

Public health preparedness and response in the USA since 9/11: a national health security imperative

Ali S Khan

The condition upon which God hath given liberty to man is eternal vigilance.

John Philpot Curran (1790)

The terrorist attacks on Sept 11, 2001 (9/11) uncovered weaknesses in the US national public health infrastructure. Response efforts did not have the integrated communications and unified command needed for a large-scale response, and information crucial for decision making was not shared among agencies.¹ First responders were poorly trained and equipment for their roles was inadequate; according to the Centers for Disease Control and Prevention (CDC), high rates of respiratory illness in rescue workers in New York City 1 year after the attacks could be linked to inadequate use of personal protective equipment.²

The anthrax attacks, which were the first domestic occurrences of bioterrorism, exposed additional deficiencies in local, state, and federal responses. Communication during the events was difficult because not only did local, state, and federal health officials have to be kept informed, but also all case investigations had to be coordinated with agents from the Federal Bureau of Investigation (FBI), who had their own independent legal authorities. The attacks emphasised national vulnerability to the use of weapons of mass destruction and made public health a new subject of security discussions. This led to the emergence of health security as a new legislative focus, as Congress recognized the need to expand the resiliency of the public health system to respond to national security threats. The Pandemic and All-Hazards Preparedness Act (PAHPA) of 2006 specifically includes health security. PAHPA broadened the previous focus on bioterrorism to a more comprehensive, all-hazards approach that acknowledged the growing concern of emerging or reemerging infectious diseases and natural disasters, in addition to intentional threats from chemical, nuclear, or radiological incidents. In turn, the US Department of Health and Human Services released its National Health Security Strategy.

The 2001 terrorist attacks underscored the importance of the minor investments made in public health preparedness in the last decades of the 20th century. These investments were made largely in response to a growing awareness of the emergence and re-emergence of infectious diseases and to reports of an extensive Soviet bioweapons programme.^{3,4} New funding resources for infectious diseases led to improvements in epidemiological capacity at the state and local levels, a core national stockpile of medical assets, and a novel laboratory diagnostic network for bioterrorism agents. Since 9/11, the US public health system has received unprecedented national investments in recognition of its importance to the national security. These investments have resulted in increased capacity that is most evident in well populated states and large urban areas where new resources were mostly directed. The terrorist attacks also led to a cultural shift in the way state and large city health departments work and interact with other agencies and sectors. Health departments are now becoming increasingly accepted as equal partners by traditional first responders, such as law enforcement agencies, fire departments, and emergency medical services. These interactions are supported by the incorporation of public health components into the National Response Framework and the National Incident Management System. Public health bodies at the local, state, and federal levels now routinely use this system to ensure that everyone has the same focus, whether responding to daily incidents or major disasters.

Further substantial investments were made in state and local preparedness and response infrastructure, planning, and capability development for routine outbreaks and to help ensure health security in the event of large disasters or epidemics. The US Department of Health and Human Services established several additional resources, including deployable teams from the US Public Health Service that can rapidly assist in a response to a public health emergency. The National Disaster Medical System expanded its mission to include medical treatment for victims of terrorist attacks. Sustained efforts to leverage technology in advanced research and development of countermeasures to increase protection from radiological or nuclear, chemical, and biological agents have improved diagnostic tests and led to new vaccines and antitoxins for smallpox and botulism, and drugs for anthrax, smallpox, and influenza.

CDC's Strategic National Stockpile increased its core formulary to support the prophylaxis of more than 50 million people to prevent anthrax, plague, or tularaemia, and acquired enough smallpox vaccine to immunise every person in the USA. The Stockpile also started the forward placement of lifesaving antidotes for terrorist attacks with chemical or nerve agents (the CHEMPACK programme⁵). The mission of the Laboratory Response Network has expanded from biological and chemical agents to include emerging infectious diseases and other public health threats and emergencies, and from US borders to

international partnerships with Mexico, Canada, the UK, and others. After 9/11, the US Congress passed the USA PATRIOT Act of 2001⁶ and the Bioterrorism Act of 2002,⁷ which substantially strengthened the ability of the USA to oversee select agents and toxins that could pose public health threats. A recent Presidential Executive Order⁸ stipulated that the list of select agents will be adjusted to focus on agents of greatest concern. Several US Government programmes (eg, CDC's Global Disease Detection, Department of Defense's Biological Threat Reduction Program, Department of State's Global Threat Reduction Programs, and USAID's Emerging Pandemic Threats Program) have also been involved in enhancing worldwide capacity to rapidly detect and contain emerging health (and bioterror) threats. These programmes increasingly focus on the development of local health capacity to support WHO's revised international health regulations in conjunction with other worldwide and native efforts directed at epidemic preparedness and response.⁹

Although preparedness and response capabilities for public health emergencies have been difficult to define and measure¹⁰ (a task that CDC continues to address¹¹), reports from CDC and organisations such as the Trust for America's Health have documented substantial improvements.^{12,13} These reports show that public health departments are now better equipped to identify health threats rapidly and have improved their abilities to respond effectively to and communicate emergencies. For example, 48 of 50 states (96%) have shown their ability to activate staff and their emergency operations centres. Similarly, the medical response to a public health emergency has been strengthened.¹⁴ Progress in preparedness made in the past decade

Panel 1: Progress in public health preparedness, 1999–2011	
Then	Now
• Before 1999, CDC did not fund states for public health preparedness.	• After the 2001 attacks, the US Congress appropriated funding for CDC to provide to all states to improve their preparedness and response capabilities.
• Before 1999, no national stockpile of medical supplies was available for use in emergencies. In 2001, few states had written plans for receiving, distributing, and dispensing stockpiled assets from CDC's Strategic National Stockpile.	• CDC's Strategic National Stockpile ensures the availability of key medical supplies. 100% of states have plans to receive, distribute, and dispense these assets.
• In 2001, state and local response efforts were coordinated from an ad-hoc CDC emergency operations centre.	• Response activities are coordinated through a state-of-the-art emergency operations centre at CDC and centres at almost all state public health departments, and roles and responsibilities are defined for many agencies and jurisdictions.
• In 2001, response efforts had few integrated communications and unified command needed for a large-scale response.	• Public health departments in every state have established relations and done exercises with emergency management and other key players.
• Before 2000, no secure system was available to share information about emerging health threats.	• CDC's Epidemic Information Exchange (Epi-X) provides a secure, web-based communication system for sharing of preliminary health surveillance information.
• Before 2001, no requirements existed in the USA for licensing, registering, or identifying bodies working with select agents and toxins.	• The USA issued Select Agent Regulations to enhance oversight of the safety and security of select agents and toxins and minimise inherent risks.
• Before 1999, CDC did all tests to detect and confirm the presence of biological threat agents, such as anthrax.	• More than 150 laboratories in the USA belong to CDC's Laboratory Response Network and can test for biological agents.

has benefited routine and large scale or unexpected responses, therefore saving lives and preventing illness and injuries.¹⁵ Annual investments through CDC's Public Health Emergency Preparedness cooperative agreement with states support crucial everyday systems. These investments support more than 5000 front-line public health workers who routinely assist local and regional responses for incidents 24 h per day 7 days per week, such as outbreaks of foodborne and infectious diseases, and regional environmental disasters, such as wildfires, floods, and ice storms.

Federal investments in public health infrastructure have effectively supported several large-scale responses, the most recent being for H1N1 pandemic influenza (2009). Within 2 weeks of a novel virus being identified and confirmed, CDC validated a new PCR assay for rapid definitive laboratory diagnosis, manufactured new diagnostic kits, and began distributing them to partner laboratories in the USA and abroad in support of WHO. This response not only led to rapid selection and development of the vaccine strain, which is still used, but also confirmed early cases in field investigations for rapid characterisation of the geographical spread of the virus, and the patient groups at highest risk of illness complications. Additionally, about 90% of member laboratories in the Laboratory Response Network were mobilised for the 2009 H1N1 influenza pandemic (including key partner laboratories in the Department of Defense), and CDC's Strategic National Stockpile deployed 25% of its antiviral drugs and personal protective equipment within planned timelines.

The effectiveness of responses are judged by accurate communications of emerging health threats in addition to response and health outcomes. CDC's secure, web-based Epidemic Information Exchange (Epi-X) allows state and local public health officials to access and share health surveillance information about such events as illnesses associated with a case of human bubonic plague (2010), reports about airline travellers potentially exposed to communicable disease (2010), and the recreational use of designer drugs that were components of items marketed as bath salts (2011). In April 2009, Epi-X reported cases of acute

Network (HAN) is another important system of communication for sending messages to health professionals and the public (including media). HAN alerts have featured guidance about use of influenza antiviral agents during the 2010–11 season, and updates for detection of increased levels of radioactive material in the USA caused by the 2011 Japanese Fukushima nuclear incident.

The US Government is increasingly recognising that preparedness and core (routine) investments in public health are synergistic. Large-scale and unpredictable natural, accidental, or intentionally caused disease outbreaks and environmental disasters need many of the same routine surveillance, laboratory, risk communication, and other core public health systems. The flexibility of the Laboratory Response Network shown during the anthrax attacks, for example, has also played a key part in validating BioWatch results, and for responses ranging from severe acute respiratory syndrome (SARS), monkeypox, West Nile virus, and H5N1, to investigations for ricin and saxitoxin poisonings and numerous exposures to mercury. Individuals, families, and communities are also essential partners in building resilience to public health hazards. Development of informed empowered individuals and communities (a cornerstone of the whole-of-nation policy approach¹⁶) demands new actions and investment in many sectors to transform the populace from victims to potential responders. Prepared communities understand potential risks and their roles before, during, and after an adverse incident. These communities also have members who are engaged in local decision making, are prepared to take action during an incident, and are committed to their personal preparedness to protect their own health and that of their neighbours until help arrives. A continued public health focus on building healthy communities can also have ancillary benefits to improve preparedness because healthy people are more resilient to health threats.

Although the USA is better prepared to prevent, rapidly respond to, and recover from public health emergencies than it was a decade ago, much more work still needs to be done. Of increased concern are natural emerging infectious diseases caused by novel zoonotic pathogens with pandemic potential like SARS, or known pathogens, such as another pandemic influenza virus. A main driver for this convergence is the volume and speed of human travel across the world, which provides infectious agents with unprecedented opportunities for broad geographical reach and new populations of human and animal hosts. Furthermore, technological barriers are continually being overcome for development of modified versions of microbes with new or enhanced virulence traits or even completely new life forms, which can all inflict great harm. The genomes of thousands of microbes have been sequenced and their blueprints are available for rapid sharing across the internet along with instructions for development of chemical agents. These and other types of advanced technologies are becoming increasingly accessible and easy to use by less-skilled individuals. In 2009, President Obama signed an Executive Order¹⁷ to bridge gaps in the ability of the USA to respond rapidly to a biological attack, and CDC has created an Anthrax Management Team to develop guidelines for preparing for and responding to this threat. In view of its unique biochemical properties and clinical effects, anthrax is the most concerning biological agent to the USA.

Another major challenge is the continuing economic crisis and its effect on health departments. From 2008 to 2010, more than 44 000 jobs were lost in state and local health departments, and health workers such as public health physicians and nurses, laboratory specialists, and epidemiologists were reduced.¹⁸ Thus, states must grapple with continued declines in funding levels that have already affected the ability of the public health system to respond effectively to routine and major public health incidents, especially when an increased investment was needed to protect the nation uniformly and address substantial gaps. A 2009 survey¹⁹ found that only 37 state epidemiologists reported substantial-to-full capacity for bioterrorism emergency response—a 10% decline since the peak of federal funding in 2004. Similarly, advances in laboratory reporting are tempered by the reality that in 2010, 12 (24%) states could not submit 90% of *Escherichia coli* test results to CDC's PulseNet database within 4 working days, compromising rapid identification of outbreaks and subsequent recalls.¹² States cannot adequately meet everyday needs, let alone increase efforts for emergency incidents that have potential national implications, without reliable, dedicated, or sustained federal funding. Because all responses are initially local, this limitation is the primary vulnerability to national preparedness.

Determination of appropriate priorities for public health preparedness for state and local health departments is also a key challenge, as is measurement of preparedness. 10 years ago, recommendations indicated that necessary investments be made to ensure optimum local, state, and national preparedness in the context of a defined set of standards for recognition of diseases and bioterrorist activities.²⁰ CDC continues to work to have a better definition of what it means to be prepared for all hazards, and to develop and implement standardised measures to assess progress. For the first time, in spring 2011, CDC released national standards¹¹ for preparedness to guide state and local health departments in assessing needs, building 15 capabilities, measuring outcomes, and directing preparedness funds to priority areas.

Lessons can be learned from other national efforts for pandemic influenza preparedness, both in the benefits of preparedness and in the existing shortfalls. Many national self assessments document their improved H1N1 response because of their preparedness activities, and Israel presents a model of civilian-defence partnership.^{21,22} However, despite years of preparation, communities worldwide were still challenged by shortcomings in communication; access to reliable information; access to quality care; health-care worker skills, quality, density, and distribution; access to essential medicines; and poor organisational infrastructure for emergency response.²³ After the H1N1 pandemic, WHO asserted that “the world is ill-prepared to respond to a severe influenza pandemic or to any similarly global, sustained, and threatening public-health emergency.”²⁴

For the next decade, specific issues in public health preparedness should be further addressed (Panel 2). Public health threats increasingly have substantial potential for political, economic, and social influence. To ensure health security in the USA and worldwide—a crucial component of a nation's overall national security—and cumulatively our global health security, new commitments from the national to the local level are needed.

Panel 2: Issues to be addressed in public health preparedness within the next decade

- Increase the focus on communities and better define and enhance community and local resilience and personal preparedness
- Ensure a robust state, territorial, local, and tribal public health infrastructure with a special focus on biosurveillance to ensure accurate and complete data collection and analysis enabled by electronic medical and laboratory records, and new data fusion and visualisation devices
- Increase the focus on vulnerable populations that need additional assistance in emergencies, including mental and behavioural health needs
- Leverage the full range of investments in crucial infrastructure made across the US federal enterprise, including the Department of Homeland Security
- Improve coordination of public health, health care, emergency medical services, and the private sector
- Improve linkages between domestic health security and global health security
- Improve the evidence base for preparedness activities, including measurement

Conflicts of interest

I am Director of the Office of Public Health Preparedness and Response at the Centers for Disease Control and Prevention. I declare that I have no conflicts of interest.

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