

# Public Health COVID-19 Impact Assessment: Lessons Learned and Compelling Needs



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## About the NAM series on Emerging Stronger After COVID-19: Priorities for Health System Transformation

This discussion paper is part of the National Academy of Medicine's Emerging Stronger After COVID-19: Priorities for Health System Transformation initiative, which commissioned papers from experts on how 9 key sectors of the health, health care, and biomedical science fields responded to and can be transformed in the wake of the COVID-19 pandemic. The views presented in this discussion paper and others in the series are those of the authors and do not represent formal consensus positions of the NAM, the National Academies of Sciences, Engineering, and Medicine, or the authors' organizations.

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## Introduction

Gains in life expectancy and quality of life over the course of American history can be attributed to forward-looking investments in public health infrastructure [1]. For example, the creation of municipal public health authorities in the 19th century supported improvements in sanitation and reduced the mortality burden from infectious diseases such as typhoid and cholera. Likewise, strategies to promote healthier environments and improve access to clinical services have improved the prevention and management of chronic diseases such as cardiovascular disease and cancer. In addressing each population health challenge, the

public health sector has played a multifaceted role, from surveilling the causes and consequences of disease (e.g., the National Notifiable Diseases Surveillance System), to convening stakeholders across sectors to develop coordinated solutions (e.g., historical collaborations with housing authorities), to informing policymakers and the public about best practices (e.g., resources to promote tobacco cessation) [2,3,4].

These interdisciplinary functions are more important than ever due to the complexity and scope of population health challenges in the modern era. For the first time in generations, life expectancy in the United States (U.S.) has begun to decline, with primary driv-

ers including increasing rates of drug overdoses and the growing burden of chronic diseases [5]. In parallel, evidence continues to accumulate about the disparities in health outcomes across racial groups and socioeconomic strata, emphasizing the need for health interventions that address both the medical (e.g., health behaviors, environmental influences) and non-medical (e.g., housing, transportation) drivers of poorer health [6,7].

Yet as the need for robust public health infrastructure has grown, federal investment in public health capabilities has declined, with health departments operating for decades under persistent and widening resource gaps. Chronically inadequate funding, workforce shortages, and outdated infrastructure limit the sector's capacity to address existing population health needs and its flexibility to respond to emergency situations [8]. COVID-19 has newly exposed and further exacerbated these long-standing challenges, while also illuminating the pervasive racial and socioeconomic inequities in health care access, quality, and outcomes in the U.S. While health departments have been foundational to the nation's response to the pandemic (e.g., guidance development, testing and tracing) the sector has experienced numerous challenges with causes both old (e.g., gaps in information technology) and new (e.g., politicization and mistrust of public health leaders and guidance). From the subversion of public health's mandate to the malignment of public health officials to the neglect of public health capabilities, the pandemic has illustrated the need for structural reforms to restore the public health sector's foundational role in American communities.

This discussion paper seeks to examine the public health sector's experience during COVID-19, exploring how legacy systems and policies shaped the sector's capacity to respond, highlighting health departments' key contributions and challenges during the pandemic, and identifying priority areas and policy considerations to enable the sector to be better prepared to meet population health needs in the 21st century.

### The Pre-Pandemic State of Public Health

In America, the functions of public health are inextricably tied to the varied forms of health department governance and operations. While health departments have faced numerous challenges during COVID-19, the roots of these problems—institutional siloes, rigid funding streams, ambiguities over authority, and neglected infrastructure and workforce development—long predate the pandemic. Consequently, understanding the

barriers to and lessons from the pandemic's response requires first establishing the public health ecosystem leading into the pandemic. This section outlines the structural and political context for the sector, with a focus on public health's (1) mandate and governance and (2) functions and funding.

### Mandate and Governance

The Institute of Medicine's (IOM) 1988 report on *The Future of Public Health* defined the mission of public health in the U.S. to be "the fulfillment of society's interest in assuring the conditions in which people can be healthy" [9]. To convert this aspiration into action, the nation has developed a complex system of governance comprised of a diverse set of local, state, territorial, tribal, and federal agencies and authorities, all of whom collaborate to advance the public's health [10,11]. While a comprehensive and inclusive approach to public health governance is needed for the post-pandemic era, the authors represented in this paper will primarily focus on the experiences and perspectives of local and state health departments during COVID-19.

The governance of public health in America is local in origin, with municipal health boards pioneering advances in sanitation and cities and states developing laboratory capacity to support outbreak control. National initiatives for specific public health needs (e.g., tuberculosis control, HIV/AIDS) and the emerging interdependencies between the public sector's health, medical, and social service programs (e.g., partnerships between health departments and state Medicaid programs) increased the federal government's involvement in public health. However, while federal financing mechanisms (e.g., block grants) generally emphasize state responsibility, a national policy environment that prioritizes cost containment limits state health departments' capacity to respond to emerging public health needs [9].

Today, the organization of functions, delivery of services, and availability of resources for public health in the U.S. varies tremendously due to the country's size and the heterogeneity of community needs and demographics. The day-to-day governance and administration of public health is distributed across the 59 recognized state and territorial health departments and an estimated 2,500 local health agencies nationwide [12,13]. While this decentralized model can offer advantages by emphasizing local context, health departments are hindered by the uneven distribution of purviews and foundational public health capabilities. From an operational perspective, state-local gover-



**FIGURE 1 |** Models of Public Health Governance

SOURCE: Adapted from <https://astho.org/Research/Data-and-Analysis/State-and-Local-Governance-Classification-Tree/>, with permission.

nance structures for public health can generally be described by four models: centralized, decentralized (or home rule), mixed, and shared (see *Figure 1*) [14]. For example, Rhode Island can be considered a “centralized” model as it operates as a unified local and state health agency, while Massachusetts can be described as a “decentralized” model, with decision-making authority largely retained by 351 local health agencies across the state [14,15]. From a resource perspective, funding for public health varies widely across the country. For example, state per capita spending on public health ranged from \$7 in Missouri to \$140 in New Mexico in 2019 [157].

In parallel with local public health efforts are the national initiatives led by the federal government. These include support for baseline public health functions, facilitation of pre-decisional and deliberative planning processes (including local and state health agencies) to prepare for public health threats, creation of countrywide health priorities (e.g., the Healthy People 2030 goals), support for cross-state collaborations, and resource allocation for public health and health care programs.

While there are many models of governance in public health, it is clear that the system as currently configured—with its origins from a different time with different population health challenges—is not optimally designed to meet the needs of America’s communities in the 21st century. Health departments should of course be tailored to the needs of their local constituents. However, while agencies may vary in their form, they should not vary in their basic functions. Significant variation in how health departments make decisions (described above) and what resources are available to them to deliver services to their communities (described below) have contributed to heterogeneous outcomes prior to and during the pandemic.

Policymakers and public health leaders have developed various tools to achieve alignment on the public health mandate and public health governance, from accreditation programs to frameworks outlining the minimum services and capabilities for all health departments [16]. Yet these efforts have struggled to achieve scale; for example, nearly one-third of state health departments and the majority of local health departments have opted out of a national, voluntary accreditation program, in part due to the cost and staffing needs required to complete the accreditation process [17,18]. Consequently, initiatives to promote unified standards without commensurate attention to the chronic funding gaps responsible for variation in foundational public health capabilities run the risk of adding to health departments’ reporting burden without resolving their underlying needs. The next section on “Functions and Funding” outlines how such systemic resource shortages for American public health, in tandem with the governance challenges described in this section, created the preconditions for pandemic-era challenges.

**Functions and Funding**

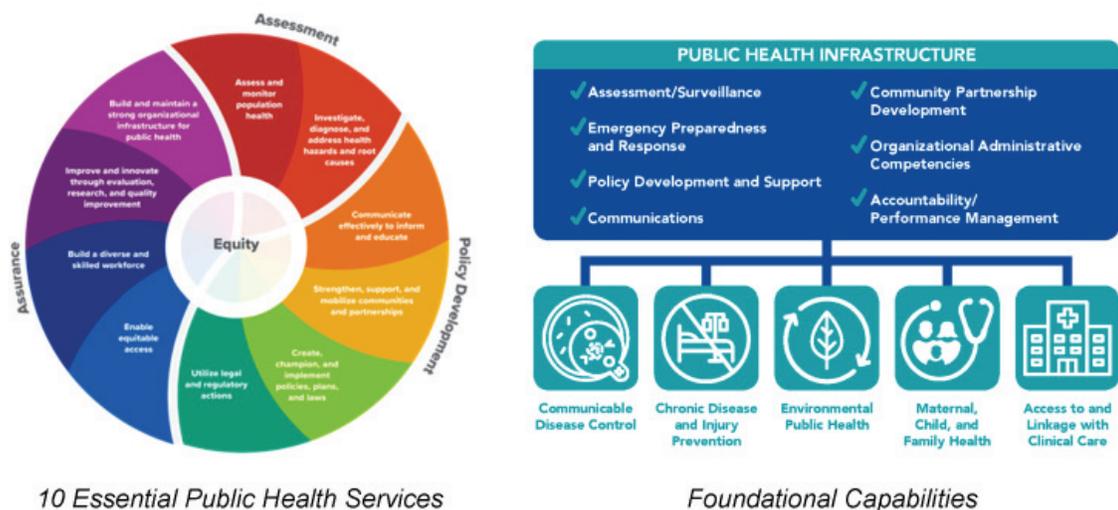
The functions of public health in America are described by the frameworks for “Essential” and “Foundational” public health services. The “Essential” public health services, which were developed in 1994 and updated in 2020, outline the key domains and areas of focus for the public health mission (e.g., investigating health hazards and their root causes), with a focus on equity centering the design and delivery of each service. In 2012, the IOM recommended that experts characterize the skills, capabilities, and services that health departments need to operationalize the goals of the “Essential” public health services framework [20]. To this end, the Public Health Leadership Forum developed

the framework of the “Foundational” public health services, which details the capabilities (e.g., emergency preparedness and response) and program areas (e.g., chronic disease and injury prevention) which all health departments should possess in addition to services tailored to the unique needs of the community which they serve [10,11]. *Figure 2* presents these two frameworks, which together provide health departments with a guide for what their responsibilities are (“Essential” services) and how they can operationalize those responsibilities for their communities (“Foundational” services).

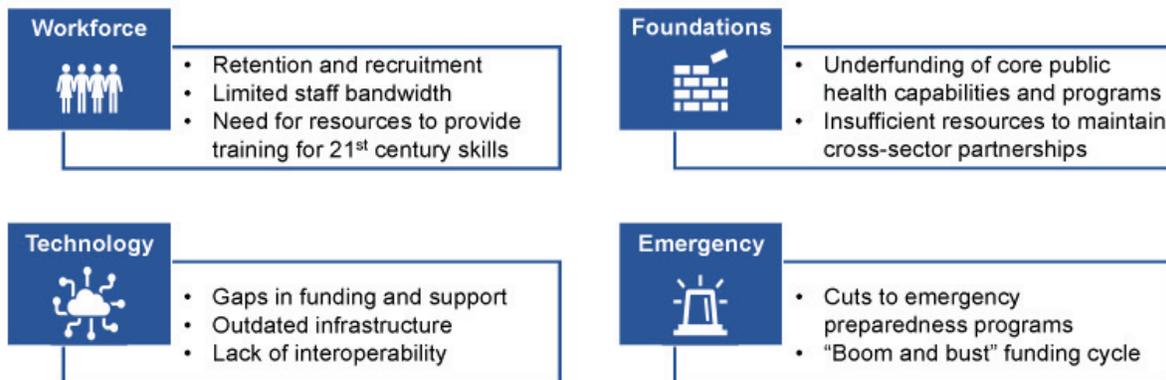
However, local execution of these programs and functions is often limited by constraints imposed by both federal agencies and state and local jurisdictions. First, funding levels have historically been inadequate to support the delivery of the Essential public health services, let alone prepare for emergency situations. Second, many funding streams for public health are “categorical”, or restricted to specific priority areas (e.g., HIV, tobacco control), which leaves little flexibility for spending to support core foundational capabilities or to support surge needs in times of crisis [19]. Other funding streams are operated as block grants, but as noted in the IOM’s 2012 report, *For the Public’s Health*, such models in practice have been vulnerable to funding cuts (e.g., funding for the Preventive Health and Health Services block grant decreased by 35% from 1995 to 2012 ) [20].

Overall funding for foundational capabilities has run dry in the face of long-standing neglect and deprioritization by both local and national leaders, with the expenditures of public health agencies decreasing by approximately 10% (between 2010 and 2018) and the share of health care spending attributable to public health declining by nearly 17% (between 2002 and 2014) [8,21]. Indeed, rather than valuing prevention, the American system has become increasingly biased in favor of reaction, with per capita spending on public health services equivalent to 1-3% of per capita expenditures on medical care [21]. Chronically deprived of resources, the capabilities of health departments have begun to atrophy over several key domains (see *Figure 3*).

First, the public health workforce is understaffed and unequipped to meet the needs of local communities. Over the past decade, local health departments have eliminated over 56,000 jobs, while state health agencies have lost over 10,000 jobs—a distressing trend considering how population health challenges have grown and multiple public health emergencies (e.g., the opioid epidemic, the Ebola and Zika outbreaks) have occurred over the same time period [8,22]. The workforce that remains does not adequately reflect the population served and lacks formal public health training, with a significant proportion of health department staff on the cusp of either leaving the profession or re-



**FIGURE 2 |** Frameworks for Essential Services and Foundational Capabilities in Public Health SOURCE: <https://www.cdc.gov/publichealthgateway/publichealthservices/essentialhealthservices.html> (left) and Public Health National Center for Innovations. Foundational public health services in action. PHNCI. <https://phnci.org/national-frameworks/fphs>. Published November 2018. (right) (reprinted with permission).



**FIGURE 3 |** Pre-Pandemic Challenge Areas for the Public Health Sector

tiring [23,24,25]. These dire trends may not reflect the full scope of workforce needs, as there is no centralized monitoring system for public health, with the sector relying on periodic point estimates conducted by third party organizations to gauge capacity. Local and state department leaders consequently have limited ability to appropriately benchmark their capacity and articulate community-specific needs. Furthermore, challenges with recruitment and retention—attributed primarily to low pay and the paucity of opportunities for career advancement, with a particular dearth of diversity in leadership positions—raise pressing concerns about the sector’s future workforce capacity [26,27]. Yet the workforce challenges are not simply a pipeline problem. Preparing the public health sector for tomorrow requires a workforce that is meaningfully different from years past, both in terms of the diversity of skills that health officials possess (e.g., need for new data science skills, digital capabilities, cultural and linguistic competencies) and the relationships health officials foster with other sectors (e.g., the health care system, the lay public). While regional Public Health Training Centers have helped fill gaps in health department capacity, and the development of new undergraduate and graduate education programs for public health have expanded the cohort of new public health professionals and trainees, additional resources and a national mandate for interdisciplinary training programs are necessary to address 21st century public health challenges.

Second is the increasingly outdated nature of department capabilities, particularly for information technology (IT) infrastructure. Data exchange between public health and health systems remains fragmented, with few departments participating in the CDC’s program to develop digital bridges due to lack of funding and

capacity within health departments [28,29]. While the Council of State and Territorial Epidemiologists has developed a roadmap for creating a “data superhighway” for public health, such initiatives to date have lacked the necessary funding and policy support to become reality [30].

Third is support for baseline preventive activities. Many core public health programs have been consistently underfunded (e.g., providing immunizations, diabetes prevention, lead control), with past funding cuts creating the preconditions for present-day population health challenges. For example, inflation-adjusted funding for the prevention of sexually transmitted diseases declined by 40% between 2003 and 2018 even as disease prevalence increased over the same time period (e.g., rates of syphilis and gonorrhea approaching 30-year highs) [31,32]. These gaps in foundational capabilities are magnified during times of crisis, which often require staff to perform “double duty” without a commensurate increase in resources. In many cases, insufficient resources have also hindered health departments’ capacity to maintain necessary cross-sector partnerships and linkages (e.g., with the social care sector, with private industry) which are needed to augment health department capacity and support locally tailored solutions.

Fourth is emergency preparedness. The turn of the millennium has witnessed the emergence of multiple pathogens with pandemic potential, including H1N1, SARS, Ebola, and Zika. Yet rather than renewing a commitment to real-time surveillance and surge capacity, funding for the Public Health Emergency Preparedness program declined by \$265 million between 2002 and 2020 [33,34]. While states and territories, as well as a few large local jurisdictions, received increased fed-

eral support during previous emergencies, such funding was time-limited and expired at the conclusion of the crisis. This “boom and bust” cycle of public health funding hinders preparedness for future emergencies, as the capacity developed in response to outbreaks is quickly eroded unless sustainable support structures are established. For example, emergency funding during the Zika outbreak equipped health departments to address long-neglected issues such as mosquito control and laboratory testing [35]. The CDC also bolstered local health department capacity by assigning field staffers to outbreak hotspots [36]. However, funding expired after 2017, leading many outbreak control efforts to be rolled back or discontinued [37].

Together, these challenges help to frame the environment in which the public health sector was operating prior to the pandemic. The next section describes how health departments navigated these existing challenges during their response to COVID-19.

### State and Local Public Health Response to COVID-19

While health departments provided key functions (e.g., data reporting, testing clinics, contact tracing) during the pandemic, the challenges they encountered (e.g., barriers to exchanging information, operational siloes, lack of disaggregated data, and insufficient capacity and training) are indicative of fundamental design flaws and a lack of investment in America’s public health system. Additionally, the sector’s overall response to COVID-19 has been uneven due to inconsistencies in national guidance, the staggered spread of the virus across the country, and differences in state and local health department capacity and authority. This section characterizes health department functions and challenges during the pandemic using the lens of the “Foundational” public health capabilities.

#### Health Department Functions

“Foundational” capabilities supporting the public health response to COVID-19 included the following domains:

1. Emergency preparedness and response (e.g., data collection and reporting);
2. Assessment and surveillance (e.g., testing and tracing capacity);
3. Communications (e.g., educating policymakers and the public);
4. Policy development and support (e.g., implementation and enforcement); and
5. Community partnership development (e.g., to address non-medical needs) (see *Table 1*).

#### Emergency Preparedness and Response

Health departments were the first line of response when the outbreak began, working to control the spread in communities across the country and putting into action their own emergency operations and response plans. These activities included, among other things, developing mechanisms to track and report data on the virus and leveraging their capabilities as Laboratory Response Network reference laboratories to support the development of COVID-19 diagnostics. As the outbreak expanded, the emergency response shifted, with public health playing a key role in the whole-of-government approach.

First, health departments began coordinating with local, state, and federal officials to support emergency planning across a given area. For example, the Northwest Healthcare Response Network was activated in Washington after the first cases were reported in Seattle [38]. Likewise, in Louisiana, the Department of Health and the State Health Officer led briefings with lawmakers and consulted with local emergency managers, enabling the Governor to issue an emergency declaration to activate necessary resources [39].

Second, with the outbreak rapidly evolving, many health departments worked to set up dashboards on their websites to display the latest data on cases, hospitalizations, and deaths. Given the outdated technical infrastructure of many health departments—where the use of fax machines continues to be common—many officials sought to partner with the private sector [40]. For example, Louisiana’s health department collaborated with Blue Cross Blue Shield to develop a COVID-19 Outbreak Tracker, while in Washington, the state health department partnered with Microsoft to develop a data dashboard [41,42]. Similarly, the health department and state officials in Michigan forged partnerships with academia to develop data dashboards and to make model-based projections to aid decision-making [43].

Third, health departments supported diagnostic development and the expansion of testing capacity. State and local public health laboratories played a key role in identifying flaws with the CDC’s diagnostic test during February 2020 [44]. As the number of COVID-19 cases began to rapidly grow, the federal government provided new flexibilities to state public health laboratories and commercial laboratories to expand the nation’s testing capacity [45]. In response, health departments (e.g., Wadsworth Center at the New York State Department of Health) supported the development of new tests, coordinated testing infrastructure (e.g., 16

**TABLE 1 |** Role of Foundational Capabilities for Public Health During the COVID-19 Response

Foundational Capability	Key Challenges	Response Example
Emergency Preparedness and Response	Health departments activated emergency protocols, developed public-facing reporting mechanisms, and supported advancements in testing technology and capacity	<ul style="list-style-type: none"> <li>• <a href="#">Louisiana</a> collaborated with health insurers to develop the state’s “COVID-19 Outbreak Tracker”</li> <li>• <a href="#">Seattle and King County (Washington)</a> developed the Seattle Coronavirus Assessment Network</li> </ul>
Assessment and Surveillance	Health departments had to organize testing and tracing capacity, requiring substantial coordination and workforce development	<ul style="list-style-type: none"> <li>• <a href="#">Hamilton County (Tennessee)</a> partnered with faith organizations to increase access to testing, while <a href="#">California</a> funded the development of sites in communities of color</li> <li>• <a href="#">Massachusetts</a> created a dedicated caller ID for its contact tracing team to increase response rates</li> </ul>
Communications	Health departments had to both combat misinformation while updating the community on evolving trends and disseminating the latest data	<ul style="list-style-type: none"> <li>• Multiple states, including <a href="#">Colorado</a>, <a href="#">Florida</a>, and <a href="#">Ohio</a> created a dedicated COVID-19 call center with 24/7 operations</li> <li>• <a href="#">North Carolina</a> launched the “3 Ws” campaign to communicate public health best practices</li> </ul>
Policy Development and Support	Health departments had to clarify the scope of their mandate and authority and develop strategies for implementing and enforcing infection control policies	<ul style="list-style-type: none"> <li>• Many cities, including <a href="#">Charlotte</a>, <a href="#">Kansas City</a>, and <a href="#">San Francisco</a> used civil or criminal penalties for enforcement</li> <li>• Many cities and states conflicted over mask policies, school closures, and social distancing requirements for retail establishments such as restaurants</li> </ul>
Community Partnership Development	Health departments had to coordinate across sectors and often perform out-of-scope functions (e.g. procurement)	<ul style="list-style-type: none"> <li>• <a href="#">Washington</a> established a Regional COVID Coordinating Center to organize medical care</li> <li>• <a href="#">Fairfax (Virginia)</a> developed a Medical Isolation Program</li> </ul>

sites led by the Georgia Department of Health), and formed public-private partnerships to support disease surveillance (e.g., the Seattle Coronavirus Assessment Network) [46,47,48].

**Assessment and Surveillance**

Testing and tracing is a core public health capability maintained by departments for both common infectious diseases (e.g., sexually transmitted infections) and epidemics (e.g., Middle East Respiratory Syndrome). However, COVID-19 has carried significant challenges (e.g., the potential for asymptomatic transmission and

“super-spreader” events), and the scale and speed of the outbreak rapidly outpaced the resources of health departments, leading experts to call for a substantial expansion in assessment and surveillance capabilities [49].

For testing, many innovations were not equally accessible to all populations, even though people of color were both more likely to test positive for COVID-19 and to experience severe outcomes from the disease [50]. For example, many of the retail testing sites established by the federal government were not accessible to communities of color [51]. Public health officials attempted

to address inequities in access where possible, despite often lacking authority and resources. In California, the state funded nearly 100 community testing sites located in communities of color [52]. Other health departments sought to meet communities where they were to increase access to testing. For example, Hamilton County in Tennessee partnered with the faith community in Chattanooga to set up free COVID-19 testing sites at predominantly Black churches [53]. Yet despite these efforts, barriers persisted throughout the pandemic due to resource inequities and gaps in federal support for local health departments.

For tracing, health departments hired tens of thousands of new contact tracers during the summer of 2020 [54]. Yet contact tracing efforts struggled, with rates of contact identification and interviews by health departments in the U.S. falling well below those of other countries [55]. Health departments have taken different strategies to improve response rates. For example, with many contact tracing calls either blocked or left unanswered due to the lack of caller identification, the Massachusetts Health Department worked with telecommunications providers to set up a standard “MA COVID Team” tag for each phone number [56]. Contact tracing efforts focused on specific, vulnerable populations have also been promising, such as Boston’s biweekly screening program at homeless shelters [57, 58].

However, efforts continued to fall short of expectations due to several challenges. First, state and local health departments lacked the resources they needed to hire and train contact tracers, with funding delayed by legislative gridlock over COVID-19 relief bills. Second, in the rush to scale, many departments relied on “quick fix” solutions for scaling disease investigation capacity (e.g., reliance on call centers) at the expense of recruiting local individuals who possessed tacit knowledge of their communities, limiting the effectiveness of tracing [59]. Third, high rates of infection and prolonged delays in testing in many regions of the country outpaced the rate at which tracing could be performed [60]. Fourth, contact tracing in communities of color—which have been disproportionately affected by COVID-19—was particularly challenging due to low levels of trust generated from historical legacies of injustice.

### **Communications**

To “inform, educate, and empower” is one of the ten essential services of public health departments in the U.S. [10]. This function has been of paramount importance during the COVID-19 pandemic, which has been

accompanied by a “pandemic of misinformation” [61]. Competing policy narratives, the undermining of public health leaders by elected officials, and the dissemination of pseudoscience and conspiracy theories through social media have left Americans understandably confused and ill-informed [62]. Patterns of misinformation and disinformation have distressingly emerged along partisan lines, contributing to the politicization of public health [63,64]. Furthermore, distrust of the health care system has grown among communities of color—who have historically experienced systemic injustices in American health care—due to gaps in the federal response to COVID-19 [65,66].

Local and state health departments have taken a number of steps to keep their local communities informed during the pandemic. For example, numerous state health departments such as those in Colorado, Florida, Minnesota, Ohio, Oklahoma, and many more established dedicated COVID-19 Call Centers to triage incoming questions [67]. In North Carolina, the state’s Department of Health and Human Services launched a “Know Your 3 W’s” campaign—wear a mask, wait 6 feet apart, and wash your hands—early in the pandemic, and has used consistent messaging on the part of public officials during daily news conferences to encourage uptake [68]. In Seattle and King County, the Department of Health expanded its social media team to increase its digital operations and translated COVID-19 materials into over 30 languages to improve their accessibility [69,70]. Health departments also sought to tailor communications campaigns around the goals of health equity. For example, the Black Arizona COVID-19 Task Force organized frequent virtual sessions and electronic communications with organizations and health care providers serving Black communities [71].

### **Policy Development and Support**

The federal government’s delayed response, misleading statements about the virus’s severity, and abandonment of the established pandemic playbook fragmented the emergency response across the U.S. [72,73]. Lacking a unified national strategy and facing conflicting guidance about infection control (e.g., travel restrictions, mask policies), local and state health departments were left to develop and enforce public health guidance on their own. This in turn led to fragmented responses and raised questions about the scope of health department mandates and authorities.

For example, lacking federal guidance, local and state officials led the way in implementing shelter-in-place policies, beginning with counties in California’s

Bay Area [74,75]. As the outbreak progressed, counties and cities began to take different strategies for enforcing public health restrictions. For example, some cities such as Kansas City indicated that violations of stay-at-home orders would be subject to civil penalties (e.g., suspension of business operations), while other areas such as Mecklenburg County in North Carolina levied criminal penalties (e.g., misdemeanor) [76,77].

However, public health and law enforcement often collaborated to emphasize that penalties were intended as a last resort. For example, in San Francisco—where noncompliant individuals could be fined or incarcerated—officials emphasized that they were “not interested in using a criminal justice approach for a public health challenge” [78]. Yet when policies were enforced, communities of color were often penalized at a disproportionate rate. For example, 61% of violations of shelter-in-place orders in Hamilton County in Ohio were attributed to Black individuals, even though only 27% of the county’s population is Black [79]. The racially skewed application of enforcement policies, coupled with the broader conversations on police brutality following the deaths of George Floyd and Breonna Taylor that occurred in the midst of the pandemic, may deepen historical distrust of the health system within communities of color.

The development and implementation of public health guidance also raised important questions about the scope of health department mandates and federal authorities. An illustrative example is the use of face coverings, which evidence from natural experiments of mask mandates in the U.S. indicate helped avert a substantial number of COVID-19 cases and deaths [81]. The CDC initially recommended against the use of face coverings for COVID-19 before reversing its stance in April 2020; even following that recommendation, the federal government did not provide consistent guidance to promote mask use [82,83,84]. State preemption also created challenges for local implementation; for example, in Texas, the Governor issued a ban on penalties for face coverings after Harris County implemented a mask mandate, while in Nebraska, the Douglas County Health Department withdrew its policy after the state’s Attorney General challenged the city’s authority for enforcement [85,86,87]. Additionally, the delegation of authority from federal to state to local government also cascaded tension and distrust of health departments, taking a toll on public health officials and politicizing the policy development process.

### **Community Partnership Development**

The pandemic not only cast a spotlight on America’s underinvestment in public health infrastructure at the local, state, and national level, it also highlighted the systemic gaps in population health [88,89]. Consequently, many health departments went beyond their routine responsibilities to meet their community’s health and social needs during the pandemic.

For some health departments, this included collaborating with actors across the health care system to coordinate health services and care planning (e.g., isolation procedures, surgery cancellations). For example, the health department of Seattle and King County helped create the Western Washington Regional COVID Coordination Center, which monitored outbreaks in long-term care facilities and coordinated referrals according to hospital capacity [38]. With shortages of medical supplies hindering the pandemic response in many areas, and federal coordination for procurement and distribution lacking, local and state health departments played an active role in coordinating with health systems and the Strategic National Stockpile for materials such as personal protective equipment, medications, and test kits.

Another key challenge for health departments was supporting the ability of vulnerable patients who tested positive to safely self-isolate. Compared to white Americans, people of color are more likely to work jobs that cannot be performed remotely, live in households that are multigenerational, and live in densely populated areas [90,91,92]. In response, the Fairfax County Department of Health in Virginia collaborated with the county’s Office to Prevent and End Homelessness and used stimulus funding from the Coronavirus Aid, Relief, and Economic Security (CARES) Act to develop a Medical Isolation Program that repurposed hotel rooms for non-congregate sheltering [93].

Beyond direct infection control, health departments have also adapted to meet other health and social needs of their population. In many counties, local health departments act as both a service coordinator (e.g., for social services) and provider (e.g., for primary and preventive care services), and due to shelter-in-place restrictions, had to adapt their operations to virtual modalities. For example, one regional health department in Kentucky transitioned to virtual visits for its Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) clinics, and was able to increase participation rates by 14% [94].

**Health Department Challenges**

Although health departments were critical to the pandemic response, their efforts were too often limited by factors ranging from ambiguity about decision-making authorities to operational fragmentation and outdated technical infrastructure (see *Figure 4*).

**Clarifying Roles and Lines of Authority**

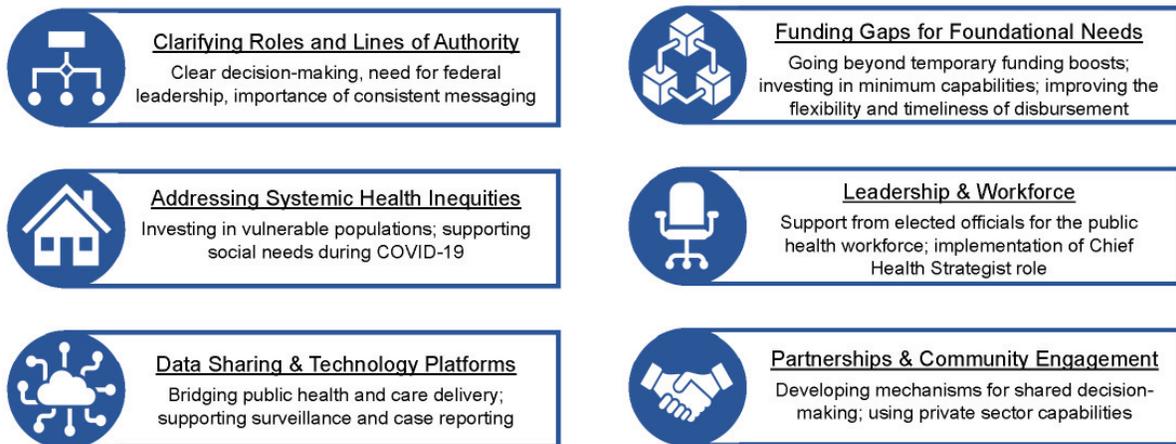
Effective local public health governance in the U.S has always benefited from strong federal leadership. However, during the COVID-19 pandemic, the federal government largely delegated its responsibilities to governors, with significant consequences for local and state health departments. This created several challenges.

First, the deviation from established federal protocols for public health emergencies and conflicting messages from senior leaders contributed to an atmosphere of confusion and fragmented the response across states. For example, states, and in some cases local jurisdictions, were left to make individual decisions about shelter-in-place orders during March 2020 without federal guidance. Given the variation in local and state health department governance models (see *Figure 1*), the lack of unified decision-making—which has persisted throughout the pandemic—has contributed to variation in the public health sector responses.

Second, local and state health departments struggled to procure supplies and navigate regulations. The federal government changed the rules for the Strategic National Stockpile—originally intended to “supplement state and local supplies during public health emergen-

cies”—in the middle of the pandemic without advance notice, shifting the onus for procurement to states [95]. The “bidding war” that resulted between states for personal protective equipment and ventilators created uncertainty for health systems and expanded the scope of health department responsibilities at a time when public health officials were already overburdened [96]. Additionally, some health departments were unfamiliar with many federal regulatory processes, such as emergency use authorizations for COVID-19 diagnostics, and the fragmented approach to test development and reagent procurement generated tremendous pressure on local and state departments.

Third, mixed messaging and shifting public health guidance—particularly around mechanisms of transmission (e.g., aerosols) and protocols for school reopenings—often became a barrier to effective local decision-making due to the presence of contradictory risk messages and misinformation campaigns. These challenges also manifested differently for local and state health departments. For example, nursing homes are regulated across multiple levels of government, occasionally leading to conflict and confusion, as was the case in Indiana where the state and county issued different orders on policies for patient transfers [97]. Likewise, oversight of school reopenings varied significantly. In California, the variability of local responses to school reopenings has led some district leaders to advocate for the state to implement more uniform standards [98]. Future emergency responses would be substantially improved by clarifying lines of author-



**FIGURE 4 |** Key Challenges for Local and State Health Departments During COVID-19

ity in an emergency and improving the consistency of messaging.

### ***Funding Gaps for Foundational Needs***

It is well-known and consistently documented that although the scope of public health responsibility has increased in recent years, the broadened purview has not been accompanied by a commensurate increase in resources, with health departments consistently remaining underfunded [8,12,99]. Previous committees convened by the IOM have repeatedly called for a paradigm shift in public funding [9,20,100]. To help guide the identification and allocation of resources for population health, the Public Health Leadership Forum developed the Foundational Public Health Services framework, which aligns with Public Health Accreditation Board's (PHAB) Standards & Measures [101,102,103]. The severity of existing resource gaps will substantially increase due to the pandemic's potentially long-lasting effects on population health (e.g., mental health) and the damage it has made to progress on other public health priorities (e.g., the opioid crisis) [104,105]. While infectious disease outbreaks—including COVID-19—typically prompt the allocation of supplemental funding, such funds are time-limited, restricted to the outbreak at hand, and generally have not been followed with the long-term commitments needed to strengthen the foundational capabilities of public health departments [34,106].

### ***Addressing Systemic Health Inequities***

COVID-19 magnified America's underlying racial and socioeconomic inequities in population health [88,89]. The disparities are especially stark for Blacks, Latinx, American Indian/Alaska Natives, and Native Hawaiians and Pacific Islanders who have experienced substantially higher rates of COVID-19 infection, hospitalization, and mortality compared to white Americans [50,107,108,109,110]. In addition, the Asian American population—for which COVID-19 data are frequently underreported and often not disaggregated—has experienced an alarming rise in discrimination and xenophobia [111,112].

To address these disparities, many health departments developed cross-cutting functions to address non-medical needs, and states such as Illinois, Louisiana, and Michigan created COVID-19 Health Equity Task Forces to explicitly address the pandemic's disparate impact [113,114,115]. With committed leadership, authentic partnership with communities, dedicated funding, accountability, and multi-sector engagement,

these task forces' recommendations and actions have demonstrated progress on addressing disparities in COVID-19. For example, Chicago's Racial Equity Rapid Response team implemented an informational campaign that increased COVID-19 testing rates by 13%, performed preventative outreach calls to 68,000 patients, and secured \$3.1 million in COVID-19 relief funding, which was used to address community needs such as rental assistance [116]. Likewise, the city health department and regional health commission in St. Louis partnered to launch PrepareSTL, which coordinated the distribution of personal protective equipment to underserved communities (e.g., at public housing complexes) and supported the expansion of testing capacity at Federally Qualified Health Centers [117]. However, despite these promising examples, the paucity of resources dedicated to addressing health inequities and the social determinants of health limited the sector's overall capacity for response.

A notable challenge from the outset of the pandemic was the delay in capturing the magnitude of disparities [118]. While the challenges of collecting and exchanging demographic data precede COVID-19, the lack of data on race and ethnicity during the pandemic was especially problematic as it delayed the prioritization and allocation of resources to hard-hit communities. As data accumulated, it became evident that COVID-19 disproportionately affected populations who were the least likely to have access to basic public health resources. For example, the incidence of COVID-19 was 3.5 times higher among American Indian/Alaska Native populations—likely an underestimate given the lack of specificity in demographic data—yet American Indian/Alaska Native populations were often the least likely to access COVID-19 diagnostics or necessary inpatient care, in addition to basic public health resources such as running water [119,120,121,122,123]. It was also well-documented that vulnerable populations who live in congregate settings (e.g., individuals in homeless shelters, justice-involved populations) were particularly susceptible to COVID-19 outbreaks, yet health departments were largely unequipped to perform the necessary surveillance testing and provide resources for rehousing and self-isolation [124,125].

The inequities exposed by COVID-19 are not new. The question is whether the pandemic will provide a sufficient impetus for elected officials to reverse the ongoing decay of public health infrastructure through meaningful, long-term investments in system capacity with dedicated resources and attention for addressing

health inequities and the social determinants of health [126].

There are multiple avenues for change, such as improving public health's analytic capacity to elucidate the root causes of disparities. Furthermore, the Chief Health Strategist model of Public Health 3.0—in which public health leaders “work with all relevant partners so that they can drive initiatives including those that explicitly address ‘upstream’ social determinants of health”—represents a promising approach to breaking down historical siloes between public health and social care to foster meaningful change [127]. For such interdisciplinary models to succeed, policymakers must address funding and resource gaps to restore health departments' foundational capabilities and make such cross-sector partnerships viable and sustainable.

### **Leadership and Workforce**

Effective crisis management for public health requires clear communication from designated leaders who are empowered to make decisions. Many local and state public health officials have been celebrated during the pandemic for their poise and focus on the facts and evidence. However, as COVID-19 has continued, public health guidance and directives—which are designed using the latest evidence and contextualized to local communities—have become increasingly politicized. Public health officials have become a casualty of the polarized climate, with nearly 200 confirmed firings, resignations, or retirements as of December 2020 [128]. Social media has played a prominent role in the harassment of public health officials, who have received death threats and been subjected to organized protests at their personal residences [129]. Distressingly, some elected officials themselves have encouraged and even participated in these attacks, which not only undermine the pandemic response, but also build on growing public distrust of non-partisan, scientific institutions [130].

The challenges extend to the public health workforce as well, which has expanded substantially during the pandemic. The majority of hires have been for temporary contact tracing positions, requiring departments to dedicate resources to short-term training without filling the long-term need for a workforce with dedicated public health training and the requisite technical, cultural, and linguistic competencies. Contact tracers hired for COVID-19 have also experienced challenges, with reports of harassment on social media [131]. Independently, several departments have had to cross-train existing staff to meet demand for contact tracing,

which can leave little spare capacity to address other core public health duties [132]. Elected leaders need to affirm their support for data-driven decision-making and the non-partisan nature of health departments to ensure their credibility, and must provide sufficient resources to ensure that public health functions are sustainable.

### **Data Sharing and Technology Platforms**

A significant limiting factor for public health departments during COVID-19 has been the use of obsolete technology platforms. Additionally, there continues to be resistance on the part of hospitals to sharing key data that could be relevant during infectious disease outbreaks (e.g., admission, discharge, and transfer data) [133]. Furthermore, even when hospitals or laboratories have been amenable to sharing data for COVID-19, they have only been required to report to the federal Department of Health and Human Services (HHS), and not to local health departments, potentially delaying local decision-making [134].

Technological limitations also mask the disparate impact of the COVID-19 pandemic on people of color, as noted in the preceding subsection on “Addressing Systemic Health Inequities” [135]. Analyses of state and local health departments suggest that more than a third of cases lacked race and ethnicity data due to both incomplete forms from clinical labs and health care sites and outdated digital infrastructure for health departments. Several states continued to report no ethnicity data at all as of September 2020 [136]. While individual health departments have sought to close the information gap, such as the New York City Department of Health and Mental Hygiene's publication of neighborhood-level COVID-19 maps as early as April 2020, the consistent gaps in public health surveillance and lack of technical uniformity have exacerbated the inequities of the pandemic [136,137].

The use of outdated infrastructure, coupled with the lack of integration of new diagnostic technologies (e.g., point of care, home-based) with health departments or the health care system, has also slowed the pandemic response and affected the credibility of health officials. For example, a backlog of over 300,000 test results occurred in California in part due to data glitches [138]. Likewise, in Texas, more than 1 million test results were lost over the summer of 2020 [139]. These data integrity challenges affected the ability of local officials to make decisions about reopenings, demonstrating the need for interoperable platforms for public health and reaffirming the urgency of ongoing collaborations

to create a “data superhighway” for public health [140]. Importantly, these deficiencies are not due to a lack of will among local and state health departments, but to a dearth of resources to support building such systems.

### **Partnerships and Community Engagement**

With the COVID-19 pandemic disrupting aspects of everyday life ranging from education to business operations to health care delivery, effective emergency response requires a broad set of community partnerships. Effective engagement strategies require health departments to convene diverse stakeholder groups, coordinate across historical siloes, and overcome cultural differences and the limited availability of funds.

For example, research indicates that the public health sector has long faced challenges with communicating across sectors [141]. While nearly all local health departments engage in cross-sector partnerships (e.g., with K-12 schools), most engagement is surface level (e.g., information exchange), with notable gaps in collaboration with the media [12]. Additionally, formal collaborations with other health care, community-based, and government partners have declined since 2008, and had not recovered to pre-recession levels prior to the pandemic. Gaps in communication posed challenges for combating misinformation and achieving compliance with COVID-19 restrictions. Partnerships provided a vehicle to support community engagement and secure buy-in. For example, “Challenge Seattle” brought together the Seattle and King County Health Department and business leaders from local companies (e.g., Amazon, Microsoft, and Starbucks) to create a forum for the co-development of best practices (e.g., workplace safety guidelines) and shared decision-making about data reporting and reopening timelines [142]. However, the depth of engagement and cooperation varied across the country and was often hindered when elected officials contradicted public health guidance. For example, states such as Florida and Texas proceeded with lifting restrictions despite failing to meet both local and national criteria for reopening. The experience illustrates the value of tools such as the Public Health Reaching Across Sectors (PHRASES) project to help proactively develop relationships and partnerships for public health [143].

Moving forward, the challenge for health departments will be developing avenues to sustain these partnerships outside of crisis settings, while also determining which infrastructure and programmatic needs would be best met through internal capacity development as opposed to external collaboration.

### **Priority Actions and Policy Considerations**

Generations of reports from the IOM have stressed the critical importance of public health infrastructure to population health and the need to address longstanding issues ranging from funding shortages to institutional siloes [9,20,100]. COVID-19 has reaffirmed this call to action, demonstrating the centrality of robust public health systems to the health and wellbeing of society. As the U.S. prepares for the post-pandemic era, it will be imperative for policymakers to not only develop mechanisms to improve preparedness for future public health emergencies, but also to address the chronic neglect of foundational public health capabilities in communities across the country. This section outlines the priority actions and policy considerations for the public health sector, with a focus on:

1. Transforming public health funding;
2. Affirming the mandate for public health;
3. Promoting structural alignment across the public health sector;
4. Investing in leadership and workforce development;
5. Modernizing data and IT capabilities; and
6. Supporting partnerships and community engagement.

### **Transforming Public Health Funding**

While public health has faced many challenges during COVID-19—including outdated infrastructure, a beleaguered workforce, and inequities in access and outcomes—the lasting lesson for policymakers must be a recognition that these structural shortcomings were not caused by the pandemic, but rather already endemic for the sector after decades of chronic neglect and underinvestment in public health. Each of the policy considerations in this section highlights an existing pressure point in the system and a series of priority actions for relieving strain on the sector and preparing public health to meet future challenges. Yet meaningful change within each domain will only be possible if policymakers address the generational gaps in resources for public health, and guide future investments with an explicit focus on health equity.

The funding problem has two dimensions. First, the scale of public health funding has long been inadequate to address the full scope of population health needs, with a particular dearth of targeted resources to address health inequities and the social determinants of health. Second, the organization of public health funding is far too restrictive and lacks the ability to rap-

**BOX 1 | Considerations for Transforming Public Health Funding**

- Allow for more flexibility in routine and emergency program funding streams to enable jurisdictions at all levels to directly meet the needs for public health surge capacity during times of crisis, in response to evolving epidemiological challenges, or to address the specific needs of vulnerable populations
- Establish adequate, reliable, flexible and sustainable funding mechanisms to support the foundational capabilities of public health via federal, state, and local mechanisms benchmarked to the populations and communities which a given department serves
- Invest in the upstream drivers of health, including the social determinants of health, to create more resilient communities with systems to support the full scope of health needs
- Create adequate, reliable, and sustainable funding sources to support jurisdictions at all levels to participate in established public health accreditation and/or quality improvement processes

idly reallocate funds to address emerging needs and crisis situations. These issues predate the pandemic and are pervasive at each level of the public health system, with COVID-19 providing a stark reminder of the human cost of disinvestments in public health.

Moving forward, policymakers should consider taking several steps to close the funding gaps in public health. For one, leaders at all levels of government—local, state, federal, tribal, and territorial—could consider implementing the recommendations from the IOM’s 2012 report to provide funding for a minimum package of public health services (e.g., maternal and child health promotion, mental health and substance abuse), and construct a system for monitoring spending and outcomes to optimize future resource allocations [20]. The Public Health Infrastructure Fund represents a model for how policymakers can organize investments in the foundational capabilities of health departments [144]. Additionally, to better equip health departments to meet their local community needs and have the capacity to adapt during emergency situations, policymakers should consider implementing the recommendations from Public Health 3.0 to develop funding sources that are flexible in nature, as opposed to the current paradigm which emphasizes categorical funding [127].

Most importantly, funding must be dedicated to the explicit purpose of addressing racial and socioeconomic inequities in health. While so-called “braiding and budgeting” strategies have been promising (e.g., “Children’s Cabinet” in Maryland), and new population-based payment models can help orient financing towards the social determinants of health (e.g., the

California Accountable Communities for Health), truly moving the needle for disparities will require dedicated funding to sustain the many pandemic-era health equity initiatives beyond COVID-19 [127,145]. Priority areas to transform public health funding are summarized in *Box 1*.

**Affirming the Mandate for Public Health**

Closing the funding gap for public health must be accompanied by a focused effort to resolve ambiguities in the scope of jurisdictional authority, which contribute to the uneven nature of public health protection across the nation. In the aftermath of COVID-19, it will be imperative for state and local public health agencies to take the steps needed to achieve accountability to performance standards advanced by established national public health accreditation entities or equivalent state and local quality improvement bodies. Recognizing that public health in the 21st century requires the capacity to manage chronic diseases, address the social determinants of health, advance health equity, and maintain preparedness for global health threats, it will be imperative that the mandate for public health agencies include “Foundational” capabilities such as risk communication and laboratory services for rapid disease detection [11]. To promote accountability, policymakers will need to ensure that any mandate for performance is sufficiently resourced and that health departments receive the necessary support and funding to perform reviews, conduct reporting, and achieve compliance—a key limiting factor for existing accreditation processes.

### **BOX 2 | Considerations for Affirming the Mandate for Public Health**

- Harmonize statutory authorities across jurisdictions
- Allocate resources to fund a mandate for accountability across all jurisdictions for performance via established national public health accreditation entities or equivalent state and local quality improvement bodies within five years
- Require better coordination with and support for tribal governments and territorial health departments

To enable state and local health departments to execute their public health mandate, policymakers will need to address inconsistencies in statutory authorities and responsibilities across jurisdictional boundaries. For example, the CDC's Public Health Law Program could consider leading a concerted effort to identify model statutory language that could be implemented to foster consistency in authorities [146]. Such steps would improve the public's understanding of expected protections and provide clarity for funding, communications, and resource allocation, particularly during emergency situations. For example, if preparedness is the purview of all local health departments, then funding for such essential services should be directed to local public health agencies rather than to other local authorities. Proactively clarifying the scope of authorities will help to foster shared accountability with core governmental partners while also supporting stronger, clearer linkages across sectors.

Finally, any policy actions to affirm the mandate for public health must be inclusive of all types of agencies, including tribal and territorial health departments, which continue to be inadequately resourced and lack the necessary technical support and political standing needed to promote the health of their communities. While the unique challenges and specific considerations for these departments are beyond the scope of this paper, which is focused on local and state health agencies, it is necessary to acknowledge the historical legacies of systemic neglect and call for improved coordination with and dedicated attention to the needs of these entities.

Priority actions to affirm and clarify the mandate for the public health sector following COVID-19 are summarized in *Box 2*.

### **Promoting Structural Alignment Across the Public Health Sector**

To operationalize their public health mandate, local and state departments need to be capable of delivering a standard set of evidence-based services to their communities. This remit is captured in the existing framework for "Essential" public health services that was updated in 2020 [10]. But as COVID-19 has shown, translating rhetoric into reality requires defined competencies and dedicated resources. The Public Health National Center for Innovations' framework for "Foundational" public health services outlines the capabilities which health departments need to develop to deliver on their mission [11]. Additionally, the PHAB accreditation process can help to objectively assess a given department's capacity to deliver the 10 essential services [17].

The challenge will be how to promote structural alignment to ensure that every local, state, tribal, and territorial public health department is equipped with the same basic tools. To be clear, promoting a convergence towards common functionality and standardized competencies does not mean that all departments must look and act exactly alike. The demographic and geographic diversity of America's communities inherently requires health departments to tailor their work to the unique needs of their local population. Rather, a standard set of guiding principles allows departments to collectively streamline their work from the outset, and also promotes excellence as a norm to improve quality and foster accountability across the nation. These steps would enhance the ability of health departments to meet the needs of their local communities and pursue innovation through cross-sector partnerships.

Health departments possess multiple avenues to promote structural alignment to advance the health of their communities. One approach is to develop for-

### BOX 3 | Considerations for Promoting Structural Alignment Across the Public Health Sector

- Align the structure and function of health departments to ensure all residents are protected by agencies possessing the foundational capabilities needed to perform the 10 Essential Public Health Services
- Define the ideal size and structure for health departments at the local level to have optimal performance, and reduce redundancy by addressing overlapping jurisdictions
- Transition towards models of shared services across jurisdictions and/or regionalization to improve effectiveness and efficiency

mal collaboratives in which departments work to coordinate services across jurisdictions and sectors. For example, Allegheny Health Department in Pennsylvania launched “Live Well Allegheny”, which aims to coordinate activities for chronic disease prevention (e.g., increasing access to healthy food, promoting partnerships for physical activity) across the 130 municipalities within the county [147]. Likewise, a number of health departments in Massachusetts have engaged in cross-jurisdictional sharing of public health services (e.g., the Central Massachusetts Regional Public Health Alliance, Berkshire Public Health Alliance), with the state’s Office of Local and Regional Health providing technical assistance to local officials interested in developing new partnerships [148].

Another model is to pursue functional regionalization, in which health departments collaborate on select initiatives to maximize efficiency. This model can help health departments achieve economies of scale for targeted public health campaigns. For example, Health Kansas City—a public-private partnership to create a culture of health—launched the Tobacco 21 | KC initiative, a regionally coordinated effort for a specific public health goal (promoting smoking cessation) in over a dozen municipalities [127]. Another use case of functional regionalization is enhancing the purchasing power and service sharing across health departments to support emergency preparedness. For example, the Western Washington Regional COVID-19 Coordination Center helped triage patients according to facility capacity and monitor inventory for personal protective equipment [38]. Likewise, in West Virginia, health departments worked together to coordinate between local pharmacies and long-term care facilities, enabling the state to be an early leader for COVID-19 vaccinations [149].

While the optimal model for a given health department will likely depend on the specific context and needs of the local community which they serve, these examples illustrate how strategic partnerships—coupled with sustainable funding—can better position health departments to deliver on their fundamental mission and address the increasingly complex health problems of the 21st century.

Opportunities to promote structural alignment are summarized in *Box 3*.

#### Investing in Leadership and Workforce Development

Public health workers and leaders have operated under unprecedented strain during the COVID-19 pandemic. The burden on staff was not only due to the scale and scope of the crisis, but also because of negative public sentiment and active interference from elected officials. Given the existing challenges for the public health workforce, which range from the lack of diversity to gaps in recruitment, persistence of uncompetitive salaries, and limited opportunities for professional growth and advancement, systemic reforms to leadership and workforce development are needed to equip health departments with the human capital needed to deliver the public health mission in the 21st century [150,151].

The kind of leadership called for during the pandemic—interdisciplinary expertise, capacity to collaborate across sectors, ability to communicate with policymakers and the public—is characteristic of the model of the Chief Health Strategist proposed in the Public Health 3.0 report [152]. The Chief Health Strategist role, as envisioned, would draw from cross-cutting and diverse partnerships to build collective impact, leverage new sources of data to extract novel insights, and bolster the pipeline for the public health workforce through

**BOX 4 | Considerations for Investing in Leadership and Workforce Development**

- Adopt the Chief Health Strategist model for health department leadership
- Support the retention and recruitment of diverse public health professionals and leaders who are representative of the community they serve, with updated mechanisms to ensure appropriate compensation and recognition
- Develop programs and resources to support the ongoing professional development of the incumbent and pipeline workforce to meet the population health needs of the 21st century

connections with non-governmental sectors like private business and academia. Chief Health Strategists will also need to possess the necessary savvy and policy relationships to support robust collaboration with local and state government and clear communication with the lay public to dispel myths and perceived tradeoffs associated with public health actions during public health emergencies. These are vital skillsets for navigating crisis situations.

Several pioneering communities across the country had already begun to experiment with this evolving model of enhanced leadership prior to the pandemic. For example, the Baltimore health department's work to address challenges ranging from the opioid crisis to racial inequities illustrated the value of having public health officials who possess the capacity to mobilize community action to address upstream social determinants that have traditionally been beyond the reach of public health agencies [153]. Likewise, the Boston Public Health Commission has used the Chief Health Strategist model to form collaborations with community organizations, government agencies, and private sector entities across the city. For instance, with the city facing rising income inequality, the department's Chief Health Strategists have led initiatives to form new strategic partnerships related to housing and anti-displacement and inclusive economic growth [154].

Fostering these collaborations is not just an attempt to energize current employees—it is critical to the sustainability of public health as a field. The public health workforce must be significantly expanded and transformed simply to meet its daily needs, let alone build reserves for the next public health crisis. Given that low pay is a leading factor undermining retention, the process of workforce development should begin with providing reasonable salaries to recruit and retain public health talent [155]. Diversifying public health skillsets will require broadening departmental

recruitment. For example, partnerships with academic institutions can help to hone education programs and skillsets for future employment through service learning and internships. Likewise, engaging the business community through business schools, short-term fellowships, and career exchange programs can provide avenues to support leadership development and foster expertise in finance and operations. Furthermore, as the COVID-19 experience has demonstrated, effective public health requires a workforce with capabilities in IT and data, to enable departments to appropriately respond to emerging health concerns and develop the capacity for online engagement with the public. Lastly, with the pandemic highlighting America's longstanding health disparities and the importance of tailoring solutions to the local context, recruitment efforts should prioritize drawing from the communities which health departments serve, with a special emphasis on developing pathways to the profession for individuals from all backgrounds and axes of representation.

Priority actions and policy considerations to support workforce development for public health are summarized in *Box 4*.

**Modernizing Data and IT Capabilities**

As outlined in the earlier section on the "State and Local Public Health Response to COVID-19", outdated technological infrastructure slowed the public health response on many occasions, from exchanging laboratory results with health systems to maintaining real-time dashboards for public information. While public-private partnerships enabled departments to fill technical gaps, the COVID-19 experience illustrated the overdue need to invest in health departments' data and IT capabilities.

In its ideal form, a 21st century health department should not only possess the capacity to provide baseline data that is timely and locally relevant, but also

**BOX 5 | Considerations for Modernizing Data and IT Capabilities**

- Build a 21st century digital infrastructure for public health at the local, state, and federal levels
- Establish national standards to enhance public health IT system interoperability
- Modernize surveillance approaches to include novel signals from data sources such as social media, electronic health records, and crowdsourcing
- Set national standards to ensure that health data is routinely disaggregated by race, ethnicity, and other key sociodemographic characteristics to the community level (as appropriate to ensure anonymity) to identify disproportionate health impacts and outcomes

be able to scale such efforts in times of crisis. This will require internal expertise as well as ongoing collaborations with academia and the private sector to enable real-time and geographically granular data (e.g., sub-county, neighborhood) to be shared, linked, and synthesized quickly to inform action. For example, the maps developed by the Coronavirus Resource Center at Johns Hopkins University are used globally as a reference point for tracking infection trends. A key area of focus will be ensuring the interoperability of data systems within the public health sector and across the health care system writ large to improve the efficiency of communication and execution. Investments in technical capabilities can also support health departments in their efforts to better identify disparities in health and address the upstream drivers of these disparities. In particular, developing and collecting standardized data elements for race, ethnicity, income, and other key demographic factors (e.g., ZIP Code) is critical to both diagnose and address inequities, as modeled by California's "vulnerability index" for COVID-19 [156].

*Box 5* highlights the policy considerations that would help to enhance the data and IT capabilities of public health agencies moving forward.

**Supporting Partnerships and Community Engagement**

The breadth of functions covered by public health requires partnerships with those outside the sector in the best of times, let alone emergency situations. In the aftermath of COVID-19, local and state public health officials need to build on the cross-sector relationships they have developed during the pandemic and develop sustainable avenues for coordination to address long-term health inequities and population health needs.

Partnership opportunities may manifest differently across each level of public health. For example, local

health departments may benefit from partnerships with multiple sectors, particularly with community-based organizations. Collaborating on community needs assessments provides an opportunity for local health departments to partner with other entities to identify shared challenges and goals for a specific population and geography. Importantly, local collaborations can create a foundation of trust to promote coordination both in foundational areas and during crisis situations. Likewise, state health departments may benefit from forging strategic partnerships at a slightly larger scale, such as coordinating preparedness efforts with local and national governments, academic medical centers, regional hospital associations, and private industry.

This focus on strategic coalition building across all dimensions of public health will not only reinforce the Chief Health Strategist model for public health leadership, but also address long-standing capacity gaps within the sector. For example, health departments should build on the PHRASES project from the de Beaumont Foundation to improve public health communication, as research shows that effective public health communication requires tailoring language to the unique context of different stakeholders (e.g., in business, in education) [141]. Likewise, building on collaborations with academia—which has exponentially increased offerings for public health training programs and provided pandemic support functions including technology development, testing and tracing centers, and vaccine distribution models—can offer added capacity for addressing complex population health challenges. The Academic Health Department model may provide a framework for future collaboration [26]. Additionally, developing mechanisms for outreach, mutual trust, and respect across community sectors can

**BOX 6 | Considerations for Supporting Partnerships and Community Engagement**

- Establish and maintain regional and/or state-level backbone entities that can be leveraged during crises for shared action
- Cultivate relationships with non-traditional partners including employers, the business sector, and technology
- Identify a new backbone national entity that can support collaboration to achieve unified policy recommendations from all the core components of the public health sector
- Enhance trust and credibility through improved risk communication with public health authorities

help streamline communication during emergency situations, when the real-time evolution of data can create an environment of misinformation and affect the credibility of health officials.

Beyond supporting communication and outreach, partnerships can also help augment the capacity of health departments to deliver on their public health mission. This requires establishing coordinating structures and identifying leadership organizations. In some cases, public health agencies may take the lead as backbone organizations, while in others, health departments may serve as a convener, with other partners leading the way for ground-level implementation. Under such models, established community entities can play crucial roles as sources of trusted information, helping to disseminate credible guidance and information for the population. Health systems and other care delivery organizations are natural partners in this regard given their role as community pillars and the shift to population health mandates and financing arrangements, as evidenced by the ongoing demonstrations for Accountable Health Communities. Such partnerships will be vital as the public health sector collaborates across government, health systems, and community organizations to scale initiatives to address health inequities.

Policy considerations for supporting partnership development and community engagement are presented in *Box 6*.

**Conclusion**

COVID-19 provides a stark reminder of the tremendous social value of robust public health systems and the harrowing consequences for populations when those capabilities are allowed to atrophy through neglect and underinvestment. The public health sector has been critical to America's pandemic response, from leading

testing and tracing efforts to monitoring infection rates to coordinating vaccination campaigns to support outbreak control. Through the crisis, health departments have led in spite of the obstacles posed by insufficient resources, inadequate infrastructure, and institutional siloes—challenges which long predate the pandemic. Consequently, enhancing the sector's preparedness for future public health emergencies will require first addressing the structural inadequacies in how American public health is funded and governed, with a dedicated focus on remediating the pervasive and preexisting health inequities which have caused disproportionate outcomes during COVID-19.

In this discussion paper, leaders from the public health sector have sought to share their experiences to date from the pandemic response and propose a series of priority actions for policymakers to consider as the nation charts a roadmap for the post-pandemic era. These include closing funding gaps for foundational capabilities, affirming the mandate for public health, promoting structural alignment, investing in workforce development, modernizing data capabilities, and supporting cross-sector partnerships. Such actions are necessary to ensure that the tragedies of the present become a turning point for the future—a future where the United States is capable of protecting and promoting the health of all people in all communities against the population health challenges of the 21st century.

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