, or establish another similar companion PPP to focus on medical needs beyond antimicrobial resistance. Attention should also be given to fixing reimbursement systems, which fail to capture the public health value of this research. Beyond infectious disease response, the successful COVID-19 PPP experience can be leveraged for other priority health areas in need of focused translational research and development, such as cancer or developing a panel of broad-spectrum antiviral compounds since, as we have seen with COVID-19, there are limited antiviral therapeutic options available.

In this arena, there is an important facilitation role for the government, whether by creation of a response infrastructure, provision of direct funding, leveraging of existing U.S. government scientific capabilities and resources, and more. All of these elements, taken in the context of a PPP, can clearly make a difference in speeding the development, procurement, and deployment of relevant vaccines, drugs, and diagnostics, especially those that, while of obvious public health impact, might have a less-attractive commercial market for industry. There is also a need to “knit together” clinical and data entities in a more coordinated and strategic way that supports rapid throughput of clinical protocols – including recruitment, intervention, and outcomes assessment. ACTIV has moved this concept forward in the context of the COVID-19 pandemic. Further establishing such an approach by filling voids and designating leadership could improve response to not only the next pandemic but also other emergent issues of our time. A
defined federal leadership body can catalyze the development of a translationally-focused PPP. Given their experience with AMR and COVID-19, BARDA or the Office of the Assistant Secretary for Preparedness and Response would be logical organizations to lead this effort.

Additionally, the strategic role of U.S. government-supported Advanced Development and Manufacturing (ADM) facilities should be reassessed, due to lack of coordination among ADMs. The U.S. government has funded the establishment of a number of ADM facilities, both in the Department of Defense (DOD) and in HHS. The overarching goal for these facilities is to serve as agile and flexible advanced development and manufacturing platforms to support the development, licensure, and manufacturing of medical countermeasures against infectious diseases of national public health importance. For a variety of reasons, however, these facilities have not been efficiently utilized. Further, there appears to be little coordination among HHS and DoD facilities in terms of cross-agency collaborative strategies to support national needs. There should be an urgent strategic reappraisal of the missions of these facilities (as well as a reimagined business model) with an eye toward developing a mechanism to coordinate their functioning, sustainment, and ability to respond to outbreaks of national importance.

Since this is clearly more than a U.S. government issue, the United States should also help facilitate and support a global response initiative. International coordination, or at least awareness of international efforts, is very important. Otherwise, we risk fragmentation and wasted resources. Sustainable financing is also absolutely critical. For surveillance of emerging viral threats, compound libraries, and assay development, we have seen the impact of disinvestment over time in maintaining knowledge across SARS, MERS, and COVID-19 outbreaks, and must avoid losing such knowledge again. Development and coordination of an actionable strategy in this area will require direct engagement of the U.S. government, led by OSTP along with other agencies such as HHS and the Department of State, with relevant international organizations like WHO, COVID-19 Vaccines Global Access (COVAX), CEPI, International AIDS Vaccine Initiative (IAVI), and Gavi, The Vaccine Alliance.

**PRIORITY #7: Align the Health Care, Public Health, and Human Service Systems to Improve Health Outcomes**

The U.S. health care delivery system must transform to be able to respond nimbly to public health emergencies. As the nation’s primary health interface with the public, the health care delivery system must be poised not only to collect, analyze, and deliver vital information—such as testing data, health information (including social determinants), viral DNA sequences, and more—that key federal agencies require to coordinate a response. Rather, the health care system also must be able to evaluate the safety and efficacy of new protocols, diagnostics, and treatments and administer those treatments to the entire U.S. population, while safely providing all necessary care, including expanded inpatient care, during public health emergencies. At the same time, the U.S. health care system must also evolve to focus on whole person health by increasing focus on providing social support needs where appropriate—traditionally the arena of public health.

While certain aspects of the U.S. health care delivery system are the envy of the world, as a population, our health outcomes are among the least favorable, because nearly **80 percent of health outcomes** are determined not by treatment of disease, but rather by other causative factors including economic, social, behavioral, and environmental risks that are largely the domain of public health and social services entities. COVID-19 has been an illustration linking these systemic imbalances and discontinuities to a general inability to respond adequate to a national public health emergency. Moreover, issues with data liquidity and inconsistent care quality must be addressed. Many aspects of the health care delivery system, like the public health system, are governed by individual states, or in some cases, counties, causing serious deficiencies in standardization in care and prevention practices, as well as marked gaps in data management, quality, and interoperability.
To unite the health delivery system and the human services system, new expectations, new modes of data sharing, and new payment models are required. Federally directed role clarity among public health departments, health delivery systems, and human service organizations is badly needed. Again, new, integrated, but federated data systems are needed to seamlessly connect health care, public health, and human services with the person or family at the center. Payment reform needs to be accelerated beyond value-based purchasing and other capitated models to include the public health and social needs of the community. Aligned incentives are critical to achieving success. To facilitate this, the United States must also invest in people, such as community health workers, and infrastructure to connect people to basic resources.

While this transformation is underway, we could greatly enhance emergency preparedness by building a bridge to a future state of comprehensive public health and social services for all Americans. This bridge would pragmatically instrument the nation’s larger, comprehensive health care delivery systems to provide many of the emergency services traditionally relegated to public health and social service entities. As we have seen during the COVID-19 pandemic, many of the nation’s larger health systems already contained (or have rapidly assembled) significant public emergency capacities, from sophisticated health analytics, health informatics, and epidemiologic competence to laboratories capable of supporting large-scale testing and new platform development, to extensive clinical trials frameworks including sample provenance and human subjects regulatory infrastructure, to the critical, high-acuity care resources (physical structures, equipment, and skilled workforce) required to manage disproportionate numbers of high-acuity patients during disease surges.

It will also be essential to develop a trusted, universal data repository at the federal level that allows all components—public health, social services, and health care delivery systems—to report information during public health emergencies. While reporting could be incentivized during normal times, reporting of essential data would be mandatory during public health emergencies, facilitating effective nation-wide policy and mitigation activities. Relevant federal agencies would also benefit from improved coordination, analysis capacity, and data interoperability with one another and the health care delivery system. And again, to facilitate this important data sharing, HIPAA will likely need to be amended, since certain aspects of HIPAA appear to have impeded appropriate medical and public health data sharing during the current pandemic. Lastly, in addition to role clarity, all system components would require clear decision rights during public health emergencies.

**PRIORITY #8: Operationalize Health Equity**

In addition to stark disparities in COVID-19 infection and mortality, disparities in care delivery unveiled marked health inequities during the pandemic. As an example, despite quick expansion of coverage for telehealth services at the outset of the pandemic, issues of access arose due to disparities in broadband availability, video or teleconferencing capabilities, and communication barriers. With vaccination key to addressing the crisis, uneven access to vaccines and distrust of research and science among communities experiencing pre-existing health inequities were amplified as critical issues. A key challenge for the science, medical, and public health sectors is that overcoming the COVID-19 pandemic necessitates research and engagement with the communities most adversely affected and distrustful of the biomedical enterprise. Now, more than ever, it is imperative that science, medicine, and public health policies and strategies focus on advancing health equity.

That advancement must be more than drawing lines connecting our work to equity. It must be purposeful and centered on the necessity of advancing, and ultimately achieving, equity. We can only do this by building trust and deep understanding of the racial, socio-economic, and cultural factors among the diverse communities we aim to support through science, public health, medicine, and policy. A
coordinated, collaborative approach engaging all the necessary partners is required for transformative change. This type of broad-based collaborative effort necessitates leadership from government officials. The COVID-19 Health Equity Task Force has been a productive body and may serve well as a pilot leading into a broader, inclusive effort to achieve health equity.

To map the path forward, several key steps can be implemented in short order. The first is to convene stakeholders, patients, and key community brokers focused on strategic deliverables, including identification of areas of focus and specified goals, preparation, action planning, and concrete next steps. The second is to construct a blueprint or action plan that reflects strategies and resources to speed implementation of transformative adaptations to care delivery and workforce approaches that help achieve equity. Precise and specific goals should be set for closing the most urgent disparity gaps by a defined percentage over a defined timeframe. A critical concurrent priority is building leadership to compel the collection and transparent, public reporting of race and ethnicity data as a condition of participation in all federal programs. Transparency is key in order to help ensure accountability and incentivize efforts centered on equity. Finally, measurement, analysis, and monitoring must be included in the blueprint or action plan to evaluate progress toward stated goals. Leadership in this area must be bold and sustained – if we want things to change, we will have to pay for things differently, deliver care differently, and prioritize differently.

Additionally, it would be valuable if agencies such as the Agency for Healthcare Research and Quality, the National Institutes of Health, or the Center for Medicare and Medicaid Innovation could further health services research and innovation agendas that include examining interventions in delivery and/or demonstrations of payment models that advance health equity, forge collaborations with other relevant research entities, and provide guidance that can inform the types of partnerships described above.

As with President Biden’s priority to carry forward the “moonshot” to cure cancer that he first championed as Vice President, we have an opportunity to advance similarly bold, coordinated efforts to counteract the public health crises of our time—COVID-19, eliminating disparities, and addressing social determinants of health. To do so, we must set specific and measurable goals and timelines, such as eliminating the maternal mortality gap for Black women within 3 years. Such efforts require cross-sectoral and holistic approaches that leverage the unique capabilities and infrastructures of public and private entities, to not just advance, but finally achieve, health equity.

**PRIORITY #9: Restore Public Trust and Advance Science Literacy**

Peer-reviewed studies have documented a decades-long degradation in trust in science. Interestingly, a post-pandemic 2020 3M State of Science survey showed some reduction in skepticism from peak levels among survey respondents (from 35 percent to 28 percent). However, this same survey showed that “63 percent rarely think about the impact of science in their everyday lives and 52 percent believe that their lives wouldn’t be that different if science didn’t exist.” During the COVID-19 pandemic, lingering mistrust in science was amplified by a profound politicization of the scientific and public health response, resulting in greater mistrust of many aspects of the pandemic—from questions about its very existence, doubt as to its severity, and suspicion of the benefits of public health guidance. Going forward, more robust strategies must be developed to insulate scientific agencies and staff against real or perceived political interference.

There is a complex relationship between public trust of the professionals and institutions representing science; the public’s ability to understand science-based concepts such as numeracy (e.g., the practical meaning of a 5 percent risk of hospitalization or death); and willingness to believe science-based public health guidance. While independent concepts, all three of these factors impact the public’s willingness to
adhere to public health recommendations, and all must be addressed to rebuild public trust and increase the public’s willingness to follow the recommendations of science.

While the endeavor to build public trust in science to improve adherence to public health advice is ambitious and will require a combination of strategies aimed at the individual components underlying the challenge, as discussed above, an initial step would be to leverage the positive public sentiment related to the COVID-19 vaccine, which more recent surveys indicate is gaining acceptance even among groups initially skeptical, including communities of color. Success will require a well-coordinated effort with dedicated resources, including funds and expert leadership, and clear oversight with a single point of accountability, potentially OSTP. A national program to improve science literacy and numeracy in K-12 and adult settings, aimed at high school educational levels, would be an important component. At the same time, a sophisticated marketing campaign that competes with anti-science messaging in politics and social media will also be essential.

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This concludes the NAM Working Group’s list of the nine most urgent priorities in medicine, public health, and biomedical science based on lessons learned from the COVID-19 pandemic. We urge swift action in all of these priority areas in order to capitalize on the current appetite for improvement permeating all reaches of the health and medical community, fueled by the difficult lessons learned during the COVID-19 pandemic. There exists in this moment real potential to transform health in the United States through progress and innovation in these areas, which will in turn echo globally. The NAM and its members stand ready to assist in capitalizing on these critical opportunities.

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