

**A Survey of Biological Terrorism and  
America's Domestic Preparedness Program**

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**ESDP-2001-06  
BCSIA-2001-11**

**September 2001**

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This paper may be cited as Gregory D. Koblentz. "A Survey of Biological Terrorism and America's Domestic Preparedness Program." BCSIA Discussion Paper 2001-11, ESDP Discussion Paper ESDP-2001-06, John F. Kennedy School of Government, Harvard University, September 2001.

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*The Executive Session on Domestic Preparedness is supported by Grant No. 1999-MU-CX-0008 awarded by the Office for State and Local Domestic Preparedness Support, Office of Justice Programs, U.S. Department of Justice. The Assistant Attorney General, Office of Justice Programs, coordinates the activities of the following program offices and bureaus: the Bureau of Justice Assistance, the Bureau of Justice Statistics, the National Institute of Justice, the Office of Juvenile Justice and Delinquency Prevention, and the Office for Victims of Crime. Points of view or opinions in this document are those of the author and do not necessarily represent the official position or policies of the U.S. Department of Justice.*

## INTRODUCTION

Since 1996, the federal government has been engaged in a large-scale effort to prepare for a potential terrorist attack in the United States with a weapon of mass destruction (WMD).<sup>1</sup> The threat of terrorists employing biological weapons has been a source of great concern to officials involved in domestic preparedness activities. A 1996 survey by the National Governor's Association found that states were not prepared to deal with the threat of biological weapons.<sup>2</sup> A July 1999 National Guard Bureau report to Congress concluded that, there is insufficient capability to determine that a biological attack has occurred, make timely identification of biological agents, provide treatment to mass casualties, and contain the event. In sum, the United States is ill prepared to respond to attacks involving biological agents."<sup>3</sup> According to the Department of Justice's *Five-Year Interagency Counterterrorism and Technology Crime Plan*, "By far, our greatest deficiency in regard to WMD lies in our limited capability to detect, prevent and respond to the use of biological agents."<sup>4</sup>

Concern about the use of biological weapons by terrorists was driven in part by reports that Aum Shinrikyo, the Japanese cult responsible for the nerve gas attack in the Tokyo subway system in 1995, had also developed biological weapons. The group was reported to have disseminated, without success, anthrax and botulinum toxin and to have experimented with Q fever and Ebola.<sup>5</sup> Aum Shinrikyo, it was feared, had broken a long-standing

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<sup>1</sup> For details about these efforts, see Gregory Koblenz, "Overview of Federal Programs to Enhance State and Local Capability to Respond to WMD Terrorism," ESDP Discussion Paper ESDP-2001-03, John F. Kennedy School of Government, Harvard University, April 2001.

<sup>2</sup> National Governors Association, "Terrorism: Is America Prepared?" issue brief, February 2, 1997. <http://www.nga.org/Pubs/IssueBriefs/1997/970202terrorism.asp>

<sup>3</sup> National Guard Bureau, *Report to Congress: Enhancing the National Guard's Readiness to Support Emergency Responders in Domestic Chemical and Biological Terrorism Defense* (Washington, DC: Government Printing Office, 1999), pp. 17-18.

<http://www.ngb.dtic.mil/wmd/report/reportcover.htm>

<sup>4</sup> Department of Justice, *Five-Year Interagency Counterterrorism and Technology Crime Plan*, unclassified edition, (Washington, DC: Government Printing Office, 1999), p. 36.

<sup>5</sup> For an early assessment of Aum's biological weapons program, see John Sopko and Alan Edelman, "Global Proliferation of Weapons of Mass Destruction: Study on the Aum Shinrikyo," staff statement in Senate Committee on Governmental Reform, Permanent Subcommittee on Investigations, *Global Proliferation of Weapons of Mass Destruction, Part I* (Washington, DC: Government Printing Office, 1996), pp. 63-64.

Subsequent reports indicate that Aum was less successful than initially believed in cultivating pathogenic organisms. Aum apparently failed to produce a lethal strain of botulinum toxin and had access to only a harmless vaccine strain of anthrax. There is no evidence Aum obtained strains of either Q fever or Ebola. See Milton Leitenberg, "Aum Shinrikyo's Effort to Produce Biological Weapons: A Case Study of the Serial Propagation of Misinformation," *Terrorism and Political Violence*, vol. 11, no. 4, pp. 149-158; Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction, *First Annual Report to the President and the Congress: Assessing the Threat*, (Washington, DC: Government Printing Office, 1999), pp. 48-51.

taboo among terrorist groups and was the harbinger of other nonstate actors interested in causing mass casualties and capable of acquiring nuclear, biological, and chemical weapons. The rise of these groups, coupled with major domestic terrorist attacks in the United States, raised the specter of a WMD attack occurring on U.S. soil.<sup>6</sup>

The proliferation of biological weapons and the ties that many of the states with biological weapons programs had with international terrorist groups also contributed to the perceived increase in the threat posed by biological terrorism. In the 1990s, the problem of biological weapons proliferation was highlighted by revelations about the Iraqi and former Soviet offensive biological weapons programs and intelligence that indicated that at least ten other nations were pursuing offensive biological warfare programs.<sup>7</sup> The vigor with which Iraq and the former Soviet Union pursued biological weapons belied the conventional wisdom that had prevailed since the early 1970s that these weapons were of limited military utility. The economic chaos in Russia since the breakup of the Soviet Union has also intensified fears that scientists from the now defunct Soviet biological weapons program would work for other nations attempting to develop these weapons.<sup>8</sup> Six of the seven nations on the State Department's list of state sponsors of terrorism are believed to have or be developing biological weapons.<sup>9</sup>

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<sup>6</sup> The emerging trend in terrorist interest in causing mass casualties and employing WMDs is described in Richard Falkenrath, Robert Newman, and Bradley Thayer, *America's Achilles' Heel: Nuclear, Biological and Chemical Terrorism and Covert Attack* (Cambridge, MA: MIT Press, 1998); Jessica Stern, *The Ultimate Terrorists* (Cambridge, MA: Harvard University Press, 1999); *Terrorism with Chemical and Biological Weapons: Calibrating Risks and Responses* ed. Brad Roberts (Alexandria, VA: Chemical and Biological Arms Control Institute, 1997).

<sup>7</sup> For details about the Soviet Union's biological warfare program, see Ken Alibek with Stephen Handelman, *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World* (New York: Random House, 1999).

The best summary of what is known about the Iraqi biological weapons program is United Nations Security Council Document S/1999/94, Annex C: Status of the Verification of Iraq's Biological Warfare Programme, January 25, 1999.

[www.un.org/Depts/unscom/s99-94.htm](http://www.un.org/Depts/unscom/s99-94.htm)

For assessments of the extent of the proliferation of biological weapons, see General Accounting Office, *U.S. and International Efforts to Ban Biological Weapons*, GAO/NSIAD-93-113, (Washington, DC: Government Printing Office, 1992),

p. 3 and unclassified statement for the record by Special Assistant to the DCI for Nonproliferation John A. Lauder on the Worldwide WMD Threat to the Commission to Assess the Organization of the Federal Government to Combat the Proliferation of Weapons of Mass Destruction, April 29, 1999. [http://www.cia.gov/cia/public\\_affairs/speeches/archives/1999/lauder\\_speech\\_042999.html](http://www.cia.gov/cia/public_affairs/speeches/archives/1999/lauder_speech_042999.html)

<sup>8</sup> Jonathan B. Tucker and Kathleen M. Vogel, "Preventing the Proliferation of Chemical and Biological Weapon Materials and Know-How," *The Nonproliferation Review* (Spring 2000).

<sup>9</sup> The seven nations are Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria. Department of State, *Patterns of Global Terrorism 1999*, (Washington, DC: Government Printing Office, 2000). <http://www.state.gov/www/global/terrorism/1999report/1999index.html>.

For information on the biological weapons programs of Iran, Iraq, Libya, North Korea, Sudan and Syria, see Department of Defense, *Proliferation: Threat and Response* (Washington, DC: Government Printing

The United States' clear superiority in conventional weapons, demonstrated repeatedly in the 1990s, has led to an expectation that a future enemy may seek to avoid a direct confrontation on the battlefield and instead rely on the covert use of a nuclear, biological, or chemical weapon against U.S. forces or civilian targets in the United States.<sup>10</sup> Biological weapons, cheaper and easier to produce than nuclear weapons and more lethal than chemical weapons, are now perceived as the weapon of choice for both states and nonstate actors seeking to inflict maximum damage while minimizing the risk of detection and retaliation.

This paper examines America's preparedness for an act of biological terrorism and the current status of efforts by the federal government to improve national, state, and local capabilities to recognize and respond to such an attack.<sup>11</sup> The first section provides an overview of bioterrorism and the ways in which preparing for and responding to bioterrorism differs from that of other forms of terrorism. The second section describes current programs underway in the United States to prepare for and respond to biological terrorism. In an address to the National Academy of Sciences, D. A. Henderson, head of the Center for Civilian Biodefense Studies at Johns Hopkins University, stated that it is "near impossible to summarize succinctly the status of what is best characterized as a miscellaneous array of fragmented, poorly coordinated initiatives."<sup>12</sup> Nonetheless, that is exactly what this paper attempts to do. The final section concludes with some observations on areas of preparedness that require additional attention.

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Office, 1997) and Central Intelligence Agency, *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July through 31 December 1999*, (Washington, DC: Government Printing Office, 2000).

<http://www.state.gov/www/global/terrorism/1999report/1999index.html>.

<sup>10</sup> Department of Defense, *Proliferation: Threat and Response*, p. iii.

<sup>11</sup> Although biological agents can also be used to attack crops and livestock, this report focuses solely on biological terrorism aimed at humans. For in-depth treatments of the former subject, see Thomas Frazier and Drew Richardson, "Food and Agriculture Security: Guarding against Natural Threats and Terrorist Attacks Affecting Health, National Food Supplies, and Agricultural Economics," *Annals of the New York Academy of Sciences*, vol. 894 (1999) and Anne Kohlen, *Responding to the Threat of Agroterrorism: Specific Recommendations for the United States Department of Agriculture*, ESDP Discussion Paper ESDP-2000-04, John F. Kennedy School of Government, Harvard University, October 2000.

<sup>12</sup> D. A. Henderson, "US Response to Possible Bioterrorism," address to National Academy of Sciences, May 2, 2000.

<http://www.hopkins-biodefense.org/pages/events/speeches.html>

## OVERVIEW OF BIOLOGICAL TERRORISM

Biological terrorism can take many forms. The spectrum of potential scenarios ranges from localized food contamination with a common bacteria to the dissemination of anthrax or plague in a subway station to the infection of an airplane full of people with smallpox. Scientists at the Centers for Disease Control and Prevention have estimated that a bioterrorism attack that exposed 100,000 people to tularemia could cause 6,000 fatalities and have an economic impact of almost \$4 billion. If anthrax were used instead, fatalities and costs would increase fivefold.<sup>13</sup> For planning purposes, the Federal Emergency Management Agency (FEMA) uses a scenario in which 4,000 people are exposed to 100 grams of anthrax, resulting in 3,000 cases of pulmonary anthrax within two to five days.<sup>14</sup> Appendix A presents additional estimates of the effects of a bioterrorist attack, on a large indoor arena and a city the size of Boston. This section provides an overview of biological terrorism. The first part describes likely agents, production and delivery methods, targets, and bioterrorism scenarios. The second part examines how a covert attack may unfold and the challenges it would present to local, state and federal responders. The section concludes with a summary of the implications for preparing for and responding to an act of biological terrorism.

### Agents, Delivery Methods, Targets, Scenarios

#### Biological Agents

Roughly a dozen microorganisms, mainly bacteria, viruses, and toxins, are viewed as likely candidates for use in biological warfare or biological terrorism (see Table 1). Once bacteria and viruses have infected a host, they begin to multiply rapidly, thus enabling a relatively small dosage to result in the death or debilitation of the host within days, weeks, or months. Biological toxins, in contrast, do not replicate in the body so the exposure dose itself is what causes the illness. However, toxins are extraordinarily lethal, the most potent being 100,000 times more toxic than sarin. Toxins can be thought of as chemicals that are produced by living things: animals (venom from snakes), plants (ricin from castor beans) or microorganisms (botulinum toxin produced by the bacteria *Clostridium botulinum*). The agents listed in bold in Table 1 are those designated by the CDC as “critical agents” because of the ease with which they can be disseminated or transmitted from person to person, their lethality, their potential to cause public panic, and the degree of special preparations that must be made by

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<sup>13</sup> Arnold Kaufmann, Martin Meltzer, and George Schmid, “The Economic Impact of a Bioterrorist Attack: Are Prevention and Postattack Intervention Programs Justifiable?” *Emerging Infectious Diseases*, vol. 3, (April-June 1997).

the public health and medical communities to diagnose the agent and treat infected individuals.<sup>15</sup> In general, these agents can cause moderate (30%) to very high (90-100%) fatality rates if treatment is not provided in a timely fashion or if there is no treatment available once a person begins to show symptoms. Thus, these agents require early diagnosis for medical intervention to be successful. It should be noted, however, that this list does not encompass the full range of naturally occurring pathogens and toxins that have been weaponized by state-sponsored biological weapons programs. In addition, it is possible to create new strains of existing agents to enhance their virulence or resistance to antibiotics. To date, the only confirmed act of biological terrorism in the United States utilized the organism *Salmonella enterica* serotype Typhimurium, a common cause of food poisoning.<sup>16</sup>

See Appendix B for a list of the CDC-designated critical agents and Appendix C for more information on the characteristics of some of these agents.

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<sup>14</sup> Federal Emergency Management Agency, *Consequence Management for NBC Terrorism: A Status Report to the President*, (Washington, DC: Government Printing Office, 1996), pp. B-5, B-6.

<sup>15</sup> “CDC Ranks Bioagents in Terms of Public Health Threat,” *Biodefense Quarterly* (September 1999), p. 3; CDC, “Biological and Chemical Terrorism: Strategic Plan for Preparedness and Response,” *Morbidity and Mortality Weekly Report* (April 21, 2000), p. 5.

<sup>16</sup> Thomas Tojork et al., “A Large Community Outbreak of Salmonellosis Caused by Intentional Contamination of Restaurant Salad Bars,” in *Biological Weapons: Limiting the Threat*, ed. Joshua Lederberg pp. 167-184; W.

**TABLE 1. BIOLOGICAL AGENTS OF CONCERN**

TYPE	BIOLOGICAL AGENT	DISEASE	LETHALITY	POSTSYMPTOMATIC TREATMENT?
BACTERIA	<i>Bacillus anthracis</i>	Anthrax	Very High	No
	<i>Yersinia pestis</i>	Plague	Very High	Yes within 24 hours
	<i>Francisella tularensis</i>	Tularemia	Moderate	Yes
	<i>Vibrio cholerae</i>	Cholera	Moderate	Yes
	<i>Brucella</i>	Brucellosis	Very Low	Yes
RICKETTSIA	<i>Coxiella burnetti</i>	Q Fever	Very Low	Yes
VIRUS	<i>Variola major</i>	Smallpox	Moderate	No
	Alphaviruses	Encephalitis	Low-High	No
	Filoviruses and arenaviruses (Ebola, Marburg, Lassa)	Hemorrhagic Fever	Low-High	Some Yes/Most No
TOXIN	<i>Clostridium botulinum toxin</i>	Botulism	High	Respiratory support only
	<i>Staphylococcus enterotoxin B (SEB)</i>	Toxic syndrome	Very Low	No

Sources: David Franz et al. "Clinical Recognition and Management of Patients Exposed to Biological Warfare Agents," *Journal of the American Medical Association*, vol. 278, no. 5 (August 6, 1997); *Handbook on Medical Management of Biological Casualties* (Frederick, MD: U.S. Army Medical Research Institute of Infectious Diseases, 1996).

### Production

The barriers to acquiring biological weapons are relatively low.<sup>17</sup> Information on agents, as well as production and dissemination techniques, is available from public sources. Seed stocks of agents can be obtained from the

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Seth Carus, "The Rajneeshes (1984)," in *Toxic Terror: Assessing the Use of Chemical and Biological Weapons*, ed. Jonathan Tucker (Cambridge, MA: MIT Press, 2000), pp. 116-137.

<sup>17</sup> This section is derived from Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, pp. 113-126.

environment, from commercial sources, or by theft from a government, university or private laboratory. In addition, production equipment is widely available, and the skills necessary for such production are not highly specialized. Production activities can be conducted safely with minimal precautions and are not likely to create a unique signature that can be identified by law enforcement agencies before a terrorist attack. In addition, the amount of biological agent required to cause mass casualties can be measured in tens to thousands of grams, reducing the size of the requisite production facilities and dissemination devices. In comparison, the amount of chemical agents required for a large-scale attack would be measured in tens to hundreds of kilograms and an improvised nuclear device would probably weigh more than 1,000 kilograms.

Biological agents can be produced in two versions: as a liquid slurry or as a dry powder. The slurry is easier to produce but is more difficult to disseminate than the dry version. In addition to their ease of dissemination, dry agents are typically more concentrated, and therefore more potent, than liquid agents.<sup>18</sup> The processing of the dry agent, however, presents additional safety problems to the would-be terrorist.<sup>19</sup>

### Dissemination

The weaponization and dissemination of a biological agent is the most significant challenge to a potential bioterrorist. The Aum Shinrikyo cult in Japan, even with hundreds of millions of dollars and well-educated scientists, failed on seven separate occasions to successfully aerosolize virulent strains of anthrax and botulinum toxin.<sup>20</sup> According to the General Accounting Office (GAO), “terrorists working outside a state-run laboratory infrastructure would have to overcome extraordinary challenges to effectively and successfully weaponize and deliver a biological agent and cause mass casualties.”<sup>21</sup> Unlike chemical agents such as mustard and VX, biological agents cannot be absorbed through the skin—they must enter the body through inhalation, ingestion, or cuts in the skin. The most effective means of infecting a large number of people is to create an aerosol of respirable particles in the 1-5 micron range.<sup>22</sup> Aerosols would be the preferred delivery method for biological

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<sup>18</sup> William Patrick quoted in “Bio-Terrorism: Policy, Technology, Nature of the Threat,” *The Officer*, (March 2000).

<sup>19</sup> William C. Patrick III, “Biological Warfare: An Overview,” in *Director’s Series on Proliferation*, ed. Kathleen Bailey, No. 4, UCRL-LE-114070-4 (May 1994), p. 4.

<sup>20</sup> David E. Kaplan, “Aum Shinrikyo (1995),” in *Toxic Terror: Assessing the Use of Chemical and Biological Weapons*, ed. Jonathan Tucker (Cambridge, MA: MIT Press, 2000), p. 221; W. Seth Carus, *Bioterrorism and Biocrimes: The Illicit Use of Biological Agents in the 20<sup>th</sup> Century* (Working Paper National Defense University, Washington, DC, July 1999), p. 56.

<sup>21</sup> GAO, *Combating Terrorism: Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks*, NSIAD-99-163, (Washington, DC: Government Printing Office, 1999), p.13.

<sup>22</sup> A micron is one-thousandth of a millimeter. A human hair has a diameter of about 50 microns.

agents since the infectious dose of most agents is generally lower if inhaled than if ingested and the lethality of agents such as anthrax and plague is significantly higher if the agent has been inhaled and deposited in the lungs. In addition, small-particle aerosols are able to stay airborne longer, thus increasing the potential area of infection.<sup>23</sup> Creating a respirable aerosol is difficult but can be accomplished with modifications to off-the-shelf equipment.<sup>24</sup>

A critical variable affecting the dissemination of biological agents is meteorology. Most microorganisms are fragile and thus are susceptible to environmental conditions such as ultraviolet radiation and humidity. Aerosols are also delicate creations and can be disrupted or rendered ineffective by very low or very high wind speeds, unstable atmospheric conditions, and urban terrain.<sup>25</sup> Moderate snow and rain will not affect a biological aerosol.<sup>26</sup> In general, the best times to disseminate biological aerosols to minimize the impact of meteorological degradation are at sunset, at night, or shortly before daybreak.<sup>27</sup> Thus, an open-air biological weapons attack would require extensive planning and access to accurate meteorological information for the target area. Releasing a biological agent in a confined space such as building or subway station eliminates these obstacles.

There are two main types of devices that terrorists could employ to disseminate a biological agent. Devices using explosive energy are the simplest but also the least efficient means to create an aerosol of properly-sized particles. An explosive device also provides an obvious indication of an attack, although the contents of the device may not be determined immediately. Devices employing gaseous energy are more efficient than explosive devices, are widely used in industrial and agricultural applications, and could even be built from scratch.<sup>28</sup>

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Particles smaller than 1 micron will be exhaled instead of being trapped in the lungs. Particles larger than 5 microns will not be able to penetrate past the upper respiratory tract.

<sup>23</sup> Leroy Fothergill, "The Biological Warfare Threat," in American Chemical Society, *Nonmilitary Defense: Chemical and Biological Defenses in Perspective*, Advances in Chemistry Series No. 26: American Chemical Society, (July 1960), p. 26.

<sup>24</sup> Department of Health and Human Services, *Proceedings of the Seminar on Responding to the Consequences of Chemical and Biological Terrorism*, (Washington, DC: Government Printing Office, 1995), pp. 1-63.

<sup>25</sup> Frederick Sidell, William Patrick, and Thomas Dashiell, *Jane's Chem-Bio Handbook* (Alexandria, VA: Jane's Information Group, 2000), pp. 237-239; Department of the Army, *Employment of Chemical and Biological Agents*, Field Manual 3-10 (Washington, DC: Government Printing Office, 1966), p. 44.

<sup>26</sup> Patrick, "Biological Warfare," p. 5.

<sup>27</sup> Fothergill, "The Biological Warfare Threat," p. 26; Patrick, "Biological Warfare," p. 5.

<sup>28</sup> William C. Patrick III, "Biological Terrorism and Aerosol Dissemination," *Politics and the Life Sciences* (September 1998), pp. 208-210; Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, pp. 119-123.

Contamination of food would be easier to accomplish, since sophisticated aerosolization devices would not be required, and could also infect a large number of people. In 1984, the Rajneesh cult in Oregon successfully infected at least 750 people by contaminating restaurant salad bars.<sup>29</sup> In contrast to popular beliefs, contamination of water supplies is not believed to be an effective method for infecting a large population.<sup>30</sup> Wells, service reservoirs, and water mains serving smaller populations could however be vulnerable.<sup>31</sup> It is also possible to use vectors such as mosquitoes, fleas, and ticks to spread disease.<sup>32</sup>

Biological weapons are uniquely suited for covert delivery. Given the small amount of a biological agent needed to infect a large population, the dissemination device for such an agent can be relatively compact. In addition, aerosols of biological weapons are tasteless, odorless, and invisible. Finally, the delayed time of onset for the diseases caused by these biological agents would enable terrorists who employed them in an attack to leave the affected region or even the country before the first victim even became symptomatic.

### Targets

Buildings and other confined spaces present an inviting target to a bioterrorist, since releasing an agent indoors reduces the unpredictable effects of the environment on an aerosolized agent, dissemination of an aerosol may be enhanced by a building's air circulation system, and even low concentrations of an agent in a confined space will infect a large number of people if they are exposed long enough.<sup>33</sup> Releasing an agent indoors would also bypass protective features such as positive pressure systems and filters on air vents designed to prevent contamination from the outside. Preventing a terrorist from smuggling a small amount of a biological agent and a dispersal device into a building would be extraordinarily difficult.<sup>34</sup>

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<sup>29</sup> Tojork, et al., "A Large Community Outbreak of Salmonellosis," p. 167.

<sup>30</sup> Carus, *Bioterrorism and Biocrimes*, p. 20; Falkenrath, Newman, and Thayer, *America's Achilles' Heel*, p. 120; Sidell, Patrick, and Dashiell, *Jane's Chem-Bio Handbook*, p. 242.

<sup>31</sup> Al Venter, "Poisoned Chalice Poses Problems: The Terrorist Threat to the World's Water," *Jane's Intelligence Review*, (January 1999); W. Dickinson Burrows and Sara E. Renner, "Biological Warfare Agents as Threats to Potable Water," *Environmental Health Perspectives*, vol. 107, no. 12 (December 1999) pp. 975-984; J.C. Cotterill, *Major Conclusions from a Study of the Feasibility of Clandestine Chemical Attack on Water Supplies in War* (London: Home Office, 1982).

<sup>32</sup> Sidell, Patrick, and Dashiell, *Jane's Chem-Bio Handbook*, p. 242.

<sup>33</sup> Department of Health and Human Services, *Proceedings of the Seminar on Responding to the Consequences of Chemical and Biological Terrorism*, Bethesda, MD (July 14-15, 1995), pp. 1-59.

<sup>34</sup> Biological weapons expert William C. Patrick III reports that he has never been stopped and questioned by security guards at federal buildings or airports regarding the vials of biological simulants and munitions props he carries with him for lectures. William Broad and Judith Miller, "Bill Patrick: Once He Devised Germ Weapons, Now He Defends against Them," *New York Times* (November 3, 1998), p. D1.

A terrorist seeking to maximize the number of casualties caused by a biological weapon could conduct such an attack, so that the victims would be geographically dispersed by the time they become symptomatic and require hospitalization. This tactic could significantly delay recognition of the attack by physicians or public health personnel by reducing the number of victims presenting at any one medical treatment facility and hinder an effective response by increasing the barriers to communication between medical treatment facilities and public health departments located in different cities, states, or even countries. Based on these criteria, the most likely targets for a bioterrorist seeking to inflict mass casualties would be those that are indoors, have a high volume of traffic, and are frequented by people from outside the city or state in which the target is located. Thus, major transportation hubs, sports arenas, convention centers, special events, and tourist attractions would be the most likely targets for this type of bioterrorist attack. Terrorists more interested in causing mass disruption than mass casualties may select targets for their symbolic importance or adopt tactics that increase the likelihood of an attack being detected early in order to generate higher levels of fear and panic.

### Planning Scenarios

Planners must consider three generic scenarios for a biological terrorist event. The first scenario is the hoax or suspicious package. Between 1996 and June 1999, the Federal Bureau of Investigation recorded about 300 threats to release biological agents, the most cited being anthrax.<sup>35</sup> In 1999 alone, there were approximately 200 nuclear, biological, and chemical scares, including some 140 anthrax hoaxes.<sup>36</sup> Although these situations pose the least risk to the public among the scenarios discussed here, they consume valuable resources, can cause temporary disruptions for entire buildings or city blocks, and can create public panic if not handled properly.<sup>37</sup> A comprehensive strategy for addressing biological terrorism must take these types of incidents into account.<sup>38</sup>

The second scenario, the no-notice release of a pathogen, is the most likely scenario for an act of bioterrorism for three reasons. Historically, less than 5% of actual or attempted conventional terrorist bombings have been preceded by a threat.<sup>39</sup> Second, terrorism analyst Bruce Hoffman has noted the emergence of a trend in the

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<sup>35</sup> Prepared statement of Barbara Martinez before the House Committee on Transportation and Infrastructure, *Preparedness for Terrorism Response*, June 9, 1999.

<sup>36</sup> Chitra Ragavan and David Kaplan, "The Boom in Bioterror Funds," *U.S. News and World Report* (October 18, 1999).

<sup>37</sup> See John Buntin, *Anthrax Threats in Southern California*, Case No. 1577, Case Program, John F. Kennedy School of Government, Harvard University, Cambridge, MA, May 2000.

<sup>38</sup> For guidance on how to respond to WMD threats (including anthrax), see National Domestic Preparedness Office, "WMD Threats: Sample Guidelines Reissue," Special Bulletin 6 (January 12, 2000).

<sup>39</sup> Department of Justice, *State and Local Domestic Preparedness Stakeholders Forum*, Washington, DC, August 27-28, 1998, 28.

1990s in which responsibility for the most lethal terrorist attacks goes unclaimed.<sup>40</sup> Third, by providing notice, a terrorist would negate one of the primary advantages of biological weapons: the difficulty in diagnosing and recognizing an attack in time to provide effective treatment. Warning the authorities of an impending attack would also prevent the terrorists from taking full advantage of the disease's incubation period to cover their tracks and avoid capture. Although the recent anthrax hoaxes have demonstrated that cities and states must be prepared to manage bioterrorist threats, a no-notice release presents the most difficult challenge and therefore should be the primary basis for emergency response planning.

A third scenario is a credible threat of a biological terrorist attack. There have been no publicly reported cases of this occurring. In 1997, however, FBI Director Louis Freeh stated that most threats to use chemical or biological weapons, "have made little mention of the type of device or delivery system to be employed, and for this reason have been deemed technically not feasible. Some threats have been validated."<sup>41</sup> The FBI, with the assistance of other agencies, conducts threat assessments based on behavioral, technical, and operational criteria.<sup>42</sup> Once a threat has been validated and is deemed credible, the FBI notifies FEMA and other relevant federal agencies as well as local law enforcement agencies in the affected state.<sup>43</sup> The extent to which federal, state and local agencies have examined and addressed this type of scenario has not been analyzed in any systematic fashion.

### **Characteristics of a Bioterrorism Incident**

The characteristics of any biological terrorist attack will be highly dependent on the agent employed, the delivery system chosen, and the venue targeted. It is possible, however, to make some generalizations based on the biological agents of greatest concern. First, a biological attack via aerosol is unlikely to be detected until patients present symptoms, unless biological aerosol detection equipment is present where the attack is deployed. Contamination of food and water can also be done covertly. Second, the first indicators of the attack may be individuals seeking medical attention, either from their own doctors or hospital emergency departments. Thus, in the event of a biological terrorist attack, doctors and nurses will be the first responders, not police officers and firefighters. Third, the initial symptoms of many biological agents are either nonspecific or are

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<sup>40</sup> Bruce Hoffman, "Why Terrorists Don't Claim Credit," *Terrorism and Political Violence*, vol. 9, no. 1 (Spring 1997), pp. 1-6.

<sup>41</sup> Statement of Louis Freeh, Director, Federal Bureau of Investigation, before the Senate Appropriations Committee *Hearing on Counterterrorism*, May 13, 1997.

<sup>42</sup> Senate Committee on the Judiciary, Subcommittee on Technology, Terrorism and Government Information, *Biological Weapons: The Threat Posed by Terrorists* (Washington, DC: Government Printing Office, 1998), pp. 146-147.

<sup>43</sup> FEMA, *Federal Response Plan: Terrorism Incident Annex* (Washington, DC: GPO, April 1999), p. TI-5.

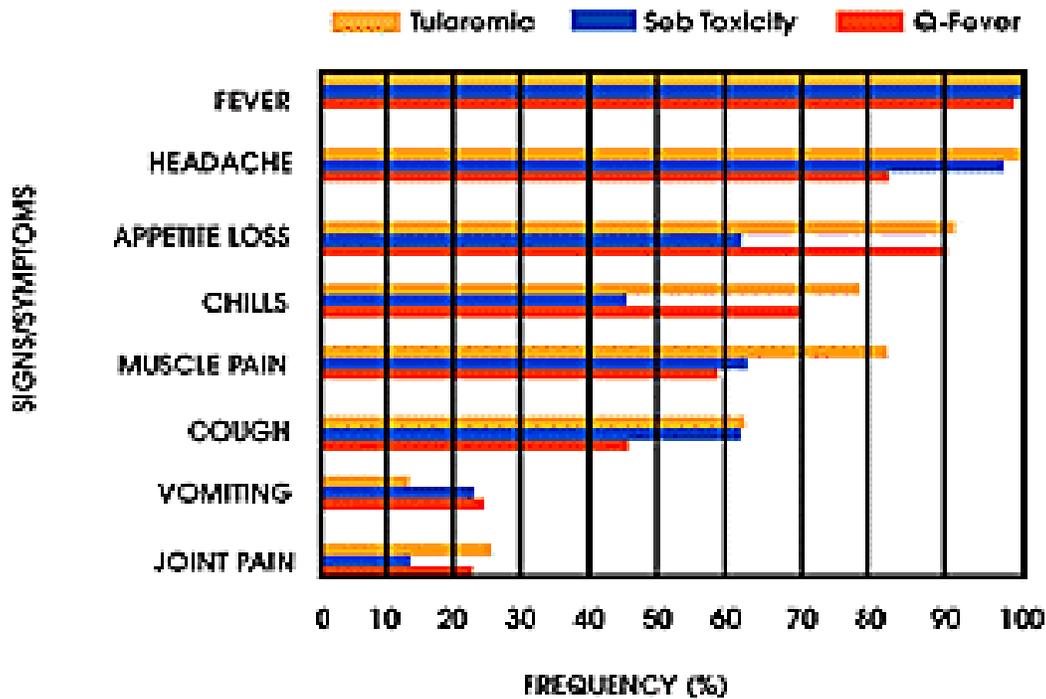
similar to those of naturally occurring diseases.<sup>44</sup> The initial symptoms of agents such as tularemia, staphylococcal enterotoxin B (SEB), and Q fever mirror those of influenza (see Figure 1). A few diseases such as plague, smallpox, and the viral hemorrhagic fevers cause lesions, rashes, and other cutaneous manifestations that could alert a doctor to the presence of an agent of biological terrorism.<sup>45</sup> Unless physicians have a heightened index of suspicion, however, based on clinical observations or epidemiological features of an outbreak, early victims of a bioterrorist attack are likely to be misdiagnosed with more common and less severe illnesses such as the flu. Since the flu is caused by a virus and is not responsive to treatment with antibiotics, doctors usually send patients home with orders to rest, take Tylenol, and drink plenty of fluids.

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<sup>44</sup> Mark Kortepeter et al. eds., *Medical Management of Biological Casualties Handbook, Fourth Edition* (Frederick, MD: United States Army Research Institute of Infectious Diseases, February 2001), pp. 10-11.

<sup>45</sup> By the time these cutaneous manifestations typically present, however, the disease is no longer responsive to medical treatment. In addition, since these diseases are all contagious, those with whom the patient has had close contact as well as the patient's health care providers may already have been exposed by the time the disease is diagnosed. Thomas McGovern, George Christopher, and Edward Eitzen, "Cutaneous Manifestations of Biological Warfare and Related Threat Agents," *Archives of Dermatology* 135 (March 1999), pp. 311-322.

**FIGURE 1. SIMILARITIES BETWEEN SYMPTOMS OF BW AGENTS AND THE FLU**



Source: Biological Weapon Defense Division, Defense Advanced Research Projects (DARPA).

Fourth, to be effective, treatment of many diseases caused by biological weapons must begin before the onset of symptoms or within 24-48 hours of onset.<sup>46</sup> Therefore, an incorrect diagnosis could mean that the patient does not receive the proper, and possibly lifesaving, medical treatment for the agent to which he has been exposed. Of the agents of greatest concern, only tularemia and some of the viral hemorrhagic fevers respond to medical treatments initiated more than 24 hours after the patient becomes symptomatic. Standard laboratory analysis of clinical specimens requires growing samples of organisms in culture, which could take 24-48 hours.<sup>47</sup> Thus, by the time a diagnosis is made the patient could be dead. Since most clinical labs are currently unable to provide a confirmatory diagnosis of most of the critical terrorism agents, samples would need to be shipped to labs with more sophisticated equipment, further lengthening the delay in identifying the causative agent of an outbreak.

<sup>46</sup> Kortepeter, p. 11.

<sup>47</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response* (Washington, DC: National Academy Press, 1999), p. 79.

Fifth, unlike other forms of terrorism, the effects of bioterrorism are delayed. The incubation period of a biological agent varies for different individuals depending on the virulence of the pathogen, the dose received, and the strength of the individual's immune system. As a result, the onset of symptoms among the infected population could be distributed over a period of days to weeks, roughly in the shape of a bell curve. This characteristic of bioterrorism provides the public health system with a window of opportunity to recognize that an outbreak is underway and begin investigating its scope, source, and severity.<sup>48</sup> Thus, the initial epidemiological investigations in a bioterrorism attack may be triggered by reports of a large or unusual outbreak of influenza given the time of year or an outbreak of an unknown or unusual disease.<sup>49</sup>

Sixth, there is a significant potential for person-to-person transmission of some diseases. Plague, smallpox, and the viral hemorrhagic fevers are contagious and can be spread from person to person with varying degrees of ease. Smallpox is the most communicable of the critical agents. In 1970, a single case of smallpox in Germany resulted in 19 other cases, the quarantine of an entire hospital, including staff and patients for four weeks, and the vaccination of 100,000 people.<sup>50</sup> On average, each case of smallpox can be expected to infect 10 other individuals.<sup>51</sup> In Madagascar in 1997, one patient with pneumonic plague transmitted the disease to 18 other people.<sup>52</sup> Therefore, early diagnosis of a contagious disease is crucial for enabling medical treatment facilities to protect their staff and other patients from infection as well as to begin treating people who have had contact with infected individuals.

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<sup>48</sup> An act of bioterrorism is likely to expose members of a population to a pathogen at the same time resulting in a more compressed epidemic curve than a natural outbreak. Outbreaks of foodborne illnesses can also present a compressed epidemic curve, however, so this is not a definitive indicator of bioterrorism. Julie Pavlin, "Epidemiology of Bioterrorism," *Emerging Infectious Diseases*, vol. 5, no. 4 (July-August 1999).

<sup>49</sup> Outbreaks of rare diseases or diseases not endemic to the area are not necessarily indicators of bioterrorism, however, as the West Nile Virus outbreak in New York City in late 1999 demonstrated.

<sup>50</sup> D. A. Henderson, "Bioterrorism as a Public Health Threat," *Emerging Infectious Diseases*, vol.4 (July-September 1998).

<sup>51</sup> Donald A. Henderson's testimony before Senate Appropriations Committee and Senate Veterans' Affairs Committee, *Bioterrorism: Domestic Weapons of Mass Destruction* (Washington, DC: Government Printing Office, 2000), p. 56.

<sup>52</sup> M. Ratsitorahina et al., "Epidemiological and Diagnostic Aspects of the Outbreak of Pneumonic Plague in Madagascar," *Lancet* (January 8, 2000), pp. 111-113 cited in Thomas Inglesby et al., "Plague as a Biological Weapon: Medical and Public Health Management," *Journal of the American Medical Association*, vol. 283, no. 7 (May 3, 2000), p. 2283.

Finally, there is an important, but poorly understood, psychological component to biological terrorism.<sup>53</sup> Although all forms of terrorism aim to intimidate and influence governments or particular segments of the population, the use of disease-causing organisms, particularly contagious ones, would add a new and more horrifying dimension to the attack. As Jessica Stern has noted, although one cannot predict ahead of time the scope of a biological terrorism attack, “what we can predict is that the radius of psychological damage would exceed that of injury and death.”<sup>54</sup> Biological weapons are insidious, mysterious, frightening and unknown. The association of disease and pestilence in biblical texts as forms of divine wrath adds to their mystique. A biological terrorism attack would have a direct effect psychological impact not only on the victims, their families, and individuals involved in responding to the attack but potentially on the nation as a whole.<sup>55</sup> The news media may play a role in amplifying the psychological impact of a bioterrorism incident through excessive and/or inaccurate media coverage.

## Implications

Responding to an attack with a biological weapon is fundamentally different from responding to a chemical terrorist event, as illustrated by the figures in Appendix D. As a government-commissioned task force of health care providers noted in a recent report on medical preparedness for a WMD incident, “Unless such an attack is announced, the local health care system, especially emergency departments, will be the first and most critical line of defense for detection, notification, rapid diagnosis, and treatment.”<sup>56</sup> Unfortunately, the current overall level of preparedness for responding to a large-scale disease outbreak is low. This low level of readiness is driven by the nature of the modern health care system, exacerbated by the traditional lack of communication between the medical and public health communities, and reinforced by the long-term neglect of both

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<sup>53</sup> For studies on the potential psychological effects of a biological terrorism attack, see Cleto DiGiovanni, “Domestic Terrorism with Chemical or Biological Agents: Psychiatric Aspects,” *American Journal of Psychiatry* (October 1999), pp. 1500-1505; David Siegrist, “Behavioral Aspects of a Biological Terrorism Incident,” presentation to the Association for Politics and the Life Sciences Convention, Atlanta, Georgia, September 2, 1999; Anne Norwood, “Psychiatric Aspects of Chem/Bioterrorism,” presentation to the American Medical Association Annual Meeting, Chicago, Illinois, June 19, 1999. <http://www.ama-assn.org/meetings/public/annual99/edu/norwood.ppt>

<sup>54</sup> Jessica Stern, *The Ultimate Terrorists* (Cambridge, MA: Harvard University Press, 1999), p. 30.

<sup>55</sup> Falkenrath, Newman, and Thayer, *America’s Achilles Heel*, op cit., pp. 6-7.

<sup>56</sup> Task Force of Health Care and Emergency Services Professionals on Preparedness for Nuclear, Biological and Chemical Incidents, *Executive Summary: Developing Objectives, Content and Competencies for the Training of Emergency Medical Technicians, Emergency Physicians, and Emergency Nurses to Care for Casualties Resulting from Nuclear, Biological or Chemical (NBC) Incidents*, contract no. 282-98-0037 (July 2000), p. 3.

communities by public safety and national security agencies. Maryland's strategic plan for responding to an act of WMD terrorism states bluntly, "A mass casualty event with casualties in the hundreds would quickly overwhelm the health system."<sup>57</sup>

The first opportunity for a disease outbreak to be recognized as an act of biological terrorism would present itself to physicians in emergency departments, intensive care units, and primary care settings. In medical school, students are trained with the maxim, "when you hear hoofbeats, think horses, not zebras." Anecdotal evidence suggests that the index of suspicion for biological agents of concern is still fairly low. Only 1 of 17 doctors in the Pittsburgh area was able to recognize the distinctive rash caused by smallpox.<sup>58</sup> A similar test was conducted at Johns Hopkins University Hospital and none of the doctors quizzed recognized the symptoms of inhalation anthrax.<sup>59</sup> Two-thirds of the respondents to a more scientific survey of emergency medicine physicians conducted in 1998 considered their ability to recognize and clinically manage victims of biological terrorism to be less than adequate.<sup>60</sup> Thus, the first wave of victims of a biological terrorist attack is unlikely to receive proper treatment or trigger an alarm unless physicians have a heightened index of suspicion.<sup>61</sup>

In addition, the capacity of the medical community to manage a large-scale outbreak of infectious disease is low. During planning for a biological terrorism tabletop exercise held in Boston, hospital representatives indicated that as few as 80 patients requiring critical care would saturate their patient care capabilities.<sup>62</sup> In recent years, hospitals have been cutting beds and staff to minimize excess capacity, and cities have been losing emergency departments as a result of cost-cutting measures. Based on experience with the 1999-2000 flu season, serious shortages of healthcare providers and beds are expected to develop during a large outbreak.<sup>63</sup>

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<sup>57</sup> Maryland Institute for Emergency Medical Services Systems and Maryland Department of Health and Mental Hygiene, *The Maryland Strategic Plan to Improve the Health and Medical Response to Terrorism* (February 23, 2000), p. 34.

<sup>58</sup> "Pittsburgh Doctors Fail Pop Quiz Testing Reaction to Mock Outbreak," *Associated Press*, February 14, 2000.

<sup>59</sup> John G. Bartlett prepared statement before the Senate Committee on Health, Education, Labor and Pensions Subcommittee on Public Health in *Bioterrorism: Our Frontline Response; Evaluating U.S. Public Health and Medical Readiness* (Washington, DC: Government Printing Office, 1999), p. 46.

<sup>60</sup> N. Pesik, M. Keim, and T.R. Sampson, "Do US Emergency Medicine Residency Programs Provide Adequate Training for Bioterrorism?" *Annals of Emergency Medicine*, vol. 34, no. 2 (August 1999), p. 175.

<sup>61</sup> Christopher Richards, Johathan Burstein, Joseph Waeckerle, and H. Range Hutson, "Emergency Physicians and Biological Terrorism," *Annals of Emergency Medicine*, vol. 34, no. 2 (August 1999), pp. 183-190.

<sup>62</sup> Gregory Koblentz, *Enhancing Massachusetts' Preparedness for Biological Terrorism*, Master's Thesis, John F. Kennedy School of Government, April 6, 1999, p. 21.

<sup>63</sup> Monica Schoch-Spana, "Hospitals Buckle during Normal Flu Season: Implications for Bioterrorism Response," *Biodefense Quarterly*, vol. 1, no. 4 (March 2000), p. 1.

Financial pressures also severely limit the ability of hospitals and doctors to enhance their preparedness.<sup>64</sup> Unlike that for fire departments, emergency medical services and law enforcement agencies, there is typically no established mutual aid system for health care facilities. In the event of a bioterrorism incident that affects a wide geographic area or has the potential to do so, hospitals that are hard pressed to maintain the standard of care for their regular flow of patients may be unable or unwilling to provide assistance to other facilities. There is also the risk that even a small outbreak, magnified by media reports, could overwhelm local medical facilities with the “worried well”.

The public health surveillance system currently in place at the state and local levels is incapable of detecting a bioterrorism incident in a timely fashion. Currently, the public health system relies on physicians and laboratories to submit to their public health department, usually by fax or mail, reports of notifiable diseases or unusual outbreaks.<sup>65</sup> Such passive surveillance systems, however, are “notorious for their poor sensitivity, lack of timeliness, and minimal coverage [and] the quality of information is greatly limited.”<sup>66</sup> In addition, “the reliability of passive surveillance systems is often quite low.”<sup>67</sup> Thus, the public health system may not be able to detect an outbreak and identify its parameters in time to initiate an effective response.

Another important implication of a no-notice release is that unless federal response assets are pre-positioned at the site of a release because of a special event, local and state governments will have to rely on their own resources until federal assistance can be mobilized and deployed. The timeline for the federal response is unknown, since a full deployment of federal public health and medical assistance in response to a simulated bioterrorism incident has never been conducted.<sup>68</sup> In addition, specialized military WMD terrorism response units at the state and national level, such as the National Guard's Weapons of Mass Destruction Civil Support Teams (WMD-CSTs) (formerly known as RAID teams) and the Marine Corps' Chemical Biological Incident Response Force (CBIRF) have few of the capabilities required to assist state and local authorities in detecting a

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<sup>64</sup> Ibid.

<sup>65</sup> The list of notifiable diseases is compiled by state and federal epidemiologists, but the CDC has no authority to force states to adopt the CDC's preferred list. Therefore, the list of notifiable diseases varies slightly from state to state. The CDC-developed list includes anthrax, botulism, and plague tularemia, but not smallpox or the viral hemorrhagic fevers. CDC, *Nationally Notifiable Infectious Diseases, United States*, 2000. <http://www.cdc.gov/epo/dphsi/infdis.htm>

<sup>66</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. 66.

<sup>67</sup> Ibid., p. 67.

<sup>68</sup> The biological field exercise component of the TOPOFF exercise conducted in Colorado, Denver in May 2000 did not include, among other things, the deployment of pharmaceuticals from federal stockpiles or the simulated relocation of patients from hospitals overwhelmed by bioterrorism victims and the worried well via the National Disaster Medical System (NDMS).

covert bioterrorist attack or treating bioterrorism casualties (see below). These units are more suitable for responding to acts of chemical terrorism, assessing suspicious packages, or for being pre-positioned at a special event or in response to a credible threat.

## **CURRENT BIOLOGICAL TERRORISM PREPAREDNESS PROGRAMS**

### **Background**

Concerted efforts to prepare for an act of biological terrorism in the United States did not emerge until 1998. The focus of the early domestic preparedness efforts centered on chemical terrorism, motivated by Aum Shinrikyo's development and use of the nerve gas sarin. The primary recipients of federal domestic preparedness assistance were the traditional first responders: law enforcement agencies, fire departments, hazardous materials teams, bomb squads, and emergency medical services.<sup>69</sup> During the initial phase of this domestic preparedness initiative, biological weapons were lumped into the "chem-bio threat." By 1998, however, several programs were underway to address the unique challenges posed by biological terrorism.

A federal interagency tabletop exercise held in March 1998 revealed significant gaps in the nation's preparedness for biological terrorism.<sup>70</sup> In April of that year, President Clinton and senior federal officials met with a group of outside experts to discuss the role of biotechnology in responding to the threat of biological weapons.<sup>71</sup> This group submitted a plan to the president in early May recommending improvements in research and development and public health surveillance and the creation of a stockpile of drugs and vaccines to, among other things, protect up to 40 million people against smallpox. The cost of these efforts over five years was estimated at \$420 million.<sup>72</sup> Later that month, President Clinton announced a major new initiative to enhance preparedness for biological terrorism, including the creation of a civilian stockpile of pharmaceuticals and stepped-up research on new drugs and diagnostics tools.<sup>73</sup> In June, the White House requested that an additional \$294 million be added to the administration's request for domestic preparedness programs, including funding

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<sup>69</sup> For a summary of federal domestic preparedness efforts, see Gregory Koblenz, *Overview of Federal Programs to Enhance State and Local Capability to Respond to WMD Terrorism*, ESDP Discussion Paper ESDP-2001-03, John F. Kennedy School of Government, Harvard University, April 2001.

<sup>70</sup> Judith Miller and William Broad, "Exercise Finds U.S. Unable to Handle Germ War Threat," *New York Times*, April 26, 1998, A1.

<sup>71</sup> White House, "Roundtable on Genetic Engineering and Biological Weapons," press release April 10, 1998.

<sup>72</sup> William Broad and Judith Miller, "Germ Defense Plan in Peril as Its Flaws Are Revealed," *New York Times*, August 7, 1998.

<sup>73</sup> White House, press release, "Remarks by the President at the United States Naval Academy Commencement," (May 22, 1998).

for the pharmaceutical stockpile, increased research and development, and enhancing public health surveillance.<sup>74</sup> According to Frank Young, former director of the Office of Emergency Preparedness (OEP) and moderator for the April 1998 meeting, about 75% of the group's recommendations were included in this funding request.<sup>75</sup>

The majority of new funding for countering bioterrorism has been provided to the Department of Health and Human Services. Under Presidential Decision Directive (PDD) 62, "Protection Against Unconventional Threats to the Homeland and Americans Overseas," the Department of Health and Human Services (HHS) "will be the lead agency to plan and to prepare for a national response to medical emergencies arising from the terrorist use of weapons of mass destruction."<sup>76</sup> Within HHS, two organizations are responsible for preparations to detect and respond to a biological terrorism incident: the Office of Emergency Preparedness (OEP) and the Centers for Disease Control and Prevention (CDC).

OEP, located within the U.S. Public Health Service, has the responsibility within HHS for managing and coordinating federal health, medical, and health-related social services for major emergencies and federally declared disasters, including acts of terrorism. OEP was the first federal agency to begin preparing local first responders for a terrorist attack involving a WMD with the establishment of the first Metropolitan Medical Strike Team (MMST) in 1995 in the Washington, D.C. metropolitan area. This system became the prototype for the Metropolitan Medical Response Systems (MMRS) that OEP established in more than 70 cities between 1997 and 2000.<sup>77</sup> OEP is also a participant in the National Disaster Medical System (NDMS), a joint effort of HHS, FEMA, Department of Defense (DOD), Department of Veterans Affairs (VA), and private hospitals throughout the nation to provide medical treatment to casualties of a war or major disaster. OEP has trained and equipped four volunteer medical teams that are part of NDMS to be able to provide medical treatment to the victims of a chemical or biological weapon attack.<sup>78</sup>

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<sup>74</sup> White House, press release, "President Requests Additional Funding for Protection against Biological and Chemical Terrorism," press release, June 9, 1998.

<sup>75</sup> Lois Ember, "Bioterrorism: Combating the Threat," *Chemical and Engineering News*, July 5, 1999, p. 15.

<sup>76</sup> Presentation by Matthew Payne, HHS Liaison to the National Domestic Preparedness Office, at Defense Week Conference, "Weapons of Mass Destruction and Domestic Preparedness III: Interoperability & the Medical Management of a Bio-Terrorist Incident," Washington, DC, November 3, 1999.

<sup>77</sup> "President Clinton Unveils New Efforts to Combat Terrorism in an Address to the International Association of Firefighters," White House Fact Sheet, March 15, 1999; prepared statement of Robert Knouss, Director, Office of Emergency Preparedness, Department of Health and Human Services, before the House Committee on Government Reform, National Security, Veterans Affairs, and International Relations Subcommittee Hearing, *Terrorism Preparedness: Medical First Response*, September 22, 1999.

<sup>78</sup> Prepared statement of Robert Knouss, June 11, 1999.

The CDC's mission is "to promote health and quality of life by preventing and controlling disease, injury, and disability."<sup>79</sup> In late 1998, the CDC established its Bioterrorism Preparedness and Response Program (BPRP) to lead an agency-wide effort to prepare for and respond to acts of terrorism that involve the actual, threatened, or suspected use of biological or chemical agents. In addition to upgrading the CDC's epidemiological, surveillance, and laboratory capabilities, BPRP also initiated a grant program in 1999 to improve the capacities of municipal and state health departments to detect and respond to a terrorist attack involving a biological or chemical agent. Besides providing grants specifically designed to enhance public health laboratories, the CDC has established the Laboratory Response Network (LRN) that links public health departments at all levels to advanced diagnostic capabilities. The network is designed to increase the number of laboratories capable of detecting critical biological agents, reduce the time needed to confirm the presence of a critical agent in a clinical or environmental sample, and improve the communication of testing results within the public health community.<sup>80</sup> Finally, the CDC has established a National Pharmaceutical Stockpile (NPS) to ensure that sufficient quantities of antibiotics and medical supplies can be rapidly supplied to jurisdictions targeted by a biological weapons attack.

As a result of the White House initiative in mid-1998, the HHS budget for domestic preparedness increased from \$16 million in 1998 to \$173 million in 1999.<sup>81</sup> In 2000, HHS received \$277 million for domestic preparedness activities and has requested \$265 million for 2001.<sup>82</sup> Appendix E contains a breakdown of HHS and CDC funding to combat biological terrorism. As Table 1 in Appendix E and Figure 1 in Appendix F illustrate, HHS devotes roughly two-thirds of its resources to programs to prepare for and respond to terrorism while research and development efforts receive the other one-third. Among the programs to enhance preparedness and response capabilities, most of the funds are earmarked for public health and surveillance projects (Figure 2, Appendix F). The bulk of research and development funds are used to develop new vaccines against biological warfare agents (Figure 3, Appendix F). Within CDC, the two largest bioterrorism preparedness programs are the national pharmaceutical stockpile and grants to state and local public health departments to upgrade surveillance and laboratory capabilities (Figure 4, Appendix F). Figure 5 in Appendix F shows that over the past three years, CDC has distributed the most funds to establish the Health Alert Network

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<sup>79</sup> CDC website. <http://www.cdc.gov/aboutcdc.htm>

<sup>80</sup> CDC, "Biological and Chemical Terrorism," p. 10.

<sup>81</sup> Office of Management and Budget, *Annual Report to Congress on Combating Terrorism: Including Defense Against Weapons of Mass Destruction/Domestic Preparedness and Critical Infrastructure Protection*, May 18, 2000, pp. 61-62.

<sup>82</sup> Department of Health and Human Services, "HHS Initiative Prepares for Possible Bioterrorism Threat," HHS fact sheet, May 18, 2000. <http://www.hhs.gov/news/press/2000pres/20000518.html>

(HAN), an information technology program described below. Current grants are split fairly evenly among the five different components of bioterrorism preparedness: HAN, surveillance, epidemiology, laboratory, and preparedness planning. Finally, Figure 6 in Appendix F illustrates that the share of CDC bioterrorism funds for enhancing state and local preparedness comprises a little under 40% of the CDC's overall funding for domestic preparedness.

Preparing for biological terrorism involves a range of activities undertaken by multiple agencies at the local, state and federal levels of government.<sup>83</sup> Besides HHS, several other federal agencies, such as the DOD, VA, FEMA, the Department of Energy (DOE), and the Department of Justice (DOJ), play important roles in preparing for and responding to biological terrorism. This section describes the federal programs currently in place to improve the nation's capacity to detect and respond to a biological terrorist attack and the coordination of the nation's efforts toward those goals.

## **Detection**

The key to mounting an effective response to a bioterrorist attack is early warning. The earlier an attack is detected, the earlier treatment of those affected by the attack can be started and precautions taken to prevent further transmission of the disease if it is contagious. A study by scientists at the CDC found that the single most important means of reducing casualties caused by bioterrorism is rapid recognition of the attack and identification of the agent. According to the study, "Arithmetic increases in response time buy disproportionate increases in benefit (preventing losses)."<sup>84</sup> As noted above, the task of increasing response time is much more complicated for a biological attack than for a nuclear, chemical, conventional, or radiological attack: unlike biological agents, each of these weapons has a detectable signature.

There are two general methods of detecting a covert attack with a biological weapon. The first is the public health model, which relies on the collection, analysis, and investigation by public health departments of data submitted by physicians and clinical laboratories. The second focuses on detecting aerosol clouds of biological agents. This method could detect a biological attack with an aerosolized agent while it was underway and

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<sup>83</sup> For a comprehensive discussion of the role of interagency and intergovernmental coordination in domestic preparedness, see Arnold Howitt and Gregory Koblentz, "Organizational Capacity and Coordination: Obstacles and Opportunities for Preparing for Domestic Terrorism," discussion paper, Executive Session on Domestic Preparedness, Cambridge, MA, forthcoming.

<sup>84</sup> Arnold Kaufmann, Martin Meltzer, and George Schmid, "The Economic Impact of a Bioterrorist Attack: Are Prevention and Postattack Intervention Programs Justifiable?" *Emerging Infectious Diseases*, vol. 3, April-June 1997.

therefore provide enough warning to allow prophylaxis of exposed individuals before they became ill. This section examines the role of the public health system in detecting an outbreak caused by the intentional release of a microorganism, programs underway to enhance the effectiveness of this system to provide prompt and accurate information on infectious disease outbreaks, and the status of biological aerosol detectors that have been deployed or are under development to provide near-real-time warning of a bioterrorism attack.

### Public Health

The public health system is designed to detect outbreaks of illnesses, discover their source, and intervene to save lives, as well as to conduct research to prevent, or at least detect more quickly, future outbreaks. The public health model has four components: diagnosis, surveillance, epidemiology and laboratory analysis. The approach reflected in this model is effective only after an attack, once victims become ill and seek medical attention. The public health system is capable of detecting a disease outbreak however, regardless of its cause or route of infection. Thus, investments in the public health system for the purpose of preparing for bioterrorism can also contribute to efforts to fight naturally occurring diseases.

Physicians play a crucial role in detecting a bioterrorist event. An alert physician may recognize an individual's symptoms as being caused by an unusual or rare disease or note an unusual epidemiological pattern in a large number of patients with similar symptoms.<sup>85</sup> In the more likely event that a disease outbreak caused by bioterrorism goes undetected by physicians because of the nonspecific symptoms of the victims and the "noise" of other medical problems masking the "signal" of a bioterrorism incident, the next line of detection is the public health surveillance system. Physicians and clinical laboratories provide the crucial inputs for this system. Laboratories also play a vital role by providing definitive confirmation of a disease outbreak and determining the strain of a particular organism involved in the outbreak. Even after an outbreak is detected, its cause and scope may not be readily apparent. Thus, epidemiologists must begin investigations to determine the scope and severity of the outbreak, its cause, and the population at risk. In the event of an intentional release of a pathogenic organism, law enforcement agencies will also launch criminal investigations to identify and apprehend the suspected perpetrators. Efforts currently underway to enhance the capabilities of these components of the public health system to detect and recognize a bioterrorism event are described below.

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<sup>85</sup> In New Mexico in 1993, an astute physician, on the basis of only two unusual cases, alerted public health authorities to what turned out to be an outbreak of hantavirus pulmonary syndrome. Prepared statement of James Hughes, Director, National Center for Infectious Disease, CDC, before Senate Committee on Appropriations, Subcommittee on Department of Labor, Health and Human Services, and Education and Related Agencies, *Preparedness for Epidemics and Bioterrorism*, June 2, 1998.

### *Diagnosis*

The federal government currently follows a three-prong strategy for improving the ability of health care professionals at the local level to accurately diagnose an outbreak of a biological agent.<sup>86</sup> First, OEP has contracted with professional medical organizations to develop a standard curriculum for training medical personnel on how to recognize and manage victims of a WMD. Second, the DOD, OEP, and CDC offer training and educational materials. Third, OEP and the CDC provide funding to state and local governments that can be used to conduct training.

### *Curriculum Development*

In 1998, OEP commissioned the American College of Emergency Physicians (ACEP) to establish a task force of professional medical organizations that would develop a curriculum and standards for educating health care providers in recognizing and treating victims of nuclear, biological, and chemical weapons. The task force submitted its final report to OEP in August 1999, and that report is currently under review.<sup>87</sup> OEP has also funded the development of clinical guidelines for use by civilian health care providers in treating victims of chemical and biological agents. This curriculum and these standards and guidelines are prerequisites for any large-scale training and education effort.

### *Training and Education*

A 1995 HHS review of training available to health care providers on the medical response to a WMD terrorist incident found such training “almost totally lacking.”<sup>88</sup> Since that time, federal agencies have established multiple training programs on diagnosing and treating biological agents for physicians and other health care providers.

The Domestic Preparedness Program, established to train the largest 120 cities on how to prepare for and respond to a WMD terrorism incident, includes a “Hospital Provider” course for emergency department physicians and nurses. As of May 1, 2000, more than 22,000 individuals in 82 cities, including 5,400 hospital

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<sup>86</sup> Of course, individual doctors, state and local governments, and institutions such as hospitals and medical organizations have taken the initiative and utilized their own funds to provide invaluable training and education to a number of health care providers. This section, however, focuses on federal efforts, since these are the most visible and form the foundation for efforts by other entities.

<sup>87</sup> Presentation by Matthew Payne, at Defense Week Conference, Weapons of Mass Destruction and Domestic Preparedness III: Interoperability and the Medical Management of a Bio-Terrorist Incident.

<sup>88</sup> Cited in Department of Justice, *Five-Year Interagency Counterterrorism and Technology Crime Plan*, p. 52.

providers, had received this training.<sup>89</sup> The goal of the course is to train physicians and nurses on how to properly decontaminate, triage, diagnose, and treat victims of a WMD and protect themselves and other patients while doing so.<sup>90</sup> The length of the course (eight hours) has reportedly made it difficult however, for physicians and nurses to attend.<sup>91</sup> The entire city training program will be transferred to the Department of Justice in October 2000.<sup>92</sup>

Another training mechanism is the Noble Training Center at Fort McClellan, Alabama, operated by OEP. The facility, a converted former Army hospital with 100 beds, is the only mock hospital in the United States devoted to medical training for diagnosing and treating victims of conventional or WMD terrorist incidents.<sup>93</sup> The training, based on the curriculum being developed by the ACEP-led task force under contract with OEP, will be offered free of charge to hospital administrators, emergency department physicians and nurses, and paramedics.<sup>94</sup> This project received \$4 million in 1999 and expects to begin training by the end of September 2000.<sup>95</sup>

A third mechanism is distance-learning courses sponsored by the CDC. In September 1999, the CDC and USAMRIID cosponsored a video broadcast on bioterrorism and public health that reached more than 17,000 health care and public health professionals.<sup>96</sup> The CDC also provides a streaming-video version of this

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<sup>89</sup> E-mail communication with an official with the Domestic Preparedness Program, Soldier Biological and Chemical Command, Department of Defense, May 18, 2000.

<sup>90</sup> Soldier Biological and Chemical Command Fact Sheet, "Training Program: Hospital Provider," August 2, 1999.

[http://dp.sbcom.army.mil/fs/dp\\_hospital\\_provider.html](http://dp.sbcom.army.mil/fs/dp_hospital_provider.html)

<sup>91</sup> E. M. Eitzen, "Education Is the Key to Defense against Bioterrorism," *Annals of Emergency Medicine*, vol. 34, no. 2 (August 1999), p. 222.

<sup>92</sup> President William Clinton, "Designation of the Attorney General as the Lead Official for the Emergency Response Assistance Program under Sections 1412 and 1415 of the National Defense Authorization Act for Fiscal Year 1997 (Public Law 104-201)," memorandum, April 6, 2000.

<sup>93</sup> U.S. Public Health Service, "The U.S. Public Health Service Noble Training Center," fact sheet, undated.

<sup>94</sup> Telephone interview with John Hoyle, Project Manager, U.S. Public Health Service Noble Training Center, April 27, 2000; Rose Livingston, "New Center Trains for Chemical Attacks," *The Birmingham News*, January 28, 2000.

<sup>95</sup> Telephone interview with an official of the U.S. Public Health Service Noble Training Center, April 27, 2000; prepared statement of Gary Moore, Acting Deputy Director, Office of Emergency Preparedness, U.S. Department of Health and Human Services before the House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, *Domestic Preparedness against Terrorism: How Ready Are We?* March 27, 2000.

<sup>96</sup> CDC, *National Bioterrorism Preparedness and Response Initiative Briefing Packet*, April 17, 2000.

broadcast over the Internet.<sup>97</sup> In the future, CDC plans to use the Health Alert Network currently under development to conduct training for the public health community.<sup>98</sup>

Finally, the network of more than 1,500 nonfederal hospitals enrolled in the National Disaster Medical System (NDMS) provides another mechanism for training health care providers. NDMS is a joint program of federal agencies such as DOD, HHS, FEMA, and VA and the private sector to provide staffed, acute care beds for treating large numbers of people. NDMS operates during peacetime after a major disaster or as a backup to the military medical system during a conflict. PDD-62 mandated that the Public Health Service and Department of Veterans Affairs provide WMD training to the hospitals participating in the NDMS. However, no such training has yet been delivered. The Public Health Service received \$1 million to carry out this mission in 2000 and is authorized to provide the VA with another \$1 million. As of April 2000, the VA had not yet received any money from PHS, however.<sup>99</sup> The training curriculum under PDD-62 will be based on the recommendations of the ACEP task force. Another potential training mechanism for physicians that has gone unutilized to date is the VA.<sup>100</sup> The VA has been granted neither the mandate nor the funding to conduct WMD preparedness training at its own facilities even though each year more than half of all medical students and a third of postgraduate physicians in training (residents) receive some of their training at VA hospitals.<sup>101</sup>

#### *Grant Assistance*

HHS also provides grants to state and local governments that can be used to train health care providers and acquire pharmaceuticals necessary in cases of biological weapons attack. OEP's Metropolitan Medical Response System (MMRS) program provides grants of up to \$550,000 to cities to establish integrated plans to provide hospital, pre-hospital, and public health response to WMD terrorism. These funds can be used to conduct training or exercises and purchase medical supplies such as antibiotics. Through 2000, OEP had contracted with 72 cities to develop MMRSs.<sup>102</sup> Ultimately, OEP plans to include the 120 largest cities in the MMRS program. Although the initial focus of the MMRS program initially focused on enhancing preparedness for an act of

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<sup>97</sup> See the CDC's bioterrorism preparedness video library. <http://www.bt.cdc.gov/vidlib.asp>

<sup>98</sup> CDC, "Facts about the Health Alert Network," undated. <http://www.phppo.cdc.gov/han/Documents/HANFactSheet3.doc?ois=yes;template=han.asp>

<sup>99</sup> Telephone interview with an official of the Emergency Management Strategic Healthcare Group, Veterans Health Administration, Department of Veterans Affairs, April 25, 2000.

<sup>100</sup> Kenneth Kizer, Thomas Cushing, and Robyn Nishimi, "The Department of Veterans Affairs' Role in Federal Emergency Management," *Annals of Emergency Medicine*, vol. 36, no. 3, September 2000, pp. 255-261.

<sup>101</sup> Senate Appropriations Committee and Senate Veterans' Affairs Committee, *Bioterrorism: Domestic Weapons of Mass Destruction* (Washington, DC: Government Printing Office, 2000), pp. 32-33.

<sup>102</sup> Office of Emergency Preparedness website. [http://ndms.dhhs.gov/CT\\_Program/ct\\_program.html](http://ndms.dhhs.gov/CT_Program/ct_program.html)

chemical terrorism, in 1999 OEP required MMRS cities to develop response plans for a bioterrorism incident, including plans for conducting mass prophylaxis and mass patient care, managing mass fatalities, and carrying out environmental remediation.

### **Surveillance and Epidemiology**

In the absence of a definitive diagnosis by a physician of symptoms related to a biological weapons attack, the passive surveillance system operated by local and state health departments provides the next opportunity for recognizing an act of bioterrorism. Public health surveillance provides crucial data to decision makers by identifying public health problems and evaluating the effectiveness of interventions to halt or mitigate these problems. Surveillance also serves to trigger epidemiological investigations that can provide more detailed information about these attacks than passive surveillance systems. If an intentional release of a pathogen were suspected, law enforcement agencies would be called in to conduct a criminal investigation. This type of investigation could also provide the public health system with a better understanding of the scope, nature, and cause of a particular outbreak. Given the similarity of the symptoms of some critical biological agents with those of common diseases, the potential for naturally occurring emerging diseases to strike in unexpected places, and modern medicine's incomplete understanding of many diseases, clearly differentiating between a natural outbreak of an unusual disease and a man-made epidemic may not be an easy task. As Margaret Hamburg, Assistant Secretary of Health for Planning and Evaluation, has observed, "Clearly there is a gray area between how you would recognize a low-grade bioterrorist incident versus a naturally occurring outbreak of disease."<sup>103</sup> To maximize the benefit from bioterrorism preparedness, programs instituted at the state and local levels should build capacity or capabilities that will be needed for events other than bioterrorism, either on a routine basis or in an emergency.

The integration of medical and public health surveillance and epidemiology is crucial for early recognition of unusual disease outbreaks. As the case of New York City's West Nile Virus outbreak clearly demonstrated, the outbreak originally came to the attention of the city's public health department through a call from an infectious disease specialist who had two patients with similar symptoms. A follow-up by city epidemiologists revealed two more cases and eventually led to the recognition that an emerging disease had struck New York City.<sup>104</sup> This lesson is also apparent from the experience in the southwest United States with hantavirus. In 1993, after a

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<sup>103</sup> Margaret Hamburg, Assistant Secretary of Health, quoted in "Bioterrorism: Policy, Technology, Nature of the Threat," *The Officer* (March 2000).

<sup>104</sup> Monica Schoch-Spana, "A West Nile Virus Post-Mortem," *Biodefense Quarterly*, vol. 1, no. 3 (December 1999), p. 1.

physician reported that two young healthy adults had succumbed to an unknown respiratory infection, an epidemiological investigation identified 17 additional cases and led to the first-ever identification of hantavirus in the United States.<sup>105</sup>

The current national disease surveillance system is incapable of detecting a biological terrorist act in a timely manner. For example, the CDC maintains the 121 City Mortality Reporting System to track the weekly total number of deaths and deaths from pneumonia and influenza in 122 cities across the country.<sup>106</sup> Although the early symptoms of several critical agents resemble those of pneumonia and influenza, the CDC does not receive the information until two to three weeks after date of death.<sup>107</sup> By that time, an outbreak of anthrax or plague would have already taken its toll. The CDC's national infectious disease surveillance system is currently being modernized under a program called the National Electronic Disease Surveillance System (NEDSS) but this is a long-term effort.<sup>108</sup> In the interim, CDC has several programs in place to enhance the surveillance and epidemiological capabilities required to rapidly and accurately detect and identify an infectious disease outbreak.

#### *Grant Assistance*

In recognition of the limited utility of the passive surveillance systems currently in place, the CDC launched a program in 1999 to provide grants to state and municipal health departments to modernize their information technology systems and develop new surveillance systems and methods that could provide earlier recognition of a disease outbreak whether natural or intentional.<sup>109</sup> Under the Health Alert Network (HAN) program, \$29 million was distributed in 1999 to 43 state and local public health departments.<sup>110</sup> Another \$40 million is earmarked for 2000 and 2001.<sup>111</sup> As of January 1999, 50% of local health agencies surveyed lacked high-speed Internet access, and 46% did not have broadcast fax capability for use in emergency notification.<sup>112</sup> HAN will enable state and local health agencies to improve their connectivity with each other, the medical community, and the CDC. HAN will be used for routine reporting of surveillance and epidemiological information, rapid two-

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<sup>105</sup> CDC, *Preventing Emerging Infectious Disease: A Strategy for the 21<sup>st</sup> Century*, October 1998.  
<http://www.cdc.gov/ncidod/emergplan/9obj11.htm>

<sup>106</sup> This system covers one-third of the deaths in the United States.

<sup>107</sup> CDC, "121 Cities Mortality Reporting System: History," January 21, 2000.  
<http://www.cdc.gov/epo/dphsi/121hist.htm>

<sup>108</sup> Telephone interview with an official with the Epidemiology Program Office, CDC, May 3, 2000.

<sup>109</sup> The laboratory component of the CDC program is described in the following section.

<sup>110</sup> CDC, "The National Bioterrorism Preparedness and Response Initiative," March 13, 2000.

<sup>111</sup> CDC, "The National Bioterrorism Preparedness and Response Initiative," March 13, 2000.

<sup>112</sup> CDC, "Facts about the Health Alert Network," undated.

way communication regarding public health emergencies, and training for public health personnel through distance-learning technologies. Improved communication capabilities and enhanced surveillance technologies could also be used on a daily basis by public health departments to fulfill their core mission.<sup>113</sup>

The CDC also provided \$7.8 million in funding in 1999 to 41 state and local public health departments to enhance their surveillance and epidemiological capabilities.<sup>114</sup> These funds can be used to hire additional personnel, develop new means for gathering and analyzing data, create a response plan, train staff, and conduct exercises. Instead of relying on physicians and laboratory reports on specific diseases, health departments are encouraged to conduct surveillance based on syndromic indicators such as upper respiratory symptoms, influenza-like illnesses, or gastrointestinal illnesses. Gathering this type of data requires public health departments to seek new sources of information and establish ties with new partners. Other sources of information that could be used to conduct surveillance for unusual disease outbreaks include poison control centers, 911 call centers, veterinarian labs and clinics, animal health agencies, commercial pharmacies, coroners, and medical examiners. Spikes in the volume of calls to any of these agencies, or unusual patterns or numbers of symptoms or deaths reported to them, could be useful indicators that a major public health emergency is underway. Aberrations in one or more of these surveillance systems could serve as a trigger for epidemiological investigations, active surveillance, or heightened vigilance with respect to reports from standard public health surveillance systems. The West Nile Virus outbreak in 1999 illustrated the need for improved coordination between public health agencies and animal and wildlife health communities.<sup>115</sup>

New York City was the first city to develop a system that collected these types of information.<sup>116</sup> The Mayor's Office for Emergency Management created a citywide list of daily health indicators, including Emergency Medical Services' runs, deaths, emergency hospital admissions, and sales of over-the-counter anti-diarrhea

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<sup>113</sup> A program similar but unrelated to HAN is Electronic Laboratory Reporting (ELR). Under this program, Hawaii developed an electronic reporting system for the state's three largest commercial clinical labs. The results were significant. The state health department recorded a 2.3-fold increase in notifiable disease reports, reports were received five days earlier, and they were more likely to be complete and have patient contact information to facilitate epidemiological follow-up. Paul Effler et al., "Statewide System of Electronic Notifiable Disease Reporting from Clinical Laboratories," *Journal of the American Medical Association*, (November 17, 1999), p. 1845.

<sup>114</sup> CDC, *National Bioterrorism Preparedness and Response Initiative Briefing Packet*.

<sup>115</sup> General Accounting Office, *West Nile Virus: Preliminary Information on Lessons Learned*, HEHS-00-142R, (Washington, DC: Government Printing Office, 2000), p. 4.

<sup>116</sup> Interview with Jerome Hauer, Director, Mayor's Office of Emergency Management, City of New York, March 1, 2000.

medicines that are reported to the office on a daily basis.<sup>117</sup> The CDC grant assistance enables state and local public health agencies to adopt the New York City model. The Boston Public Health Commission, for example, is working with local hospitals to obtain the daily figures for the number of visits to emergency departments and urgent care centers and admissions to medical intensive care units. These figures will be combined with 911 call data submitted by the city's emergency medical service and mortality data (which is already collected by the city) to provide early warning of a disease outbreak or other public health emergency. BPHC is also hoping to collect similar data from hospitals for 1999 to establish a baseline.<sup>118</sup>

### *Pilot Projects*

The Department of Energy has also initiated a pilot project in New Mexico to enhance hospital-level surveillance by wiring the emergency and urgent care departments of a University of New Mexico hospital with touch screen computers tied directly to the state's office of epidemiology.<sup>119</sup> The system will allow physicians to input age, sex, certain respiratory and gastrointestinal symptoms, and zip codes for home and work. The system will then display a color-coded map of clusters of patients with similar symptoms.

### *Enhanced Surveillance for Special Events*

The CDC has also developed a specialized system to provide enhanced surveillance during special events. The system was first used in Seattle for the World Trade Organization meeting in November-December 1999. It was also used in 2000 during the Republican and Democratic national conventions. The WTO Enhanced Surveillance Project established an active surveillance system in the emergency departments of eight hospitals in Seattle and King County that monitored more than 10,000 clinical visits.<sup>120</sup> The system was used to monitor key syndromes such as sudden death and botulism-like illness and send the data directly to the epidemiology office in the county public health department. Although the system operated successfully and was praised by participating hospitals, it was suitable for use only for a short period because of the heavy demand it placed on

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<sup>117</sup> Prepared statement of Jerome Hauer, Director, Mayor's Office of Emergency Management, City of New York, before Senate Health, Education, Labor and Pensions Committee, *Bioterrorism: Evaluating U.S. Public Health and Medical Readiness*, March 25, 1999; interview with Jerome Hauer, March 1, 2000.

<sup>118</sup> Minutes of Boston Bioterrorism/Mass Casualty Surveillance Task Force meetings, April 10 and July 31, 2000.

<sup>119</sup> Ian Hoffman, "Tracking Diseases Via Computer," *Albuquerque Journal*, March 27, 2000.

<sup>120</sup> Seattle and King County Department of Public Health, "WTO Enhanced Surveillance Project: Local and National Collaboration Leads to Success," *Epi-Log*, vol. 39, no. 12 (December 1999), pp. 1-2.

the public health agency and emergency departments.<sup>121</sup> In addition to providing near-real-time surveillance of the city's emergency departments, the project also raised the doctors' awareness about public health surveillance and bioterrorism and improved communications between the hospitals and the public health department.<sup>122</sup>

### **Laboratory Identification of Biological Agents**

Since most of the critical biological agents the CDC has identified as posing the greatest threat to the public are not endemic to the United States, there has traditionally been little capacity or expertise at the state or local level to identify these agents. To remedy this problem, the CDC established the Laboratory Response Network (LRN) to build capacity at the state and local level and establish links between public health departments at all levels to advanced diagnostic capabilities. This network has already reduced the time needed to confirm the presence of a critical agent in a clinical or environmental sample from more than 24 hours to less than three hours and ensured that this capability exists around the country.<sup>123</sup>

#### *Laboratory Response Network*

The laboratories participating in the LRN are divided into four levels depending on their capability to safely handle and identify critical biological agents.<sup>124</sup> Level A labs are public health and clinical labs with low-level biosafety features and will employ only standard microbiological techniques, which can take up to 48 hours to identify an organism.<sup>125</sup> If a specimen is suspected of involving a critical agent, it will be forwarded to the nearest Level B or C lab.<sup>126</sup> Likewise, environmental specimens believed to contain a critical agent (such as those obtained from a suspicious package) will be transported directly to a Level B or C lab. Level B labs are state and local public health labs capable of testing for specific agents and will be used to screen samples to prevent the overloading of Level C labs. Level C labs are located at state health agencies, universities or federal facilities and will be able to conduct advanced diagnostic tests such as nucleic acid amplification and molecular

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<sup>121</sup> Telephone interview with Jeffrey S. Duchin, Chief, Communicable Disease Control and Epidemiology, Seattle and King County Department of Public Health, April 20, 2000.

<sup>122</sup> Ibid.

<sup>123</sup> The CDC accomplished this feat by developing and providing agent-specific reagents to public health laboratories compatible with the widely used direct fluorescent antibody (DFA) test. Samples believed to contain smallpox or a viral hemorrhagic fever must be sent to the CDC for analysis because they require a higher level of biosafety containment than public health labs can provide. Telephone interview with an official with the BPRP, CDC, August 21, 2000.

<sup>124</sup> This description of the LRN is drawn from CDC, "Biological and Chemical Terrorism," p. 10.

<sup>125</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. 79.

fingerprinting. Level D labs are specialized federal labs such as the CDC and USAMRIID that have experience identifying rare, unknown or genetically altered pathogens at the highest level of biosafety. As part of the LRN, the CDC maintains the Rapid Response Advanced Technology (RRAT) laboratory, which serves as the key entry point for all unknown or suspicious biological specimens sent to the CDC. The RRAT is on duty 24 hours a day, seven days a week and screens specimens before sending them to one of the agent-specific specialty labs at CDC.<sup>127</sup>

#### *Grant Assistance*

As part of the LRN program, CDC provided 41 state health departments and two municipal health departments with \$8.8 million in 1999 to develop enhanced capabilities to rapidly and accurately detect critical biological agents.<sup>128</sup> Another \$16.9 million is budgeted for 2000 and 2001.<sup>129</sup> CDC is also posting agent-specific laboratory protocols on the Internet as well as establishing an online order service for the necessary test reagents.<sup>130</sup> CDC trained 700 laboratory and public health personnel for Level A labs in August and September 1999. This training will be continued throughout 2000 and be extended to personnel in Level B and C labs as well.<sup>131</sup>

#### *Transportable Laboratories*

Besides the central laboratories that are part of the LRN, several federal agencies maintain or are developing mobile or transportable laboratories to detect biological agents.<sup>132</sup> The Naval Medical Research Institute (NMRI) currently has a deployable field laboratory that can provide confirmatory diagnoses.<sup>133</sup> The Marine Corps' CBIRF, the FBI's Hazardous Materials Unit (HMRU), and the National Guard's 27 WMD-CSTs all plan

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<sup>126</sup> In the event that a specimen is suspected to contain smallpox or a viral hemorrhagic fever such as Ebola, the specimen will be transported by the FBI directly to the CDC. Telephone interview with an official with the BPRP, CDC, April 27, 2000.

<sup>127</sup> Telephone interview with an official with the BPRP, CDC, April 27, 2000.

<sup>128</sup> CDC, *National Bioterrorism Preparedness and Response Initiative Briefing Packet*.

<sup>129</sup> CDC, "The National Bioterrorism Preparedness and Response Initiative," March 13, 2000.

<sup>130</sup> CDC, *National Bioterrorism Preparedness and Response Initiative Briefing Packet*.

<sup>131</sup> *Ibid.*

<sup>132</sup> The commercially available hand-held detectors, called "tickets," have proven to be of limited utility because of their lack of sensitivity and specificity. Institute of Medicine and National Research Council, *Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response*, 87; telephone interview with an official with the BPRP, CDC, April 27, 2000.

<sup>133</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. 87.

to field mobile labs.<sup>134</sup> The CDC also plans to equip its bioterrorism response team with suitcase-sized systems based on PCR technology.<sup>135</sup> These systems could be useful for forensic purposes, guiding environmental remediation, or bolstering the diagnostic capabilities available at the local level during crisis or consequence management.

### Aerosol Detection

Aerosols are invisible and odorless clouds of microscopic particles and therefore cannot be detected by the human senses. Special equipment for the detection of aerosols exists but is been developed by the federal government but this technology is not available to all jurisdictions nor is it capable of detecting all types of pathogens. A 1999 DOJ counterterrorism needs assessment found that “biological agent detection technology has not yet provided a complete, affordable capability.”<sup>136</sup> Furthermore, a 1999 National Research Council Institute of Medicine study found that continuous, real-time monitoring for aerosols of biological weapons is feasible only for special events or when intelligence indicates a potential threat in a specific locale.<sup>137</sup> While the DOD fields the only devices currently capable of conducting this type of detection, the DOE has a project underway to install such a system around Salt Lake City, Utah for the 2002 Olympic games.

The DOD deployed a biological aerosol detection system, called Portal Shield, at such as events as the 1997 Group of Eight international economic summit in Denver, Colorado and NATO’s 50<sup>th</sup> anniversary summit in Washington, D.C. in 1999.<sup>138</sup> The Pentagon maintains the capability to deploy this system to special events anywhere in the United States.<sup>139</sup> Portal Shield began as an advanced technology demonstrator in 1996 to detect, identify, and warn of a biological warfare attack against overseas ports and airbases. It is currently

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<sup>134</sup> Lois Ember, “Marines Offer Rapid Response to Chemical/Biological Terrorism,” *Chemical and Engineering News*, July 1, 1996, pp. 22-23; Steve Vogel, “High-Profile Marine Unit Moving Here,” *Washington Post*, January 8, 2000, p. B1; Federal Bureau of Investigation, *FBI Laboratory Annual Report 1998*, p. 3; Federal Bureau of Investigation, *FBI Laboratory Annual Report 1999*, (Washington, DC: Government Printing Office, 1999), p. 4; prepared statement of Charles Craig, Acting Assistant Secretary for Reserve Affairs, Department of Defense, before the House Committee on Government Reform, National Security, Veterans Affairs, and International Relations Subcommittee, *Combating Terrorism: The National Guard Rapid Assessment and Initial Detection (RAID) Teams*, June 23, 1999.

<sup>135</sup> Telephone interview with an official with the BPRP, CDC, April 27, 2000.

<sup>136</sup> Department of Justice, *Responding to Incidents of Domestic Terrorism: Assessing the Needs of the State and Local Jurisdictions, Phase I Report*, (Washington, DC: Government Printing Office, 1999), p. 22.

<sup>137</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism.*, p. 95.

<sup>138</sup> Department of Defense, *Nuclear Biological Chemical Defense Annual Report to Congress 2000*, (Washington, DC: Government Printing Office, 2000), p. A-3.

<sup>139</sup> Telephone interview with an official with the Joint Program Office-Biological Defense, Department of Defense, May 1, 2000.

installed at facilities in South Korea and the Arabian Peninsula.<sup>140</sup> The system comprises a network of automated sensors that can detect eight agents (plague, tularemia, anthrax, cholera, SEB, ricin, botulinum, and brucellosis) in less than 25 minutes.<sup>141</sup> If two or more sensors detect a biological agent, an alarm rings at a computer station. A false positive rate of less than 0.5% using the system has been reported.<sup>142</sup> A limitation of this system is that it is designed to provide coverage to an area several square kilometers in size, not an entire city.<sup>143</sup> The only other operational biological aerosol detection system is the Army's Biological Integrated Detection System (BIDS). Although the BIDS has the advantage of mobility since it is mounted on a HMMWV truck, it is not fully automated and thus takes longer to identify biological agents. In addition, early versions of the system could identify only four agents (anthrax, plague, botulinum toxin and SEB).<sup>144</sup>

The DOE, as part of its Chemical and Biological Nonproliferation Program, is working with Salt Lake City to develop the Biological Aerosol Sentry and Information System (BASIS) to provide continuous monitoring of a large area for airborne biological agents during the 2002 Winter Olympics.<sup>145</sup> BASIS will include a network of 50 sensors, urban hazard assessment models, a command and communication system, and decision support tools for emergency management planners in Salt Lake City.<sup>146</sup> Aerosol samples will be collected from sensors and analyzed at a central laboratory, with the results being fed directly to the special event's operations center. Since the system is still in development, operational parameters such as sensitivity, specificity, speed, accuracy, and types of agents detected are not currently available. DOE envisions that this system will be available for deployment to other special events after the 2002 Olympics.<sup>147</sup>

## Response

A large-scale biological terrorist incident could generate from hundreds to hundreds of thousands of casualties and worried well. Even a small-scale incident, infecting hundreds of people, could overwhelm the medical resources of a large city. Although early warning is essential, agencies at all levels of government must also

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<sup>140</sup> Department of Defense, *Nuclear Biological Chemical Defense Annual Report to Congress 2000*, p. A-3; "Bases in Korea and Mideast to get Bio-Warning Networks," *Defense Week*, January 26, 1998.

<sup>141</sup> Department of Defense, *Nuclear Biological Chemical Defense Annual Report to Congress 2000*, p. A-3. The list of agents is from Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. 87.

<sup>142</sup> Telephone interview with an official with the Joint Program Office-Biological Defense, DOD, May 1, 2000.

<sup>143</sup> Ibid.

<sup>144</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. 87.

<sup>145</sup> DOE, *Chemical and Biological Nonproliferation Program Annual Report 1999*, pp. 39, 173.

<sup>146</sup> DOE, *National Security R&D Portfolio: FY99-2001*, (Washington, DC: Government Printing Office, 2000), p. 147.

<sup>147</sup> DOE, *Chemical and Biological Nonproliferation Program Annual Report 1999*, pp. 49, 175.

have the appropriate capabilities in place and plans to utilize these capabilities in concert with other agencies. This section divides the current efforts to enhance local, state, and federal response capabilities into three categories: planning, medical response, and mass immunization and prophylaxis.

## **Planning**

### *Federal*

The lead agency for the federal response to a WMD terrorist incident is FEMA. FEMA uses the Federal Response Plan (FRP) to coordinate the activities of the 26 other federal agencies that participate in consequence management. Within the FRP, the HHS is the lead agency for health and medical services under Emergency Support Function #8. PDD-62 has reinforced the lead role played by HHS in preparing for and responding to medical emergencies.<sup>148</sup> Since 1996, HHS has had a plan in place to address the specific requirements of combating biological terrorism.<sup>149</sup> The plan describes the assignment of responsibilities for the separate bureaus and offices within the department as well as the mechanisms for coordinating with other agencies. This plan has not yet been updated, however, to take into account significant recent developments in domestic preparedness programs. The CDC recently published a strategic plan for preparing for and responding to biological terrorism that provided a comprehensive description of the CDC's ongoing programs but devoted only one paragraph to how the CDC or other federal agencies would respond to a biological terrorism incident.<sup>150</sup> As D. A. Henderson has noted, "There is, as yet, no agreed upon national strategy or plan to deal with bioterrorism."<sup>151</sup>

### *State and Local*

Planning for a bioterrorism incident is also lacking at the state and local level. An estimated 77% of local health departments do not have an emergency response plan that addresses bioterrorism.<sup>152</sup> Two-thirds of the cities surveyed regarding their bioterrorism planning activities responded that they had no plans in place to address a biological terrorism incident.<sup>153</sup> Plans for rapid epidemiological investigation, laboratory identification of unknown agents, and conducting mass prophylaxis campaigns would also be useful for dealing with pandemic

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<sup>148</sup> Hamburg testimony before Senate Appropriations Committee and Senate Veterans' Affairs Committee in *Bioterrorism: Domestic Weapons of Mass Destruction* (Washington, DC: Government Printing Office, 2000), p. 14.

<sup>149</sup> HHS, *Health and Medical Services Support Plan for the Federal Response to Acts of Chemical/Biological (C/B) Terrorism*, (Washington, DC: June 21, 1996).

<sup>150</sup> CDC, "Biological and Chemical Terrorism," p. 9.

<sup>151</sup> D. A. Henderson, "US Response to Possible Bioterrorism."

<sup>152</sup> CDC, "Facts about the Health Alert Network."

<sup>153</sup> Barbara Neuby, "Municipal Preparedness for Biological Events," unpublished manuscript, June 2000.

influenza and outbreaks of emerging infectious diseases. Hospitals could also benefit from planning for dealing with mass-casualty incidents and small-scale disease epidemics.

Numerous federal agencies have efforts underway to assist state and local governments in developing plans for preparing for and responding to a bioterrorist event. In 1999, the CDC distributed \$1.5 million to nine states and 2 municipal health agencies to develop model bioterrorism preparedness and response plans.<sup>154</sup> Another \$11 million is earmarked for 2000 and 2001.<sup>155</sup> At the municipal level, OEP requires each of the cities participating in the MMRS program (72 as of 2000) to develop response plans for a bioterrorism incident, including plans for improving early recognition of a bioterrorist incident, providing mass prophylaxis and mass patient care, managing mass fatalities, and ensuring environmental surety after an event.<sup>156</sup> In August 2000, Soldier Biological Chemical Command's (SBCCOM) Biological Warfare Improved Response Program published a guide for state and local agencies on how to plan for a bioterrorist incident.<sup>157</sup>

Although all U.S. hospitals are required to have disaster plans, few are believed to have plans that address the unique demands of a bioterrorist incident, such as large-scale victim isolation, laboratory work with dangerous organisms, lack of critical care availability, access to appropriate antibiotics and vaccines, and handling large numbers of corpses.<sup>158</sup> In response to this lack of planning, a team from the CDC and the Association for Professionals in Infection Control and Epidemiology devised a model bioterrorism readiness plan for health care facilities in 1999 and posted it on the Internet.<sup>159</sup> In addition, the American Hospital Association, with the support of OEP, published a report in August 2000 highlighting key issues facing hospitals in preparing for mass casualty incidents.<sup>160</sup> Internal, facility-specific planning is essential, but there is also a need for hospitals to shift their planning perspective from that of an autonomous and self-sufficient actor to that of an interdependent actor

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<sup>154</sup> CDC, *National Bioterrorism Preparedness and Response Initiative Briefing Packet*.

<sup>155</sup> CDC, "The National Bioterrorism Preparedness and Response Initiative," March 13, 2000.

<sup>156</sup> OEP, *MMRS Statement of Work Bio Add-On, draft*, January 31, 2000. [http://207.91.118.34/Public/NewsStand/Documents/MMRS\\_SOW\\_BIO.pdf](http://207.91.118.34/Public/NewsStand/Documents/MMRS_SOW_BIO.pdf)

<sup>157</sup> SBCCOM, *Improving Local and State Agency Response to Terrorist Incidents Involving Biological Weapons*, August 1, 2000. [http://dp.sbcom.army.mil/fr/bwirp\\_interim\\_planning\\_guide.pdf](http://dp.sbcom.army.mil/fr/bwirp_interim_planning_guide.pdf)

<sup>158</sup> Richards, et al., "Emergency Physicians and Biological Terrorism," p. 187.

<sup>159</sup> *Bioterrorism Readiness Plan: A Template for Healthcare Facilities* (APIC Bioterrorism Task Force and CDC Hospital Infections Program Bioterrorism Working Group, April 1999). <http://www.cdc.gov/ncidod/hip/Bio/13apr99APIC-CDCBioterrorism.PDF>

<sup>160</sup> American Hospital Association, *Hospital Preparedness for Mass Casualties*, August 2000. <http://www.ahapolicyforum.org/policyresources/MODisaster.asp>

integrated into an interagency, multijurisdiction system. Even a small-scale infectious disease outbreak, especially one amplified by the media, will create conditions that could overwhelm a hospital that lacked cooperative relationships with other hospitals as well as public health and safety agencies.

A crucial element for effective planning is conducting realistic exercises. Cities participating in the Domestic Preparedness Program have conducted a bioterrorism tabletop exercise as part of the training. Field exercises for biological terrorism are more difficult to conduct, however, because of the potential disruption to operations in participating hospitals and public health agencies. A biological terrorism field exercise was scheduled to be held in New York City in September 1999, but was postponed indefinitely due to the West Nile encephalitis outbreak that began in August. The first full-scale biological terrorism field exercise took place in May 2000 in Denver as part of the TOPOFF exercise cosponsored by DOJ and FEMA.<sup>161</sup> The results of this exercise had not been released by the time of publication.

### Medical Response

A bioterrorist incident would most likely create a grave medical emergency. The current level of readiness in the medical community to handle such an incident, however, is low. According to a DOJ study, “Most of the assessments agree that medical and hospital personnel are not prepared to provide the necessary support to address a WMD incident. Most medical personnel lack the skills to treat WMD victims, and hospitals may lack the equipment and capacity to handle casualties.”<sup>162</sup> D. A. Henderson notes that, “a recent meeting of hospital executives concluded that no U.S. hospital is prepared to deal with community-wide disasters, for a host of financial, legal, and staffing reasons.”<sup>163</sup>

As the medical community continues the trend of reducing costs by cutting staff and bed capacity and closing emergency departments, its preparedness to address mass casualty incidents, such as bioterrorism, erodes. As a result, the health care system today is extremely inelastic and incapable of responding to large-scale public health emergencies. To illustrate the lack of capacity to handle a large number of critically ill patients, consider that in Boston as few as 80 patients requiring critical care would saturate the local hospitals’ patient care

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<sup>161</sup> Michael Sniffen, “U.S. to Have Terrorism Field Test,” *Associated Press*, April 27, 2000.

<sup>162</sup> Department of Justice, *Responding to Incidents of Domestic Terrorism*, p. 24.

<sup>163</sup> D. A. Henderson, “Nation Is Perilously Unprepared for a Bioterror Event,” *The Star Tribune*, August 9, 2000.

capabilities.<sup>164</sup> In the view of Michael Osterholm, former state epidemiologist for Minnesota, the capacity to provide intensive care to 2,600 patients is “not available anywhere in the country.”<sup>165</sup> Financial pressures generated by the managed care environment limit the ability of hospitals and doctors to enhance their readiness.<sup>166</sup> In addition, unlike fire departments, EMS and law enforcement agencies, there is no established mutual aid system for health care facilities. In the event of a bioterrorism incident that affects a wide geographic area, or has the potential to do so, local hospitals that are hard pressed to maintain the standard of care for their regular flow of patients—not to mention the added burden of bioterrorism casualties or worried well—may be unable or unwilling to provide assistance. Based on the recent experience with the 1999-2000 flu season, serious shortages of health care providers and beds can be expected in the event of a bioterrorism incident.<sup>167</sup> Thus, federal assistance will be required to boost local medical care capabilities and sustain that level throughout the aftermath of a bioterrorist attack.<sup>168</sup> Federal assets, however, should not be expected in less than 24 hours after notification. Thus, the initial burden of a medical response will fall on local and state resources.

### *Mass Care*

The primary source of federal medical assistance in a bioterrorism attack will be the National Disaster Medical System (NDMS). Through NDMS the federal government can provide both civilian and military medical teams to supplement local health care providers as well as evacuate patients from the affected area to receive care at a hospital participating in the NDMS.

The principal medical support assets provided by NDMS are the 30-member Disaster Medical Assistance Teams (DMATs). The 27 Level 1 teams can be mobilized within hours and are able to sustain their operations for up to 72 hours.<sup>169</sup> An additional 30 teams, some capable of providing specialized services such as pediatrics and burn

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<sup>164</sup> Gregory Koblenz, “Enhancing Massachusetts’ Preparedness for Biological Terrorism,” master’s thesis, John F. Kennedy School of Government, Harvard University, April 6, 1999, p. 21.

<sup>165</sup> “Doc: U.S. Not Set for Bio Attack,” *Associated Press*, June 2, 2000.

<sup>166</sup> For details, see Monica Schoch-Spana, “Hospitals Buckle during Normal Flu Season: Implications for Bioterrorism Response,” *Biodefense Quarterly*, vol. 1, no. 4, March 2000, p. 1.

<sup>167</sup> *Ibid.*

<sup>168</sup> Unlike a conventional terrorist attack that produces a surge of patients at hospitals for a few hours, an act of biological terrorism could produce waves of victims seeking medical care over the course of several days. Henry Siegelson, “Aftermath: Hospitals Are on the Front Lines after Acts of Terrorism,” *Health Facilities Management* (January 1990).

<sup>169</sup> Prepared statement of Gary Moore, Acting Deputy Director, Office of Emergency Preparedness, HHS before the House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, *Domestic Preparedness Against Terrorism: How Ready Are We?* March 27, 2000.

and mental health care, are capable of deploying in one to three days.<sup>170</sup> OEP has also upgraded four DMATs, called National Medical Response Teams (NMRTs), with additional equipment and specialized training to provide medical treatment to the victims of a chemical or biological weapon attack.<sup>171</sup> Each team has access to a cache of specialized pharmaceuticals to treat up to 5,000 people exposed to a chemical weapon and hundreds of people exposed to a biological agent.<sup>172</sup> The DMATs and NMRTs rely on volunteer medical personnel who are federalized for deployment to the scene of a disaster or terrorist incident. In the past these units have also been prepositioned in anticipation of major storms and for special events.

The military cannot provide significant specialized medical assets at short notice. The Pentagon's dedicated WMD terrorism response teams, the Marine Corps' CBIRF and National Guard's WMD-CSTs, have limited medical care capabilities.<sup>173</sup> The military's premier infectious disease laboratory, USAMRIID, plans to deploy only one physician with experience in treating casualties of a biological warfare agent to the scene of an attack and then only in an advisory role.<sup>174</sup> Although the DOD has a large pool of medical personnel, the bulk is located in the reserve force rather than active duty.<sup>175</sup> These units are not designed to deploy at short notice to domestic events. Beginning in 2001, the Pentagon plans to train existing reserve units to perform tasks such as distributing pharmaceuticals, treating casualties of nuclear, biological, and chemical weapons, and providing critical incident stress counseling.<sup>176</sup> The size, composition, number, and geographic distribution of these units is yet to be determined.

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<sup>170</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. 25.

<sup>171</sup> The NMRTs are based in Denver, Colorado; Winston-Salem, North Carolina; Los Angeles, California; and Washington, D.C. The DC team does not deploy outside of the metro area. Prepared statement of Robert Knouss, Director, Office of Emergency Preparedness, Department of Health and Human Services, before the Senate Judiciary Committee, Youth Violence Subcommittee Hearing, on *Training First Responders into the 21<sup>st</sup> Century*, June 11, 1999.

<sup>172</sup> Senate Appropriations Committee and Senate Veterans Affairs Committee, *Bioterrorism: Domestic Weapons of Mass Destruction*, p. 9.

<sup>173</sup> CBIRF has a 27-member medical unit. The unit does not however, include antibiotics in its stockpile. GAO, *Combating Terrorism: Chemical and Biological Medical Supplies Are Poorly Managed*, HEHS/AIMD-00-36, (Washington, DC: Government Printing Office, 1999), p. 4.

Each WMD-CST has a four-member medical team. Jay Steinmetz, "Military Support for Response to Attacks Using Weapons of Mass Destruction," presentation to Worldwide Chemical Conference, Fort McClellan, Alabama, June 23-25, 1998.

<sup>174</sup> *Joint Chiefs of Staff (JCS) J-3 Weapons of Mass Destruction (WMD) Handbook*, (Washington, DC: Government Printing Office, 2000), p. 72. [www.anser.org/homeland/featured.cfm](http://www.anser.org/homeland/featured.cfm)

<sup>175</sup> The Army Reserve holds 59% of the Army's medical assets. Jack Siemieniec, "Army Reserve Gears Up for Civil Support Mission," *ArmyLink News*, March 22, 2000.

### *Patient Transport*

NDMS is also capable of evacuating patients from stricken areas and placing them in hospitals outside of the affected area. The DOD is charged under the FRP with providing the transportation assets necessary for this mission. More than 1,500 nonfederal hospitals participate in NDMS and would be able to accept patients in the event of an incident. As noted above, the critical care capabilities of many cities are quite limited and could be easily overwhelmed by a large outbreak of bio-terrorism-related illness. The patient relocation function of the NDMS is rarely utilized, however, and has never been exercised with a mass casualty scenario.<sup>177</sup> In addition, relatively few hospitals or local jurisdictions have experience interfacing with this system. Even if the NDMS patient relocation system functioned smoothly following a biological terrorism incident, it is expected that only noninfected patients would be transported out of the area to free beds for the bioterrorism victims.<sup>178</sup> This approach is necessary to contain the scope of the outbreak and minimize the disruption of the operations of other hospitals. In addition, in the event that the bioterrorism agent were lethal and contagious, there is an extremely limited number of assets to safely transport patients with such diseases and health care facilities capable of providing intensive care to such patients in a high biosafety environment.<sup>179</sup> Thus, based on current federal plans and capabilities, local hospitals and health care providers, supplemented by state and federal assets, will bear the brunt of providing treatment to the casualties of a biological terrorist attack.

### Mass Prophylaxis

Providing antibiotics, vaccines, and other medical supplies to exposed and at-risk populations, called mass prophylaxis, will be crucial for saving lives after an act of bioterrorism. Epidemiological and criminal investigations will provide critical inputs to a mass treatment campaign by specifying the nature of these populations and the scope of the outbreak. A successful mass immunization and/or prophylaxis campaign will have three main components: planning, personnel, and pharmaceuticals.

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<sup>176</sup> Telephone interview with an official in the Consequence Management Program Integration Office, Department of Defense, May 3, 2000.

<sup>177</sup> Telephone interview with an official in the Emergency Management Strategic Healthcare Group, Veterans Health Administration, Department of Veterans Affairs, August 23, 2000.

<sup>178</sup> This is the concept of operations in Soldier and Biological Chemical Command, *Improving Local and State Agency Response*.

<sup>179</sup> USAMRIID maintains two aeromedical isolation teams (AITs) that can each transport one patient at a time under high- biosafety conditions. USAMRIID is also the only facility in the United States that can provide patient care under high-biosafety conditions. Its capacity is limited, however, to a 16-bed biosafety level 3 ward and a 4-bed biosafety level 4 ward. George Christopher and Edward Eitzen, "Air Evacuation Under High-Level

### *Planning*

Providing drugs to large numbers of people poses severe logistical challenges. Planning is essential to ensure that the maximum number of people receive the appropriate medicine in a timely fashion. New York City's Office of Emergency Management has conducted planning for this type of public health activity. The city's point of distribution plan has been adopted in part by SBCCOM as a model response plan and is under review by several other cities as well.<sup>180</sup> The TOPOFF exercise in May 2000 included a biological field exercise in Denver that utilized this model for distributing antibiotics, but an analysis of this segment of the exercise is not currently available. In August 2000, SBCCOM published a guide for state and local agencies on how to plan for a bioterrorism incident that included a section on mass prophylaxis.<sup>181</sup> SBCCOM plans to conduct a field exercise of its bioterrorism response plan in early 2001.<sup>182</sup> A glaring gap in the planning process, however, is how the national pharmaceutical stockpile will be integrated with state and local response plans. CDC intends to convene a conference of state public health and emergency management planners in Atlanta by the end of 2000 to discuss this issue.<sup>183</sup>

### *Personnel*

Mass prophylaxis is labor intensive. For example, even a scaled-down version of New York City's point of distribution model applied to a community of 100,000 people would require 654 personnel to provide ciprofloxacin pills (the antibiotic of choice for treating inhalation anthrax) to the entire community.<sup>184</sup> Local hospital personnel would likely be unable to participate in such an effort because of the already limited number of staff available at most institutions and the necessity of treating the regular flow of patients as well as bioterrorism casualties and the worried well who are either transported to the hospital by ambulance or self-refer. Although the New York plan envisions utilizing minimally trained personnel to administer pills this may not be possible if the required prophylaxis needs to be administered intravenously or by injection. Thus, federal assets such as DMATs, NMRTs, and military medical personnel will probably be required to participate in any mass prophylaxis campaign.

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Biosafety Containment: The Aeromedical Isolation Team," *Emerging Infectious Diseases*, vol. 5, no. 2, March-April 1999.

<sup>180</sup> Telephone interview with Jerome Hauer, former Director, Mayor's Office of Emergency Management, City of New York, April 26, 2000.

<sup>181</sup> SBCCOM, *Improving Local and State Agency Response*.

<sup>182</sup> Telephone interview with an official in the Domestic Preparedness Office, US Army Soldier and Biological Chemical Command, Department of Defense, August 22, 2000.

<sup>183</sup> Telephone interview and email communication with CDC official, July 18, 2000.

<sup>184</sup> Prepared statement of Jerome Hauer, March 25, 1999.

## *Pharmaceuticals*

Pharmaceuticals are obviously critical to a mass prophylaxis campaign. At the local level, the demands of managed care have forced hospitals to minimize their inventories of pharmaceuticals and utilize a just-in-time delivery system. Thus, sufficient quantities of the appropriate antibiotics may not be readily available in a bioterrorism incident to begin chemotherapy. Given the need for antibiotic therapy to extend from one to six weeks for most diseases of concern, even a modest bioterrorism incident could consume very large quantities of antibiotics. As part of the MMRS program sponsored by OEP, cities can use a portion of their grant assistance to maintain small stocks of crucial drugs.<sup>185</sup> OEP urges cities to plan conservatively and have sufficient pharmaceuticals on hand for their entire population for 24 hours.<sup>186</sup> Prior to special events, cities and local hospitals have taken steps to increase their holdings of key pharmaceuticals, but it is unlikely that this practice could be sustained indefinitely in the absence of an immediate threat.<sup>187</sup>

HHS maintains the only pharmaceutical stockpiles in the country available for rapid delivery to the scene of an infectious disease outbreak.<sup>188</sup> HHS actually maintains two separate stockpile systems for responding to biological terrorist events, one administered by OEP and the other by CDC.<sup>189</sup> Each of the four NMRTs established by OEP possesses a small cache of pharmaceuticals for treating 80 people for four weeks for several different types of bacterial infections.<sup>190</sup> These caches are stored at VA facilities on behalf of OEP. The three deployable teams and their associated stockpiles can be deployed within four hours of notification.<sup>191</sup> These teams and their caches have been prepositioned at special events.

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<sup>185</sup> The extent to which this is being done however, has not been assessed in any reliable or systematic way.

<sup>186</sup> OEP, MMRS Statement of Work, draft, January 31, 2000. [http://207.91.118.34/Public/NewsStand/Documents/MMRS\\_SOW.pdf](http://207.91.118.34/Public/NewsStand/Documents/MMRS_SOW.pdf)

<sup>187</sup> "Hospitals Stockpiling Antidotes against Biological Weapons for WTO Meeting," *Associated Press*, November 9, 1999; Troy Anderson, "L.A. Hospitals Readied for Terror Attacks," *Los Angeles Times*, July 23, 2000; Marie McCullough, "Bioterror Scenarios Drawn Up," *The Philadelphia Inquirer*, July 23, 2000.

<sup>188</sup> Contrary to its name, CBIRF does not maintain a cache of pharmaceuticals for treating victims of biological terrorism. Prepared statement of Carlos Hollifield, Commander, CBIRF, United States Marine Corps, Department of Defense, before House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs and International Relations, *Combating Terrorism: Management of Medical Stockpiles*, March 8, 2000. <http://www.house.gov/reform/ns/hearings/subfolder/CBIRFTEST.htm>

<sup>189</sup> Both OEP and CDC maintain antidotes and other supplies for treating victims of chemical weapons as part of their stockpile programs, but this paper addresses only those portions of the stockpiles relevant to preparing for biological terrorism.

<sup>190</sup> Senate Appropriations Committee and Senate Veterans' Affairs Committee, *Bioterrorism: Domestic Weapons of Mass Destruction* (Washington, DC: Government Printing Office, 2000), p. 9.

<sup>191</sup> The NMRT based in Washington, D.C. does not deploy. Prepared statement of Dr. Knouss, Director, Office of Emergency Preparedness, Department of Health and Human Services, before House Committee on

In addition, CDC is building a national pharmaceutical stockpile for the treatment of millions of victims of bioterrorism.<sup>192</sup> The national stockpile consists of two elements: 12-hour push packages and vendor managed inventory. The push packages are palletized sets of medical supplies such as bandages and dressings, pharmaceuticals (mainly antibiotics), and medical equipment such as IVs and ventilators. The first push package became operational in December 1999 at the Edward Hines VA hospital outside of Chicago, Illinois.<sup>193</sup> There are currently eight push packages, with three being in a higher state of readiness.<sup>194</sup> The antibiotics stockpiled are for the treatment of anthrax, plague, and tularemia, the three bacterial agents identified by the CDC as posing the most critical threat. These packages will comprise roughly 20% of the entire inventory. The other 80% will come from inventories maintained by manufacturers and prime vendors. The vendor's inventory can be shipped to arrive 24 and 36 hours after notification. CDC is negotiating contracts with commercial cargo carriers to transport the pharmaceuticals to the closest airport to the areas affected by bioterrorist attack. The decision to deploy the national stockpile would be made by the director of CDC in consultation with the Assistant Secretary for Health.<sup>195</sup> CDC deployed only personnel, not pharmaceuticals, to Denver as part of the TOPOFF exercise.<sup>196</sup>

At this time, CDC is focused on delivering antibiotics as part of the pharmaceutical stockpile program. A 1999 National Research Council-Institute of Medicine study concluded, "vaccination has limited value as a primary defense for civilian populations."<sup>197</sup> Vaccines are nonetheless integral to responding to an outbreak of smallpox, however, to prevent the disease from spreading beyond the initial group of infected individuals.<sup>198</sup> HHS plans

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Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, *Combating Terrorism: Management of Medical Stockpiles*, March 8, 2000.

<sup>192</sup> Department of Health and Human Services, "HHS Initiative Prepares for Possible Bioterrorist Threat," February 9, 1999.

<sup>193</sup> House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, *Combating Terrorism: Management of Medical Stockpiles*, March 8, 2000.

<sup>194</sup> Telephone interview and e-mail communication with CDC official, July 18, 2000.

<sup>195</sup> Prepared statement of Stephen M. Ostroff, Associate Director for Epidemiologic Science, National Center for Infectious Diseases, CDC, before House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, *Combating Terrorism: Management of Medical Stockpiles*, March 8, 2000.

<sup>196</sup> Telephone interview and e-mail communication with CDC official, July 18, 2000.

<sup>197</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. 131. This finding is supported by the Johns Hopkins Center for Civilian Biodefense Studies. Philip Russel, "Vaccines in Civilian Defense against Bioterrorism," *Emerging Infectious Diseases*, vol. 5, no. 4, (July-August 1999).

<sup>198</sup> Smallpox has the potential to multiply tenfold every two weeks. D. A. Henderson before Senate Appropriations Committee and Senate Veterans' Affairs Committee, in *Bioterrorism: Domestic Weapons of Mass Destruction*, p. 56.

on eventually stockpiling 40 million doses of the smallpox vaccine.<sup>199</sup> Currently, the United States possesses 15.4 million doses of this vaccine. Only 6-7 million doses, however, are considered viable.<sup>200</sup> A portion of the stockpile is available for immediate distribution from its storage site at Wyeth-Ayerst Laboratories near Philadelphia.<sup>201</sup> Besides the limited amount of vaccine currently available, several ancillary supplies and drugs, including the diluent needed to reconstitute the freeze-dried vaccine, sterile bifurcated needles to administer the vaccine, and vaccinia immune globulin (VIG) for the treatment of adverse reactions to the smallpox vaccine, are also in short supply.<sup>202</sup> An added complication is that the VIG that does exist is owned by the DOD and is stored separately from the vaccine at a facility owned by Baxter-Highland Laboratories.<sup>203</sup>

The other agents on the CDC's critical agent list, botulinum toxin and viral hemorrhagic fevers, have limited therapeutic remedies, and items involved in these remedies are not currently in the national stockpile. Antitoxins for botulism must be administered before the onset of symptoms to be effective.<sup>204</sup> Given the relatively short time of onset for symptoms of botulinum toxin, generally between 24 and 36 hours, compared to several days for most critical biological agents, the prospects of supplying the antitoxin in time to help exposed individuals who have not yet developed symptoms are dim.<sup>205</sup> Anti-viral drugs and antibody therapy have been found to be effective against arenaviruses such as Lassa fever, the Argentine hemorrhagic fever, and Bolivian hemorrhagic fever, but not against filoviruses such as Ebola and Marburg.<sup>206</sup>

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<sup>199</sup> HHS, "HHS Initiative Prepares for Possible Bioterrorist Threat."

<sup>200</sup> Telephone interview with NIH official, April 26, 2000; Hamburg before Senate Appropriations Committee and Senate Veterans' Affairs Committee in *Bioterrorism: Domestic Weapons of Mass Destruction*, p. 26.

<sup>201</sup> HHS, *Public Health and Social Services Emergency Fund FY 2000 Operating Plan: Anti-Bioterrorism Initiative*, (Washington, DC: Government Printing Office, 2000); Peter Durantine, "Pennsylvania Town Has the Nation's Only Stockpile of Smallpox Vaccine," *Associated Press*, July 21, 1999.

<sup>202</sup> James W. LeDuc and John Becher, "Current Status of Smallpox Vaccine," *Emerging Infectious Diseases*, vol. 5, no. 4, (July-August 1999). <http://www.cdc.gov/ncidod/eid/vol5no4/letters.htm>

<sup>203</sup> Institute of Medicine, *Assessment of Future Scientific Needs for Live Variola Virus* (Washington, DC: National Academy Press, 1999). [http://www.nap.edu/html/variola\\_virus/ch7.html](http://www.nap.edu/html/variola_virus/ch7.html)

<sup>204</sup> David R. Franz, et al. "Clinical Recognition and Management of Patients Exposed to Biological Warfare Agents," in Joshua Lederberg, *Biological Weapons: Limiting the Threat*, p. 73.

<sup>205</sup> Ibid.

<sup>206</sup> David R. Franz, et al, "Clinical Recognition and Management of Patients Exposed to Biological Warfare Agents," in *Biological Weapons: Limiting the Threat*, ed. Joshua Lederberg, pp. 69-70.

## CONCLUSION

The impact that infectious disease outbreaks, both natural and man-made, can have on the health and security of the United States has risen to the top of policy-makers agendas' and fostered new partnerships between the fields of public health and national security.<sup>207</sup> In January 1999, at the unveiling of President Clinton's request for \$230 million for bioterrorism preparedness programs for 2000, Secretary of Health and Human Services Donna Shalala said, "This is the first time in American history in which the public health system has been integrated directly into the national security system."<sup>208</sup> This sentiment is echoed in the CDC's strategic plan for countering chemical and biological terrorism: "This strategic plan marks the first time that CDC has joined with law enforcement, intelligence and defense agencies in addition to traditional CDC partners to address a national security threat."<sup>209</sup>

As this paper has described, a wide array of programs are in place within multiple federal agencies addressing different aspects of the threat posed by biological terrorism. Although domestic preparedness programs for traditional first responders have been underway for four years, HHS did not receive significant funds to prepare for biological terrorism until late 1998, and state public health departments did not receive the first round of grant money from the CDC until August 1999. Thus, the gaps and shortfalls noted above should not be unexpected. When evaluating the current and proposed measures to combat biological terrorism, one should keep in mind the admonition of a recent report, "It has to be acknowledged that it will be impossible to prevent ALL mortality, no matter how good a technology can be developed, and no matter how much money we are willing to spend to enhance our response."<sup>210</sup>

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<sup>207</sup> See Christopher Chyba, *Biological Terrorism, Emerging Disease and National Security* (New York: Rockefeller Brothers Fund, 1998) and *Contagion and Conflict: Health as a Global Security Challenge* (Washington, DC: Chemical and Biological Arms Control Institute and Center for Strategic and International Studies, January 2000).

<sup>208</sup> Office of the White House Press Secretary, "Press Briefing by Attorney General Reno, Secretary of HHS Donna Shalala, and Richard Clarke, President's National Coordinator for Security, Infrastructure and Counterterrorism," January 22, 1999.

<sup>209</sup> CDC, "Biological and Chemical Terrorism," p. 2.

<sup>210</sup> Institute of Medicine and National Research Council, *Chemical and Biological Terrorism*, p. viii.

## Appendix A: Potential Casualties from Biological Terrorism

AGENT	AMOUNT	AREA AFFECTED	POPULATION EXPOSED	ESTIMATED FATALITIES
<b>Indoor Attack (Arena)<sup>1</sup></b>				
Anthrax	1-100 liters of liquid slurry	Inside Building	10,000-50,000	8,000-40,000
Brucellosis	1-100 liters of liquid slurry	Inside Building	10,000-50,000	160-800 (8,000-40,000 sick)
<b>Open Air Attack (Boston)<sup>2</sup></b>				
<b>Point Source</b>				
Anthrax <sup>3</sup>	30 kg dry powder	10 km <sup>2</sup>	50,000	25,000
<b>Line Source</b>				
Anthrax <sup>3</sup>	100 kg dry powder	140 km <sup>2</sup>	560,000	280,000
Brucellosis <sup>4</sup>	50 kg dry powder	20 km <sup>2</sup>	100,000	200 (36,000 sick)
Q fever <sup>4</sup>	50 kg dry powder	>40 km <sup>2</sup>	200,000	85 (100,000 sick)
Plague <sup>5</sup>	50 kg dry powder	20 km <sup>2</sup>	100,000	8,500 (25,500 sick)
Tularemia <sup>5</sup>	50 kg dry powder	>40 km <sup>2</sup>	200,000	25,000 (75,000 sick)
Anthrax <sup>6</sup>	50 kg dry powder	>40 km <sup>2</sup>	200,000	80,000 (20,000 sick)

Sources: Richard Falkenrath, Robert Newman, and Bradley Taylor, *America's Achilles Heel: Nuclear, Biological and Chemical Terrorism and Covert Attack* (Cambridge, MA: MIT Press, 1998); World Health Organization, *Health Aspects of Chemical and Biological Weapons* (Geneva: WHO, 1970); Office of Technology Assessment, *Proliferation of Weapons of Mass Destruction: Assessing the Risks* (Washington, DC: Government Printing Office, 1993).

1. Falkenrath, Newman, and Taylor, *America's Achilles Heel*, pp. 152-153. These estimates are based on a concentrated liquid agent slurry, low-efficiency aerosol dispersal, high inhaled dose, and the assumption that early medical treatment is not provided to the victims.

2. These estimates are for attacks using high-quality dried agents disseminated with a high-efficiency device. Whereas states with advanced biological weapons programs would be capable of conducting such an attack, nonstate actors would face significant challenges in mastering the relevant skills and technologies. "Line source" refers to the dissemination of a biological agent from a moving vehicle (ship, aircraft, or other). This is a more efficient means of spreading an agent over a large area than a single, or "point," release.

3. OTA, *Proliferation of Weapons of Mass Destruction*, pp. 53-54. Estimates are for an attack against a city with a population density equivalent to Boston's (5,000 people per square kilometer) under moderate weather conditions and assume that no medical treatment is provided to the victims.

4. WHO, *Health Aspects of Chemical and Biological Weapons* , pp. 96-99. Estimates are for an attack against a city of 500,000 people with a population density equivalent to Boston's (5,000 people per square kilometer) under ideal weather conditions and assume that no medical treatment is provided to the victims.
5. Ibid., p. 99. Assumes that victims do not receive medical treatment.
6. Ibid., p. 99. Assumes that victims do not receive medical treatment.



## Appendix B: Critical Biological Agents

Category A agents include organisms that

- can be easily disseminated or transmitted person-to-person.
- cause high mortality, with potential for major public health impact.
- might cause public panic and social disruption.
- require special action for public health preparedness.

Category A agents include

- *Variola major* (smallpox)
- *Bacillus anthracis* (anthrax)

*Yersinia pestis* (plague)

- *Clostridium botulinum* toxin (botulism)
- *Francisella tularensis* (tularemia)
- *Filoviruses*  
*Ebola hemorrhagic fever*  
*Marburg hemorrhagic fever*
- *Arenaviruses*  
*Lassa* (Lassa fever)  
*Junin* (Argentine hemorrhagic fever)
- *Related viruses.*

Category B second highest priority agents include those that

- are moderately easy to disseminate.
- cause moderate morbidity and low mortality.
- require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

Category B agents include

- *Coxiella burnetii* (Q fever)
- *Brucella species* (brucellosis)
- *Burkholderia mallei* (glanders)
- *Alphaviruses*  
Venezuelan encephalomyelitis  
Eastern and western equine encephalomyelitis
- Ricin toxin from *Ricinus communis* (castor beans)
- Epsilon toxin of *Clostridium perfringens*
- *Staphylococcus enterotoxin B.*

A subset of List B agents includes pathogens that are food- or waterborne. These pathogens include but are not limited to

- *Salmonella species*
- *Shigella dysenteriae*
- *Escherichia coli* O157:H7
- *Vibrio cholerae*
- *Cryptosporidium parvum*

Category C

Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of

- availability.
- ease of production and dissemination.
- potential for high morbidity and mortality and major health impact.

Category C agents include

- Nipah virus
- Hantaviruses
- Tick-borne hemorrhagic fever viruses
- Tick-borne encephalitis viruses
- Yellow fever
- Multidrug-resistant tuberculosis

Source: CDC, "Biological and Chemical Terrorism: Strategic Plan for Preparedness and Response," *Morbidity and Mortality Weekly Report*, April 21, 2000, pp. 5-6.

## A Survey of Biological Terrorism and America's Domestic Preparedness Program

### Appendix C: Characteristics of Select Biological Agents

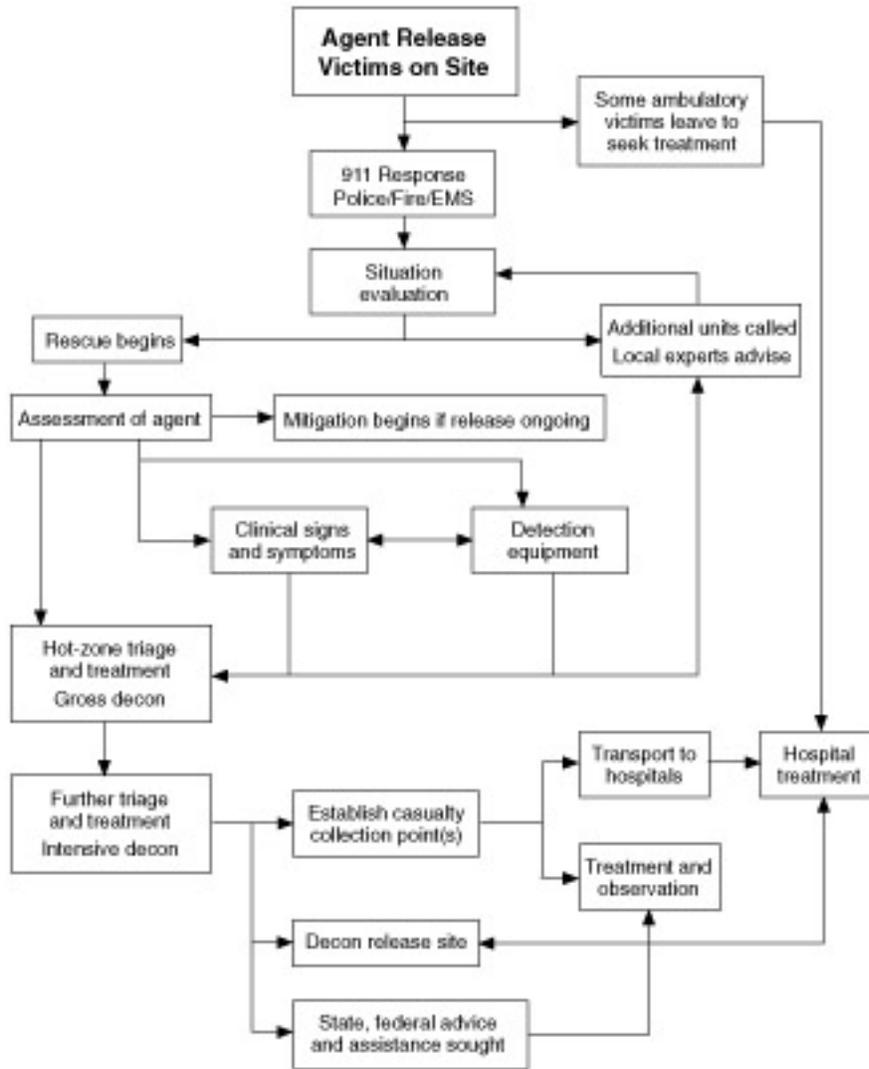
Disease	Transmit Man to Man	Infective Dose (Aerosol)	Incubation Period	Duration of Illness	Lethality (approx. case fatality rates)	Persistence of Organism	Vaccine Efficacy (aerosol exposure)
<b>Inhalation anthrax</b>	No	8,000-50,000 spores	1-6 days*	3-5 days (usually fatal if untreated)	High	Very stable - spores remain viable for > 40 years in soil	2 dose efficacy against up to 1,000 LD <sub>50</sub> in monkeys
<b>Brucellosis</b>	No	10 -100 organisms	5-60 days	Weeks to months	<5% untreated	Very stable	No vaccine
<b>Cholera</b>	Rare	10-500 organisms	4 hours - 5 days	≥ 1 week	Low with treatment, high without	Unstable in aerosols & fresh water; stable in salt water	No data on aerosol
<b>Glanders</b>	Low	Assumed low	10-14 days via aerosol	Death in 7-10 days in septicemic form	> 50%	Very stable	No vaccine
<b>Pneumonic Plague</b>	High	100-500 organisms	2-3 days	1-6 days (usually fatal)	High unless treated within 12-24 hours	For up to 1 year in soil; 270 days in live tissue	3 doses not protective against 118 LD <sub>50</sub> in monkeys
<b>Tularemia</b>	No	10-50 organisms	2-10 days (average 3-5)	≥ 2 weeks	Moderate if untreated	For months in moist soil or other media	80% protection against 1-10 LD <sub>50</sub>
<b>Q Fever</b>	Rare	1-10 organisms	10-40 days	2-14 days	Very low	For months on wood and sand	94% protection against 3,500 LD <sub>50</sub> in guinea pigs
<b>Smallpox</b>	High	Assumed low (10-100 organisms)	7-17 days (average 12)	4 weeks	High to moderate	Very stable	Vaccine protects against large doses in primates
<b>Venezuelan Equine Encephalitis</b>	Low	10-100 organisms	2-6 days	Days to weeks	Low	Relatively unstable	TC 83 protects against 30-500 LD <sub>50</sub> in hamsters
<b>Viral Hemorrhagic Fevers</b>	Moderate	1-10 organisms	4-21 days	Death between 7-16 days	High for Zaire strain, moderate with Sudan	Relatively unstable - depends on agent	No vaccine
<b>Botulism</b>	No	0.001 µg/kg is LD <sub>50</sub> for type A	1-5 days	Death in 24-72 hours; lasts months if not lethal	High without respiratory support	For weeks in nonmoving water and food	3 dose efficacy 100% against 25-250 LD <sub>50</sub> in primates
<b>Staph Enterotoxin B</b>	No	0.03 µg/person incapacitation	3-12 hours after inhalation	Hours	< 1%	Resistant to freezing	No vaccine
<b>Ricin</b>	No	3-5 µg/kg is LD <sub>50</sub> in mice	18-24 hours	Days - death within 10-12 days for ingestion	High	Stable	No vaccine

Source: Mark Kortepeter, et al., eds., *Medical Management of Biological Casualties Handbook, Fourth Edition* (Frederick, MD: United States Army Research Institute of Infectious Diseases, February 2001), pp. 10-11.

\*: During a 1979 outbreak of inhalation anthrax in Sverdlovsk in the Soviet Union, the incubation period ranged from 2-43 days with two-thirds of the patients falling sick and dying within two weeks. Jeanne Guillemin, *Anthrax: The Investigation of a Deadly Outbreak* (Berkeley, CA: University of California Press, 1999), pp. 235-237.

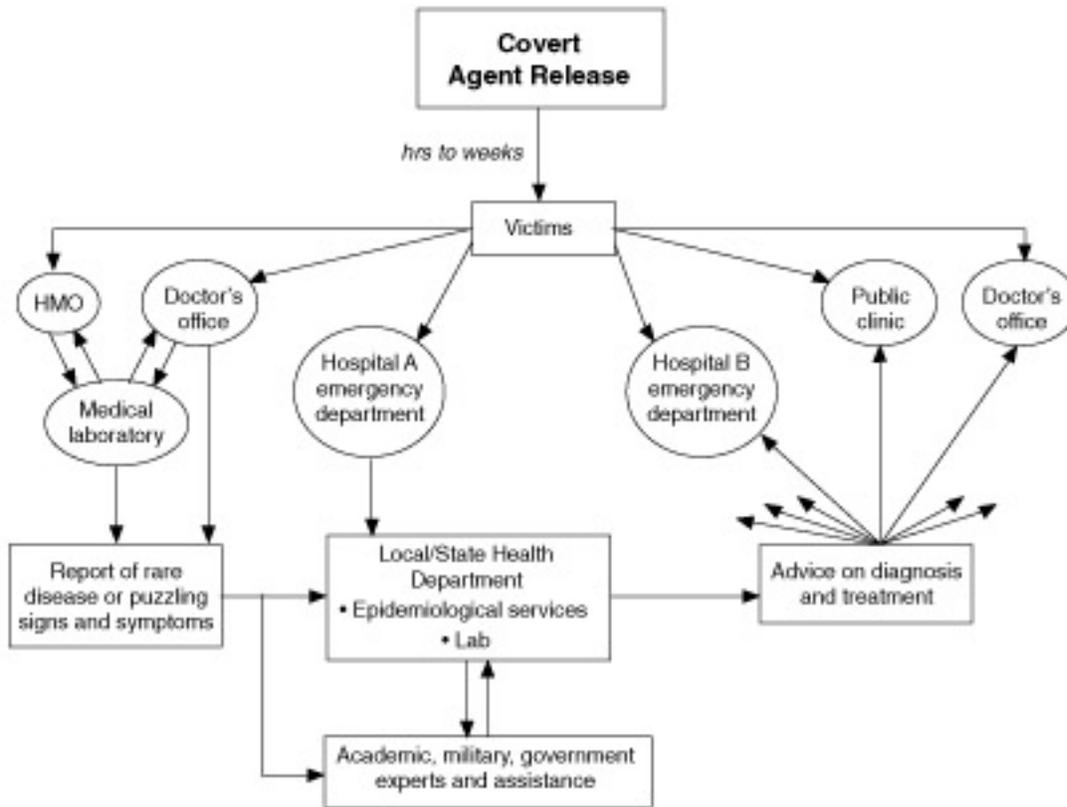
**Appendix D: Comparison of Responses to Chemical and Biological Terrorism**

**FIGURE D-1. Flow Chart of Probable Actions in Response to a Chemical Terrorism Incident**



Source: Institute of Medicine and National Research Council, *Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response* (Washington, DC: National Academy Press, 1999), p. 185.

**FIGURE D-2. Flow Chart of Probable Actions in Response to a Biological Terrorism Incident**



Source: Institute of Medicine and National Research Council, *Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response* (Washington, DC: National Academy Press, 1999), p. 186.

**Appendix E: HHS and CDC Spending on Biological Terrorism Preparedness****TABLE 1. DEPARTMENT OF HEALTH AND HUMAN SERVICES FUNDING FOR WMD TERRORISM, FY 1998–2001 (millions)**

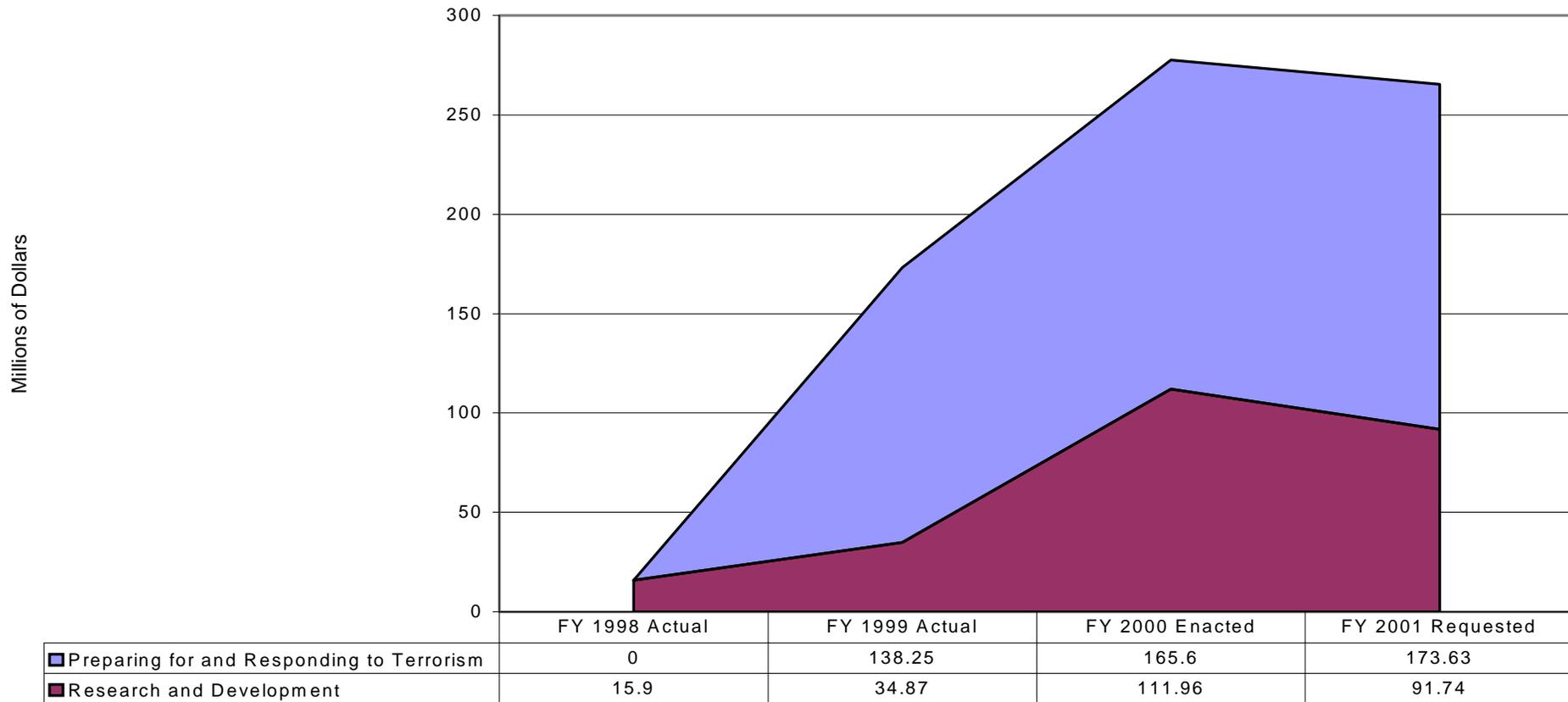
FUNCTION	FY98 Actual	FY99 Actual	FY00 Enacted	FY01 Requested
<b>Preparing for and Responding to Terrorism</b>	0	138.25	165.6	173.63
Medical Responder Training and Exercises	0	3	1	2
Other Planning and Assistance to State/Locals	0	16.25	16.5	17.43
Other	0	2	3.1	10.6
Public Health Infrastructure and Surveillance	0	62	88	85.5
Special Response Units	0	4	5	6.1
Stockpile of Vaccine and Therapeutics	0	51	52	52
<b>Research and Development</b>	15.9	34.87	111.96	91.74
Basic Research incl. Gene Sequencing	13	17.23	21.76	21.76
Detection/Diagnostics	0	5.68	5.68	8.28
Modeling, Simulations, System Analysis	0	0	0	0
Other	0	1.85	31.72	0
Personal/Collective Protection	0	0	0	1.2
Therapeutics/Treatments	0	3.98	4.35	4.35
Vaccines	2.9	6.13	48.85	56.15
<b>TOTAL</b>	<b>15.9</b>	<b>173.12</b>	<b>277.56</b>	<b>265.37</b>

Source: Office of Management of Budget, *Annual Report to Congress on Combating Terrorism: Including Defense Against Weapons of Mass Destruction/Domestic Preparedness and Critical Infrastructure Protection*, May 18, 2000, pp. 61-62.

**Appendix F: HHS and CDC Funding**

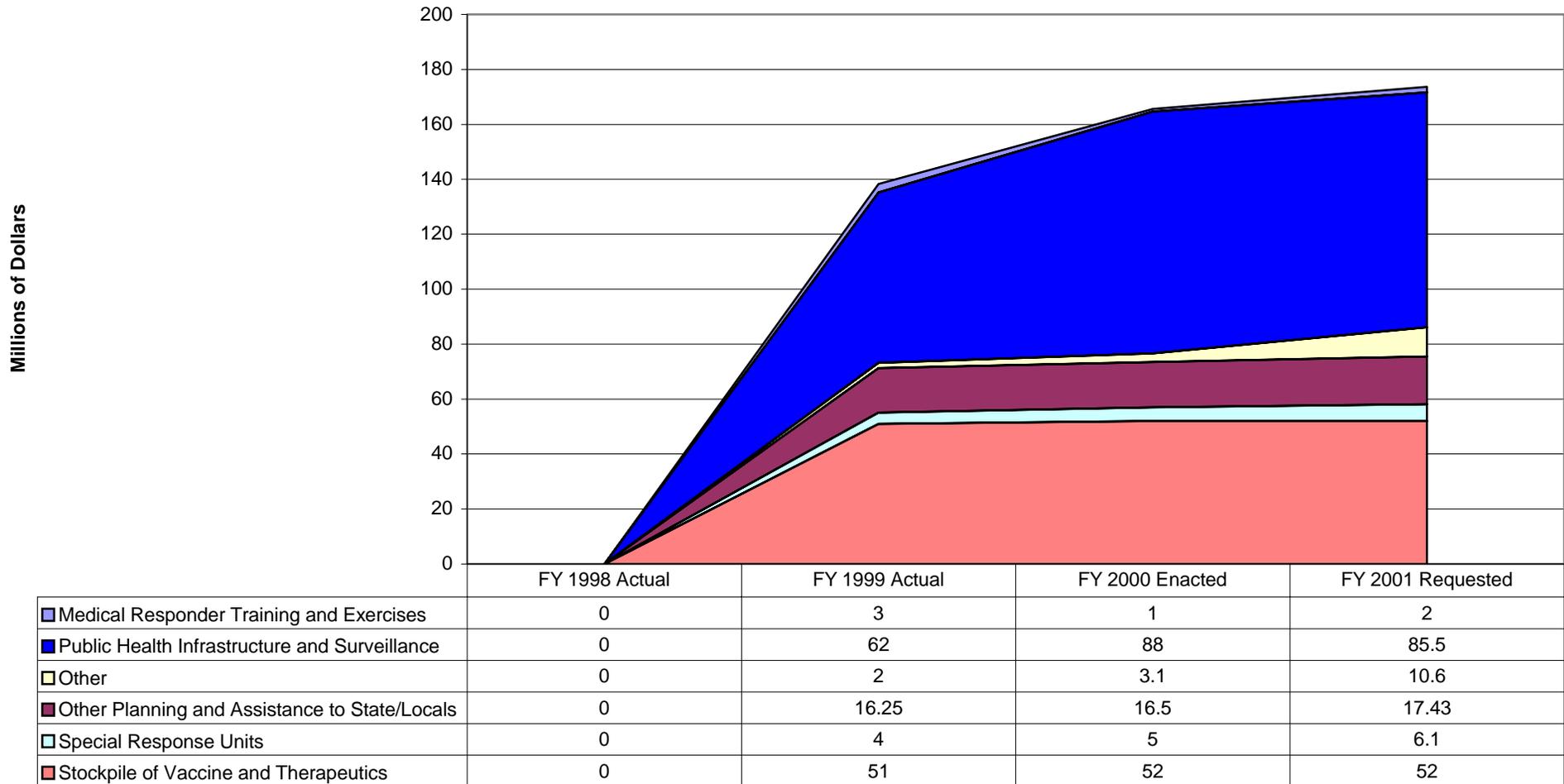
Source for the CDC charts: Centers for Disease Control and Prevention, “The National Bioterrorism Preparedness and Response Initiative,” March 13, 2000.

**Figure 1. Department of Health and Human Services Spending on Domestic Preparedness**

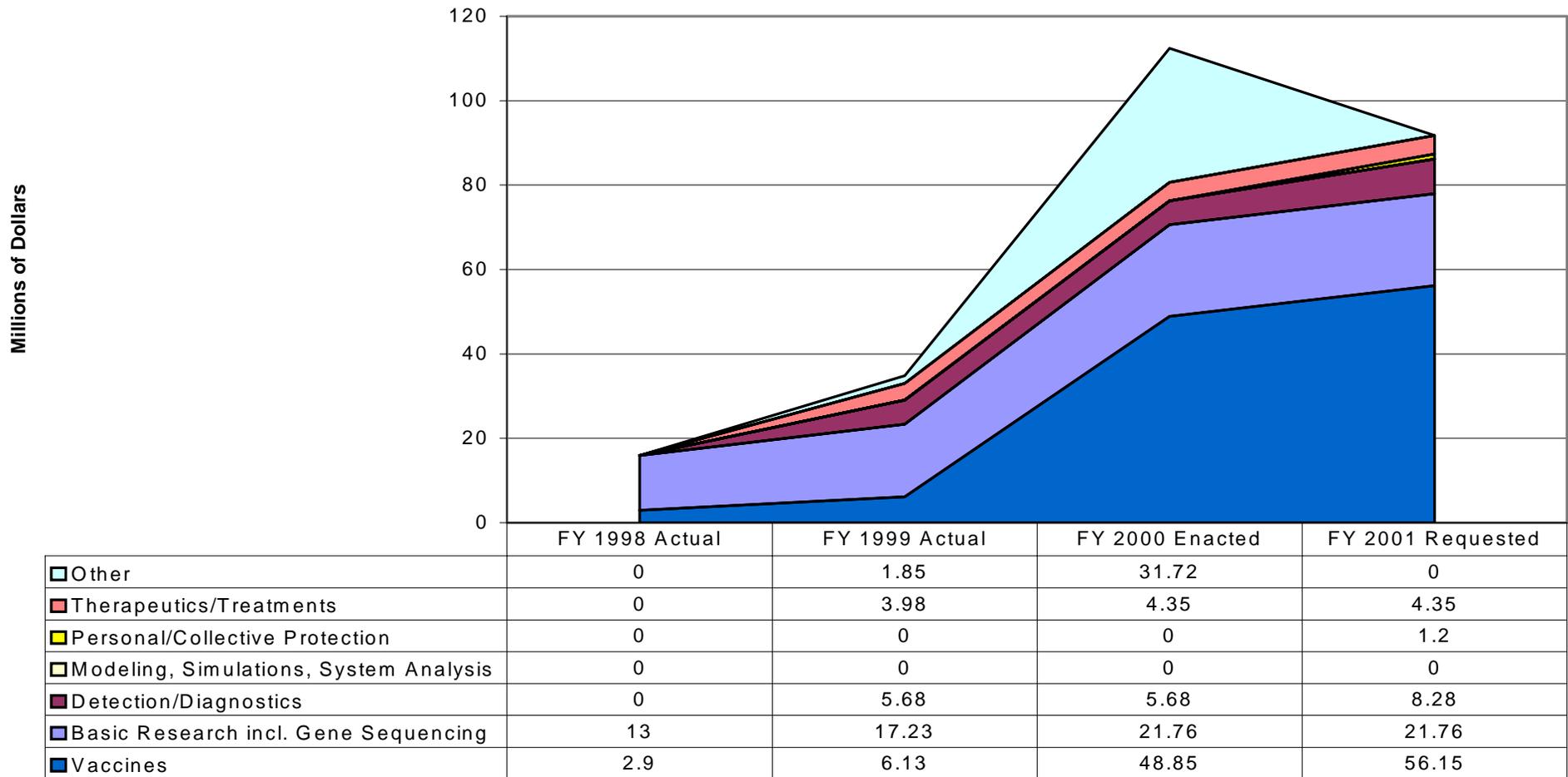


	FY 1998 Actual	FY 1999 Actual	FY 2000 Enacted	FY 2001 Requested
■ Preparing for and Responding to Terrorism	0	138.25	165.6	173.63
■ Research and Development	15.9	34.87	111.96	91.74

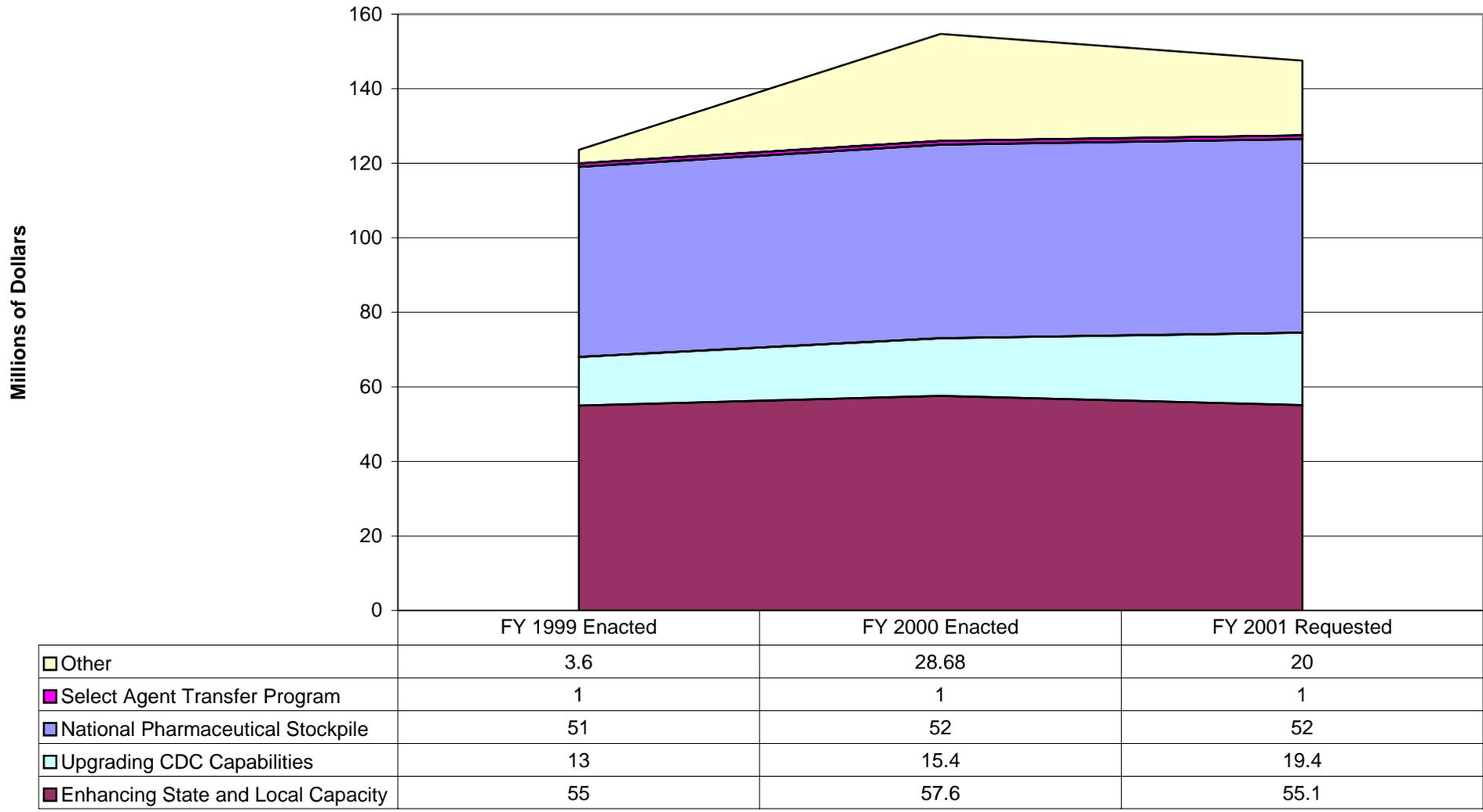
**Figure 2. Department of Health and Human Services Spending on Preparing for and Responding to Terrorism**



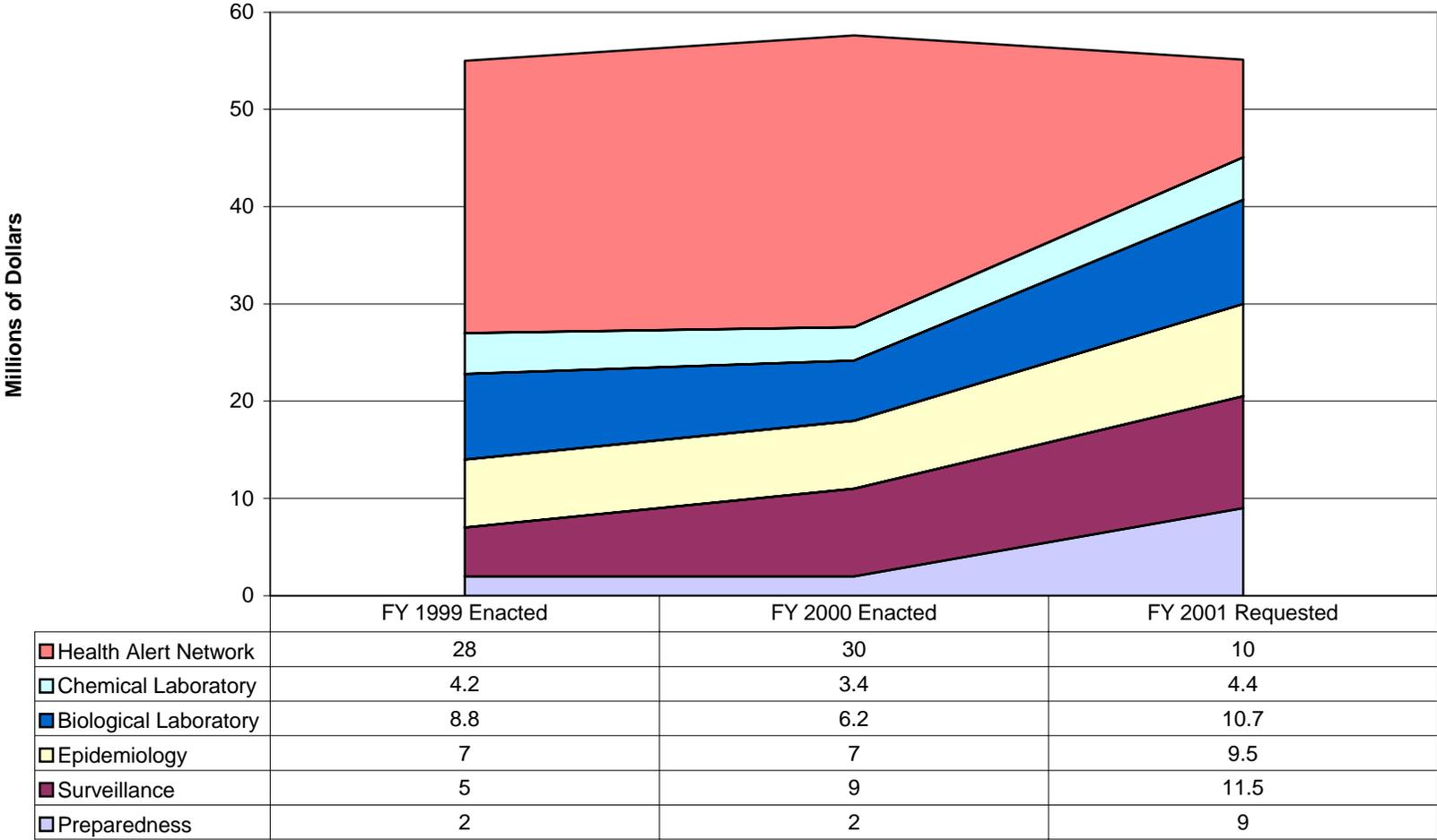
**Figure 3. Department of Health and Human Services Spending on Research and Development**



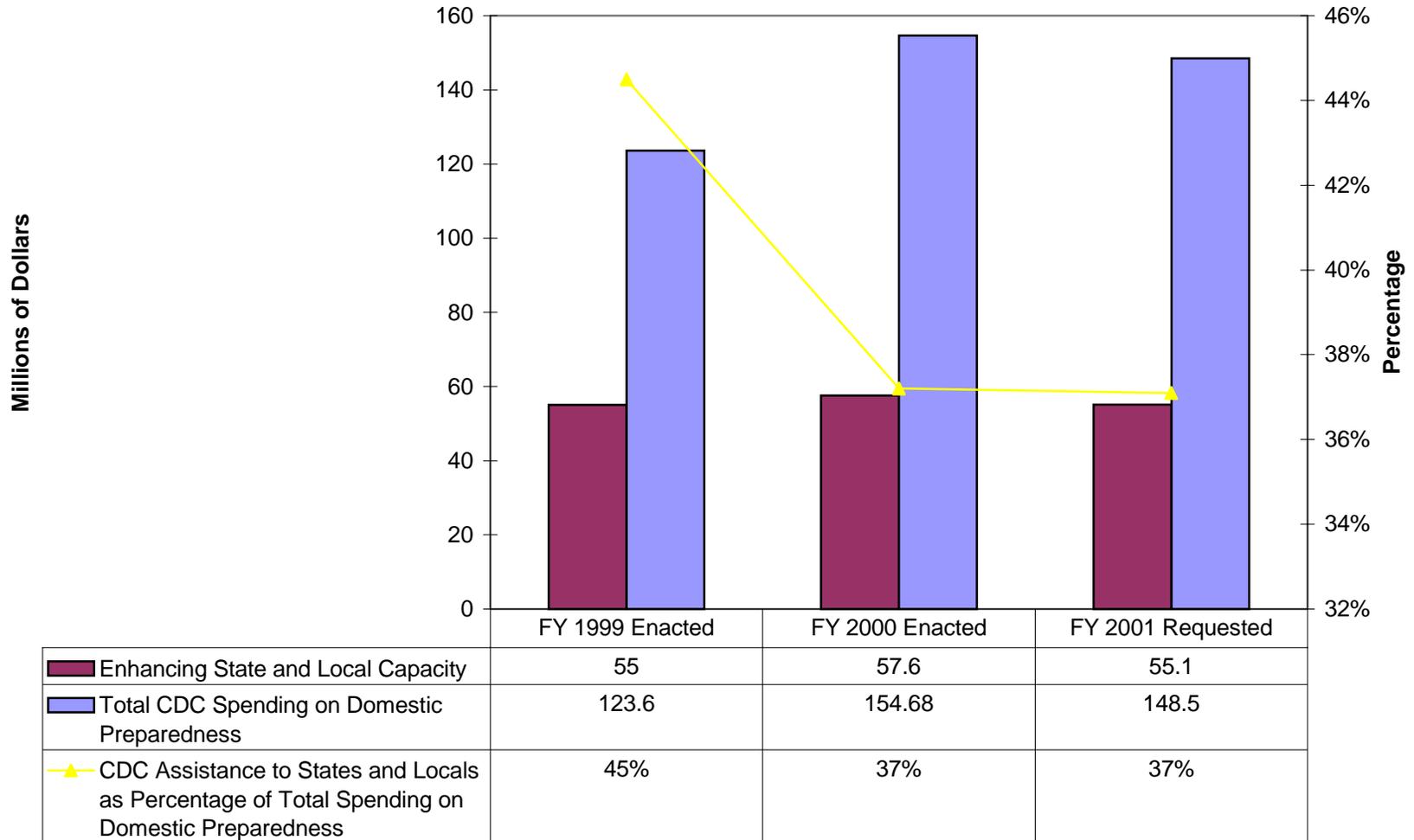
**Figure 4. CDC Spending to Combat Biological and Chemical Terrorism**



**Figure 5. CDC Support to Enhance State and Local Public Health Capabilities for Chemical and Biological Terrorism**



**Figure 6. Funding for State and Locals as Percentage of CDC Spending on Domestic Preparedness**



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Through its research, publications, and the professional activities of its members, the Executive Session intends to become a major resource for federal, state, and local government officials, congressional committees, and others interested in preparation for a coordinated response to acts of domestic terrorism.

***For more information on the Executive Session on Domestic Preparedness, please contact:***

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