

SPECIAL FEATURE: A DECADE IN BIOSECURITY ASSESSING A DECADE OF PUBLIC HEALTH PREPAREDNESS: PROGRESS ON THE PRECIPICE?

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ABSTRACT

September 11 and the subsequent anthrax attacks marked the beginning of significant investment by the federal government to develop a national public health emergency response capability. Recognizing the importance of the public health sector's contribution to the burgeoning homeland security enterprise, this investment was intended to convey a "dual benefit" by strengthening the overall public health infrastructure while building preparedness capabilities. In many instances, federal funds were used successfully for preparedness activities. For example, electronic health information networks, a Strategic National Stockpile, and increased interagency cooperation have all contributed to creating a more robust and prepared enterprise. Additionally, the knowledge of rarely seen or forgotten pathogens has been regenerated through newly established public health learning consortia, which, too, have strengthened relationships between the practice and academic communities. Balancing traditional public health roles with new preparedness responsibilities heightened public health's visibility, but it also presented significant complexities, including expanded lines of reporting and unremitting inflows of new guidance documents. Currently, a rapidly diminishing public health infrastructure at the state and local levels as a result of federal budget cuts and a poor economy serve as significant barriers to sustaining these nascent federal public health preparedness efforts. Sustaining these improvements will require enhanced coordination, collaboration, and planning across the homeland security enterprise; an infusion of innovation and leadership; and sustained transformative investment for governmental public health.

A retrospective look at the 20th century illuminates the major world events that have incrementally shaped the focus of the public health sector: the 1918 flu pandemic; the discovery of penicillin; massive global population migrations resulting from wars, disasters, and poverty; and the growing biological warfare capabilities of state and nonstate actors. The past half century has catapulted the collective psyche between vast "thermal" distinctions: a "cold" war highlighted by U.S. versus USSR polarization over the potential use of nuclear weapons, and the "hot" threat of evolving biotechnological capabilities and weaponized pathogens. Airplanes as armaments and infectious diseases carried through the U.S. postal service promulgated transformative thought regarding how to prepare and protect America from future attacks. The no-

tion of "weapons of mass destruction" and their potential devastation to populations, economies, and civil stability launched novel considerations about the relationship of public health to national security.

The anthrax attacks of October 2001 served to catalyze and influence public health's current role now, at the dawn of a new century, and in the face of deliberate threats to the country. The attacks have prompted the federal government to invest a significant level of resources intended to have the "dual benefit" of strengthening the overall public health infrastructure while also improving its ability to detect and mitigate catastrophic threats to the public's health. In many instances, federal funds were successfully used for "preparedness" activities. Surveillance and electronic health information

networks in the U.S., for example, became much more robust.

Unfortunately, a rapidly diminishing public health infrastructure at the state and local levels as a result of federal budget cuts and a poor economy have served as barriers to effectively sustaining the achievements wrought through federal public health preparedness funds. Additionally, many fundamental questions remain unanswered: for example, What are the workforce, organizational, and operational requirements necessary for local health departments to perform health security functions? What are the metrics by which public health preparedness should be measured? In short, what does a 21st century public health system look like? What will it cost?

An underappreciation for the operational complexities associated with public health emergency response programs, and difficulties projecting and sustaining long-term funding requirements, threaten to undermine the large strides made in the past 10 years in areas ranging from surveillance, detection, and health information network capabilities to medical countermeasure distribution and dispensing. In many instances, disparate but complementary federal programs have struggled to become meaningfully integrated.

This article offers a qualitative review and assessment of some of the important preparedness issues facing the public health sector and a discussion of their importance and the steps already taken to surmount these obstacles. Moreover, we endeavor to articulate the work yet to be addressed in the coming decade—one that intelligence estimates, global political events, and climatologists suggest will challenge the public health effort further.

ASSESSING THE PREPAREDNESS EFFORT

What was the goal?

The events of September 11, 2001, and the subsequent anthrax attacks placed public health on the front line of the battle for national security. Since that time, the public health sector has been asked to play a crucial role at all levels of emergency preparedness and response: surveillance and detection, epidemiologic investigation, risk communication, and, ultimately, the timely distribution and dispensing of medical countermeasures to affected populations, among others.

The 2001 anthrax attacks were a wake-up call. The U.S. public health sector reeled from limited laboratory capacity, little or no computer or internet

access, and a lack of personal or organizational familiarity among key players in critical government organizations including safety, security, and intelligence. The attacks also challenged the traditional decision-making processes of federal, state, and local public health authorities that had more experience addressing unfolding point-source outbreaks associated with familiar, nondeliberate etiologies. The Centers for Disease Control and Prevention (CDC), for example, had never been called on to respond to inexplicable instances of illness occurring nearly simultaneously in 5 geographic epicenters. (1)

Public health, in general, did not know its role during this seminal national security event, and a spectrum of government agencies were equally stymied by what expectations they should place on state or local agencies (which, heretofore, had been viewed by many as the go-to place for rabies shots or seasonal flu clinics, or the source of health care for the medically disenfranchised). At the time, hospitals and state and local health departments had limited available guidance or training on how to manage a bioterrorism attack. This lack of experience was compounded by an overwhelming demand for information and recommendations. While many state and local public health officials were reluctant to initiate public health actions, such as recommending prophylactic antibiotics, without benefit of specific CDC guidance, others made decisions prior to receiving CDC advice. (1) The tumult was complicated by the vast amount of data related to the anthrax attacks that arrived at federal and state public health agencies via email, phone, fax, and news media reports. Additionally, many communities lacked the necessary epidemiologic expertise or laboratory surveillance capabilities and surge capacity. Labs also did not have the equipment and procedures to properly secure evidence for storage. (2) As a result, many labs became compromised in the process of accessioning and testing items potentially contaminated with *Bacillus anthracis*. (2)

The “gaps” in the nation’s public health system that were exposed during the fall 2001 anthrax attacks served as a catalyst for federal funding and legislation for antibiterrorism activities. In June 2002, President Bush signed into law the Public Health Security and Bioterrorism Preparedness and Response Act (“Bioterrorism Act”), which authorized increased funding and outlined a number of new measures: improve public health capacity, improve health workers’ ability to identify and/or treat diseases associated with bioterrorism, accelerate the process to develop medical countermeasures

(MCMs), and better track and regulate dangerous pathogens in the U.S. (3) Bioterrorism prevention and the anthrax attacks also played a substantive role in the creation of the Department of Homeland Security (DHS) in November 2002—a department that would come to have an impact on the preparedness funding and efforts of the public health sector.

In December 2002, Congress appropriated a then-record \$3 billion for public health activities, including \$1 billion to “upgrade state and local public health capabilities and hospital preparedness.” (4) These funds raised the bar, tying fiscal “plus-ups” to a new mission for the public health enterprise: preventing, preparing for, and responding to any act of bioterrorism or public health emergency. (5) Homeland Security Presidential Directive (HSPD) 8, released on December 17, 2003, codified and expanded on this preparedness mission, establishing mechanisms for improved delivery of federal preparedness assistance to state and local governments as well as outlining actions to strengthen preparedness capabilities of federal, state, and local entities. (6) HSPD 10, released on April 28, 2004, outlined more specific strategies to improve national preparedness for a public health emergency, stating that the essential pillars of our national biodefense program were: “Threat Awareness, Prevention and Protection, Surveillance and Detection, and Response and Recovery.” (7)

In many respects the health security mission envisioned by federal policymakers and established in HSPDs and other federal policy stood at odds with the day-to-day roles of the public health community. Successful initiatives in the middle of the 20th century targeting improved sanitation and nutrition as well as the development and widespread use of effective antimicrobial agents and vaccines had markedly increased life span and adjusted public health’s focus from infectious to chronic and degenerative diseases and occupational and personal safety policies like seat belt use. (8) In the years before the 2001 attacks, public health was focused on alleviating the root causes of poverty, improving access to health care, and minimizing social and behavioral risk factors associated with poor community health indicators. (9) After the attacks, however, a sector that had had little prior experience with entities such as defense, intelligence, and emergency response found themselves integrated into the National Response Framework and the National Incident Management System. The public health sector scrambled to meet new requirements for “situational awareness,” “decontamina-

tion,” and surveillance for wide-area aerosolized dispersion of anthrax while still engaged in its routine, often unique daytoday community-centric public health activities.

The early days of the biodefense “bonanza” saw a divided public health community facing competing demands, novel expectations, and a focus less on endemic health indicators and more on preparing for low-probability, high-consequence threats. Public health had been at the forefront of the war on poverty, the eradication of polio and smallpox, the war on cancer, and many other large-scale efforts to reduce morbidity and mortality. The war on terrorism, however, was a game changer. It challenged skill sets, organizational structures, relationships, and responsibilities as the public health sector entered the national security stage.

What did we spend?

Roughly \$569 million was spent annually by the U.S. government on “civilian biodefense” prior to September 11, with the majority of funds divided evenly between the Department of Health and Human Services (HHS) and the Department of Defense (DoD).¹⁰ Since late 2002, Congress has invested over \$12 billion in state and local public health preparedness, hospital preparedness, and pandemic response capacity at the state and local levels. (11) In 2001, local or state programs for public health or hospital preparedness were scarce. (12) In response, the CDC established the Public Health Emergency Preparedness (PHEP) Cooperative Agreement Program. The PHEP Cooperative Agreement represents a substantive source of funding, guidance, and technical assistance for state, territorial, and local public health departments, specifically for the development of emergency-ready public health departments that are flexible and adaptable. Moreover, the HHS Hospital Preparedness Program (HPP), under the Assistant Secretary for Preparedness and Response (ASPR), continues to provide leadership and funding through grants and cooperative agreements to states, territories, and eligible parties related to a variety of public health preparedness goals. (13) Recognizing that certain areas of the country might be at greater risk, the CDC established the Cities Readiness Initiative (CRI) in 2004 to “enhance preparedness in the nation’s largest cities and metropolitan statistical areas (MSAs) where more than 50% of the U.S. population resides.” (14) The program has grown to now include a total of 72 MSAs, with at least one CRI MSA in every state. (14)

In 2001, there were no wide-scale systematic efforts to develop or distribute medical countermeasures* in the event of a catastrophic health emergency such as a large-scale bioterrorism attack or a severe pandemic. Since then, federal, state, and local public health departments have worked diligently to build MCM stockpiles and mass-dispensing contingency plans. In 2004, Congress passed the Project BioShield legislation that authorized \$5.6 billion over 10 years for the government to purchase and stockpile vaccines and drugs to fight anthrax, smallpox, and other potential agents of bioterror. The subsequent 2006 Pandemic and All Hazards Preparedness Act (PAHPA) created the Biomedical Advanced Research and Development Authority (BARDA) as the focal point in HHS leading the charge for acquisition of medical countermeasures to protect the American civilian population against chemical, biological, radiological, and nuclear (CBRN) and naturally occurring threats to public health. In so doing, CBRN threats became part of public health community lexicon and necessitated an all-hazard preparedness responsibility.

In recent years, the majority of federal funds for public health preparedness have been directed to programs in HHS for the National Institutes of Health (NIH), the Office of the ASPR, and CDC. (15) Most federal funds going to the Office of the ASPR have been allocated to BARDA and the HPP. Federal funds to NIH have largely been allocated for biodefense, radiological/nuclear countermeasures research, and chemical countermeasures research. Alternatively, the majority of CDC's budget for public health preparedness has gone to the Strategic National Stockpile program (SNS)** and a "CDC Preparedness and Response Capability." CDC's Preparedness and Response Capability generally refers to funding, guidance, and technical support to public health departments nationwide for public health emergency preparedness under the PHEP Cooperative Agreement. (16) Much of these federal dollars to states and localities have been tied to the ability of state and local health departments to fulfill annual requirements as set out by the SNS local or State Technical Assistance Review (TAR)¹⁷ in addition to regular drills and exercises.

* Medical countermeasures are a category of pharmaceuticals, nonpharmaceuticals, diagnostic tools, and procedures developed to prevent or mitigate adverse health effects from exposure to biological agents, chemicals, or radiation.

** The SNS stockpiles medical countermeasures and other supplies for a bioterrorism attack and other public health emergencies.

Congress has allocated a significant amount of federal public health preparedness funds to DHS,¹⁸ which is currently in charge of "identifying and prioritizing" threats via Material Threat Determinations (MTDs) and Population Threat Assessments (PTAs) for biological agents. (19) MTDs and PTAs are subsequently presented to HHS to "inform medical and public health consequence assessments" and to "guide" priorities for research, development, and acquisition of medical countermeasures. (19) Additionally, DHS leads the Urban Areas Security Initiative (UASI), which provides funding to "address the unique planning, organization, equipment, training, and exercise needs of high-threat, high-density urban areas, and assists them in building an enhanced and sustainable capacity to prevent, protect against, respond to, and recover from acts of terrorism." (20) In accordance with the 9/11 Act, states are required to ensure that at least 25% of UASI appropriated funds are dedicated to law enforcement terrorism prevention activities. (20) Total funding available for this program in 2011 was \$662,622,100.20

What have we achieved?

Federal resources invested over the past 10 years have resulted in dramatically improved public health preparedness. Trust for America's Health (TFAH), a nonprofit, nonpartisan organization "dedicated to saving lives by protecting the health of every community and working to make disease prevention a national priority," initiated an annual 50-state assessment process in 2002. (21) Each report assesses the level of preparedness in the states, evaluates the federal government's role and performance, and offers recommendations for improving emergency preparedness across 10 key indicators. These indicators measure the capabilities of state and local health departments (eg, "ability to distribute and dispense MCMs") as well as the capabilities of hospitals and other healthcare facilities (eg, "nursing shortages"). In 2005, over half of the states received a score of 5 or less out of 10*** according to TFAH's metrics.²² Nearly 85% of states received a score of 6 or less. As a testament to funding and dedicated efforts by the public health community, TFAH's 2010 report found, however, that:

- All 50 states now have pandemic flu plans, compared to 13 states in 2003;

*** Indicators 1 to 5 measure the capabilities of state and local health departments; 6 to 10 measure the capabilities of hospitals and other healthcare facilities.

- All 50 states have adequate plans to receive and distribute supplies from the Strategic National Stockpile, up from 2 states in 2003;
- 49 states increased or maintained Laboratory Response Network capacity in 2010, compared to 10 states in 2005;
- 75% of hospitals participating in the Hospital Preparedness Program (HPP) met 90% of programmatic goals; and
- BARDA and Project BioShield have made critical investments in domestic medical countermeasure research and development and procurement, including the first contract for a cell-based flu vaccine, expected in 2014. (23)

In addition, progress has been made in these areas:

- CDC's Strategic National Stockpile increased its core formulary to support the prophylaxis of more than 50 million people to prevent anthrax, plague, or tularemia and acquired enough smallpox vaccine to vaccinate every person in the U.S.; (24)
- State public health departments have established critical partnerships with emergency management personnel. (23)

Since fall 2001, there have been substantive improvements in our national surveillance, detection, and health information capabilities. The following highlights only a few of the wide range of successes achieved in the expansion of public health preparedness capabilities.

Laboratory Response Network

The creation of the Laboratory Response Network (LRN), a joint effort in the federal government, linked public, commercial, and military public health, food testing, environmental, and veterinary laboratories. The goal was to improve and sustain diagnostically and bioterror proficient laboratories throughout the country. (The LRN is also involved in chemical weapon response and preparedness.) The LRN was the product of a collaborative effort by the CDC, the Association of Public Health Laboratories (APHL), and the Federal Bureau of Investigation (FBI) to promulgate new laboratory methods and expand internal and external laboratory security controls. Under the LRN system, local healthcare laboratories in hospitals and clinics, in addition to large commercial laboratories, function as "sentinel laboratories" that serve as the front line for detecting infectious disease threats. The laboratorians are trained to rule out, recognize, and refer a biological isolate that

may be an agent of bioterrorism. If a biological isolate is suspected to be an agent of bioterrorism, it is immediately referred to an LRN "reference laboratory," predominantly made up of BSL-3 (25) state public health laboratories and large local public health laboratories. The final stage involves the transfer of the suspected agent to an LRN national laboratory, such as the CDC or the United States Army Medical Research Institute for Infectious Diseases (USAMRIID), for definitive testing. Currently, more than 150 LRN laboratories are capable of submitting messages to CDC or USAMRIID. (26) LRN membership is also now international, including laboratories in Australia and Canada.

The strategic accomplishments of the LRN have been instructive to the larger public health community. First, the LRN was premised on the understanding that all-source laboratory information was critical. Brokering relationships with entities with which the public health sector had little previous contact, the LRN developed a comprehensive network: public, private, commercial, military, and veterinary laboratories, all under CDC-coordinated support and oversight. Key relationships were forged and partnerships were built through the recognition that all sectors were needed to serve the mission of early detection on behalf of the country's public health. Second, the LRN reinforced the importance of capturing the earliest possible information to detect anomalies, inform decisions, and prepare response. Similar to the military's use of satellites to monitor troop build-up and possible attacks by an enemy, the value of early warning from the public health sector became acknowledged as a component of national security. Finally, the success of the LRN demonstrated the accomplishments that could be derived from a unified operational plan among all participant laboratories and the necessity of standardized protocols, tests, and performance metrics.

Other key health information systems

Robust public health information networks, with an infrastructure capable of exchanging reliable, near-to-real-time data across relevant levels of government, are also critical to mitigating morbidity and mortality associated with a public health emergency. To do so, public health information systems must be able to process, analyze, and translate data into actionable information swiftly and at a reasonable cost. (27) In recent years, the CDC has implemented a number of initiatives to improve health tracking as well as to install information and data systems throughout the country. CDC's Health

Alert Network (HAN), for example, is a strong national program that provides vital health information and infrastructure to support the rapid dissemination of emergent health information at the state and local levels. (28)

CDC has also developed the Epidemic Information Exchange (Epi-X), which provides a secure, web-based communication system for sharing preliminary health surveillance information for federal, state, and local epidemiologists, laboratories, and other public health officials to communicate and notify colleagues during public health emergencies. (24) Also important is CDC's BioSense Program, mandated in the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 and launched in 2003, which established an integrated national public health surveillance system for early detection and rapid assessment of potential bioterrorism-related illnesses. Since 2010, CDC has focused on redesigning the BioSense program (BioSense 2.0) to be able to provide nationwide and regional situational awareness for all-hazard healthrelated threats (beyond bioterrorism) and to support national, state, and local responses to those threats. (29)

Finally, CDC's Public Health Information Network (PHIN) is a national initiative, funded under the Public Health Response and Preparedness Cooperative Agreement, which promotes the advancement of interoperable information systems in public health organizations throughout the country. The goal of the PHIN is to promote an "integrated healthcare and public health system using information effectively to advance population health and well being." (30) CDC is currently in the process of developing a PHIN decision-making and policy framework tool capable of supporting public health information exchange and information security.

Workforce

When 9/11 and the 2001 anthrax attacks struck, the public health workforce was a composite of skill sets and levels of training—from licensed and credentialed personnel to those working with the benefit of dedication and on-the-job training. This reflected the very nature of public health: great variability in areas such as how local public health departments report to the state public health agency, (31) where public health is located within a government's organizational table (eg, reporting to a department of "health" or "health and environment" or other variations), and what areas of health services and programs receive prioritization of funding. This individualization, a proviso of the

Constitution, garnered flexibility for each state's decisions about regulations for, among other things, required vaccinations for school entry, the legal drinking age, and the mandatory use of motorcycle helmets. With a foundation of educational and epistemological diversity, and lacking a common credential, the public health workforce has historically "connected through shared missions." (32 – p5)

Biodefense competencies were generally limited across the civilian sector in 2001; many retired military officers were tapped to serve in newly created homeland security positions. There was a dearth of understanding regarding anthrax in the public health community, not to mention variability in public health policies regarding such events. As a result, substantial confusion arose at all levels of government during the crisis as public health officials struggled to produce accurate and clear clinical guidance for professionals and the public despite the overwhelming amount of data that arrived at federal, state, and local public health agencies during this time. (32)

The anthrax attacks demanded greater numbers, new skill sets, and uniformity of the workforce to support a new platform of national public health practice. (33) Translating streams of data into information quickly and accurately to achieve "situational awareness" and inform morbidity and mortality projections required new capabilities and workers, including epidemiologists, health information specialists, disease modelers, and others. Anticipating the needs of large affected populations would require the expertise of planners and logisticians. Novel, emerging, and deliberate threats on human populations called on the efforts of experts in animal health and zoonotic diseases.

There have been many attempts over the decade to help shape and build the preparedness skill set. Traditional "core competencies" for public health workers were complemented with new topical areas such as emergency response. From 2004 to 2010, CDC funded the Centers for Public Health Preparedness (CPHP) Cooperative Agreement, which gave approximately \$134 million to 27 accredited schools of public health throughout the country. (34) These funds were intended to enhance the relationship between academia and state and local public health agencies while, at the same time, providing education and services to meet the public health preparedness needs of the nation.

As an example, in 2006 CDC, through a cooperative agreement between the Association of Teachers of Preventive Medicine and the Columbia University School of Nursing Center for Health

Policy, attempted to define the core competencies necessary for a public health workforce in addressing bioterrorism and other public health issues. (35) In March 2011, CDC released a subsequent, exhaustive compendium of “Public Health Preparedness Capabilities,” identifying 15 skills categorized into Biosurveillance, Community Resilience, Countermeasures and Mitigation, Incident Management, Information Management, and Surge Management. (36) Capabilities, functions, performance measures, tasks, and resources are outlined and aligned to the 15 capabilities. (36) Since 2008, the National Association of County and City Health Officials (NACCHO) Project Public Health Ready (PPHR) and many other organizations, such as Columbia University’s National Center for Disaster Preparedness at the Mailman School of Public Health, have offered competency-based training and recognition programs in support of these various performance measures. (37) Other agencies, such as the Food and Drug Administration (FDA), have also provided guidance for the new threat environment, such as protecting the U.S. food supply from “increased globalization and complexity of the food supply chain.” (38 – p19)

Bioterrorism preparedness funding reinforced the importance of electronic information systems, internet access, and near-to-real-time situational awareness; the availability of hospital beds; the number of people potentially exposed within a specific geographic area; medication inventories; and other critical knowledge. As such, the role of information specialists, who were needed to support newly purchased computers and burgeoning computer networks, was incrementally added to the ranks of the public health workforce. The 2008 National Profile of Local Health Departments indicates a 13% increase in FTE information specialist (IS) positions in local public health departments. (32) Improved information flow requires individuals trained to assess information and provide appropriate and timely risk messages to the public. An increase of 9% in the number of public information (PI) specialists employed by local public health departments was seen during the period 2005 to 2008. (32) Anthrax contamination of buildings and heightened concerns about food and water safety and security highlighted the importance of environmental sanitarians in the public health workforce. From the period 2005 to 2008, the categories of “EH Specialist” and “Other EHScientist” increased 0.7% and 1.2%, respectively. (32)

Where Are the Gaps?

There is evidence that significant fault lines in the public health preparedness effort remain unaddressed. Although the U.S. has been spared (or deterred) further deliberate attacks, natural disasters and pandemics have “tested” to a lesser degree the public health sector’s evolving capabilities. The 2003 SARS outbreak, Hurricanes Katrina and Rita in 2005, the H5N1 pandemic threat, and the H1N1 pandemic all provided insights into the sector’s abilities and limitations in disease detection, response, risk communication, and collaboration. (39-42) The Bipartisan WMD Terrorism Research Center (the WMD Center), a not-for-profit research and education organization, recently found that, for most core U.S. biodefense capabilities, our nation’s level of preparedness meets “few expectations” or “none at all,” particularly in regards to preparedness for a “large-scale drug resistant” or “global crisis, contagious” public health event. (43) Among the most disturbing findings in the report:

- Despite extensive research, a scientifically and legally validated attribution capability does not yet exist for anthrax or virtually any other pathogen or toxin.
- The process for developing and producing medical countermeasures still lacks clearly defined requirements, a common set of prioritized research and development goals, coordinated budget requests, and sufficient, sustained funding. Furthermore, no local jurisdiction has demonstrated the ability to rapidly dispense medical countermeasures on a large scale under realistic conditions.
- There has been incremental but, to date, insufficient progress in developing crisis standards of care.
- There is currently no consensus-based outdoor or indoor clearance policy to establish safety standards.

Challenges of “New” Federal Funding

The findings of the WMD Center do not diminish the initiatives that have been made across the nation’s public health agencies. However, efforts to systematically and objectively measure the impact of federal funds to state and local health departments since 2001 have been fraught with complexity. For example, the federal agencies in charge of funding and overseeing state and local public health preparedness efforts—HHS, DHS, and DoD—all have distinct funding objectives and requirements for grant programs to state and local health depart-

ments, as well as different preparedness priorities or performance measurement metrics. Even within HHS, state and local public health departments must navigate through multiple agencies such as CDC or FDA or NIH in pursuit of preparedness goals and funding.

Another dilemma associated with allocating federal funding to states and localities was that it was distributed without specific, measurable desired outcomes or implementation plans, resulting in a public health sector plagued by a lack of clear requirements and metrics as well as a lack of coordination across jurisdictions and levels of government. Initial federal preparedness funding was perceived as being too prescriptive and narrowly focused, (43) impeding opportunities for dual benefit whereby federal funds could help improve both traditional public health and emergency preparedness capacities. (44) Moreover, the methods by which state governments allocate and account for federal funds to public health departments and local jurisdictions also differ widely. (45)

The public health preparedness effort also commenced from an uneven playing field; across the nation there were varying sizes of public health agencies, different levels of education and training of the public health workforce, a spectrum of organizational and reporting relationships, and vastly different levels of funding from state coffers. As the largest one-time dispersal of federal funding was released to the public health sector, delays and discussions characterized the struggle to determine where the greatest return on investment might occur. (45) Questions focused on issues such as where the bulk of funding should be allocated (state versus local), or whether or not funding levels should be more heavily weighted to communities that could amplify already existing capacities and capabilities. (45)

Although federal health experts at HHS and CDC oversee and provide guidance and major funding to state and local health departments, the authority for health matters ultimately resides with state governments, specifically the governor. Unprecedented federal dollars launched new initiatives, but preparedness funds in many states were aggregated with all sources of funding intended for state and local public health use. State legislatures approved budgets, mindful not only of preparedness responsibilities but also the very broad spectrum of public health and healthcare services required by their citizens.

Limits of Alternative Surveillance Capabilities

Although the LRN has certainly been successful, surveillance capabilities intended to speed the detection of specific biological agents in the U.S. remain somewhat limited. Programs such as DHS's BioWatch or CDC's Health Alert Network and Epidemic Information Exchange (Epi X), though complementary, have yet to be coordinated in an effective manner. For example, Dr. Alexander Garza, the Assistant Secretary for Health Affairs and Chief Medical Officer of the Department of Homeland Security, recently stated, "Our nation has extensive bio-surveillance capabilities. Unfortunately, they're not networked. What we really have now is a system of systems in bio-surveillance." (46 – p3) For example, the Congressionally mandated National Biosurveillance Integration System—a program intended to be the nation's first system capable of providing comprehensive and integrated biosurveillance and situational awareness—has struggled to meet objectives due to a lack of consistent leadership or staff support. (47) Additionally, domestic biological surveillance programs have a number of significant technical, operational, and scientific hurdles to overcome before they can be truly effective. Although the BioWatch system has generated many "actionable results," none have yet been associated with a bioterror agent or human illness. (48) Surveillance is a critical public health capability across all levels of government. As such, HHS and DHS must continue to develop, test, and evaluate current and novel detection systems and ensure continued funding and provide reasonable oversight.

A Dwindling Workforce

Starting in fiscal year 2005, steadily decreasing federal preparedness dollars²³ collided with a sector barely emerging from years of chronic underfunding. (49) This year, in fact, Congress's April 8 budget agreement slashed nearly \$445 million from biodefense spending at the federal and state levels:

- \$300 million less for NIH biodefense infectious disease research through NIAID, down from \$1.3 billion in FY2010.
- \$85 million less in grants for state and local public health preparedness programs, the lowest amount in a decade. Last month CDC announced that \$613 million in grants was available this year, down from \$698 million in FY2010.
- \$60 million less for Hospital Preparedness Program grants, for which \$352.6 million

was made available in FY2011, down from \$390.5 million a year earlier. (50)

State budgets, reeling from negative economic factors and federal budget reductions, have instituted severe cuts to government services, including public health. Trust for America's Health recently found that 33 states and Washington, DC, cut funding for public health from FY2008-09 to FY2009-10, and 18 of these states cut funding for a second year in a row. (23) The Center on Budget and Policy Priorities (CBPP) estimates that states have experienced overall budgetary shortfalls of \$425 billion since FY2009. (51)

In January 2010, 53% of local health departments reported that their core funding had been cut from the previous year, and 47% anticipate cuts again in the coming year. (52) Cuts in funding at all levels of government have resulted in unprecedented layoffs, budget constraints, and instances of closure for state and local public health departments in recent years. (53) In fact, over 15% of the local public health workforce has disappeared since January 2008, and 43% of local health departments do not now have a budget line for staff training. (32)

The NACCHO workforce report indicates the current state of preparedness personnel at the local public health agency level. The approximate size of the local public health workforce employed across all 2,794 local health departments is 155,000 employees. (32) From the period 2005 to 2008, the workforce shrank for 34% of local public health departments, most often those representing catchment areas of less than 250,000 population. Increased staffing was seen for local health departments serving populations of 250,000 to 500,000. (32)

Decreases in the position categories of physician (6%), registered nurse (9.6%), epidemiologist (10.9%), and health educator (20.2%) were seen from the period 2005 to 2008. Historically, nurses are the largest single professional group in the healthcare workforce. A cornerstone of community health and public health practice, nurses carry out or oversee most healthcare service delivery offered in public health agencies. Serving not only in clinical capacities but also in leadership and community outreach, nurses are a product of rigorous standardized training curricula and state licensing and credentialing standards. (54) Unfortunately, the workforce report noted a 10% reduction in FTEs between 2005 and 2008, owing to competing hiring demands for nurses nationally. (32)

This accelerated lack of capacity for state and local public health departments threatens the entire national preparedness framework, given that local

and state public health departments inform decisions, perform risk communication, coordinate care, and represent the final stage and interface for the dispensing of medical materiel to an affected population in response to a threat or incident. As an additional impact, many state and local public health departments have been unable to carry out core public health functions, including programs in disease prevention and health promotion.

Workforce competencies

Over the past decade, we have yet to fully develop preparedness "competencies" based on standardized educational and practice tenets. (55) While a proportion of those working in public health are credentialed in a discipline such as medicine, nursing, or environmental science and are required to maintain these credentials through continuing education and cyclic reexamination processes, these discipline-specific competencies do not necessarily meet the demands associated with today's public health threats. "Public health is virtually the only professional field without a credential." (56 – p137; 57) Limited complementary skills are exacerbated by a shrinking workforce derived from budget cuts and the graying of the employee base. Many consider that a unifying education and/or credential would serve as a "force multiplier" for the public health workforce, augmenting its shrinking resources and providing surge capacity across disciplines and government boundaries during a crisis.

CONCLUSION

In the years following the attacks of September 11, there were doubts, pushback, and false starts over the incremental path to coalesce a shared vision of public health preparedness. Many feared public health would be compromised by a "securitization" of the enterprise. (58) Nevertheless, in the past decade, major strides have been made to incorporate the public health sector into the larger national security community. Few can doubt that the public health sector has gained more skills, enhanced its visibility, and built strong partnerships with key public and private sector stakeholders. This "preparedness dividend" will stand public health in good stead in the face of predicted future CBRN attacks or events associated with natural disasters and pandemics.

Critical government entities charged with security and defense functions still do not know, however, the full extent of the capabilities and resiliencies of the public health sector, especially given its

great diversity across the country. Acknowledging the potential devastation that would result from a biological attack, some in the larger preparedness community still adhere to the notion that “relying on public health to make national security decisions” is currently premature. (59) Additionally, many basic preparedness capabilities are now threatened by budget cuts across the country. Since 2010, 40 states have cut state public health funds—and 29 of those states cut their budgets for a second year in a row and 15 states for the third year in a row. (23) The consequences of these cuts are not trivial. Mel Kohn, State Health Officer and Public Health Director of the Oregon Health Authority, recently stated, “We will be unable to absorb reductions of this magnitude simply by finding efficiencies. We have reached the point where our ability to

do this work will be seriously compromised, with life and death consequences.” (23 – p00)

In the 10 years since the fall 2001 anthrax attacks, the threat and fear of bioterrorism has, for many citizens, subsided. But Americans still believe it is the responsibility of the federal government and the public health sector to quickly and equitably protect citizens during emergencies. All efforts to reinforce and expand the capabilities that have accrued over the past decade should reinforce the goals of expanding efforts to achieve an even more cohesive, uniformly operational, and adaptable public health sector. For this to occur there must be strong and sustained federal support; for this to be warranted there must be transparency and accountability for the public health investment aimed at making the nation stronger and the public safer.

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