Drafted to Fight Terror

U.S. Public Health on the Front Lines of Biological Defense

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Executive Summary

New domestic security challenges have thrust the faultlines of our nation’s public health system into high resolution. Looming natural disease threats, such as pandemic influenza, severe acute respiratory syndrome (SARS), West Nile virus, and monkeypox and the possibility of deliberate biological attacks using infectious agents such as anthrax and smallpox will severely challenge the capabilities of the public health sector to protect populations. As such, these systems have become the focus of increasing scrutiny.

With a rich history of supporting and protecting the health of a nation since its earliest days, the American public health sector’s mission evolved to meet the needs of growing and culturally diverse populations. During the late 19th century—galvanized by the impacts of infectious diseases on armies at war—the rapidly expanding sciences of sanitation, epidemiology, microbiology, and modern medicine allowed public health to more effectively control the spread of infectious diseases. As the incidence and impact of infectious diseases waned during the 20th century, chronic and degenerative diseases such as cancers and cardiovascular disease became the dominant causes of mortality and morbidity in the United States. As a result, interventions at the behavioral level, and at the level of social and economic forces that influenced the overall health of individuals, became more central to the public health sector’s mission. Public health’s initiatives began to target diet, substance abuse, unplanned pregnancy and poor fetal health, access to healthcare, cancers, premature death from smoking and heart disease, and other diverse ills, stretching thin the resources available for core public health activities that include the surveillance, detection, investigation, and control of transmissible diseases. Additionally, the rapid development of advanced medical technology following World War II increased both the cost of and demand for healthcare, spurring the emergence of the health insurance industry. The public health sector largely became a safety net provider of medical services for those who could not afford healthcare and health insurance.

The 21st century harkens back to earlier times of plagues and poxes. Today’s threats may come in envelopes through the mail and may defy the efficacy of our trusted repertoire of antibiotics and vaccines (referred to in current times as “medical countermeasures”). Epidemiologists, public health administrators and laboratory experts are among the group of specialists considered “first responders” in a biological weapons incident, and have been assigned unique consequence management responsibilities as initially laid out by Presidential Decision Directive 39.1 During such an incident, there would be demands on the public health system to rapidly detect novel and acute health events, transmit “health intelligence” to an array of vital stakeholders representing not only medicine but law enforcement, security, and other “responders,” and to react quickly with the tools and skills needed to halt the spread of and prevent exposure to potentially fatal diseases.

Recent reports indicate that, despite infusions of new federal biodefense preparedness dollars, the public health system has yet to achieve required response capabilities. Several fundamental issues will impede the public health sector’s ability to address today’s health challenges with the required levels of preparedness, responsiveness, and sustainability.

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• It is a “system” that has continued to assume new responsibilities through old paradigms—a “system” that has been cobbled together, not constructed. Thus, as a sector, it lacks a foundation from which to build and develop its expanding role and mission.

• The public health sector lacks delineation of the requirements and capabilities that will be expected in the 21st century. Absent this guidance, it is difficult to set and fund preparedness goals.

• It is difficult to impose new requirements of biodefense on a public health “system” that has been overtasked with a wide array of responsibilities, many of which focus on health care delivery for vulnerable populations rather than health protection for all populations.

• New “responder” capabilities are relatively unpracticed. This unfamiliarity with the “readiness” role can impede a swift and effective response to an unprecedented health emergency.

• The public health sector has been late to acquire sophisticated data systems, communication equipment, and other tools that would render it more effective in the collection, analysis, and dissemination of critical health information.

• The public health sector is just beginning to foster relationships with other critical sectors. These collaborations are essential to coordinate and integrate responses at the community level to maximize human resources and minimize morbidity.

• The public health workforce comprises multiple occupations that do not share a common, standardized or basic level of training. A lack of common workforce functionality will restrict workforce expandability (“surge capacity”) under the stress of a large-scale and protracted epidemic or other health emergency.

• Public health organizations at the local and state levels are organized around narrowly focused programmatic areas. Their lack of horizontal integration contributes to limited organizational agility under the stress of a large-scale and protracted epidemic or other health emergency.

• It is very difficult to impose national standards of preparedness and response on the 2,800 local health departments that are challenged by an array of missions and objectives that emphasize local needs.

Preparing public health for future events of bioterrorism, for novel and emerging pathogens, and for epidemic and pandemic diseases such as influenza and SARS will require different strategies, not just new money. It will demand a consistency and uniformity of skills and training that has received little interest from the public health workforce. It will require efforts to recruit new talent into the public health sector, plus improved salaries and incentives to persuade the current workforce to remain in place. It will require alternative sources of medical care for the uninsured and underinsured to allow public health departments to focus on protecting and promoting the health of the community as a whole. It will require a goal of achieving performance measures nationally, superimposed on a system that was built to uphold state-centric federalist precepts. It will require a new culture of partnership with multiple stakeholders, and it will need to be operationally interdependent with the medical and hospital sectors. It will be informed only through strong leadership that must determine the requirements of a 21st-century public health system, defining the optimal number of local agencies and the size, scope, and capabilities of the workforce, the number of professionals representing appropriately diverse specialties (but unified through a basic skill set), and the performance measures to which it will be held accountable.

The public health sector has successfully challenged many infectious disease threats over the past hundred years, including polio, smallpox, human immunodeficiency virus/acquired immune deficiency syndrome
(HIV/AIDS), drug-resistant tuberculosis, and human foodborne diseases such as virulent forms of *E. coli*. However, the predictability of naturally occurring disease outbreaks bears faint translation to the unpredictability, lethality, and scale of a deliberate threat deployed by malevolent forces. Yesterday’s public health “system” is not constructed or equipped to meet today’s threats.

There are two immediate needs: The first is to thoughtfully determine the role that public health will play in protecting populations in the 21st century. A modernized public health system should be reconstructed, funded, and held to rigorous accountabilities. The workforce that makes up this system should be consistently trained, credentialed, and competent to support and sustain the demands that will be placed on these agencies.

The second, and more immediate, need is to identify the strategy with the current capabilities of protecting populations from the devastation of disease should an event occur tomorrow.
Report Overview

This report begins with a history of the strategies, sciences, and practices that have promoted public health efforts in the United States, from fledgling colonies to the country’s global leadership today. It is important that these efforts be understood within the context of the country’s growth, because in the future, as in the past, evolution demands adaptation. Section I reviews the public health sector’s continual adaptations—and successes—through war and conflict, fiscal crisis, societal changes, technological advancements, disease and epidemics.

Today’s threats of emerging pathogens, epidemics, and bioterrorism portend a tumultuous new century ahead and intimate the need for yet more adaptation by the public health system. Section II critically assesses weaknesses in four key areas that are fundamental to public health’s ability to address novel and future health challenges:

1. The public health mission
2. The public health workforce
3. The organizing and funding of public health
4. Public health’s interoperability

Section III, “Conclusions,” offers four options to redefine and strengthen the country’s public health systems for the 21st century.

The report is informed by the literature as well as two processes designed to assemble the opinion and perspective of professionals contributing to the practice of public health. Strategy One entailed the collection of data through a self-administered survey of 54 public health practitioners and professionals. Strategy Two engaged public health professionals in facilitated, one-hour focus groups in which three specific discussion questions were explored.

**Strategy One**

The study’s methodology consisted of identifying a cohort of 23 experts who hold organizational, academic, and other leadership positions and have nationally recognized reputations within or directly contributing to public health. These experts were asked to provide the names of public health practitioners and professionals who are closely engaged in supporting efforts to anticipate and prepare public health for its new responsibilities. They identified 121, who constituted the initial subject group.

Through a personal email, these 121 professionals were invited to participate in this study. Attached to the invitation were instructions and a unique web address for an 18-question web-based survey instrument titled “Public Health and Emerging Challenges” that could be opened only by the intended respondent. The survey requested responses in the form of yes-or-no answers, a numerical range of values, and open-ended responses. The collection vehicle used was the survey platform of the Association of Public Health Laboratories, which has long-standing and well-recognized experience in building and conducting web-based survey instruments. Three successive invitations were distributed to ensure all potential respondents the opportunity to participate. The survey was open for three weeks. Of the 121 professionals invited to participate, 54 completed surveys (a 45% response rate).
The data collection instrument was pilot-tested before its launch as a survey vehicle. No statistical tests were applied to validate the study questionnaire. Free text responses were reviewed and aggregated into categories by independent reviewers on the study team, capturing the prevalent view and common themes of the participants. The study team collaborated to compare categorizations and assure consistency. The quantitative data set was reviewed and edited. Missing values were excluded in the final analysis. Exploratory analysis of the data from the 54 study participants was conducted for each of the 18 survey questions using the R application statistical software program.\textsuperscript{2} Statistical services were supported by the Consulting Center at the Johns Hopkins University Bloomberg School of Public Health, Department of Biostatistics.

Participants represented all regions of the United States. Their years in public health practice ranged from 15 to 30, reflecting an experienced pool of professionals. Over 60\% indicated professional training in public health; 35\% had professional training in medicine, 25\% in epidemiology, 15\% in environmental health, 12\% in nursing, 12\% in laboratory science, and 10\% in public administration (not mutually exclusive categories); 20\% reported professional training in additional fields. The largest proportion of study participants, 45\%, held positions at state (21\%) and local (24\%) public health agencies, followed by 25\% in academia. The remaining participants held positions in health policy or think tank organizations, health professional organizations, federal public health agencies, hospitals or healthcare, and other public health–related agencies not specifically listed above.

\textbf{Strategy Two}

At the 2003 combined four-day conference of the National Association of County and City Health Officials and the Association of State and Territorial Health Officials\textsuperscript{3} in Phoenix, attendees were invited to participate in a focus group in a hotel suite proximate to the meeting site, at times that did not conflict with conference sessions. Selected leaders were invited in advance, and invitational flyers were posted in conference center and hotel areas beginning on the initial day of conference registration.

Seven focus groups were conducted. At the start of each, one of three facilitators (per group) explained the project’s objectives and assured participants that their comments would not be attributed to any specific individual. Focus group discussions were not tape-recorded; however, one of the facilitators manually recorded all salient comments.

After the conference, the study team reviewed the comments and aggregated them into common themes. No statistical methods were applied to this data set, and they will be offered within this report as anecdotal information to reflect the opinions and concerns of a self-selected group of public health professionals.

A review of the findings and data from this report are aggregated (see “Conclusions and Options”) into three discussion points. In reviewing these, the following caveats should be considered:

- The extent to which changes can and should be made to improve public health competencies for bioterrorism and virulent pathogens is informed by the literature as well as by survey and focus group


\textsuperscript{3} The National Association of County and City Health Officials and the Association of State and Territorial Health Officials co-locate their annual meetings every three years to provide shared learning sessions, formal discussions, and informal networking.
data collected specifically for this study. The numbers of participants in the survey and focus groups were limited and, therefore, not generalizable across the entirety of the public health sector. These data have been offered to provide useful insights.

- The inferences and assessments presented in this report constitute a national perspective. Certainly there are specific localities that have heavily invested in improving and advancing their public health biodefense capabilities, and can, therefore, serve as models for other public health agencies.

- Finally, the information contained in this report reflects the competing priorities, budgetary strains, and political forces that have weakened a system asked to exceed its resources for many decades. Despite the frailties of the system, the dedication of the personnel who contribute to the public health effort are ever strong, and they serve as the backbone of this country’s goal to sustain and improve the health status of its citizens.
I. Public Health Practices Protect a Growing Nation

Throughout history, civilizations have drawn strength and stability by establishing systems designed to sustain and improve the good health of their populations. The ancient Greeks, for example, believing that disease causes an imbalance between humans and their environment, began protecting water supplies and educating aristocratic populations about personal hygiene, nutrition, and healthy behavior. The Romans erected extensive sewage and water supply systems, promoted hygiene by building public baths, and appraised undeveloped land to determine whether it would support healthful habitation; all of these practices allowed Roman society to flourish.4

Conversely, the decline of great civilizations has often been accompanied by disruption of efforts that supported the health of populations. For instance, after invading Goths during the 5th century damaged principal aqueducts, in turn disabling sanitation services throughout the Roman Empire, the Empire dissolved, contributing to Europe’s plunge into the Dark Ages.5 The pre-Columbian civilizations of Central and South America were decimated by both European colonization and the introduction of the African slave trade, largely because the native populations did not have systems in place to control new diseases, like smallpox, from the Old World.6

The history of organized public health structures and strategies in the United States reflects efforts to mitigate continually evolving health threats, to adapt disease control policies relevant to new cultures and growing populations, and to support an expanding economy. The earliest public health efforts in the American colonies were motivated by the perceived association between community health and piety. Colonists saw epidemic diseases as a signal of moral and social dissolution, believing that the diseases resulted from a community’s failure to obey the will of God.7 The Puritans of the Massachusetts Bay Colony considered human ills to be “God’s chastisement for sin,” curable through fasting, prayer, and humiliation.8 Accordingly, as they did with other religious and virtuous activities, members of the social elite assumed a religious obligation for early public health efforts.9

During the 18th century, the American colonies shifted from an agrarian economy to a mercantile one. The mobility of populations increased—as did their contact with foreign traders. The port cities of the eastern seaboard became hubs not only of commerce, but also for exposure to and spread of communicable diseases. Epidemics of infectious diseases, such as yellow fever and cholera, arriving on trade ships impeded the economies of the young cities and demanded the adoption of effective public health measures. Although the microbiological causes of infectious disease had yet to be discovered, it

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5 Ibid.
9 Elizabeth Fee, “History and Development of Public Health.”
became common practice to quarantine trade ships suspected of carrying sick individuals,\(^{10}\) repeating a 40-day harbor detention process or *quarantina* established in Venice in 1485.\(^{11}\) Indeed, the effectiveness of isolation and quarantine demonstrated to 18th-century Americans that disease could be controlled more effectively through public action than through religious piety.\(^{12}\) But in the absence of the science that would later come to verify the contagious nature of diseases, these actions were seen as economically disruptive. Merchants and businessmen tried to suppress any public knowledge of epidemics in their communities, recognizing that quarantines and other restrictive methods to control communicable disease would interfere with the free flow of commerce.\(^{13}\) As a result, public health measures tended to respond more heavily to political influence and business interests than to epidemiological principles. The close relationship that developed during this time between public health regulations and economic activity heavily politicized organized public health from its outset.

Epidemics of infectious diseases transmitted across indigenous populations became an increasing concern as the United States experienced intense population density, urbanization, and industrialization during the 19th century. Crowding and poor sanitary conditions promoted the spread of communicable diseases in American cities and limited population growth and economic productivity.\(^{14}\) At the time, two ultimately complementary explanatory models of disease impelled public health efforts. The “contagionists” attributed epidemic diseases to contagious contact with sick individuals, and the “sanitarians” adhered to the Greek and Roman notions of miasma, believing that noxious vapors emanating from refuse were the cause of disease. Disease became associated with filthy environmental conditions during the ensuing “sanitary movement.” In response, public health strategies were modified from isolating and quarantining individuals toward improving the common environment through disinfection and sanitation.\(^{15}\) For example, to protect the continued viability of urban centers and mercantilism, local authorities would quarantine trade ships suspected of carrying contagious disease,\(^{16}\) concomitantly cleaning privies and alleys and removing dead animals and decaying vegetables (thought to produce disease-causing gasses) from open streets.\(^{17, 18}\) They worked to reduce conditions underlying “putrefactive fermentation” in graveyards, sugar boilers, slaughterhouses, and other places prone to filthy conditions. These strategies reinforced the notion that *prevention* of disease was as important as *intervention* after an outbreak.\(^{19}\)

\(^{10}\) Ibid.

\(^{11}\) “The Changing Faces of Quarantine,” University of Washington School of Public Health and Community Medicine, 2000; http://wearcam.org/envirotech/decon_showers_for_immigrants_quar2.html.


\(^{15}\) Institute of Medicine, *The Future of Public Health*.

\(^{16}\) Elizabeth Fee, “History and Development of Public Health.”

\(^{17}\) Elizabeth Fee and Theodore M. Brown, “The Unfulfilled Promise of Public Health: Déjà Vu All Over Again,” *Health Affairs*, vol. 21, no. 6, Nov/Dec 2002, p. 27.

\(^{18}\) Elizabeth Fee, “History and Development of Public Health.”

\(^{19}\) Institute of Medicine, *The Future of Public Health*.  

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The major 19th-century public health disease control strategies—isolation, quarantine, and sanitation—were scientifically reinforced during the latter half of the century. In the 1840s, German-born anatomist Friedrich Gustav Jacob Henle released his *Handbook of Rational Pathology*, which incorporated evidence from the medical literature to argue that living microscopic organisms caused infectious diseases.²⁰ A British physician, John Snow, conducted the first rigorous epidemiological investigation in 1854, tracing the origin of a devastating cholera outbreak in London to a single water well that had been contaminated by the feces of a sick child.²¹ In the 1860s, Louis Pasteur’s experiments in fermentation and silkworm disease showed that microorganisms, not miasma, caused the infectious diseases associated with rotting organic material. In 1876, Robert Koch, a former student of Henle, conducted experiments characterizing the life cycle of *Bacillus anthracis* to demonstrate causality between specific microorganisms and disease sequelae.²² These scientific advancements in microbiology and epidemiology became the underpinnings of modern public health strategy and practice by clarifying the concepts of infectious disease transmission and providing the foundation for the successful intervention upon many infectious diseases in the late 19th and early 20th centuries.

Public health’s role and reach in the United States resulted, in part, from developments in science supporting disease identification, investigation, and containment, especially after 1860. However, the impact of infectious diseases during military engagements heavily influenced the development of organized public health efforts. Two-thirds of the 360,000 Union soldiers who died in the American Civil War, which began in April 1861, were killed by infectious diseases such as dysentery,²³ prompting President Lincoln to create a commission to investigate the sanitary conditions in the Union military. The commission advised military authorities to improve sanitation and educate personnel on the merits of personal and public hygiene and the spread of infectious diseases. In Southern cities it occupied, the Army instituted sanitary programs, some of which continued post-bellum.²⁴

Later, in 1898, during the Spanish-American War, the United States sent troops to occupy Cuba. During the ensuing conflict, 968 American soldiers died from battle wounds, but more than five times that number, 5,438 soldiers, died of infectious diseases endemic to Cuba, most notably yellow fever.²⁵ It became clear once again that infectious disease was as great an enemy to American armed forces as any army. Once the occupation of Cuba was secured in 1900, Major Walter Reed was put in charge of addressing the problem of yellow fever. His Yellow Fever Commission discovered and demonstrated that the deadly disease was being transmitted among troops by mosquitoes. A mosquito-eradication campaign began immediately, and the disease was eliminated in Havana. Yellow fever and malaria (another infection proven to be mosquito-borne) had severely hampered efforts to build the Panama Canal, leading to abandonment of the project in 1889. The canal, if completed, would provide a critical link in international sea trade. The revelation that mosquitoes transmitted these two diseases persuaded the commission in charge of the project to rigorously pursue vector control; as a result, the United States succeeded in completing the canal in 1914.²⁶

²³ Elizabeth Fee, “History and Development of Public Health.”
²⁴ Elizabeth Fee and Theodore M. Brown, “The Unfulfilled Promise of Public Health.”
²⁵ Elizabeth Fee, “History and Development of Public Health.”
Early 20th-century leaders of social reform in the United States saw the advancement in knowledge as an opportunity to organize public health activities at the national level and beyond. The engagements in Cuba and Panama led many Americans to view international public health initiatives as a way to secure trade routes, expand political influence, and assure the country’s competitive trade position among Europe’s economically powerful nations.27

The rigorous scientific foundation that was laid down during the latter half of the 19th century allowed American society to achieve, between 1890 and 1930, a golden age of public health, the benefits of which reverberated through the following decades. During this period, infectious disease incidence was reduced dramatically in the United States through such population health initiatives as water purification, food inspection, vector control, and personal hygiene education. Infant and child mortality rates declined and life expectancy increased.28 The addition of antibiotic drugs—such as the sulfa compounds and penicillin, developed in the 1930s and 1940s—to the inventory of medical interventions was of enormous public health benefit. By the 1960s many antibiotics were available to treat a vast array of common afflictions.29 The plethora of cures led Australian Nobel Laureate Sir MacFarlane Burnet to conclude in 1962, “To write about infectious disease is almost to write of something that has passed into history.”30 The development of vaccines allowed public health workers and physicians to eradicate the decimating disease smallpox from the Earth by 1979, and polio from the Americas in the early 1990s.31

In 1900, the leading causes of death in the United States were tuberculosis, influenza, and pneumonia.32 But as infectious diseases declined and longevity increased, the chronic and degenerative diseases, many of which were associated with advancing age, replaced infectious diseases as the leading causes of morbidity and mortality. By 1910, heart disease had become the leading cause of death. In 1933, cancer became the second leading cause of death in the United States, replacing pneumonia (all forms) and influenza,33 behind heart disease. These two diseases of civilization have remained the leading causes of mortality in the United States ever since.34

Degenerative conditions challenged the repertoire of public health measures aimed at halting communicable disease—investigating outbreaks, isolating infected persons, administering prophylactic antibiotics to break the chain of infectious disease transmission, and implementing vector control. Instead, successfully impacting chronic health disorders required improving socioeconomic status, facilitating access to healthcare, and changing behavior, among other contributions to overall well being. As the United States entered the 1930s, contemporary societal values supported a strong federal role in ensuring social welfare. Accordingly, public health adopted a social health agenda, focusing on the effects and root causes of a wide array of concerns: poverty, drug and alcohol addiction, nutrition, teenage sexual activity,

29 Madeline Drexler, Secret Agents.
30 Ibid.
33 Ibid.
34 Ibid.
low fetal survival rates, poor housing, intentional and non-intentional injury, and occupational health and safety.

This chronology reflects two major epidemiological transitions in the United States. The first, characterized by increasingly frequent infectious disease epidemics and the rising incidence of endemic infectious diseases, coincided with the industrialization and urbanization of the 19th century. The public health principles of detection, disease containment, and prevention of infectious disease outbreaks through such means as isolation, quarantine, and sanitation were employed by both the civilian and non-civilian sectors to reduce morbidity and mortality.

The second transition was characterized by the escalating incidence of chronic and degenerative diseases, the natural result of populations living longer and surviving previously fatal infections. As a result, public health expanded its scope of activities into community health planning and program development to address new social and behavioral causes associated with non-infectious health problems.

Scholars have argued in recent years that the global community is witnessing a third epidemiological transition as we enter a century characterized by the emergence of novel infectious diseases and the re-emergence of drug-resistant biotypes of old pathogens. Researchers are increasingly discovering that many prevalent chronic diseases have microbial components to their etiologies. For instance, *Helicobacter pylori* infection has been linked to gastric cancer, human papilloma virus has been shown to cause cervical cancer, hepatitis B virus has been shown to cause liver cancer, and chronic bacterial infections have been linked to the development of cardiovascular disease, among many other developing etiological relationships. Additionally, according to the CDC, nearly 40 newly identified infectious diseases have emerged since the early 1970s, including HIV, hepatitis C, *E. coli* O157:H7, Ebola virus, Hanta virus, and the SARS virus. Many previously identified infectious pathogens, including tuberculosis, malaria, and West Nile fever, have resurfaced by developing drug resistance or have expanded their geographical distribution. During the 1970s and 1980s, acquired drug resistance allowed cases of gonorrhea in the United States to increase by nearly 170% and cases of tuberculosis to increase by about 20%. The U.S. mortality rate from infectious diseases, which declined in the early 20th century and then stabilized, is now double what it was in 1980.

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40 “Infectious Diseases,” Programs in Brief, CDC, Atlanta, February 2003.
A 2003 report from the Institute of Medicine concluded that 13 factors account for this resurgence in the threat of infectious diseases:45

- Microbial adaptation and change
- Human immunological vulnerability
- Misuse of antimicrobial drugs
- Climate and weather
- Changing ecosystems
- Economic development and land use
- Human demographics and behavior
- Advances in medical technology
- International travel and commerce
- Breakdown of public health measures; poverty and social inequality
- War and famine
- Lack of political will
- The threat of bioterrorism

The end of the Cold War has renewed concerns about infectious disease outbreaks in the form of threats from biological warfare. Following the fall of the Soviet Union, it was discovered that, during the 1970s and 1980s, Soviet scientists had developed the most advanced biological weapons program known. The Soviets had weaponized smallpox, anthrax, plague, and other deadly pathogens and had developed and tested dispersion devices such as biological missiles. Experts believe that desperate bioweapons scientists in post-Soviet Russia may have sold their services and expertise to rogue states and terrorist organizations that threaten the United States.46 Iraq was known to have developed a biological weapons program between 1985 and 1991,47 and nearly a dozen other countries (including Iran, Syria, Libya, and North Korea) either possess or are actively pursuing offensive biological weapons capabilities.48

Both the September 11, 2001, attacks on the World Trade Center and Pentagon, and the subsequent yet still unattributed anthrax attacks that resulted in five deaths and 22 illnesses, allude to the possibility of

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future terrorist attacks on U.S. soil. The potential for Americans to confront virulent and lethal forms of pathogens, including deliberately released diseases once thought conquered (smallpox), or biotechnologically designed (weaponized anthrax), or newly emerging (SARS, monkeypox) places renewed burdens of disease detection, surveillance, and containment upon the U.S. public health systems.
II. Today’s Public Health Systems—
Fundamentals and Faultlines

Assuring the health of America’s populations supported America’s growth—its geographic expansion, civil structures, and economic leadership. The chronicles of evolving public health practices recount efforts to control and contain infectious diseases through the 18th and 19th centuries using increasingly sophisticated tools that included the microscope, sanitation, vector control, the collection of vital statistics, and outbreak investigation. The 20th century saw tremendous declines in infectious disease incidence thanks to advances in biotechnology and pharmacology, with increasing ability to advance the accuracy of disease diagnosis, to prevent disease occurrence through an array of vaccines, and to treat disease with effective antibiotics. Military engagements often provided the impetus for much of the domestic public health expansion and development. Political leaders of the era witnessed the fact that, as with battlefield conditions, a nation is only as strong as the health of its people. For example, in the midst of U.S. engagement in World War II, the director of preventive medicine in the Army spoke not only of the need for a military population’s strength, but also declared, “A civil population that is not healthy cannot be prosperous and will lag behind in the economic competition between nations.”

As health threats changed and the science of disease transmission and diagnosis evolved, the public health sector adapted its strategies, activities, and organizations. These efforts demanded that new skill sets and personnel complements be incorporated into the public health workforce. In harmony with the nation’s federalist precepts, in which the states hold the legal authority and responsibility for health—and absent a national strategy—public health departments arose from the particular needs identified at the state and local levels, from an agrarian focus in the heartland to occupational safety in the factories of the Northeast.

Three levels of public health organization contribute expertise to the overall mission of public health, defined as “fulfilling society’s interest in assuring conditions in which people can be healthy.” In the broader context, the federal level provides knowledge development, establishes nationwide health objectives, and disburses funding, the state level provides the statutory base for achieving health objectives, and the local level assures the provision of programs and population and personal healthcare services as a reflection of these objectives. Today, public health agencies are still characterized by their wide diversity of concerns, priorities, levels of funding, and organizational structures, as reflected by their very titles. Of the 57 state and territorial departments designated the lead state agency for health, there are 31 with the department title “health” or “public health,” 15 with or within an organization the title of which also includes “human” or “social services,” three departments of “health and environment,” two departments of “health and senior services,” and the remainder with a variety of other titles.

50 Institute of Medicine, The Future of Public Health.
51 Ibid., pp. 7-9.
52 Summary of the Organization of Public Health Services within the States and Territories of the United States, November 4, 2003.
recently, the nation’s 2,800 local health departments celebrated their absence of uniformity through the expression “If you’ve seen one health department, you’ve seen one health department.”

The resulting public health landscape is a disparate and uneven collage of resources, capabilities, and responsibilities that defy ready definition and challenge attempts to fund and build a consistent floor of preparedness and response. The following sections will present a review and analysis of four specific areas—(1) mission, (2) workforce, (3) organizations and funding, and (4) interoperability—that are critical to public health’s ability to address new threats from deliberate and natural biological assaults.

The Public Health Mission

From its earliest roots, public health efforts in America’s growing cities and communities fought with limited skills and knowledge to prevent the disease epidemics that might stultify its expanding national agenda. However, in the post-Depression days of the 1930s, from Franklin D. Roosevelt’s “New Deal” through Lyndon B. Johnson’s “Great Society,” a surge of progressivism engulfed national policy. This period of widening social health responsibilities was embraced by the public health system, which diminished its role in infectious disease fighting (especially as acute communicable diseases were viewed as a waning threat) to assume a larger role in providing social and clinical services for the poor and vulnerable. The Social Security Act of 1935 channeled money through the Public Health Service to state health departments for the public provision of maternal and child health services, among other services. Amendments to the Social Security Act in 1965 under Johnson’s “War on Poverty” created the Medicaid and Medicare programs to cover the healthcare costs of the poor and the elderly, respectively.

Medicaid, in particular, while becoming an important source of revenue, ultimately became an instrument of undoing much of the legacy infectious disease control mission of public health departments. While giving an incentive for their expansion into the delivery of personal healthcare services, over time Medicaid dollars insidiously supplanted state government support—both in funding and philosophy—for cornerstone population health programs concentrating on disease prevention and health protection and promotion. By dictate and default, public health, in large part, was relegated to the role of healthcare delivery for the poor.

Although public health has played a critical role in the delivery of clinical preventive services (involving the diagnosis and treatment of persons with infectious diseases—such as tuberculosis and sexually transmitted diseases—and their contacts), health departments began to expand their inventory of medical and personal healthcare services to include home nursing visits, maternal and child health programs, school clinics, and well-baby clinics. Public health never intended to be a comprehensive medical home, and, in many ways, these medical interventions have contributed to the fragmentation of healthcare received by many Americans.

53 Comments by Ed Baker, MD, former Director of the Public Health Program Practice Office, CDC, at the National Association of County and City Health Officials Annual Conference, July 1999.
56 Institute of Medicine, The Future of Public Health.
With the rise of managed care beginning in the 1970s, it was believed that health maintenance organizations (HMOs) could remove the responsibility for the planning and provision of personal healthcare services from public health departments. With the fundamental goal of maintaining health status and preventing more expensive illness and injury of enrollees, managed care has achieved cost saving successes that have attracted public purchasers, including federal programs like Medicaid. Managed care organizations have engaged in major efforts to enroll low-income populations and have assumed more risk consistent with the responsibility of enrolling individuals who may require more social and health services than the normal enrollee.

However, although the goal of managed care has been realized to some degree, a series of surveys conducted by the National Association of County and City Health Officials between 1999 and 2000 reveal that local public health agencies are still heavily involved in the provision of many medical services, generally consistent with the size of the local health agency, with the larger agencies usually offering a greater number of services. In its report *The Future of Public Health* (1988), the Institute of Medicine noted the shift of clinical responsibilities to the public health sector, stating, “Increasingly, health departments have become ‘providers of last resort’ for uninsured patients and those Medicaid patients rejected by or simply beyond the reach of private providers and institutions.”

More recently, increasing numbers of local public health agencies have been attempting to relinquish many medical safety-net functions and refocus on population-based services by instituting service contracts with managed-care organizations and hospitals for the care of vulnerable and low-income populations. Such efforts to stop providing direct patient care are consistent with the perspective of Dr. Richard Remington, Chair of the Institute of Medicine Committee for the Study of the Future of Public Health. To paraphrase a 1988 statement by Remington, the provision of medical care by local governmental public health agencies is not good policy, as such agencies can never have the resources to provide a significant portion of care needed by low-income populations, but gives the impression that the problem of limited access “is taken care of.” Unfortunately, in many communities around the country, private medical providers, including HMOs, have backed out of commitments to provide services to Medicaid and other low-income populations, and there are still many socially and medically complex patients who are being referred to governmental public health agencies by the managed-care organizations of which they are members. Consequently, local public health agencies in these areas are finding it difficult, if not impossible, to extricate themselves from the direct provision of medical services. Their concerns are consistent with the study findings in Survey Data Box 1.

60 Institute of Medicine, *The Future of Public Health*, p. 52.
62 Personal conversation with Hugh Tilson, M.D., Dr.PH, 1991.
Survey Data Box 1
Strategies for moving primary care and personal healthcare services

Study participants were asked to rate an array of strategies for moving primary care/personal healthcare services from health departments. Choices included “no change,” “establishing local primary care partnerships for low-income families,” “providing tax incentives to the private medical care system,” and “transferring care of patients to community health clinics.” Over 50% of respondents selected the community health clinic solution; 20% selected tax provisions, and 25% selected local partnerships. Fewer than 5% of respondents thought that personal care services should remain the responsibility of public health departments.

The developing interest in eliminating a majority of medical and personal healthcare responsibilities has influenced efforts to clarify the role and mission of the public health sector. In *The Future of Public Health*, the Institute of Medicine formulated three “core functions” that defined the public health mission: *assessment*, *policy development*, and *assurance*. The institute critically assessed capabilities and concluded that the nation’s public health agencies seriously lacked the capacity to fulfill these core functions.

In the early 1990s, as President Clinton sought to drastically reform the healthcare delivery system in the United States, it became even more imperative that the public health sector clearly define its role and mission as distinct from the healthcare services it had been compelled to assume. Clinton’s plan incorporated a list of “Core Functions of Public Health” in the Health Security Act that went before Congress in 1993. Over the following year, several public health advocacy groups released revised versions of this list. In 1994, the CDC’s Public Health Practice Program Office and the Office of Disease Prevention and Health Promotion, in conjunction with a Core Functions of Public Health Steering Committee, produced a list of the “Essential Services of Public Health.”

- Monitor health status to identify and solve community health problems
- Diagnose and investigate health problems and health hazards in the community
- Inform, educate, and empower people about health issues
- Mobilize community partnerships and action to identify and solve health problems
- Develop policies and plans that support individual and community health efforts
- Enforce laws and regulations that protect health and ensure safety
- Link people to needed personal healthcare services and assure the provision of healthcare when it is otherwise unavailable
- Assure a competent public and personal healthcare workforce
- Evaluate effectiveness, accessibility, and quality of personal and population-based health services
- Research for new insights and innovative solutions to health problems

63 Community Health Centers are one of four types of private, nonprofit Federally Qualified Health Centers established by Congress in the mid-1960s. The other three types are Migrant Health Centers, Health Care for the Homeless, and Health Care for Residents of Public Housing. The services they provide include clinical care, diagnostic laboratory and radiology, perinatal services, immunizations, well-child exams, and family planning. See “Federally Qualified Health Centers”; http://ohiopca.org/what_is_fqhc11.htm.

64 Institute of Medicine, *The Future of Public Health*.

Additional efforts to delineate and measure the performance and capacity of local and state public health functions occurred in rapid succession in the latter part of the 20th century. Between 1987 and 1991, for example, the National Association of County and City Health Officials developed the Assessment Protocol for Excellence in Public Health project, a tool that allows local health agencies to comprehensively assess their role, management, and organization within the community. Building on this protocol, the National Association of County and City Health officials developed “Mobilizing for Action Through Planning and Partnerships,” a community-wide strategic planning tool for improving community health with public health leadership. In the late 1990s, CDC’s Public Health Practice Program Office worked with the National Association of County and City Health Officials, the Association of State and Territorial Health Officials, the National Association of Local Boards of Health, the American Public Health Association, and others to develop performance standards for local and state public health systems (consisting of all entities that contribute to the health of the community) and for local boards of health. Those standards were incorporated into three assessment tools that make up the national Public Health Performance Standards Program.

For approximately the past three decades, the responsibilities of state and local public health departments have included not only disease control activities, but also, in varying combinations, programs in mental health, maternal and child health, alcoholism services and addiction services, ambulance services, home healthcare, family planning, health education, indigent care, crippled children services, environmental health, food inspection, housing inspections, dental health, school health, and nursing care. Public health’s legacy reflects continuing attempts to rise to the challenges of new pathogens while consumed by the growing concerns associated with the social determinants of health, health disparities, and healthcare access. The result is a “system” that is actually a fragmented and diverse collection of approximately 2,850 state and local departments and agencies encompassing a wide array of organizational structures, responsibilities, and missions.

To this array of dissimilar agencies, and spurred by the 2001 anthrax attacks, nearly $1 billion was allocated under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. The CDC was given responsibility for administering and distributing the funds. Recognizing that it was seeking to build new “response” capacity, the CDC released a guidance document titled “Cooperative Agreement Notice and Grant Guidance, Guidance for Fiscal-Year 2002 Supplemental Funds for Public Health Preparedness and Response for Bioterrorism.” CDC also recognized that, to be sufficiently comprehensive, preparedness and response initiatives must include hospitals. As a result, the Health Resources and Services Administration received $135 million of this award to improve hospital infrastructure and efforts to detect and respond to new threats.

The document attempted to guide expenditures by state health departments with the new federal biodefense funding. However, research on the state and local receptiveness to this guidance has shown

66 National Association of County and City Health Officials Programs: Assessment Protocol for Excellence in Public Health (APEXPH); http://www.naccho.org/project47.cfm.
69 Lloyd F. Novick and Glen P. Mays, p. 419.
that although the document helped grantees channel short-term efforts and provided an important framework to prepare for new public health responsibilities, federal mandates are not congruent with the diversity of capabilities, capacities, and priorities found among local public health agencies.\footnote{Elin Gursky, \textit{Progress and Peril: Bioterrorism Preparedness Dollars and Public Health} (New York: Century Foundation, 2004); http://www.tcf.org/Publications/HomelandSecurity/Gursky_Progress_Peril.pdf.} Furthermore, anecdotal data suggest that many within the public health sector eagerly anticipate the early conclusion of these possible threats so that they may return to their previous responsibilities. As public health sees its time, attention, and resources diverted, there is growing fear that the \textit{biodefense} mission will overtake the \textit{public health} mission. Nonetheless, data collected for this study, as indicated below, confirm public health’s willingness to participate in these new responsibilities.

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\textbf{Survey Data Box 2}
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\textbf{The likelihood of a terrorist situation}

Study respondents were asked to consider the \textit{likelihood of a terrorist situation} over the next several decades. At least 80\% of respondents indicated that they thought there was the likelihood of a “biological attack,” an attack to “agriculture, food or the water supply,” or an attack on a “chemical production facility”; 70\% of respondents indicated the likelihood of an attack on a “nuclear facility” or “military installation.” Approximately 50\% indicated the likelihood of attacks occurring at a “public recreation/amusement park.”

When asked to what degree public health should be involved in bioterrorism preparedness and response planning, 85\% of respondents indicated \textit{moderately high to high}. “Bioterrorism,” “emerging infections,” and “communication/surveillance” were rated as only \textit{moderate} concerns when participants were asked to rank the \textit{five most important public health issues} facing the public health sector in the next several decades. “Behavioral health/lifestyle,” “chronic health,” and “access to healthcare” were assigned the \textit{highest} priority concerns. “Environmental issues” were of the \textit{lowest} priority.

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\textbf{The Public Health Workforce}

From its earliest days to present times, the public health workforce has proffered a human cornucopia of backgrounds, interests, training, and skills. The social elite and the pious championed some of the earliest public health interventions in the American colonies. The efforts of police forces were required to assist with quarantine activities when presented with the threat of epidemic diseases. The emergence of the “sanitary movement” necessitated the expertise of engineers, sanitation workers, and hygiene educators within the public health workforce. The proficiencies of microbiologists and epidemiologists supported the evolving scientific rigor of public health practice by the early 20th century.\footnote{Elizabeth Fee, “History and Development of Public Health.”}

It eventually became clear that many activities carried out by health departments required the support of a qualified and trained professional workforce. In his 1850 “Report on the Sanitary Condition of Massachusetts,” public health visionary Lemuel Shattuck called for local and state boards of health staffed by physicians and nurses trained in the sanitary sciences and charged with collecting vital statistics in the community.\footnote{Lloyd F. Novick and Glen P. Mays.} Later, in 1913, the New York State Legislature passed a law requiring that public
health officers have specialized training; however, the requirements of this training and where it could be obtained were never specified.

The two professional groups identified by Shattuck in 1850 as vital to the practice of public health at the state and local levels—physicians and nurses—indeed came to dominate the public health workforce during the late 19th and early 20th centuries. In 1900, physicians represented 80% of the membership in the American Public Health Association, which was founded in 1872. Physicians held the vast majority of leadership roles in public health agencies, while scientists and nurses held supporting positions. Physicians and nurses were particularly integral to the public health workforce during the early 20th century, in part due to their critical role in providing mass examinations and disease prevention activities during the substantial wave of immigration into the United States. (Between 1905 and 1914, an average of more than 1 million immigrants, predominantly from Austria-Hungary, Italy, and Russia, entered the United States each year.) Physicians from the federal Public Health and Marine Hospital Service, which became the U.S. Public Health Service in 1912, conducted medical inspections of all entering immigrants at sites such as Ellis Island in New York to prevent the introduction of communicable diseases into the country. The Visiting Nurse Associations that organized in growing American cities during the late 19th century became a critical public health partner for disease containment and case identification in the tenements crowded with arriving immigrants.

As the impact of infectious diseases declined during the 20th century and the country adopted a strong social imperative, public health followed suit and assumed a more prominent role in providing medical and personal healthcare services. Medical and nursing staff remained an important component of public health programs (although many physicians provided only part-time clinical coverage rather than organizational leadership) and were joined by other specialties that could address the growing social and behavioral concerns that were contributing to chemical addictions, poor prenatal health, intentional injury, accidents, heart disease, and cancers, among other health challenges of mounting concern.

The ranks of the public health workforce grew and diversified greatly with the addition of health educators, outreach workers, social workers, dieticians, mental health specialists, environmental health specialists, industrial hygienists, attorneys, and others. Following nurses, the largest cohorts of employees in professions included environmental health scientists and engineers, mental health counselors, and alcohol and substance abuse counselors.

Despite the wide spectrum of professions within the public health workforce, there remains a glaring under-representation of particular skill sets critical to the disease threats facing public health. For example, scientific advances and the proliferation of molecular testing methods have created a need for training to update the skills of current laboratory staff, but it was found that such training was often

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78 National Association of County and City Health Officials, Local Public Health Agency Infrastructure: A Chartbook, October 2001.
A 1999 report from the U.S. General Accounting Office (GAO)\textsuperscript{80} found that staffing constraints prevent public health laboratory directors and state epidemiologists from conducting surveillance and testing for diseases they consider important.\textsuperscript{81} A study conducted by the Association of Public Health Laboratories found that recruitment and retention problems are serious among local public health laboratories and that resources for training are very spotty.\textsuperscript{82}

Additional data indicate the dilemma of underemployment within the public health sector among the specialization of epidemiologists (specialists in monitoring health status, and diagnosing, investigating and containing disease outbreaks, among other activities).\textsuperscript{83} Two of the states included in the 1999 GAO study conveyed concern that they did not have enough epidemiologists to appropriately investigate health emergencies.\textsuperscript{84} It was estimated in 2000 that epidemiologists made up only 0.5\% of the public health professional workforce.\textsuperscript{85} A 2003 survey conducted by the Council of State and Territorial Epidemiologists found that most state and territorial epidemiologists report having insufficient staff and resources and that there had been no growth in the epidemiology workforce over the past decade. In 1992, there were approximately 1,700 full-time equivalent positions engaged in epidemiologic surveillance. According to the 2003 survey, that number had dropped below 1,400 full-time equivalents. Of those currently employed, approximately 42\% of the state and territorial epidemiology workforce lacked formal academic training in epidemiology, and few engaged in systematic research and publication.\textsuperscript{86}

Surveys regarding the composition of the public health workforce have been infrequent, but available data reflect the priorities in contemporary public health departments. A 1992-1993 survey of local health department staff composition by jurisdiction size revealed that nurses made up the largest group of employees in local health departments in jurisdictions of all sizes. In even the smallest jurisdictions, nurses made up 57\% of the local health department workforce.\textsuperscript{87} Nursing skills contribute to many public health activities, but the high number of nurses in local health departments also reflects the prioritization of medical and personal healthcare services such as maternal and child health programs, in which nurses are very involved.\textsuperscript{88} A more recent survey, conducted in 1999-2000 by the National Association of County and City Health Officials, showed that nurses remain the largest group employed by local health departments, behind administrative staff, an issue of particular concern today, as the average nurse is over 45 years old.\textsuperscript{89}

\textsuperscript{80} In 2004, GAO’s name changed to Government Accountability Office.
\textsuperscript{81} Ibid.
\textsuperscript{83} “State Public Health Employee Worker Shortage Report,” Association of State and Territorial Health Officials, June 2004.
\textsuperscript{88} Lloyd F. Novick and Glen P. Mays.
Today’s public health workforce consists of more than two dozen occupational categories. In fact, the practice of public health has emerged as an aggregate of professions oriented toward the goal of reducing disease and protecting the health of the population, not toward developing some central system or body of knowledge. Whereas most labor research efforts can employ one or a combination of four classification schemes to define a workforce—educational preparation, professional licensing/certification, work responsibilities/activities, and site of employment—a definition of the public health workforce yields to no such scheme. Indeed, people who work in public health today lack a common educational background, lack common licensing or certification requirements, engage in an array of diverse activities, and are employed at a wide variety of sites. Quite simplistically, the U.S. Department of Health and Human Services defines the public health workforce to include “all those providing essential public health services, regardless of the nature of the employing agency.” In 1915, William Henry Welch, first director of the Johns Hopkins University School of Hygiene and Public Health, from 1916 to 1926, stated: “It is a well-known fact that there are no social, no industrial, no economics problems which are not related to problems of Health.”

Eighty-five years later, Alfred Sommer of the Johns Hopkins School of Hygiene and Public Health and Mohammad N. Akhter, executive director of the American Public Health Association, noted Welch’s statement and provided a strong perspective on the need to distinguish specific workforce capabilities: “True enough,” they commented. “But while schoolmarms and investment bankers have an impact on the health of society, they are not public health professionals.”

Since the landmark 1988 Institute of Medicine report The Future of Public Health, agencies, associations, committees, and expert panels have come together to discuss strategies for enhancing workforce capacity and professionalizing workforce competencies through methods such as credentialing, accreditation, and licensure. Credentialing, the formal process of acknowledging and “title protecting” a professional’s qualifications to perform a specific service, strives to guard the public from unethical and incompetent providers who do not meet the minimum qualifications established by an appropriate governing body. Licensure is a form of legal regulation purporting that persons may not even engage in the practice of a particular profession or trade unless they meet the requirements set forth by the state under its regulatory power. States require licensing of people practicing the traditional professions, such as attorneys, physicians, dentists, accountants, architects, and engineers, as well as a list of trades including barbers, auto mechanics, bill collectors, cosmetologists, pest control specialists, tax preparers, and insurance agents (although the list varies from state to state). The processes involved in earning a license vary as well but usually include showing evidence of training, passing a written examination, and, at times, serving under the supervision of a licensed professional for some period. A license may be bound by time

90 Lloyd F. Novick and Glen P. Mays, p. 121.
91 Elizabeth Fee, “History and Development of Public Health.”
92 Lloyd F. Novick and Glen P. Mays.
limits and may require retesting, reappraisal of skills, or evidence of continuing education prior to renewal.

Despite efforts by CDC and some practitioners at the state and local levels, members of the public health workforce generally oppose credentialing, citing diverging perspectives regarding costs, time, and competencies as barriers to achieving consensus. Furthermore, many believe that a professionally diverse cohort is required within the sector to assure the application of sociological and behavioral strategy within the mission of public health.\textsuperscript{97} As such, initiatives to institute a process of defining and requiring national certification of individuals working within the public health sector remain stalled and impede efforts to achieve uniform capabilities and consistent qualifications among the workforce.

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\textbf{Survey Data Box 3}
Factors that support public health systems
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Study participants were asked to rate the level of importance for factors that support public health systems. Their responses indicated that (a) increasing the size of the workforce, (b) attaining standardized core competencies, and (c) improving public health laboratory capabilities were of the highest importance.

Additional factors, but rated of moderate importance, considered relevant to supporting public health roles and activities over the next decade, included (d) credentialing the public health workforce, (e) achieving consistency of practices nationally, (f) accrediting public health agencies, and (g) assuring clarification of legal authorities and public health laws. The factor rated lowest in importance was (h) nationally consistent configuration of public health agencies.

Another specific issue of growing concern within the public health sector, especially in the post-9/11 climate, is the need to build strong leadership capabilities.\textsuperscript{98} The issue of leadership was highlighted in the 1988 Institute of Medicine report: “Today, the need for leaders is too great to leave their emergence to chance.”\textsuperscript{99} Consequently, CDC has established and continues to support the National Preparedness Leadership Initiative, a joint undertaking of the Harvard School of Public Health and the John F. Kennedy School of Government with the goal to build senior leadership capacity for national crises. At the inaugural meeting, held in November 2003, participants from the fields of public health, public policy and government, medicine, law, and management were charged with guiding the initiative in investigating emerging models of leadership and translating these into a curriculum and training program that will contribute to national post-9/11 preparedness.\textsuperscript{100}

\begin{footnotes}
\footnote{97}{Kristine Gebbie, Jacqueline Merrill, and Hugh H. Tilson, “The Public Health Workforce,” \textit{Health Affairs}, vol. 21, no. 6, pp. 57-67.}
\footnote{99}{Institute of Medicine, \textit{The Future of Public Health}.}
\footnote{100}{National Preparedness Leadership Initiative, “Summary Report of the Inaugural Meeting.”}
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Survey Data Box 4
Specific competencies

Study participants were asked to list specific competencies that were required by—and currently missing from—the public health workforce to deal with the challenges of the next decade; 55% of respondents indicated that “leadership and management skills” were a deficiency. This was followed by “risk communication skills” (approximately 40%), “epidemiology and surveillance systems” (37%), and “informatics” (33%).

Workforce size, a problem identified even during pre-9/11 days, has become a more serious issue as the repertoire of responsibilities for the public health sector increases. Attracting eager and capable young professionals into the ranks of public health depends, in part, on opportunities for career growth and compensation. In general, salaries within the governmental public health sector are relatively low, contributing to the difficulty in attracting students into the field, as well as retaining the numbers of proficient personnel already in the field. A GAO report in 2003 noted that noncompetitive salaries prevented health departments from hiring needed epidemiologists. Additionally, many within the public health workforce, especially laboratorians, epidemiologists, and bio-statisticians, have been lured away by the larger salaries and greater upward mobility offered by the nongovernmental sector, such as private industry.

Moreover, much of public health practice takes place within government, a sector that, in many jurisdictions, is bound by civil service hiring restrictions and subject to the ebbs and flows of revenue within state and/or local coffers. As a result, this setting is often characterized by limited career advancement and job security, especially during periods of sharp budget cuts. Additionally, government departments of human services tend to view unlicensed personnel as fungible rather than dedicated assets and are unable to compensate the public health workforce at levels that would tend to attract and retain individuals with specialized public health skills.

Efforts to redefine the public health mission have sparked concerns regarding the workforce available to support it. In 1999, the Public Health Functions Project under Department of Health and Human Services released The Public Health Workforce: An Agenda for the 21st Century to address growing workforce concerns and offer recommendations for the future. The following year, the Health Resources and Services Administration commissioned an exhaustive evaluation of the size and composition of the public health workforce. These two reports reinforce the need to remain vigilant regarding the size, makeup, and competency of the public health workforce.

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Despite the relative flood of federal funds to state and local health departments in 2002, a 2003 report from GAO revealed that critical workforce shortages remained a major concern in health departments. A June 2004 Association of State and Territorial Health Officials report noted that there are “current vacancy rates [within the public health sector] of up to 20 percent in some states.” A report published by the Century Foundation showed that the release of the federal bioterrorism funding for public health preparedness occurred at precisely the same time that state and local public health agencies were experiencing severe budgetary crises associated with the national recession. Consequently, new federally funded positions did not augment the rapidly shrinking complements of state and local personnel.

For federal public health agencies involved in bioterrorism preparedness and response, this workforce crisis is particularly daunting. The Executive Director of the Association of Schools of Public Health has stated that fewer than 20% of master’s-program graduates of schools of public health pursue careers in governmental public health. A 2003 report from the Partnership for Public Service found that, despite the rising demand for employees with the appropriate scientific and medical expertise and talent, the supply of such employees was likely to decline. It noted that the federal agencies involved in biodefense were losing some of their most talented and experienced employees because of limitations on the government pay systems and the lure of the academic and private sectors. The report also found that nearly half of the federal employees critical to biodefense will be eligible to retire by 2008, and that limitations on recruiting and strategic staffing will likely prevent federal agencies from replacing the lost cohort.

In addition to its limited overall workforce size, the broad scope of professions characterizing the public health workforce and the under-representation of key components of expertise such as epidemiology exacerbate the dilemma fundamentally posed by a lack of basic skill sets and unified training that can readily be brought to bear upon an extreme health emergency. According to the CDC/Agency for Toxic Substances and Disease Registry Public Health Workforce Development Initiative, an estimated 80% of the nation’s frontline public health workers lack the basic skills to respond to current and emerging public health threats. Fewer than 500,000 persons identify themselves as members of the public health sector. only 44% of the public health workforce has formal public health education, and only 22% of local public health officials have graduate degrees in public health.

Notwithstanding the skills and relationships acquired over time, the absence of both formalized training and standardized proficiencies within the public health workforce may reduce the ready integration of the public health workforce with other sectors that have been assigned “responder” status for the consequence management of a large-scale emergency (see Appendix).

108 Elin Gursky, Progress and Peril.
113 CDC/Agency for Toxic Substances and Disease Registry Public Health Workforce Development Initiative.
Today, as the country and its public health workforce meet what may be the planet’s greatest threat to survival—that of new or deliberately deployed and lethal biological weapons—there are insufficient numbers of well-trained professionals, especially within medicine, nursing, epidemiology, information technology, and laboratory sciences, to address these challenges.

As a possible sign of improvement for future workforce cohorts: a 2003 annual report by the Association of Schools of Public Health noted that the number of accredited schools increased to 33, up from 24 in 1988-1989, and that in the fall of 2003 the number of applicants to schools of public health increased by 6.9%. Furthermore, as early as 1993, a revision to the Council on Education in Public Health accreditation requirements for schools of public health institutionalized involvement with health agencies, clinics, and community organizations, recognizing the necessity of linking public health education with public health practice. According to a report by the Association of Schools of Public Health, the majority of students completing internships tend to move into practice positions. However, although every school of public health offers external learning opportunities (referred to as “practica,” “internships,” and “field placements”), these experiences are not required of every program within the schools. Additionally, many practitioners point out that schools of public health have not always offered curricula and training consistent with preparation for careers in public health practice, and that experience and specialized training, in combination, may provide capabilities that exceed what might be offered through a public health degree program. The 1988 Institute of Medicine report The Future of Public Health supported this viewpoint: “Many observers feel that some schools [of public health] have become somewhat isolated from public health practice and therefore no longer place a sufficiently high value on the training of professionals to work in health agencies.”

There is an immediate need to recruit students into public health, to encourage schools of public health to emphasize practice-specific public health career paths within government, and to train these individuals in health threats, disease surveillance and control, and executive leadership and decision making. In 1994, the Association of Schools of Public Health and CDC held a three-day national workshop called Disaster Preparedness in U.S. Schools of Public Health. Participants produced a document, Guidelines for Developing Curricula for Emergency Public Health in Schools of Public Health, which presented a rationale and framework for developing such curricula, along with defined universal competencies and roles for public health in emergencies. While it is not mandated that an accredited graduate school of public health offer curricula in disaster preparedness, the CDC funds 21 academic centers of public health preparedness based within schools of public health to provide training in bioterrorism, infectious disease outbreaks, and other health emergencies.

117 Ibid.
118 Institute of Medicine, The Future of Public Health, p. 17.
Although there are few metrics to establish the optimal size and composition of the public health workforce, most public health leaders acknowledge the growing concern regarding inadequate numbers of potential public health personnel in the pipeline. The June 2004 Association of State and Territorial Health Officials Worker Shortage Report offers the following admonition:

The most difficult challenge state and local public health agencies face in developing the capacity to respond to terrorist events, emerging infectious diseases, and other public health threats and emergencies is assuring [that] a qualified workforce is available to carry out these functions. If current workforce demographic trends are left unchecked, they will have an adverse [effect] on the capacity of state health agencies to carry out their mission….  

Organizing and Funding Public Health

Local boards of health were organized in 1794, and similar efforts expanded over the next century, from the local and state levels to multistate quarantine and sanitary conventions. The latter half of the 19th century witnessed the organization of public health activities throughout the country at the state and regional levels. In 1912, the federal government began to expand the responsibilities of the U.S. Public Health Service, formerly the Marine Hospital Service, to include outbreak investigation, the provision of health information to the public, medical inspection of arriving immigrants, endemic disease control, and public health research. State and local health departments supplemented these activities. The federal government made public health in military and civilian populations a high priority. For example, when endemic malaria threatened the health of individuals in the southeastern United States during World War II, the U.S. Public Health Services established a new component called the Communicable Disease Center as a direct successor to the Office of Malaria Control in War Areas, which had been established four years earlier in 1942. In 1970, the center was renamed the Center for Disease Control to reflect a broader mission in public health. In 1992, as more emphasis was placed on prevention and global problems, the name was changed to the Centers for Disease Control and Prevention, and today it is one of the central organizations in federal public health.

Supported in their colonial years through tithes and taxes, state and local health departments were later funded by Congress through “categorical” grants targeting specific diseases or subpopulations that fell into specific high-risk groups. The first federal categorical grant program, which began in 1918 during World War I, targeted venereal disease transmission among American soldiers. The Sheppard-Towner Act of 1922, which provided states with some funding for maternal and child health programs, followed as a political move to address the concerns of women, who had been granted the right to vote by the ratification of the Nineteenth Amendment to the Constitution in 1920. This approach proved...
politically advantageous for leaders and policy makers, allowing them to win the support of powerful constituent groups backing specific causes. Throughout the remainder of the 20th century, public health continued to be defined by the diverse array of discretely funded and goal-oriented initiatives. Federal grants have focused on crippled children (1935), tuberculosis (1944), mental health (1947), industrial hygiene (1947), and dental health (1947).128

The emergence of federally funded state public health programs in the early 20th century contributed little to the development of a coherent public health system nationally. Rather, because of political forces and special interests, distinct and multiple funding streams129 had a fragmenting effect on state and local public agencies, facilitating the creation of isolated and insular programs and organizational “silos.” Funneling money into silos became the dominant solution to a given public health problem instead of supporting an entire public health system capable of responding to new threats. In public health, therefore, it became an axiom that the initiatives that get done are those that get funding, the initiatives that get funding are those that have political backing, and the initiatives that have political backing fall into narrowly focused silos.

In fact, disease-specific morbidity rates and other health concerns have declined through this focused strategy. For example, between 1993 and 2002, the reported incidence of AIDS dropped from 40.20 to 15.29 per 100,000 population, hepatitis A dropped from 9.40 to 3.13, tuberculosis from 9.82 to 5.36, and varicella from 118.54 to 10.27.130 However successful, disease-specific funding has created an environment of uneven competencies and programmatic structures nationally. Although federal funding has taken deliberate aim at important health concerns, few fiscal opportunities have been directed specifically toward constructing and maintaining a public health infrastructure that could be responsive to the dynamic forces that interplay between humans and disease.

Further, the resultant fragmentation of the public health effort is attributable, in part, not only to the legacy of discrete federal funding streams, but to the state-specific shaping of public health agencies through governmental and political forces. For example, although the direct delivery of public health services occurs at the local level, there are diverging amounts of responsibilities, autonomy and supervision within these agencies across the nation’s “centralized” versus “de-centralized states.”131 Additionally, state public health services have for the most part evolved into standalone cabinet-level agencies—with one central government body that oversees public health services and separate agencies for social services, aging, mental health, and environmental health—or organizations with multifunctional superagencies. Although based on the assumption that the superagency paradigm will improve governmental efficiencies and reduce operating costs and personnel redundancies, in fact these actions occur in the absence of any published studies examining the comparative efficiencies or outcomes

128 Elizabeth Fee, “History and Development of Public Health.”

129 Traditional federal sources of funding include the U.S. Department of Health and Human Services (including the Food and Drug Administration, the Indian Health Service, the Agency for Healthcare Research and Quality, the Public Health Services, the Centers for Disease Control and Prevention, the Substance Abuse and Mental Health Services Administration, and the National Institutes of Health), the Department of Housing and Urban Development, the Department of Agriculture, the Environmental Protection Agency, and the Department of Education. In Lloyd F. Novick and Glen P. Mays, p. 419.


131 These terms reflect the degree to which the state retains or confers its authorities on local public health agencies to function as administrative units of the state health agency. In Lloyd F. Novick and Glen P. Mays.
associated with state-level organizational consolidation. The result is an organizational model that may skew the public health mission towards retaining the responsibility for social and human services and personal healthcare and diverting from its distinctive role in disease detection and mitigation.

Moreover, the full spectrum of the public health effort responsible for detecting disease and containing epidemics may be organizationally fragmented across separate, although functionally relevant, agencies within each state, including veterinary medicine and zoonoses programs, environmental health, food safety and inspections, agriculture, and water. For example, environmental health experts, a nationally credentialed body of professionals, may be organizationally housed within a local or state public health agency or reside within a separate governmental entity. Anecdotal information suggests that, in many instances, this group may have had slower access to preparedness funds and training for biodefense and less integration into the response planning efforts under way. The level to which environmental health practitioners are successfully assimilated into the emergency preparedness and response system depends on their relationships with inter- and intra-agency stakeholders. Yet, with regard to capabilities, it is this very group of experts who would be responsible for guiding determinations of air quality after a blast or fragmentation attack, appraising the potability of water and safety of food subsequent to deliberate adulteration, and advising the correct method for the disposal of bodies to prevent secondary exposure from an infectious or chemical agent.

The expansion of public health organizations has been stimulated by the recognition of disease prevalence and evolving science, but supported to the extent that leaders have been persuaded by a particular health indicator’s importance within a wide array of other health concerns and government responsibilities. Many health issues have vaulted to the top of the funding priority list at one time or another, only to fall out of budgetary favor over subsequent budget cycles. Moreover, the funding of public health systems as a whole has suffered the cycles of social movements and local and national interests. In post–World War II America, what had become traditional public health activities were overshadowed by general enthusiasm for and expansion in healthcare and biomedical research. Responding to the demand for healthcare and access to modern medical technology that followed the rise of private health insurance, Congress passed the Hill-Burton Act of 1946, which promised to support the construction of modernized public and not-for-profit hospitals across the country. At the same time, political leaders, influenced by the conservatism and McCarthyism that pervaded national politics during the 1940s and 1950s, denounced population health initiatives as “communism,” opting for less controversial expansions in the healthcare sector. Further, the epidemiological shift toward chronic and degenerative diseases that occurred during the 20th century made biomedical research a national priority. Federal expenditures for biomedical research grew from $28 million in 1947 to $186 million over a decade. Most of this money supported clinical and laboratory research instead of epidemiological research. In 2003, the Institute of

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133 Perri S. Leviss, “Financing the Public’s Health,” in Lloyd F. Novick and Glen P. Mays, pp. 413-430.
134 Conversation with Julia Miller, Terrorism Response Coordinator for the National Environmental Health Association.
135 Elizabeth Fee and Theodore M. Brown, “The Unfulfilled Promise of Public Health.”
136 Elizabeth Fee, “History and Development of Public Health.”
Medicine acknowledged that health-related research was disproportionately focused on biomedical initiatives and individual health at the expense of epidemiologic and population-based research.\(^{137}\)

In assessing non-research dollars, 1993 data indicate that, of the nation’s total health expenditures (approximately $888 billion),\(^{138}\) including federal, state, and local revenues as well as Medicaid payments, patient fees, and regulatory fees, less than 1% was devoted to public health.\(^{139}\) Furthermore, of this 1% (according to 1980 data), nearly three-quarters of expenditures in state and local health departments went toward personal healthcare services rather than the population-based functions such as communicable disease detection and outbreak control.\(^{140}\) Although these data suffer from a lack of clear and consistent definitions categorizing public health expenditures across each state, in the aggregate this information supports the premise that there is woefully little funding to sustain population-health capacities, systems, and organizations that must be in place to assure the provision of health protection and disease mitigation activities.

**Survey Data Box 5**

**Program focus**

Study participants were asked whether *significantly less focus* should be given to existing programs, activities, and responsibilities within state and local health departments when considering the challenges the public health sector would be facing in the next several decades. Of the 45% who indicated yes, 40% identified “clinical care/direct healthcare services” as one such responsibility; 30% noted “narrowly-focused/non-population-based programs,” just under 20% indicated “bioterrorism,” and 10% suggested “inspections.”

The relative paucity of funding for the public health sector and the spending restrictions that have resulted from delimited funding streams have taken their toll on today’s public health systems. In all but the smallest of health departments where limited complements of staff wear multiple hats, public health agencies are vertically constructed silos of skill sets and program focus. These organizational structures, also pejoratively referred to as stovepipes, have long been the bane of many within the public health workforce who have recognized the several unfortunate consequences—including in efficiencies in the use of staff; inconveniences for recipients of personal healthcare services who face differing eligibility requirements, clinic hours, and providers; barriers in using computers and other equipment across separately funded programs; different budget cycles; multiple grant submission requirements; and multiple program site visits. In the context of emergency preparedness, the stovepipes are associated with limited organizational expandability during a large-scale health event and reduced capacity to sustain competencies over the course of a lengthy disease outbreak investigation and control effort. Evidence of these limitations was reported by local health departments working at the epicenters of the 2001 anthrax

\(^{137}\) Institute of Medicine, *The Future of the Public’s Health in the 21st Century*; 

\(^{138}\) Insurance Information Institute, Facts and Statistics, Health Insurance; 
http://www.iii.org/media/facts/statsbyissue/health/?table_sort_736329=3.

\(^{139}\) Lloyd F. Novick and Glen P. Mays, *Public Health Administration*.

\(^{140}\) Institute of Medicine, *The Future of Public Health*. 

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attacks. With all their efforts and resources diverted to the anthrax effort, many months later these agencies were still catching up with other important disease control efforts that had been set aside.\(^{141}\)

Categorical funding and its consequent categorical organizational paradigms remain principal culprits in fragmenting public health capabilities and compromising its resiliency in meeting the challenge of new epidemic threats. The Institute of Medicine in 1988 concluded that the U.S. public health system had fallen into a state of “disarray”\(^{142}\) amid novel microbial challenges. In a follow-up report in 2003, the institute stated, “Current funding structures frequently burden the work of state and local public health jurisdictions with administrative requirements. ‘Stovepipe’ funding is often inflexible, at times discouraging evidence-based planning and use of funds or the blending of resources in special circumstances.”\(^{143}\)

Today, public health faces declining resources. States that had become quite dependent on federal public health funding over the previous decades were forced to cut many existing programs in the 1980s.\(^{144}\) Furthermore, established funding paradigms have hampered the effective use of federal bioterrorism preparedness funds, which began to pour into state health departments in 2002, a result of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, which was triggered by the anthrax attacks of 2001. As a result of that act, state health departments received a total of nearly $1 billion along with federal guidelines designated to improve state and local public health preparedness. However, biodefense preparedness funds were awarded concomitant with staggering state deficits and budget cuts, and many traditional public health programs were closed.\(^{145}\) A report released in early 2004 concluded that, as a consequence of these cuts and the diversion of staff from core programs, public health gained little in the way of additional resources to sustain surge capacity during an emergency.\(^{146}\) The report notes the following:

> Both across-the-board and program-specific reductions have had staggering effects on public health agencies, what one study participant referred to as a “death of a thousand cuts.” Fourteen of the forty-two health officials … have sustained in total more than $27 million in budget reductions and the loss of 384 full-time equivalent positions. Most study participants who identified specific program details complained that their tobacco control programs have sustained significant cuts, if not complete elimination. Additional program setbacks included cuts in substance abuse programs, maternal child health programs, mental health programs, violence prevention, school-based clinics, elder care programs and home visiting, teen pregnancy and wellness programs, perinatal services, nursing, water quality and environmental health, as well as tuberculosis, HIV, and other communicable disease control programs.\(^{147}\)


\(^{142}\) Institute of Medicine, The Future of Public Health.

\(^{143}\) Institute of Medicine, *The Future of the Public’s Health in the 21st Century*.

\(^{144}\) Elizabeth Fee, “History and Development of Public Health.”


\(^{146}\) Elin Gursky, *Progress and Peril*.

\(^{147}\) Ibid.
Consequently, despite new bioterrorism funding, the process of federal funds in and state funds out has netted public health departments a zero-sum game, often losing more human assets than they have acquired.

Several of the respondents in the above-referenced study\(^{148}\) noted that the federal guidance plan also prevented the development of a cross-operational infrastructure for preparedness within their state and local health departments. Many have noted that bioterrorism planning and funding initiatives, rather than expanding resources, augmenting scalability, and amalgamating personnel had, itself, become a unique and narrowly focused stovepipe.

**Interoperability**

*Interoperability* is a state in which systems, equipment, or personnel accept or exchange services to enable them to operate effectively together.\(^{149}\) Similarly, to engage the public health mission, workforce, and organization, there must be an operational platform that facilitates the exchange of services across public health and other sectors. Elements that promote public health’s interoperability, critical to ensuring an effective response to large-scale health threats, epidemics, and bioterrorism, are information sharing, relationships and collaborations, and authorities.

One of public health’s earliest and singularly eminent roles has been the collection of information to describe, analyze, and monitor the health of populations. The compilation of vital statistics—recording births, deaths and other sentinel event markers—has been a compulsory governmental responsibility in this country since colonial times. Early evidence of activities to observe and record adverse health events may be ascribed to the colony of Rhode Island, which, in 1741, required tavern keepers to report contagious disease among their patrons. National disease monitoring began in 1850 with the collection of mortality statistics, and in 1878, Congress authorized the collection of morbidity reports regarding quarantine measures used against cholera, smallpox, plague, and yellow fever. By 1901, all states had laws requiring notification to local authorities of selected communicable diseases such as smallpox, tuberculosis, and cholera. National disease reporting was initiated in 1925 as a result of the poliomyelitis epidemic and the influenza pandemic of 1918-1919. Disease surveillance refers to “the continued watchfulness over the distribution and trends of incidence through the systematic collection, consolidation and evaluation of morbidity and mortality reports and other relevant data” and the regular dissemination of these data “to all who need to know.”\(^{150}\)

Through the evolution of public health and medical science, data collection, analysis, and dissemination have become essential epidemiological tools, demanding shorter intervals between each element when facing infectious disease processes and other health threats that require swift identification, intervention, and mitigation. Although constituting one of its most important responsibilities, disease surveillance has been one of the most difficult of public health’s jobs and one that has frequently engendered criticism. Serving as the purveyor of bad news is an unpleasant role for any professional group: public health information has community-wide ramifications and, at times, incites castigation of the messenger. The political costs can be high: The public often demands a remedy in response to disturbing data, sometimes

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\(^{148}\) Elin Gursky, *Progress and Peril*.  
in advance of the “definitive” science that may be a long time in coming. When no response is available or scientifically warranted, advocacy groups can and sometimes do apply pressure to the elected officials to whom public health reports. The data results may necessitate more investigation or epidemiologic study to determine the strength of an association between a possible causative agent and a negative health outcome. These efforts may be resource intense and lengthy.

Good science takes time, and public health has always endeavored to provide good science. Unfortunately, time is an extravagance in the face of virulent and potentially lethal pathogens that require fast decisions, quick actions, and often the experience and judgment of a seasoned public health practitioner when the scientific evidence or laboratory confirmation may be unavailable or slow in coming. The lag phase between understanding the risk of a pathogen—the threat assessment—and determining its most efficacious mitigation has, at times, promoted concerns about the public health sector’s credibility.

The time-sensitive process of knowledge acquisition and transfer can affect a cascade of related events, as can be seen through an analysis of the 2001 anthrax attacks. Physicians in the anthrax epicenters relied on the promise of timely guidance from federal health authorities regarding which patients presenting to their emergency rooms might be at risk for illness after exposure to anthrax-contaminated mail, and what diagnostic and medical interventions should be applied. This information was perceived to be late in coming. The weeks of inquiry involved to comprehend the health threat from inhalational exposure to weaponized *Bacillus anthracis* impacted not only clinical care, they delayed and confused the process of effective risk communication from the public health sector. The news media experienced public health’s uphill learning curve through a persistent lack of reliable, consistently updated information from which to provide accurate and timely reporting to the public. This stimulated a run on public health laboratories, which were deluged with—and often incapacitated by—samples of white substance feared to be powdered anthrax.151

The deliberate collection and analysis of public health data has resulted in a “system” that is process dependent. The public health enterprise has not been well integrated within the scopes of efforts of the sectors that are largely response oriented. However, the attacks on the World Trade Center and the Pentagon on September 11, 2001, along with the subsequent anthrax attacks and ongoing national security efforts to protect civilian populations such as the Phase I smallpox vaccination program, have propelled public health into the public consciousness. Public health officials are now reporting that they are, for the first time, being invited to the table to incorporate their expertise into biodefense planning—and evolving response capabilities—with other responder groups.152, 153

To sustain ongoing professional relationships, there must be a mutual understanding and acknowledgement of each sector’s role and mission. For example, it would not be an overstatement that strong linkages between the public health and the healthcare delivery sectors are critical to prompt disease intervention and mitigation. In fact, the information needed by public health to detect outbreaks and evaluate health trends originates in the clinical care sector. There have been many studies relating the decoupling of medicine and public health that occurred during the 20th century. Several causal factors

have been recognized, including the removal of the “population effect” (the role of community, socioeconomic, environmental and behavioral factors) from the practice of clinical care to the individual patient. This has been associated with multiple factors, including the recognition of the biomedical foundation of disease; the separation of workforce training through the establishment of a defined medical school curriculum; and the perceived encroachment upon medical practice and physician income by public health’s move to institute the delivery of health services, crossing the boundary from its role in sanitation and hygiene to a disease-specific focus.\textsuperscript{154} Additionally, the shifting paradigm of medical care delivery through a managed-care environment has necessitated additional new roles and partnerships for public health. A 1995 George Washington University study investigating Medicaid managed-service agreements found that most contracts were silent on how key public health services were to be delivered, that local health department agencies were not included as in-network providers of certain services, and that many contracts did not detail the range of responsibilities of the contractors within the so-called “comprehensive healthcare system.” This latter factor can result in denying local health agencies information from plans related to the treatment of communicable diseases and subsequent locating and treating of non-member contacts within the community.\textsuperscript{155}

Efforts to bring the medical care and public health sectors into closer working relationships have been met with caution over the past decade, and while much more needs to be done, several efforts have been attempted. In 1994, the American Medical Association and American Public Health Association formed the Medicine and Public Health Initiative, a partnership to improve the communication and relationship between the public health and medical disciplines, to foster collaborative efforts at the national, state, and local levels, and to develop innovative solutions for the health needs of people.\textsuperscript{156} The American Hospital Association created the Health Research and Education Trust\textsuperscript{157} and California’s Medicaid program Med-Cal Managed Care requires health plans to develop relationships with local health departments to define their roles.\textsuperscript{158} In 2003, the Joint Commission on Accreditation of Healthcare Organizations recommended that the medical care and public health sectors collaborate to develop health surveillance systems, promote inter-organization communication systems, and train healthcare providers to identify signs and symptoms of exposure to chemical, biological, or radiological agents.\textsuperscript{159}

Many benefits of these collaborations accrue to the partners, including the development of tools and strategies for researching outcomes, the measurement of the effectiveness and cost parameters of various health interventions, and improvement in the significance of health education as a strategy to reverse adverse health behaviors. All these and more benefit health; however, the mutually dependent integration of mission and systems between medicine and public health is critical to the nation’s security. Achieving

\textsuperscript{158} George W. Rutherford, “Public Health, Communicable Diseases, and Managed Care: Will Managed Care Improve or Weaken Communicable Disease Control?” \textit{American Journal of Preventive Medicine}, vol. 14, no. 3S, 1998.
the earliest possible clinical disease notification and promoting timely and appropriate interventions will help to minimize morbidity and disease spread and possibly avert an epidemic.

Although the relationship between the medical care sector and the public health sector has been tenuous, there are other relationships that, until recently, have been relatively absent. The anthrax attacks necessitated the novel collaboration between public health and members of the law enforcement community, particularly the FBI. With public health and law enforcement people using decidedly different techniques of investigation, sample collection and testing, information sharing, and terminology (like “surveillance”), some public health officials were excluded by law enforcement from the anthrax attack sites. They tended to view this relationship as a formidable obstacle to, and a constraint on, their disease intervention efforts.\(^{160}\) However, leaders in other communities overcame this chasm by pairing public health investigators with FBI agents to conduct joint interviews of possible cases and to improve information sharing.\(^{161}\) A “Forensic Epidemiology” course jointly developed by the CDC and FBI is facilitating future cooperative investigation efforts.\(^{162}\)

There are many other sectors with which public health has had infrequent contact but for which the relationship equation will need to improve as the health of Americans achieves even greater significance within the national security context. These vital partners will necessarily include community, state and federal agencies, including law and safety, veterinary health, and agencies such as Agriculture, Defense, and Homeland Security.

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**Survey Data Box 6**

**Important strategies to implement**

Study participants were asked to list three to five of the most important strategies that public health must implement in the next two to three years to improve its ability to respond to threats such as emerging pathogens and bioterrorism. Over 60% of the respondents identified “forming collaborations and partnerships” with other first responders as being one of the most important strategies.

When asked to indicate the importance of collaboration with a range of potential partners and stakeholders on a scale of low, medium, and high, study participants rated “hospitals and the medical sector,” “veterinary health,” “food/agriculture,” “emergency responders,” and “business and industry” as high (with “hospitals and the medical sector” being the “highest”). Receiving medium ratings were “police,” “DOJ/FBI,” “Military/DoD,” “National Guard,” “DHS.”

Using the same scale and elements, study participants were asked to indicate the current level of collaboration. None were rated high, and several received ratings of low, including “DOJ/FBI,” “Military/DoD,” “National Guard,” and “Business and Industry.” The remainder received medium ratings.

Relationships will be key to improving public health’s ability to respond to biological and other forms of terrorism and outbreaks of emerging pathogens. Sophisticated electronic information systems can

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\(^{160}\) Elin Gursky, unpublished data.


\(^{162}\) CDC Forensic Epidemiology: Joint Training for Law Enforcement and Public Health Officials on Investigative Responses to Bioterrorism, Public Health Law Program, CDC.
facilitate these relationships by supporting ongoing data exchange, analysis, and notification and response among all relevant parties. Systems will be required to handle numerous data streams from multiple reporting sources in a real-time, nonlinear mode, moving information from designated sentinels or legally obligated reporting sources to public health for analysis and interpretation, and to information recipients (clinical care, law enforcement, emergency response sectors and others) to inform treatment recommendations and exposure precautions and to provide ongoing updates that characterize the epidemic.\textsuperscript{163} These systems will reduce the burden of reporting, decrease error rates, increase the speed of data transfer, and assure that all appropriate stakeholders are in the loop.

Historically, the public health data-to-information chain has been replete with obstacles. Physicians have been less-than-thorough reporters of health conditions because, among other reasons, they view reporting as an infringement of the physician-patient relationship,\textsuperscript{164} would rather omit the labor-intensive process that may involve duplicate reporting (having to complete charting in a patient record and then re-enter certain data on a state morbidity form),\textsuperscript{165} and acknowledge with frustration that they receive little subsequent feedback from the public health sector.\textsuperscript{166} Public health’s job has been to assimilate physician reports—as well as data streams from hospitals, laboratories, and, with the advent of syndromic surveillance systems, pharmacies and groceries that may report increasing sales of over-the-counter drugs such as anti-emetics and anti-diarrheals; this reporting was until recently a largely manual, time-consuming process.

A 1999 GAO report investigating public health surveillance of emerging infectious pathogens found that many public health departments lacked basic equipment such as computers and fax machines, did not have secure sites for the exchange of electronic information, and often required that data streams received electronically be converted with pencil to paper.\textsuperscript{167} Another report emphasized the relative absence of informatics capabilities and training in information technology within the public health sector.\textsuperscript{168}


\textsuperscript{164} Allan M. Brandt and Martha Gardner, “Antagonism and Accommodation.”


\textsuperscript{166} Ibid.


Survey Data Box 7

Important strategies to implement

Study participants were asked to list three to five of the most important strategies that public health must implement in the next two to three years to improve its ability to respond to threats such as emerging pathogens and bioterrorism; 50% to 55% of responders identified “enhancing surveillance,” “coordinating an effective workforce,” and “creating an integrated public health emergency response plan” as such strategies; 40% listed improving “risk communication” and “infrastructure development.”

When asked to rate the level of importance of factors relevant in supporting public health roles and activities over the next decade, study participants considered “Information Technology,” “Communication Systems,” and “Reliable Surveillance Systems” of highest importance.

Building the computing systems required within the framework of a decentralized and highly variable public health infrastructure will be a significant challenge, particularly since there has historically been little sharing of resources and best practices between states—and, within states, among local health departments. Expertise will be needed to develop computing systems, and strong leadership will be required to assure its adoption. The public health sector has made progress in implementing electronic information systems. To improve the exchange of data across multiple systems, the CDC and its partners are developing the Public Health Information Network, which is envisioned to be a live, secure, Internet-based network for exchanging critical health information across all levels of public health (local, state, and federal) as well as with other critical information systems.169 The Public Health Information Network is intended to address five key functions: detection and monitoring, data analysis, information resources and knowledge management, alerting and communications, and response.170 Other CDC-based electronic information efforts include the National Electronic Disease Surveillance System,171 the Health Alert Network,172 and the Epidemic Information Exchange (a secure communications network accessible only to designated personnel, established in 2002 to provide health surveillance information, “up-to-the-minute alerts, reports and assistance”).173

Investments in computers and high-speed Internet access have been made possible only through recent federal biodefense funding initiatives, and they are a key step toward improving the bidirectional flow of critical public health information. However, computer purchases by public health departments have not necessarily occurred in concert with the information infrastructure investments of hospitals and other critical reporters and users of sentinel health information.174 In fact, the lack of interoperability of electronic communication and information-sharing equipment continues to be cited as an ongoing and urgent problem. This is particularly relevant to the healthcare delivery sector and, therefore, of particular concern to public health, because such a large component of public health surveillance data comes from laboratories, hospitals, and physicians. The potentially virulent and deliberate threats posed by the specter

170 CDC, Public Health Information Network; http://www.cdc.gov/phin.
171 Association of State and Territorial Health Officials, First Public Health Information Network Stakeholder’s Conference.
172 Ibid.
of bioterrorism require reporting systems to overcome longstanding, chronic underreporting of disease incidence and the long lag time between diagnosis and reporting.  

A 2001 report by the President’s Information Technology Advisory Committee report noted, “The U.S. lacks a broadly disseminated and accepted national vision for information technology in health care.” The report found that national deficiencies exist in foreseeing, adopting, and investing in information technology practices for healthcare. Additionally, healthcare organizations may not readily have the functional and institutional architecture to accept the implementation and application of information technology. The committee’s 2004 report, “Revolutionizing Health Care Through Information Technology,” emphasized the criticality of implementing sophisticated information technologies within the healthcare delivery sector to control costs and maintain quality, noting, “But amid multimillion-dollar diagnostic instruments, highly trained caregivers, and a vast facilities infrastructure, the most fundamental and pervasive basis on which American receive health care is the handwritten notation.” Obviously, handwritten notes will offer little support for the immediate transfer of potentially critical disease data during an epidemic or biological attack.

The National Health Information Infrastructure initiative is an effort to improve the effectiveness, efficiency, and overall quality of healthcare in the United States. It is a comprehensive, knowledge-based network of interoperable systems of clinical, personal health information, and public health. The planned approach to its development, based on local health information exchange, lends itself to public health participation as a full partner with the clinical care sector in this critical information infrastructure. But, as with all efforts to collect high-quality (error-free) information and analyze and rapidly convey this health intelligence to the appropriate parties, the success of these platforms will depend on consensus among disparate user organizations regarding data exchange standards, the coordinated purchasing and building of compatible systems, and the shared goal—the early detection and mitigation of disease outbreaks. The challenge appears daunting, but nonetheless critical, especially in recognizing that federal agencies involved in bioterrorism preparedness have identified 72 information systems and supporting technologies and 12 other information technology initiatives. This includes 28 within the Department of Health and Human Services, 14 within the Defense Department, 14 within the Energy Department, 10 within the Agriculture Department, 5 within the Environmental Protection Agency and 1 at the Veterans Administration.

There are other impediments to the bidirectional information flow that affect public health’s ultimate interoperability across the responder communities. The exchange of data may be impeded between public health and law enforcement by restrictions in access to sensitive and classified information, and
between the medical care and public health sectors by misconceptions of privacy laws.\textsuperscript{181} Efforts are under way to address these critical issues.

One problem caused by efficient and sophisticated computing systems is that they will facilitate the rapid and urgent throughputs of health data. This, in turn, will truncate the time span between information analysis and response, forcing expeditious public health decision making and necessitating a clear pre-event delineation of the public health rules of engagement. As seen during the 2001 anthrax attacks, there were many instances in which the decision-making processes preceded the full understanding of an evolving health crisis. In the early weeks of the attacks, state and local public health officials were reluctant to initiate public health actions (such as recommending preventive antibiotics) until after receiving guidance from the CDC, while other health departments made decisions to initiate rapid preventive interventions before receiving CDC guidance.\textsuperscript{182}

Additionally, to assure the application of public health expertise, legal authorities must be well understood and, in many places, upgraded. The 2003 Institute of Medicine report, \textit{The Future of Public Health in the 21st Century}, noted that public health laws at the federal, state, and local levels are often outdated and internally inconsistent, impeding efficient responses to health threats and contributing to a lack of coordination in emergency situations that require an immediate public health response. Many public health laws are 40 to 100 years old and outmoded in ways that reduce their effectiveness and do not reflect contemporary legal trends, the most recent scientific premises of disease spread and risk, the nature of emerging diseases, or the terrorism environment. For example, in the 1990s, during a resurgence of multi-drug resistant tuberculosis that affected major metropolitan areas, many state statutes did not allow for directly observed therapy, a technique developed to increase adherence to medication regimens.\textsuperscript{183} Moreover, public health laws vary from state to state, a specific problem since infectious disease spread is not bound by jurisdictional boundaries.\textsuperscript{184} Legal authorities are further challenged by gaps in command-and-control relationships and the overlap and diversity of local, state, and federal organizations involved in public health emergencies. This has led many within public health to seek guidance to the often unanswered question of who’s in charge during a crisis.\textsuperscript{185} An example of this uncertainty was demonstrated during the public health response to the anthrax attacks of 2001. In the Washington, DC, metropolitan area, three health departments (Maryland’s, Virginia’s, and the District of Columbia’s) were involved in the anthrax investigation and response. Though each was responsible for actions in its own jurisdiction, geographically contiguous relationships and contradictory recommendations caused confusion among public health practitioners and citizens. Recognizing the gaps in legal authorities in the face of novel threats, CDC engaged the Center for Law and the Public’s Health at Georgetown and Johns Hopkins universities to draft guidance to states regarding the legislative authorities required to support disease detection and containment efforts during a public health crisis.

\textsuperscript{181} U.S. Department of Health and Human Services, Office for Civil Rights; http://www.hhs.gov/ocr/hipaa/.


\textsuperscript{184} Institute of Medicine, \textit{The Future of the Public’s Health in the 21st Century}.

\textsuperscript{185} Ibid.
emergency. These are important first steps that must be followed by further delineation of legal roles and authorities across federal, state, and local agencies during health crises.

It has often been noted that, absent a large disease outbreak or unusual health emergency, the public health effort is largely invisible. Bioterrorism has increased its visibility, but has also forced public health to become far more interoperable to successfully address these new threats.

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III. Conclusions and Options

The potential of future attacks of bioterrorism and the certainty of the continuing emergence of novel and resistant pathogens and disease epidemics have placed unprecedented demands on the U.S. public health system. While historically formed to protect and promote the health of populations through the detection, investigation, and containment of disease outbreaks, public health today has many expanded responsibilities and competing demands for its limited resources, the most recent of which is bioterrorism planning and response.

As history has proven, public health has consistently risen to meet new challenges, battling infectious disease spread without benefit of the knowledge of the microbiological foundation of disease; instituting post-exposure and mass vaccination efforts with the acquisition of the science and technologies required to augment the body’s own immune system; and controlling epidemics, some of which were successfully controlled, only to reappear more virulent after thwarting the antibiotics that had been built to destroy them. However, for the past approximately 30 years, the public health mission has slowly migrated from infectious disease protection and mitigation to an expanding role in the delivery of many primary medical and personal healthcare services. The public health sector business case has assumed the void of service delivery for the uninsured, the underinsured, and the undocumented and has become encumbered with providing health screenings, behavioral health interventions, prenatal and postnatal services, and a wide range of activities focused on improving community health status. Public health has been instrumental in reducing risk from injury at the worksite and in automobiles, in reducing mortality from substance-abusing behaviors like tobacco use, and improving disease outcomes through early screening and detection of cancers. However, national health indicators reflect recently recognized epidemic rates of chronic health conditions, which now account for 7 of every 10 U.S. deaths. From 1980 through 2002, the number of Americans with diabetes more than doubled, from 5.8 million to 13.3 million. In the past two decades, the prevalence of obesity has nearly doubled, increasing from 15% to 27% of the American adult population. Obesity is on the rise in children and adolescents too: 13% of America’s youth are now overweight. More than 50% of American adults do not get enough physical activity to provide health benefits. For public health, the job of promoting the health of Americans is far from over—the job of protecting the health of Americans has entered a new chapter.

The country has awakened to the 21st-century possibility of catastrophic bioterrorism. Federal, state and local agencies, including the CDC, have sought new strategy, organizational structures, and the

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190 “Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity 2004.”
acquisition of tools and skills within this environment of heightened vulnerabilities and expanded societal risk “to meet the challenges of public health in the 21st century.”192

What follows is an analysis of three core questions regarding the public health sector’s ability to detect, respond to, and contain the potentially catastrophic events of bioterrorism, large-scale epidemics, and outbreaks of novel and emerging pathogens.

**Do state and local public health systems have the capabilities to address current and future threats from novel biopathogens and bioterrorism?**

A biological pathogen poses the potential of infection across a broad population through a number of mechanisms, “point source” (such as a contaminated food), “direct” (from one infectious person to another), or “indirect” such as through airborne spread or contact with contaminated surfaces. The detection of an anomalous cluster of patients or unusual symptoms or seasonality can occur from alert clinicians or sophisticated disease surveillance systems. The mitigation of an infectious disease outbreak necessitates swift and appropriate actions, involving risk communication to avert future disease exposure and spread, the administration of medical countermeasures (such as antibiotic chemoprophylaxis or vaccines), cohorting ill and possibly infectious individuals, identifying and eliminating the source of infection, and active population monitoring to assure outbreak containment and conclusion. In fact, these capabilities are fundamental to public health’s imperative to control infectious disease. However, there are many reasons to doubt public health’s ability to engage these capabilities swiftly and effectively when facing a unique health event or a covert and deliberate bioattack.

- The public health sector is deficient in the required numbers of appropriately trained disease detectives or epidemiologists, estimated to be 1 per 500,000 population.193 There are current and projected deficiencies in the overall numbers of personnel,194 resulting in inadequate professional capacity to respond to health emergencies. The median number of full-time staff in local health departments is 13 persons.195

- Many public health practitioners continue to eschew credentialing, uniformity of academic background, and other suggestions of personnel (or organizational) standardization. Despite access to short course and web-based training opportunities, superimposing consistent and robust biopreparedness competencies on the current educationally and professionally diverse workforce will be difficult.

- Until very recently, the public health workforce has been woefully deficient in fundamental information and communication systems, like computers and Internet access. The capabilities for transforming information flows into rapidly analyzed usable health intelligence are at beginning stages.

- The demands of a biological attack or large-scale epidemic will require seamless and timely integration of a much larger “system,” one that encompasses multiple sectors and competencies, each through its

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unique capabilities supporting the efforts by public health to protect people and halt the spread of disease. Critical relationships—especially across medical and hospital systems—do not yet exist on a scale sufficient to ensure early and efficient reporting to and from the public health system. Furthermore, these relationships are inadequately integrated to seamlessly engage the assistance of the medical and hospital sectors in the administration of medical countermeasures and in other coordinated response activities. Moreover, relationships with police DOJ/FBI, DOD/Military, National Guard, and DHS are limited in their perceived importance, and their current operational levels were rated by study participants as low.

- Complex political processes, ill-defined rules of engagement and legal authorities, and evolving command structures limit the ability of public health officials to swiftly engage its resources to minimize disease spread.
- Silos of programs and personnel limit the organizational agility and expandability (surge capacity) necessary to sustain efforts through the containment of the outbreak. This is exacerbated by the lack of basic skill sets across the multiple professions that make up the public health workforce and by still evolving systems of 24/7 coverage across local public health agencies across the country.
- The development of new vaccines against microbes that cause diseases such as Hemophilus influenzae B and Meningococcal disease (*Neisseria meningitides*) have reduced the number of urgent epidemics and “live-fire exercises” to which the public health sector has had to respond, thus limiting the amount of practical experience the public health sector has had with large-scale events.

*To improve preparedness and response for bioterrorism and novel and emerging pathogens, public health capabilities must be defined and enhanced.*

**Has bioterrorism preparedness become the new mission of public health?**

For the past two decades, public health has become acutely aware of the health threats associated with novel pathogens. Diseases such as HIV-AIDS and Lyme disease, Hanta virus, and more recently West Nile virus, SARS, and monkeypox have elevated biosecurity concerns within the context of an increasingly globalized planet and have added to the already full plate of public health responsibilities. The public health sector has taken serious note of these emerging issues, applying new focus to research and biotechnology efforts, workforce training, and community risk education. These activities have improved disease surveillance activities and prepared the public health sector for greater levels of responsiveness than have been seen in previous years.

However, the public health system faces ongoing challenges to respond to acute and emerging health threats while it continues to provide its unique social goods through health promotion and as a safety net for healthcare delivery. This presents an obstacle in that the overall small size of the public health workforce is insufficient, as confirmed by over 60% of study respondents. The conundrum of competing priorities and ever expanding responsibilities cannot be solved merely by increasing the number of public health assets. Current events have forced public health to redefine its role in modern society. An overwhelming majority—70%—of survey respondents stated that the mission of public health has changed since the attacks of 2001. One example of this change is apparent from the 95% of study participants who indicated that the direct delivery of primary care and personal healthcare services should be withdrawn from the public health sector.
Across the spectrum of responsibilities facing the public health sector, bioterrorism preparedness is not among the top or most immediate priorities. The social and community health promotion obligations are deeply ingrained within the primary mission of public health. While many acknowledge the likelihood of future terrorist attacks and indicate overwhelmingly that public health should be involved in preparedness and planning, both “bioterrorism” and “emerging infections” were rated as only moderate concerns behind the three most important issues of “behavioral health and lifestyle issues,” “chronic health,” and “access to healthcare.” Furthermore, the threat of bioterrorism remains intangible. As one public health focus group participant noted, bioterrorism preparedness “is like chasing a ghost. Is there a real threat or just ‘hype’ that [we should] try not to get wrapped up in?”

Among those within public health who agree that biodefense is an important new component of public health, many (in fact an overwhelming 70% of study participants) state that bioterrorism preparedness is not fundamentally different from other public health sector responsibilities. These responses appear to reinforce recurring concerns regarding the public health sector’s ability to fully appreciate the nature and scope of a deliberate bioattack and the stresses such attacks will place on the public health system.196 Although some number of public health practitioners have significant experience containing infectious disease outbreaks, these skill sets are not pervasive across the practice community and are not necessarily congruent with the demands that a serious epidemic may present with unique and unanticipated patterns of disease spread, initial symptomatology and clinical presentations, incubation periods, and other attributes that require rapid decision making under novel and highly stressful circumstances.

For the nation to adequately protect its citizens from the potential of catastrophic disease, public health must understand the nature of the threat and make biodefense preparedness and response a priority.

Can additional resources build a more robust public health system that is capable of addressing novel threats and bioterrorism?

As a specific theme, federal bioterrorism preparedness initiatives have provided the public health sector with the greatest amount of categorical funding it has ever received. Over fiscal years 2001, 2002, and 2003, CDC received almost $2 billion specifically for upgrading state and local public health capacity.197 Vitally important goods have been acquired, including computers, mobile communication equipment, continuous high-speed Internet access, and personal protective equipment. Training has been offered, and planning and discussion have extended into sectors previously unfamiliar to public health.

Yet numerous reports illuminate the difficulties being encountered by public health agencies as they attempt to absorb and encumber these funds, identify best practices for achieving preparedness objectives, overcome local and state legislative hurdles to engage in purchasing activities, provide essential and ongoing training to workforce members who find it problematic to leave their job to attend training, and address an array of other difficulties.198, 199, 200

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196 Elin Gursky, Progress and Peril.
198 Elin Gursky, Progress and Peril.
199 Trust for America’s Health.
200 Association of State and Territorial Health Officials report.
The 2002 CDC document “Cooperative Agreement Notice and Grant Guidance, Guidance for Fiscal-Year 2002 Supplemental Funds for Public Health Preparedness and Response for Bioterrorism” established 14 critical benchmarks to guide planning and purchasing. At the meeting of the Health and Human Services Secretary’s Council on Public Health Preparedness in May 2004, a presentation by the CDC Office of Terrorism Preparedness and Emergency Response indicated that none of the states as yet had achieved 100% of these critical benchmarks. For example, up to 25% of states have achieved benchmark 6 (develop and maintain the strategic national stockpile program and personnel), and benchmark 13 (establish procedures for the dissemination of risk communication messages) and 25% to 49% of states have achieved the criteria for benchmark 4 (exercise all response plans for the Class A bioagents).

Despite record funding and three years of focused effort, public health remains far short of its preparedness and response goals. One plausible conclusion is, therefore, that preparedness is not wholly attributable to funding schemes. Several explanations for this conclusion are presented in the following discussion.

First, biodefense preparedness activities are being retrofit onto a public health foundation that has been successively weakened by decades of underfunding and overtasking. Even with substantial new funding, the foundation is not capable of sustaining new requirements or activities with its current, ongoing responsibilities. One focus group participant spoke of juggling the competing demands of biopreparedness and “regular” public health work stating, “[I’m] treading water and trying to do my day-to-day job.” In its current state, public health is not prepared to take on the task of biodefense.

Second, the prevailing perspective in public health is local and may not necessarily translate into the national preparedness competencies required to protect the country from infectious diseases that are not constrained by geopolitical boundaries. Indeed, local political needs and interests will almost always trump federal funding priorities and frustrate efforts to build uniform and consistent public health practices for biodefense.

Third, to many public health professionals, bioterrorism preparedness presents a climate fraught with competing efforts and fundamental clashes of cultures. Many practitioners view biodefense funding as diminishing the investment in “traditional” public health responsibilities rather than increasing the dual benefits that can be wrought from improving biodefense capabilities, such as surveillance and disease monitoring. One focus group participant spoke of the new requirements for public health personnel assigned to biodefense duties: “They [public health] must be available 24/7 and must be ready to engage in more acute care and response. Public health workers are not accustomed to 24/7 availability or security-related roles.”

Nationally consistent requirements must be defined and adhered to in order to achieve national preparedness.

The following four options offer suggestions for expanding the capabilities of the public health sector, specifically local health agencies, to address the demands inherent to the detection of and response to deliberate and natural biological threats. These options also suggest opportunities for maximizing the use and direction of preparedness funds, and they describe strategy for augmenting the public health response through additional resources.

**Option One—Improve Public Health Agency Capabilities (Current)**

The strategy behind Option One is to retain the public health system as currently configured while developing efforts to improve response across the breadth of the nation’s 2,800 local public health agencies. An example of programs that focus on improving biopreparedness organizational capabilities is the Metropolitan Medical Response System, which was developed in 1996 and now resides within the Department of Homeland Security. The system’s goal is to enhance health and medical consequence management in major U.S. cities until other external resources are mobilized.205

Another example of efforts to enhance organizational biopreparedness capabilities is the program Public Health Ready, funded by CDC in collaboration with the National Association of County and City Health Officials and the Center for Health Policy at the Columbia University School of Nursing. The goal of this project is one of “preparing staff of local governmental public health agencies to respond and protect the public’s health through a competency based training and certification.”206 For a local health department to be recognized as being “public health ready,” it must achieve criteria in three key areas: emergency preparedness planning (defining its response to an event and its relationship with other agencies), workforce competency development (each public health worker will identify his or her role in an emergency and demonstrate competency in preparedness and response functions), and exercises and simulations. This project is in its 4th year and is being guided by a National Association of County and City Health Officials advisory committee that will ensure relevance to public health practice and future sustainability. In March 2004, the initial pilot testing phases, consisting of 13 selected sites, was completed and resulted in 11 local public health agencies being recognized as “public health ready.” This project is being evaluated by RAND; no published information assessing the project’s effectiveness is available yet.

The Option One goal of building fully responsive public health agencies will require the promise of long-term, sustained federal funding and consensus and commitment from local and state health and government leaders. This is a goal that will require multiple years of effort through incremental advances. Option One will require strong and specific preparedness guidance from experts like CDC, which should be charged with assuring that rigorous accountability and measures of progress are maintained. In the event of a large-scale epidemic or catastrophic health emergency, deliberate or natural, external assistance to augment existing public health capabilities will most likely be required within 48 hours of learning of the disease outbreak.

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205 About MMRS; http://www.mmrs.fema.gov/Main/About.aspx.
**Option Two—Expand Capacity Through Embedded Capabilities and Response Teams**

The strategy in Option Two retains the current public health department model. However, unlike Option One, which prepares the entire agency to respond, Option Two assures the training and preparedness of specific “embedded” members of the agency’s workforce in designated public health responder duties. Option Two builds a team of specific capabilities across contiguous health departments, capitalizing on regional resources. Regional approaches may provide enhanced capacity to respond to and contain an infectious disease outbreak, providing an efficient use of preparedness funding.

**Example Responder Roles**

- Incident Command
- Epidemiology
- Medical/Nursing
- SNS deployment
- Risk Communication
- Transportation (samples, personnel)

Examples of this “embedded” approach exist within and outside the public health sector. For example, within the military there are many types of quick-reaction forces, with unique skill sets and rapid mobilization capabilities. In April 1996, as a result of planning guidance issued by General Charles Krulak, then Commandant of the Marine Corps, stating the need to respond to and counter the growing chemical and biological threat, the Commandant’s Warfighting Laboratory established the Chemical Biological Incident Response Force, a rapidly deployable contingent of over 40 military specialties. The force is trained in agent detection and analysis, providing medical intervention, the removal of casualties, and overall support to the nations’ first responders, among other actions. During domestic

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Another example of embedded capabilities can be found in the public health sector. In 1999, CDC, the Association of Public Health Laboratories, and the FBI developed the Laboratory Response Network. Funded largely by CDC, it was established to maintain an integrated national and international network of laboratories that is fully equipped to respond quickly to acts of chemical or biological terrorism, emerging infectious diseases, and public health threats and emergencies. In addition to the labs run by state and local health departments, the network comprises federal labs (CDC, Department of Agriculture, Food and Drug Administration), the Defense Department (including the U.S. Army Medical Research Institute of Infectious Diseases), food testing, environmental, and veterinary labs. Labs are designated part of the network only upon successfully demonstrating specific competencies.209

To be fully achieved, federal preparedness funding should be directed at identifying required capabilities, ascertaining individuals with required augmentable skill sets across a designated region, and equipping, training and exercising the response teams. Because Option Two focuses on specific public health practitioners with pre-selected capabilities, its goals may be more readily achievable and operational than those of Option One.

Option Three—Augment Public Health Response Through External Capabilities

The strategy behind Option Three is to access external capabilities to support the local public health sector’s needs as soon as a potential epidemic or catastrophic health emergency that may subsequently be designated a deliberate bioattack is recognized.

Several types of external assistance may be available. The National Disaster Medical System, a section within the Department of Homeland Security, works in partnership with the Department of Health and Human Services, the Defense Department, and the Veterans Administration, serving as the lead federal agency for medical response under the National Response Plan. Initially developed in 1984, its three major responsibilities are moving patients from a disaster site, providing definitive medical care, and responding to a disaster area with teams, supplies, and equipment. Disaster Medical Assistance Teams consist of approximately 35 volunteers with a variety of health or medical skills (physicians, nurses, EMTs, paramedics) and support personnel to provide communications, logistics, maintenance, and security. Team members are required to maintain appropriate certifications and licensure within their individual disciplines so that in the event the teams are federalized, this certification is recognized by all states. The National Disaster Medical System also includes Disaster Mortuary Response Teams and Veterinary Medical Assistance Teams.

Led by the U.S. Surgeon General, another example of external capabilities include the Public Health Service Commissioned Corps. The Public Health Service Commissioned Corps consists of 6,000 officers in a wide variety of professional categories, including physicians, dentists, nurses, therapists, environmental health specialists, engineers, and others whose mission is to provide a variety of medical and health care services. Additionally, within the Public Health Service is a “cadre of … officers, uniquely qualified by education and skills, who can be mobilized … during disaster, strife, or other public health emergencies and in response to domestic or international requests.” Known as the Commissioned

Corps Readiness Force, this group was created in 1994 by the Office of the Surgeon General to improve the ability of the Department of Health and Human Services to respond to public health emergencies. In July 2003, Secretary of Health and Human Services Tommy Thompson announced a proposal to expand the capacity of the entire Public Health Service Commissioned Corps to be completely deployable by the end of 2005.\textsuperscript{210}

Within its expanded domestic security mission, the Defense Department, in addition to its \textit{warfighting} role, has assumed greater responsibilities in the response to multiple, simultaneous, and geographically dispersed biological attacks. Civil support is a well-established role for U.S. military forces with the advantage of being able to quickly marshal and deploy a large number of personnel and resources and effectively employ them under unity of command.

Currently the military is the only large-scale source of trained personnel, many with occupational specialties specific to or supportive of the \textit{disease-fighting} public health role within the civilian sector, including physicians, nurses, and general support such as transportation and logistics. Moreover, the military has certain advantages in training and resources: in excess of 450,000 military personnel have recently received smallpox vaccinations, compared to fewer than 40,000 civilian responders similarly vaccinated.\textsuperscript{211} The Joint Task Force Civil Support, headquartered in Fort Monroe, Virginia, plans and integrates Defense Department support to the designated lead federal agency for consequence management of incidents involving chemical, biological, radiological, nuclear, and high-yield explosives. As a unit within U.S. Northern Command, the task force can deploy to an incident site and provide civil authorities with decontamination, medical assistance, and other help through the duration of containment or establishment of a stabilized environment.\textsuperscript{212}

However, public health departments should not engage their response planning while assuming or budgeting for a specific level of Defense Department support. The Secretary of Defense must approve all force deployment and employment, must further specify the military command relationships under which the force must operate, and establishes the support relationship to the designated lead federal agency.\textsuperscript{213} As explained by Col. Richard Kokko, Deputy Commander of Joint Task Force Civil Support, “The availability of DoD personnel and resources for this purpose is always dependent on worldwide commitments and competing requirements at the moment.”\textsuperscript{214}

In the event that civil support teams are deployed to assist efforts during an attack or major disease outbreak, local public health and government officials will remain responsible for all disease control activities. The time frame in which external resources such as the Defense Department’s would be requested through the lead agency (the Federal Emergency Management Agency), and the specific types of assistance, would be a function of internal public health agency capabilities relative to the type of external support required. For example, a local public health department may be able to manage the flow of case reporting from hospitals to provide appropriate disease monitoring and epidemic tracking, but

\begin{itemize}
  \item \textsuperscript{210} Health and Human Services Secretary Tommy Thompson, “Transformation of the Commissioned Corps of the Public Health Service,” speech, July 3, 2003; http://www.hhs.gov/news/speech/2003/030703.html.
  \item \textsuperscript{211} Holly Myers, Elin Gursky, Georges Benjamin, Chris Gozdor, and Michael Greenberger, “The Threat of Smallpox: Eradicated But Not Erased.”
  \item \textsuperscript{212}Joint Task Force Civil Support; http://www.jtfc.northcom.mil/pages/mission.html.
  \item \textsuperscript{213} Ibid.
  \item \textsuperscript{214} Personal communication with Col. Richard Kokko, July 27, 2004.
\end{itemize}
might require immediate assistance with risk messaging in the event of a breach of normal communication channels, or in dispensing biologics from the Strategic National Stockpile.

**In Option 3, biodefense preparedness and response funding strategies should focus on developing and executing exercise scenarios in which external assistance is requested and received, chain of command issues are reviewed, and the smooth integration of external assets can be accepted and appropriately tasked to assist local public health efforts.**

**Option Four—Reconfigure the Departments That Offer Public Health Functions**

The philosophy behind Option Four is that the need for public health expertise is too broad to be contained within one agency. Thus, this strategy proposes the division of functions into two types of agencies: one that continues to focus on social, behavioral, and chronic etiologies underlying low community health status indicators and continues to provide medical and personal health care services (Model A), and a second type of agency that focuses on today’s health security concerns associated with disease outbreaks—from natural and deliberate sources—that require early detection and rapid intervention capabilities (Model B).

This new health security agency, Model B, would train for and be equipped with the necessary technologies and capabilities to be fully interoperable with the other responder communities. Both organizations would house medical capabilities but with different responsibilities. The Model A agency would continue to provide many valuable medical and health support services, such as hypertension care, well-baby care, prenatal care, and nutrition. As part of its infectious-disease control responsibilities, the Model B agency would provide clinical preventive capabilities to assure the timely diagnosis of individuals with communicable diseases and containment of disease spread through rapid identification and treatment of their contacts. It would continue to offer diagnosis and treatment of patients—and their contacts—with sexually transmitted diseases, tuberculosis, and hepatitis A and to be responsible for pre- and post-exposure mass immunization.
One might argue, with justification, that it would be difficult to fund both the Model A and Model B agencies simultaneously at the levels of support required. However, there already are many examples across the country where public health has been consolidated into health and social services agencies at the state level (and in about a dozen agencies at the local level) and, therefore, may not be conceptually or financially difficult to replicate on a larger scale. Additionally, there have been discussions about reducing the overall number of local health agencies from 2,800 nationally. This model may help state and local governments consider future funding and governance planning for their local health agencies over the next few decades. Model B agencies would be widely dispersed over large populations and would therefore be fewer.
The following summary chart indicates the strengths and weaknesses of the four options.

<table>
<thead>
<tr>
<th>Option</th>
<th>Strengths</th>
<th>Limitations</th>
<th>Funding Strategy</th>
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</thead>
<tbody>
<tr>
<td>I: Current</td>
<td>Increase organizational surge capacity and strengthen response skills.</td>
<td>Will require relatively large amounts of effort and time and consistent local leadership to forge needed personnel consensus. Current wide variability in local capacity will limit effectiveness of this option in communities served by very small local health departments. Turnover in small- to medium-sized health departments would interfere, potentially significantly, with response capacity.</td>
<td>Will require long-term sustained funding from federal sources, rigorous accountability, and the pledge from state and local health and government officials that these funds will be used only as directed.</td>
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<tr>
<td>II: Response Teams</td>
<td>Increase regional surge capacity. Will require less ramp-up time than Option One, especially if basic skill sets can be identified within the existing members of the public health workforce that will constitute the response team.</td>
<td>Requires specific training and maintenance of skills of response team members. Regular duties of response team members will have to be assumed by others when the team is deployed. Requires delineation of cross-jurisdictional authorities, expenditure of funds, and clear understanding of the command structure.</td>
<td>Funding for the response teams will be specific to training, equipping, exercising and maintaining skills among members. New training will be required as response team members retire or withdraw. Funding for the public health agency should focus on exercising reachback capabilities when response team members are deployed.</td>
</tr>
<tr>
<td>III: External Capabilities</td>
<td>The public health agency can continue to perform essential public health responsibilities. Public health agencies will be relieved of much of the preparedness planning and response activities.</td>
<td>Public health’s role within preparedness and homeland security severely diminishes. May fracture integrated approaches found in some communities. Completely dependent upon external expertise from the point at which there is knowledge of the health emergency.</td>
<td>Federal preparedness funds are largely shifted to other responder agencies. General bioterrorism training is provided annually to public health departments.</td>
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<tr>
<td>IV: Reconfigure</td>
<td>Preparedness responsibilities are deferred to Model B, which assumes the burden and responsibility of activities related to health security.</td>
<td>Reduces overall surge capacity. May significantly compromise the scope and quality of public health services offered through most local public health agencies; may not be feasible in rural and frontier areas of the country.</td>
<td>Federal preparedness funding is directed to Model B, Health Security Agencies. Calculations of the number of such agencies required nationally should precede this effort. Model B agencies are fully interdependent with other responder agencies, including medicine, police, security, intelligence, and safety. (This is a fiscally viable option best approached by assessing the spectrum of government services within a county or city and realigning potentially duplicative programs to assure that the services delivered under Model A would not be debilitated.)</td>
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Closing Thoughts

The expectations placed on the public health sector have increased in a way that is not commensurate with the growth and acquisition of resources, workforce, or skill sets. Three years since the 9/11 and anthrax attacks, studies validate the woefully constrained progress the public health system has achieved in its terrorism preparedness. To adequately protect civilian populations in the times ahead, we must determine, as a nation, the requirements and capabilities of a 21st-century public health system. These decisions cannot be informed solely from the local or state levels; it is clear that the protection of populations is a grave national concern.

These extraordinary times and unique challenges present the United States with a momentous opportunity to rebuild structures, organizations, and concepts of operations. In protecting this great country from formidable threats, there should be few constraints on multidimensional thinking, creativity, and sense of purpose to impede our leadership. The government that, over the past decade, has undertaken to “change welfare as we know it” and has merged 22 agencies into a new federal department should not be limited by failures of imagination in its efforts to create systems that will protect Americans from novel and potentially catastrophic threats.

In a May 2004 Atlantic Monthly article, former New York Times executive editor Howell Raines speaks of efforts to engage in a “revitalization strategy” within the newspaper’s culture. The New York Times, Raines notes remorsefully, “is a culture that requires mass allegiance to the idea that any change, no matter how beneficial on its surface, is to be treated as a potential danger.”215 This report will have succeeded if it has established the reasons why change is necessary and has successfully argued that these changes must occur without delay to protect Americans from threats that can have devastating ramifications on civil order, economic leadership, political processes, and human life. The task ahead is one of reconstructing public health and realizing capabilities that may have faded into the backdrop in previous years but are now necessary as new threats arise—emerging pathogens and weapons of terror.

## Appendix: Comparison of Workforce Education and Training

<table>
<thead>
<tr>
<th>Terminal Degree Required</th>
<th>Medical Doctor</th>
<th>Registered Nurse</th>
<th>Firefighter</th>
<th>Public Health Workforce</th>
<th>Police</th>
<th>Military</th>
<th>EMT/Paramedic</th>
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<tr>
<td>Undergraduate degree with pre-medical curriculum, 4 years at one of the LCME-accredited U.S. medical schools or colleges of osteopathic medicine.</td>
<td>MD or DO from accredited institution.</td>
<td>BS degree in nursing; associate degree in nursing; or a hospital diploma.</td>
<td>High school diploma or GED.</td>
<td>None.</td>
<td>High school diploma or GED.</td>
<td>High school diploma or GED.</td>
<td>None.</td>
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<tr>
<td>Basic Training</td>
<td>Registered nurses must complete a BS degree in nursing program, a 2- to 3-year associate degree in nursing program, or a 3-year hospital training program, receiving a hospital diploma.</td>
<td>Common training standards include training courses in both basic firefighting and what has come to be considered “first responder” roles. These courses include dealing with potentially hazardous materials, operating in hazardous environments, and basic medical training.</td>
<td>None.</td>
<td>Police officers have no nationally standardized curriculum regime. However, recurring state and local standards include 60 hours of college credit at a 2.0 or higher grade point average; 2 years’ active-duty military service with honorable discharge; or 2 years’ continuous, full-time law enforcement service and eligibility for rehire from previous agencies.</td>
<td>To serve in the U.S. military, candidates must participate in and pass an armed services vocational aptitude minimum battery, a 9-week basic training program, and a variable-length “advanced-initial” occupational training program meant to prepare individuals for the roles they are expected to fill.</td>
<td>Training is offered at progressive levels: EMT-Basic, also known as EMT-1; EMT-Intermediate, or EMT-2 and EMT-3; and EMT-paramedic, or EMT-4. EMT-1 represents the first level of skills required to work in the emergency medical system. Coursework typically emphasizes emergency skills such as managing respiratory, trauma, and cardiac emergencies and patient assessment.</td>
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<tr>
<td>Specialty Training</td>
<td>In addition, candidates must possess 3 to 7 years or more, depending on specialty, of professional residency training under senior physician educators and 1 to 3 years of optional fellowship training in a subspecialty.</td>
<td>Nursing specialties, advanced practice nursing.</td>
<td>Optional.</td>
<td>Specialty training programs are available and required for officers to perform specific job duties (tactical squads, SWAT teams, narcotics task forces, emergency response teams).</td>
<td>None.</td>
<td>Specialty training is required to reach EMT-4. Candidates are required to attend around 1,400 hours in curriculum training. Training imparts skills to provide pre-hospital care to emergency patients in an out-of-hospital setting (administering drugs intravenously, interpreting EKGs, and using manual defibrillators).</td>
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<td>Continued Education</td>
<td>Physicians continue to receive credits or continuing medical education, and some states and hospital staff organizations require a certain number of continuing medical education credits per year to ensure that the doctor’s knowledge and skills remain current.</td>
<td>Nurses are required to have continuing education to maintain state licenses.</td>
<td>Emphasis on physical training and endurance.</td>
<td>Continued training available (but not required) through distance learning such as webcast and satellite down-links presented by the Public Health Practice Program Office of CDC.</td>
<td>Continued training available (but not required) through organizations like “Police Corps.”</td>
<td>Continued training in one’s occupational field is a requirement for all enlisted personnel in the U.S. armed forces.</td>
<td>To maintain employment, EMTs and paramedics must reregister, usually every 2 years. To re-register, an individual must be working as an EMT or paramedic and meet a continuing education requirement.</td>
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<tr>
<td>Continued Education and Training Required for Advancement</td>
<td>Medical Doctor$^1$</td>
<td>Registered Nurse$^2$</td>
<td>Firefighter$^3$</td>
<td>Public Health Workforce$^4$</td>
<td>Police$^5$</td>
<td>Military$^6$</td>
<td>EMT/Paramedic$^7$</td>
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<tr>
<td>None.</td>
<td>None.</td>
<td>Most departments require continued education for advancement within the department.</td>
<td>None.</td>
<td>Varies by state and locality. Through police department academies, regional centers for public safety employees established by the states, and federal agency training centers, instructors provide annual training in self-defense tactics, firearms, use-of-force policies, sensitivity and communications skills, crowd-control techniques, relevant legal developments, and advances in law enforcement equipment.</td>
<td>None.</td>
<td>Promotion and increase of rank are based primarily on demonstrated skills and time enlisted. However, to assume higher rank, there are specific training requirements. Additionally, candidates must pass through a &quot;senior phase&quot; in which they are expected to master fundamentals of the Uniform Code of Military Justice, ethics, administration, and leadership.</td>
<td>Training commonly includes 35 to 55 hours of additional instruction beyond EMT-1. The Paramedic Technology program usually lasts up to 2 years and results in an associate degree in applied science. Such education prepares the graduate to take the NREMT examination and become certified as an EMT-4. Extensive related coursework and clinical and field experience are required.</td>
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<tr>
<td>Legally Recognized Oath, License, or Certification</td>
<td>Following undergraduate, medical school and graduate medical education, a physician must obtain a license to practice medicine from a state or jurisdiction of the United States by completing a series of exams and applying for the permanent license.</td>
<td>All registered nurses must pass a state licensing exam.</td>
<td>Official Firefighter’s Oath of Service.</td>
<td>Public Health Officers (not the general public health workforce) in New Jersey and Michigan require a license.</td>
<td>Police officers are sworn to uphold the law. The specific oath varies but is consistently present.</td>
<td>Military personnel are sworn to uphold the constitution of the United States and to protect the nation from threats.</td>
<td>Formal training and certification are needed to become an EMT or paramedic. All 50 states possess a certification procedure.</td>
</tr>
</tbody>
</table>

$^1$ All information in this column comes from the American Medical Association; [http://www.ama-assn.org/ama/pub/category/2320.html](http://www.ama-assn.org/ama/pub/category/2320.html).

$^2$ All information in this column comes from the American Association of Colleges of Nursing at [http://www.aacn.nche.edu/education/Career.htm](http://www.aacn.nche.edu/education/Career.htm).


$^4$ This excludes the small percentage of licensed physicians (3%), nurses (25%), laboratorians (7%), and environmental health specialists (10%) who make up the public health workforce. Kristine Gebbie, The Public Health Workforce: Enumeration 2000, Health Resources and Services Administration, December 2000.

$^5$ Information in this column comes from the Houston Police Department Hiring Standards at [http://www.houstonisd.org/vgn/images/portal/cit_23015118/25823578258235784110_C.doc](http://www.houstonisd.org/vgn/images/portal/cit_23015118/25823578258235784110_C.doc), the Wisconsin Department of Transportation, and the Rescue House Center for Emergency Responders.


$^7$ Information in this column comes from the Rescue House Center for Emergency Responders and the Pennsylvania Search and Rescue Council at [http://www.psarc.org/standards.html](http://www.psarc.org/standards.html).
Bibliography


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