

The Role of Veterans Affairs in Support of DOD in Biodefense

A Monograph

by

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Abstract

The Role of Veterans Affairs in Support of DOD in Biodefense, by Pui-Man Paul Low, MD, 42 pages.

In 2001, the United States suffered from a bioterrorist anthrax attack. The US government recognized that it was unprepared to respond to such bioterrorist attacks. This monograph will argue that the Department of Veterans Affairs (VA) provides robust biodefense support to the Department of Defense (DOD). Bioterrorist agents, like anthrax, are easily accessible and inexpensive weapons of mass destruction and may be highly favored by terrorist organizations. Given the dramatic expansion of terrorism in both Africa and Middle East, it is not a question of whether terrorists will attack the United States again, but when and how. Since 2001, the VA has instituted several biodefense strategies. However, the White House report on the VA has recently criticized agency leadership, which may conceivably render VA's current emergency preparedness process unsuitable to support the DOD and the Department of Homeland Security (DHS) in a future bioterrorist attack. This monograph proposes several ways to enhance VA's biodefense capabilities to provide proper support to the DOD and the DHS. In addition, VA can also use its network of facilities to conduct surveillance of imminent endemic of infectious diseases. Based on these findings, the monograph concludes that the VA can play a very important supportive role in DOD's biodefense program.

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Acronyms

BWC	Biological and Toxins Weapons Convention
CBRN	Chemical, Biological, Radiological, or Nuclear
CBW	Chemical and Biological Weapons
CDC	Center for Diseases Control and Prevention
COA	Course of Action
CPRS	Computer Patient Record System
CRT	Crisis Response Team
DEMPS	Disaster Emergency Medical Personnel System
DHS	Department of Homeland Security
DOD	Department of Defense
ELISA	Enzyme-linked Immunosorbent Assay
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
GAO	Government Accounting Office
HHS	Department of Health and Human Services
HSPD	Homeland Security Presidential Directive
ISIS	Islamic State of Iraq and al-Sham
LRN	Laboratory Response Network
MEFs	Mission Essential Functions
MOA	Memorandum of Agreement
NBC	Nuclear-Biological-Chemical
NBIC	National Biosurveillance Integration Center
NDMS	National Disaster Medical System
NEMRT	National Emergency Medical Response Teams
NIOSH	National Institute for Occupational Safety and Health

NRF	National Response Framework
OEM	Office of Emergency Management
OHA	Office of Health Affairs
OIG	Office of Inspector General
PCR	Polymerase Chain Reaction
PMEF	Primary Mission Essential Function
POC	Points of Contact
PPE	Personal Protective Equipment
PRA	Patient Reception Area
PRC	Primary Receiving Center
PSI	Proliferation Security Initiative
RODS	Real-Time Outbreak Disease Surveillance
SAMS	School of Advanced Military Studies
SECDEF	Secretary of Defense
SSC	Secondary Support Center
TJC	The Joint Commission
TPMRC-A	Theater Patient Movement Requirements Center – Americas
TRAC2ES	TRANSCOM Regulating and Command & Control Evacuation System
TTE&E	Test, Training, Exercise, and Evaluation
UNSCOM	United Nations Special Commission
USAMRIID	United States Army Medical Research Institute of Infectious Diseases
VA	Department of Veterans Affairs
VA IOC	VA Integrated Operations Center
VHA	Veterans Health Administration
VISN	Veterans Integrated Service Network
WMD	Weapons of Mass Destruction

Introduction

Even before the 11 September 2011 terrorist attacks, analyst Bruce Hoffman warned that terrorism constituted a serious threat.¹ Terrorism has been defined as the threat or use of extraordinary violence for political ends.² This monograph will argue that the VA can provide robust biodefense support to the DOD. Stephen Flynn, the Jeane J. Kirkpatrick Senior Fellow in National Security Studies at the Council on Foreign Relations, opined that we are living on borrowed time, and, if 11 September was a wake-up call, we have fallen back asleep.³ One of the greatest terrorist threats stems from the employment of chemical and biological weapons (CBW).⁴ Among the CBW, the biological weapons have the greatest potential for lethality of any weapon.⁵ Investigators of the Aum Shinrikyo's nerve gas attacks in the Tokyo subway reported that the Japanese terrorist group had actually acquired and attempted to weaponize biological agents for the attack.⁶

The Biological and Toxins Weapons Convention (BWC), signed on 10 April 1972, defined biological weapons as “microbial or other biological agents, or toxins whatever their

¹Laura K. Egenorf, *Terrorism: Opposing Viewpoints* (San Diego, CA: Greenhaven Press, 2000), 17.

²George Buck, *Preparing for Biological Terrorism: An Emergency Services Planning Guide* (Albany, NY: Delmar, 2002), 7.

³Stephen Flynn, *America the Vulnerable: How Our Government is Failing to Protect Us from Terrorism* (New York, NY: HarperCollins Publishers, 2004), 1.

⁴Nadine Gurr and Benjamin Cole, *The New Face of Terrorism: Threats from Weapons of Mass Destruction* (New York, NY: I. B. Tauris & Co., 2005), 1.

⁵Lloyd J. Matthews, *Challenging the United States Symmetrically and Asymmetrically: Can America Be Defeated?* (Carlisle, PA: U.S. Army War College, July 1998), 199.

⁶Steve Bowman, *Biological Weapons: A Primer* (New York, NY: Novinka Books, 2001), 1.

origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes.”⁷ On the other hand, the US DOD defined biological warfare (BW) agents as “those biological pathogens and toxins that are intended for use during military operations to cause death and disease among personnel, animals, or plants, or to deteriorate material.”⁸ These BW agents include pathogens like bacteria, viruses, rickettsia, and fungi. However, they also include acellular toxins like snake venom, ricin from castor beans, and toxins from bacteria and fungi. One of the most alarming security threats is the potential employment of lethal bioweapons, which include anthrax, botulism, smallpox, viral hemorrhagic fevers like Ebola, and bubonic plague.⁹ Brucella, Salmonella, and Shigella are some of the less lethal but devastatingly incapacitating agents. In 2003, the US Government Accounting Office (GAO) reported that many urban hospitals were not prepared for a bioterrorist attack. Bioterrorist agents, like anthrax, are easily accessible and inexpensive weapons of mass destruction (WMD) and may be highly favored by terrorist organizations. This might explain why terrorists have only succeeded in attacking the United States with anthrax instead of radiological, nuclear, or chemical agents. Given the dramatic expansion of terrorist networks in both Africa and Middle East, it is not a question of whether terrorists will attack the United States again, but when and how.

This monograph is organized in five sections. Section One will provide a history and overview of global biological weapons usage and the anthrax threat, including bioterrorism’s inherent characteristics and the connection between terrorism and human diseases. It will also provide an overview of the most likely Center for Diseases Control and Prevention (CDC)

⁷Al Mauroni, *Chemical and Biological Warfare: A Reference Handbook* (Santa Barbara, CA: Contemporary World Issues, 2003), 3-4.

⁸Ibid.

⁹Anne L. Clunan, Peter R. Lavoy and Susan B. Martin, *Terrorism, War, or Disease? Unraveling the Use of Biological Weapons* (Stanford, CA: Stanford University Press, 2008), 1.

Category A, bioterrorist agent anthrax. Because the focus of this monograph is on the strategy of biodefense rather than the tactical details of countermeasures against the myriad of bioagents, anthrax will be the archetype bioagent typified for discussion and illustration. The clinical properties of anthrax and the capabilities of currently available diagnostic and therapeutic interventions will also be examined. Section Two will examine the current US bioterror strategy and policy, including risks to the United States. Section Three will explore the VA's role in the biodefense strategy. Section Four will conduct some analysis in order to discuss from a VA's perspective. In addition, Section Four will introduce specific recommendations that would enable the VA rectify the root cause of the current biodefense gap and employ its institutional resources more efficiently and effectively to support the DOD and the DHS in a future anthrax attack on the United States. Section Five will provide the conclusion.

History of Global Biological Weapons Usage and the Anthrax Threat

Biological warfare is a historical phenomenon. In 1346, when the Mongols sieged Kaffa on the Black Sea, they catapulted the corpses of bubonic plague victims over the walls into the city.¹⁰ During the French and Indian Wars (1756-63), British soldiers reportedly donated smallpox-contaminated blankets to American Indian tribes allied to the French. Although this incident has been the source of heated scholarly controversy, historian Elizabeth Fenn has demonstrated that Henry Bouquet's subordinates most likely executed the plan of spreading smallpox among American Indians near Fort Pitt in 1763 and 1764.¹¹ Since American Indians had

¹⁰Russell D. Howard and James J. F. Forest, *Weapons of Mass Destruction and Terrorism* (New York, NY: McGraw Hill, 2008), 572.

¹¹Elizabeth A. Fenn, "Biological Warfare in Eighteenth-Century North America: Beyond Jeffery Amherst," *The Journal of American History* 86, no. 4 (March 2000), 1552-1580, accessed 3 February 2015, <http://www.jstor.org/stable/pdfplus/2567577.pdf?acceptTC=true>.

no previous exposure to or immunity against smallpox and other European diseases, many of them died during the consequent smallpox endemic.

During the Second Sino-Japanese War and World War II, the infamous Japanese Unit 731 experimented CBW on Chinese and allied prisoners of war and civilians, causing more than 10,000 casualties from anthrax, cholera, bubonic plague, chemical agents, extreme cold exposure, and other diseases.¹² In 1994, Dr. Yan Renying, a graduate of Peking Union Medical College and Columbia University's postgraduate training, alleged that US forces executed a biological warfare campaign in northeastern China and Korea in 1952.¹³ Though the United States had admitted it had previously tested successfully aerosolized biological weapons on caged animals on ships in the Pacific, President Richard M. Nixon terminated the program and destroyed all stockpiled bioweapons in 1969.¹⁴ In 1973, more than 100 nations, including the United States and the Soviet Union, signed the BWC that banned the development, deployment, and stockpiling of bioweapons. However, there was no provision in the treaty to monitor or enforce compliance.¹⁵ In contradistinction to nuclear weapons, bioweapons are unlikely to be contained by a legal ban and meticulous verification.¹⁶ In fact, the former director of Biopreparat, the civilian arm of the Soviet Union's bioweapon program, told US officials that Biopreparat

¹²Stephen Ednicott and Edward Hagerman, *The United States and Biological Warfare: Secrets from the Early Cold War and Korea* (Indianapolis, IN: Indiana University Press, 1998), 24.

¹³Ibid.

¹⁴Ibid.

¹⁵Ibid.

¹⁶Joshua Lederberg, *Biological Weapons: Limiting the Threat* (Cambridge, MA: The MIT Press, 1999), 7.

actively researched and stockpiled bioweapon agents like anthrax, smallpox, and bubonic plague. Biopreparat even applied genetic engineering to enhance its bioweapons.¹⁷

In 1997, the United Nations Special Commission (UNSCOM) reported that Iraq had manufactured 8,000 liters of concentrated anthrax solution, more than 20,000 liters of botulinum toxin solution, and ten liters of concentrated ricin toxin solution.¹⁸ Many of these bioweapons, including anthrax and botulinum toxin, had been weaponized and integrated in the warheads of SCUD missiles prior to the 2003 United States invasion of Iraq. According to R.A. Zilinskas, the United States has faced three outbursts of national security vulnerabilities.¹⁹ After World War II, the United States rested secure under the protective blanket of its atomic monopoly. However, Soviet Union's detonation of an atomic weapon in 1949, and subsequent development of intercontinental ballistic missiles (ICBM), shattered the United States' sense of security. Zilinskas argues that only after the end of the Cold War in 1989 did this period of vulnerability end. As the only remaining superpower in the post-Cold War period, the United States experienced a brief period of security, which was broken in the mid-1990s with the emergence of nuclear-biological-chemical (NBC) terrorism threat. In January 1999, President William Jefferson Clinton warned that the United States could be targeted by terrorists with CBW within a few years. The US Defense Secretary, William Cohen, emphasized: "The question is no longer if this will happen, but when."²⁰ Zilinskas insists that the rise of Islamic terrorism since the 1990s ushered in the

¹⁷Joshua Lederberg, *Biological Weapons: Limiting the Threat*.

¹⁸R. A. Zilinskas, "Iraq's Biological Weapons: The Past as Future?" *Journal of the American Medical Association* 278, no. 5 (6 August 1997): 418-424, accessed 21 October 2014, <http://jama.jamanetwork.com/article.aspx?articleid=417897&resultClick=3>.

¹⁹Ibid., 418-424.

²⁰Ibid.

current “third wave of vulnerability.” Furthermore, Samuel Huntingdon developed the thesis of “clash of civilizations” in the post-Cold War World conflicts, where expansionist Islamic Fundamentalism would replace expansionist Communism as the greatest menace to national security.²¹ Radical religious terrorists are more inclined than secular ones to employ nuclear-biological-chemical weapons because they have less ideological constraints, while the secular terrorists might be concerned of losing political support from the populace.²² On 28 August 2014, two reporters from *Foreign Policy*, Harald Doornbos, and Jenan Moussa, reported finding a 19-page Arabic document on how to develop biological weapons and how to weaponize the bubonic plague from sick animals in a captured Islamic State of Iraq and Syria (ISIS) militant’s laptop computer.²³

Many security experts consider biological weapons as “a poor man’s atomic bomb.”²⁴ Unlike an atomic bomb, biological agents have a unique, destructive characteristic of reproducing themselves. Thus, their potential lethal and disabling impacts can grow exponentially and unremittingly. Even though the United States’ first Ebola index case in September 2014 was not a bioterrorist attack, one can study this single index case of Ebola and deduce the profound economic, social, and public health impacts of a potential bioterrorist attack. When the Ebola patient, a Liberian, arrived in Dallas, Texas, in September 2014, no one knew that he was

²¹Zilinskas, “Iraq’s Biological Weapons,” 418-424.

²²Ibid.

²³Harald Doornbos, and Jenan Moussa, “Found: The Islamic State’s Terror Laptop of Doom” *Foreign Policy*, accessed 30 November 2014, http://www.foreignpolicy.com/articles/2014/08/28/found_the_islamic_state_terror_laptop_of_doom_bubonic_plague_weapons_of_mass_destruction_exclusive.

²⁴Richard Danzig, *Catastrophic Bioterrorism – What Is To Be Done?* (Washington, DC: The Center for Technology and National Security Policy, 2001), 1.

suffering from Ebola viral infection. It was only after his Ebola infection had progressed to a much more symptomatic stage that he started to seek medical assistance. He was eventually admitted to the hospital, where he was diagnosed to have Ebola infection, and he became the infamous first index case of Ebola infection in the United States.²⁵ However, the search for more contacts to the lethal Ebola virus widened on 17 October 2014 to over 700 airline passengers and crew following the diagnosis of a second Texas Health Presbyterian Hospital nurse, who had made a round trip commercial flight between Dallas and Cleveland.²⁶

The multiple Ebola diagnoses elevated concerns about potential bioterrorist attacks using Ebola virus infected body fluids in major metropolitan areas. On 9 October 2014, Ted Thornhill reported that the terrorist group ISIS might be considering using Ebola as a suicide bioweapon against the West.²⁷ Other military experts also warned that ISIS operatives could turn themselves into Ebola “suicide bombers” against the West.²⁸ They envisioned that the ISIS operatives could intentionally contract Ebola virus infection by exposing themselves to Ebola patients’ infectious body fluids. They could then take antipyretics like acetaminophen to mask their fever to evade

²⁵Manny Fernandez, and Jack Healy, “C.D.C. Says It Should Have Responded Faster to the Dallas Ebola Case,” *New York Times*, 14 October 2014, accessed 19 October 2014, <http://www.nytimes.com/2014/10/15/us/cdc-says-it-should-have-responded-more-quickly-to-dallas-ebola-case.html?action=click&contentCollection=Africa&module=RelatedCoverage®ion=Marginalia&pgtype=article>.

²⁶Nicole Kwan, “Contact tracing for Ebola patients, those possibly exposed, widens,” *Fox News*, 17 October 2014, accessed 19 October 2014, <http://www.foxnews.com/health/2014/10/17/contact-tracing-for-ebola-patients-those-possibly-exposed-widens/>.

²⁷Ted Thornhill, “Could terrorists turn themselves into Ebola suicide ‘bombs’? Experts fear ISIS jihadists may infect themselves to spread virus in West,” *MailOnline*, 9 October 2014, <http://www.dailymail.co.uk/news/article-2786433/Could-Ebola-used-weapon-ISIS-Terror-experts-raise-prospect-jihadists-infecting-spreading-virus-Western-countries.html>.

²⁸“Experts Warn of ‘Ebola Suicide Bombers’,” *Al Arabiya Network*, 20 October 2014, accessed 19 October 2014, <http://english.alarabiya.net/en/News/world/2014/10/10/Experts-warn-of-Ebola-suicide-bombers-.html>.

airport temperature screening before boarding flights to the United States. After arrival in US cities, they could travel widely to spread the Ebola virus by direct contact and/or covert contamination of the public environment with their own infectious body fluid. Though these ISIS operatives will likely die from Ebola infection, they will generate massive casualties in the United States and intensify public panic. While many health care facilities created bioterror contingency plans after the anthrax attack of 2001, many experts doubted if all US health care facilities could effectively respond to a bioterrorist attack.²⁹

In addition, the CIA has reported that Al-Qaeda had a wide gamut of agents and delivery vehicles to choose from for chemical, biological, radiological, or nuclear (CBRN) attacks.³⁰ The Intelligence Community believed that Al-Qaeda might have obtained a very dangerous BW agent, referred to as “Agent X” in unclassified literature, and had been successfully isolating “cultures” of Agent X.³¹ From the term “cultures” used in the Intelligence Community’s report, one can surmise that Agent X is not an acellular toxin, but could be a virus, bacterium, fungus, or Rickettsia. Though the incidence of sporadic or naturally occurring anthrax has declined over the last century, anthrax remains a potential bioterrorist weapon. One week after the 11 September 2001 attacks, terrorists launched a bioterrorist attack by mailing letters containing anthrax spores to multiple news media offices and two US Senators’ offices, resulting in 22 infections and five fatalities. In support of the biodefense effort of the executive branch of the US government, the US Congressional Office of Technology Assessment projected that a 100 kg payload of

²⁹John D. Blair, Myron D. Fottler, and Honorable Albert C. Zapanta, *Bioterrorism, Preparedness, Attack and Response* (Oxford, UK: Elsevier, 2004), 5.

³⁰Anthony H. Cordesman, *The Challenge of Biological Terrorism* (Washington, DC: The CSIS Press, 2005), 31-36.

³¹Ibid.

aerosolized anthrax spores could potentially result in 130,000 to 3,000,000 deaths, comparable to the lethality of nuclear weapons.³² Given such colossal casualty estimates, the current emergency preparedness process of the VA may not be suitable to support the DOD and the DHS in a future anthrax bioterrorist attack.

Before the VA can accurately assess its capacity to support the DOD and the DHS in a future anthrax attack, it needs to develop a fuller understanding of the threat of bioterrorism, the risk of bioterrorist attack, and the difference between the concepts of *threat* and *risk*.³³ In the case of bioterrorism, *risk* is the nation's susceptibility to terrorist chemical, biological, radiological, or nuclear attack, which can be mitigated, but not entirely eliminated. *Threat* refers to the terrorists' organizations and their affiliates, which can be defeated and eliminated. Since President Nixon ended the US offensive biological warfare program in 1969, the DOD has focused mainly on a defensive biological warfare program.³⁴ The DOD and other security agencies are now more oriented toward eliminating the terrorist threat. The VA is more geared towards supporting the DOD in mitigating the risks of successful bioterrorists' attacks. The major domains of defensive strategies against BW agents include hazard assessment, detection, physical protection, medical countermeasures, identification, and diagnosis.³⁵ In addition, as new medical science and technology are developed, the United States needs to re-evaluate its traditional ethical

³²Anthony H. Cordesman, *The Challenge of Biological Terrorism*, 31-36.

³³Richard Danzig, *Preparing for Catastrophic Bioterrorism: Toward a Long-Term Strategy for Limiting Risk* (Washington, DC: National Defense University Center for Technology and National Security Policy, 2008), 3-4.

³⁴Coleen K. Martinez, *Biodefense Research Supporting the DOD: A New Strategic Vision* (Carlisle, PA: U.S. Army War College, 2007), 1.

³⁵Alexander Kelle, Malcolm R. Dando, and Kathryn Nixdorff, *The Role of Biotechnology in Countering BTW Agents* (Prague, Czech Republic: Kluwer Academic Publishers, 1998), 1-51.

assumptions and principles, including the principles of military medical triage in mass casualties, procedures, and protection of staff from BW agents.³⁶

Dr. Leonard A. Cole of Rutgers University and the University of Medicine and Dentistry of New Jersey warns that bioterrorism is still a threat to the US.³⁷ The Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism (WMD Commission) published a report card in 2010 on previous administrations' actions in response to its previous recommendations.³⁸ The grade for the administration's inaction to "enhance the nation's capabilities for rapid response to prevent biological attacks from inflicting mass casualties" was "F." For the administration's insufficient supervision of high-containment laboratories, the grade was "D+." There have been multiple criticisms. For instance, the US biodefense endeavor has advanced the understanding of the bioterrorist threat, development, deployment of modern detection devices, and enhancements of countermeasures. However, the creation of high security laboratories and expansion of their personnel do incur potential risks of malicious diversion by staff or accidental spills. Even though the Weapons of Mass Destruction Prevention and Preparedness Act of 2009 fostered laboratory security, provided for creating uniform standards for handling pathogens, and appointed a single coordinator to direct select agent programs, it will always remain questionable how much security is adequate.

³⁶Robert E. Armstrong, Mark D. Drapeau, Cheryl A. Loeb, and James J. Valdes, *Bio-Inspired Innovation and National Security* (Washington, DC: National Defense University Press, 2010), 17.

³⁷Leonard A. Cole, "Bioterrorism: Still a threat to the United States," *Combating Terrorism Center at West Point*, accessed 2 December 2014, <https://www.ctc.usma.edu/posts/bioterrorism-still-a-threat-to-the-united-states>.

³⁸Bob Graham and Jim Talent, "Prevention of WMD Proliferation and Terrorism Report Card," Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism, January 2010, accessed 10 March 2015, http://www.pharmathene.com/WMD_Report_Card.pdf.

Anthrax is useful as an archetype for reviewing the US biodefense system because it is a bioagent that has been well studied. Indeed, some healthcare workers have encountered anthrax in their professional lives, as there have been sporadic outbreaks of anthrax infection. For instance, there was an outbreak of skin infection among heroin users in Britain and Germany in 2010 and 2011.³⁹ In the 2001 US anthrax attacks, there were 18 confirmed and four suspected anthrax cases, 11 of which were inhalational and 11 of which were cutaneous anthrax.⁴⁰ Since bioterrorists had successfully carried out the 2001 anthrax attacks, today's bioterrorists are likely to learn from their previous experience and may be able to launch an equally, if not more devastating, anthrax attack in the future.

The first step to develop understanding of weaponized anthrax requires a review of the clinical properties of anthrax. *Bacillus anthracis* is the germ that causes the disease anthrax.⁴¹ *B. anthracis* is a sporulating gram-positive rod. Soil and mammals are the two natural environmental habitats, in which it can thrive. Thus, *B. anthracis* is often a normal soil bacterium. When the soil condition is supportive, it may grow explosively, heightening the risk of infecting grazing animals. People become accidentally infected through contact with infected animals or animal products. When the spores of virulent *B. anthracis* penetrate into patient's skin, they would multiply and spread with the aid of their antiphagocytic capsule. Anthrax's exotoxin would cause extensive brawny swelling of skin and tissue necrosis, which characterize the syndrome of

³⁹Kenneth H. Wilson, "Microbiology, pathogenesis, and epidemiology of anthrax." *UpToDate*, accessed 7 December 2014. http://www.uptodate.com/contents/microbiology-pathogenesis-and-epidemiology-of-anthrax?source=search_result&search=anthrax&selectedTitle=3%7E70.

⁴⁰"Summary of the Investigation into the Anthrax Attacks," Trust for America's Health, accessed 2 December 2014, <http://healthyamericans.org/health-issues/story/summary-of-the-investigation-into-the-anthrax-attacks>.

⁴¹Kenneth H. Wilson, "Microbiology, pathogenesis, and epidemiology of anthrax."

cutaneous anthrax. However, when the patient inhales anthrax spores, which are between 2 and 5 microns in size, they settle in the lung's microscopic subunits called alveoli.⁴² The patient's defensive cells (alveolar macrophages) then ingest the spores but very often fail to kill the spores. When the macrophages move to the mediastinal lymph nodes, the anthrax spores continue to multiply and cause bleeding and inflammation of the central chest structure known as mediastinum, resulting in a hemorrhagic mediastinitis. Subsequently, the bacteria would spread into the blood stream, resulting in bacteremia and likely spreading to other organs like the meninges, causing meningitis. If patient has eaten any contaminated raw meat, anthrax can cause gastrointestinal anthrax with further abdominal dissemination causing hemorrhagic mesenteric adenitis, ascites, and sepsis, which may culminate in hemorrhagic septic shock and death.⁴³

Early detection of an anthrax bioterrorist attack requires prompt detection of the biological event. After the anthrax attack of 2001, there were considerable efforts to enhance emergency preparedness. Nevertheless, there is still doubt about whether healthcare organizations are able to implement effective and timely responses. For instance, Gretchen Gavett reported that a retired Air Force colonel was able to bypass all security measures and smuggled an anthrax-like specimen without detection into the White House.⁴⁴ This incident highlights the need to create and continually enhance a sensitive detection system to ensure early identification and speedy response to bioterrorist attack. A fully integrated early detection and immediate response system to bioterrorist attacks requires tight cooperation between public health agencies and security

⁴²Kenneth H. Wilson, "Microbiology, pathogenesis, and epidemiology of anthrax."

⁴³Ibid.

⁴⁴Gretchen Gavett, "How Prepared is the U.S. For a Bioterrorism Attack?" accessed 3 December 2014, <http://www.pbs.org/wgbh/pages/frontline/criminal-justice/anthrax-files/how-prepared-is-the-u-s-for-a-bioterrorism-attack/>.

organizations, which are essential for the proper deployment of national detection assets and vaccine stockpiles to local authorities in affected areas.

Because many bioterrorist agents' release is not visible and they often elicit flu-like and other non-specific symptoms, it is difficult to detect a biological attack early. In 1999, The Center for Biomedical Informatics at the University of Pittsburgh developed an automated bioterrorism detection system, the Real-Time Outbreak Disease Surveillance (RODS).⁴⁵ The codirector of the RODS laboratory, Michael Wagner, collaborated with contractor Ron Aryel to develop the National Retail Data Monitor system to collect and analyze real-time data from nationwide retail data sources to detect cluster pattern indicative of possible a bioterrorist attack. Michael Wagner and Ron Aryel then continued to collaborate to elaborate and expand the theories and applications of a new interdisciplinary science of biosurveillance, which seeks to detect real-time outbreaks of bioterrorist epidemics.⁴⁶ Currently, the United States has several biosurveillance operations covering public health, agriculture, husbandry, food processing, water, and environmental domains in both public and private sectors.⁴⁷ The Office of Health Affairs (OHA) of the DHS

⁴⁵Agency for Healthcare, *Research and Quality, Availability and Comparative Value of Data Elements Required for an Effective Bioterrorism Detection System*, 28 November 2001, accessed 3 December 2014, <http://rods.health.pitt.edu/LIBRARY/dato2AHRQInterimRpt112801.pdf>.

⁴⁶Michael Wagner, Andrew Moore, and Ron Aryel, *Handbook of Biosurveillance*, accessed 3 December 2014, http://books.google.com/books?hl=en&lr=&id=98twE2_n4wYC&oi=fnd&pg=PA183&dq=handbook+of+biosurveillance+pdf&ots=CU1L3v10DK&sig=uBLoMTJSEhhmt-Q8dSEiFW91Gw#v=onepage&q=handbook%20of%20biosurveillance%20pdf&f=false.

⁴⁷Office of Homeland Security, Written testimony of OHA acting Assistant Secretary Dr. Kathy Brinsfield and S&T Under Secretary Dr. Reginald Brothers for a House Committee on Homeland Security, Subcommittee on Emergency Preparedness, Response, and Communications hearing titled "BioWatch: Lessons Learned and the Path Forward," 6 June 2014, accessed 3 December 2014, <http://www.dhs.gov/news/2014/06/10/written-testimony-oha-acting-assistant-secretary-and-st-under-secretary-house>.

operates the National Biosurveillance Integration Center (NBIC), which is responsible for integration, analysis, and dissemination of the country's biosurveillance information to ensure national safety, security, and resilience. The OHA has developed and implemented the BioWatch program, developed in 2001, that deploys specimen-collection devices in over 30 high-risk cities to promptly detect any aerosolized bioterrorist pathogens before the appearance of symptoms among its victims.⁴⁸ The OHA has integrated its other biodefense operations with those of the BioWatch program. In addition, OHA has also assimilated its biodefense operations with the National Biosurveillance Integration System's other federal and local agency partners.⁴⁹ The OHA and the Office of Science & Technology (S&T) of the DHS are also investing in an Apex Lite2 program that would institute an integrated national systems approach to biodetection. In order to push outward the envelope of early detection of global bioterrorism before its imminent spread to the United States, the DOD has developed several global detection systems to warn of spread or imminent bioattacks from foreign countries.⁵⁰

Since mitigating the devastating effect of anthrax bioterrorist attack requires early diagnosis and treatment of its victims, healthcare providers play a critical role in bioterror response. Primary care physicians, emergency room physicians, urgent care physicians, infectious disease specialists, and infection control providers are often the first responders encountering victims of bioterrorist agents like anthrax.⁵¹ All frontline clinicians need to be aware of the

⁴⁸Office of Homeland Security, "BioWatch: Lessons Learned and the Path For War."

⁴⁹Ibid.

⁵⁰Cheryl Pellerin, *Global Nature of Terrorism Drives Biosurveillance*, Department of Defense, 27 October 2011, accessed 3 December 2014, <http://www.defense.gov/news/newsarticle.aspx?id=65852>.

⁵¹ Bernard J. Turnock, *Public Health: What It Is and How It Works*, 4th ed. (Sudbury, MA: Jones and Bartlett Publishers, 2009), 439-41.

possibility of bioterrorism and be cognizant that an outbreak of a rare disease could be the manifestation of a bioterrorist attack. Hence, healthcare providers should list bioterrorism on the top of the differential diagnosis list, whenever there is a cluster of cases of a rare disease or multiple isolations of an uncommon germ in the laboratory tests or cultures.⁵² This section will briefly elaborate the strategy to differentiate anthrax from other common diseases and comment on the latest therapy recommendations.

Anthrax is normally an infection of cattle, pigs, sheep, and horses.⁵³ The spores of *B. anthracis* are the infectious stage of the germ, and infect humans through contact with animals, inhalation, or swallowing of spores. There are three main anthrax manifestations: cutaneous, inhalation, and gastrointestinal anthrax.

Cutaneous anthrax is the most common natural form of anthrax. Within two weeks of infection, a red painless papule develops on the inoculated skin, which transitions into a vesicle. The vesicle eventually ulcerates and forms a black or purple scab. The historical case-fatality rate of cutaneous anthrax is usually less than one percent with timely antibiotic treatment but rises to almost 20 percent without adequate therapy.⁵⁴ The inhalation anthrax occurs after exposure to spores from contaminated animal products such as wool or bioterrorist weapon. Symptoms usually develop between ten days to six weeks after exposure to anthrax spores. The natural course of anthrax infection can be divided into two phases. During the first phase, patient may develop nonspecific flu-like symptoms, consisting of malaise, fever, headache, cough, shortness of breath, and congestion of nose, throat, and vocal cords. In this phase, the symptoms of anthrax

⁵²Bernard J. Turnock, *Public Health: What It Is and How It Works*, 4th ed.

⁵³Wilson, Kenneth H. "Microbiology, pathogenesis, and epidemiology of anthrax."

⁵⁴Ibid.

infection are similar to many common community acquired diseases. Therefore, it is difficult to differentiate anthrax cases from common respiratory infections like influenza, and community-acquired pneumonia. One helpful strategy to differentiate influenza from anthrax is to perform a rapid immunofluorescence assay or enzyme immunoassay for influenza.⁵⁵ If the result of an influenza test in a patient with flu-like symptoms is positive, the patient most likely has influenza, not anthrax. The second phase of anthrax infection often develops four to five days after the start of the flu-like symptoms. During this second phase, the clinical symptoms and signs of anthrax infection are similar to those of community-acquired pneumonia. In order to differentiate anthrax from community-acquired pneumonia, physicians often search for a subset of symptoms that are more commonly found in anthrax than community-acquired pneumonia, which are shortness of breath, nausea, emesis, impaired mental status, paleness, cyanosis, and high hematocrit value of more than 45 percent.⁵⁶ In addition to this subset of symptoms and signs, patient's chest X-ray findings may also help physicians in diagnosing anthrax infection. For instance, presence of pleural effusion on chest X-ray would be more suggestive of anthrax infection than community-acquired pneumonia.⁵⁷ The chest X-ray is usually a very sensitive test for anthrax infection and is abnormal in nearly all anthrax cases from bioterrorist attack.⁵⁸

⁵⁵Maxine Papadakis, Stephen McPhee, and Michael Rabow, *Current Medical Diagnosis & Treatment*, 2013 ed., (New York, NY: McGraw Hill, 2013), 1395-1400.

⁵⁶N. Hupert, G. M. L. Bearman, A. I. Mushlin, and M. A. Callahan, "Accuracy of screening for inhalational anthrax after a bioterrorist attack," *Annals of Internal Medicine* 139 (2003): 337.

⁵⁷Kenneth H. Wilson, "Clinical manifestations and diagnosis of anthrax," *UpToDate*, accessed 7 December 2014, http://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-anthrax?source=search_result&search=anthrax&selectedTitle=1%7E70.

⁵⁸Maxine Papadakis, *Current Medical Diagnosis & Treatment*, 1432.

When the anthrax infection progresses further, the bacilli may invade the bloodstream, and then spread to the rest of the body, causing diseases of various body organs. For instance, meningitis can occur in about 50 percent of anthrax patients.⁵⁹ With the complication of meningitis, the mortality rate would rise very high to around 92percent.⁶⁰ In addition to the lung and the meninges, anthrax can also infect the patient’s mouth and bowels, resulting in oropharyngeal anthrax and gastrointestinal anthrax, respectively. The gastrointestinal anthrax infection is more common than the oropharyngeal anthrax infection, with a case-fatality rate ranging from 40 to 60 percent. The oropharyngeal anthrax infection is less frequent and usually develops after ingesting undercooked contaminated meat. Though oropharyngeal anthrax infection may appear deceptively less serious, its mortality rate can be high even with antibiotic therapy.⁶¹ Hence, physicians often regard any form of anthrax infection a serious infection and render prompt aggressive antibiotic therapy.

Since naturally occurring anthrax is sporadic and rare, most clinical laboratories do not provide adequate support for rapid and accurate diagnosis. As the clinical course of anthrax is often fulminant and its case-mortality rate is high, healthcare providers and clinical laboratories need to collaborate with, and promptly seek assistance from, the regional Laboratory Response Network (LRN) reference laboratory.⁶² In 1999, the CDC collaborated with the Association of Public Health Laboratories (APHL), the Federal Bureau of Investigation (FBI), and the United States Army Medical Research Institute of Infectious Diseases (USAMRIID) to create the LRN

⁵⁹Kenneth H. Wilson, “Clinical manifestations and diagnosis of anthrax.”

⁶⁰Kenneth H. Wilson, “Microbiology, pathogenesis, and epidemiology of anthrax.”

⁶¹Ibid.

⁶²S. A. Morse, R. B. Kellogg, S. Perry, et al, “Detecting Biothreat Agents: the Laboratory Response Network,” *ASM News* 69 (2003):433, accessed 4 December 2014, <http://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-anthrax/abstract/36>.

for the rapid identification of select agents including anthrax. The LRN reference laboratories are part of a network of sentinel and national reference laboratories and have locations in all fifty states. There are very strict rules and guidelines for handling and transporting the specimens, as they are highly contagious and dangerous if mishandled. The clinical diagnosis of anthrax infection is confirmed if the clinical presentation of the case is compatible with anthrax and the organism is isolated from the patient, or at least two other non-culture tests for anthrax are positive. The non-culture supportive laboratory tests include the LRN polymerase chain reaction (PCR) assay, immunohistochemical staining (IHC) of tissues, and an anti-protective antigen (PA) IgG detected by an enzyme-linked immunosorbent assay (ELISA).⁶³ On the other hand, a suspect case is defined as a compatible clinical picture, a positive supportive test, and a negative culture of *B. anthracis*. A suspect case can also be a case that has a clinically consistent scenario linked epidemiologically to a confirmed exposure to *B. anthracis*, but at the same time lacks confirmative laboratory results.⁶⁴ Routine laboratory results for anthrax infection are usually nonspecific. For instance, the white cell count of a patient with anthrax infection can be completely normal or only mildly elevated. If the white cell count of a patient with anthrax infection were high, the patient's white cells would likely show the characteristic feature of high proportion of neutrophils with some immature forms of white blood cells.⁶⁵ If a patient presents with a more advanced phase of anthrax infection, such as anthrax meningitis, other organ-focused

⁶³“Update: Investigation of anthrax associated with intentional exposure and interim public health guidelines,” Centers for Disease Control and Prevention (CDC), MMWR Morb Mortal Weekly Report, 2 November 2001, 50(43):941-972, accessed 13 March 2015, <http://www.cdc.gov/mmwr/PDF/wk/mm5043.PDF>.

⁶⁴Ibid.

⁶⁵Maxine Papadakis, Stephen McPhee, and Michael Rabow, *Current Medical Diagnosis & Treatment*, 2013 ed., (New York, NY: McGraw Hill, 2013), 1431-1433.

laboratory tests may be very helpful. For example, in a suspected case of anthrax meningitis, the physician may perform a lumbar puncture on the patient to get a sample of the cerebrospinal fluid for various laboratory tests. If the patient has anthrax meningitis, the cerebrospinal fluid is often bloody. On microscopic examination of the gram stain of the cerebrospinal fluid, one may find the bacteria appearing as boxcar-shaped rods in chains.⁶⁶

Due to the critical public health and biodefense repercussions of anthrax and the precipitously deteriorating course of the disease, healthcare providers need to have a high index of suspicion and institute rapid testing of patients and antibiotic therapy.⁶⁷ For patients suspected to have inhalation anthrax, healthcare providers would send blood specimens immediately for Gram stain, a culture, and for PCR at a LRN laboratory. For patients suspected of having cutaneous anthrax, healthcare providers would aspirate vesicles and submit the aspirate for Gram stain, culture, and PCR. If patients have skin ulcers without intact blisters, clinicians would sample the ulcer base with sterile saline-soaked swabs and send specimens to the laboratory for Gram stain, culture, and PCR.⁶⁸ For patients suspected of having oral and gastrointestinal anthrax, healthcare providers would submit swab specimens of oropharyngeal lesions for Gram stain, culture, and PCR.⁶⁹ All patients with system anthrax, including gastrointestinal anthrax, inhalational anthrax, anthrax bacteremia, and anthrax meningitis should be admitted to hospitals.

Infection control during bioterrorism is paramount in containing the spread of the bioagent. Besides providing prompt treatment of various stages of anthrax infections in victims of

⁶⁶Kenneth H. Wilson, "Clinical manifestations and diagnosis of anthrax."

⁶⁷Ibid.

⁶⁸Ibid.

⁶⁹Ibid.

bioterrorism, the team should immediately put the patients on standard precautions that include wearing gloves for contact with nonintact skin, skin lesion, or mucosa.⁷⁰ Healthcare team members should wear personal protective equipment (PPE) if there is likely creation of aerosols, splash of body fluids, or provision of postmortem care. If an anthrax bioterrorist attack is strongly suspected or confirmed, the first responder healthcare team should implement protocols recommended by the CDC for decontamination of patients and the surrounding milieu. The first responder healthcare team members should direct patients to remove all contaminated clothes and store them in labeled biohazard bags with special care to minimize disturbance that may generate anthrax aerosols.⁷¹ The healthcare team should wear PPE, such as gown, gloves, and respiratory protection, to remove all contaminated clothes and fomites. Then, they should direct and/or assist victims to shower methodically with soap and water. For decontaminating the milieu, the healthcare facility personnel should wear PPE and decontaminate the surfaces with 0.5 percent hypochlorite solution, which can be prepared by adding one part of bleach to nine parts of water, or other approved sporicidal/germicidal agents.

Current US Bioterror Strategy and Policy

As part of the United States' holistic biodefense approach, multiple US agencies synchronize and integrate their individual efforts. The US Department of Health and Human Services (HHS) has designated the CDC as the lead agency. The CDC coordinates national emergency bioterror preparedness with both the FBI, and the Federal Emergency Management

⁷⁰“Lessons for Control of Heroin-Associated Anthrax in Europe from 2009–2010 Outbreak Case Studies, London, UK,” Centers for Disease Control and Prevention (CDC), accessed 9 December 2014, http://wwwnc.cdc.gov/eid/article/20/7/13-1764_intro.

⁷¹ Protecting Workers From Anthrax Infection,” Centers for Disease Control and Prevention (CDC), accessed 9 December 2014, <http://www.cdc.gov/niosh/docs/2002-142/pdfs/2002-142.pdf>.

Agency (FEMA). The FBI will take a leading role in a bioterrorism response, while the CDC is tasked to continuously enhance public health capabilities at all levels of government.⁷²

According to Charles Perrow, after 11 September 2001, the US government shifted from a mental model for addressing state-sponsored threats of nuclear missile attacks to the new terrorist threat.⁷³ The United States has improved its security status after changes in the Federal Aviation Administration (FAA), the creation of the DHS, and the Immigration and Customs Enforcement.⁷⁴ For instance, information sharing across the intelligence community has greatly improved, and the DHS has been able to convey intelligence on threats to the homeland in a context that is useful and relevant to the law enforcement and homeland security officials at the state and local levels.⁷⁵ The DHS has improved analysis of travel-related data since 11 September. Though watch lists existed before 11 September, they were neither coordinated nor consolidated to the same degree and depth as today. Currently, four federal centers share information regarding potential terrorist travel, leveraging threat-related intelligence and travel-related data, which is essential in identifying, targeting, and interdicting known and suspected terrorists as well as suspicious cargo prior to entering the United States or boarding a flight bound

⁷²Jane Bullock, George Haddow, Damon Coppola, and Sarp Yeletaysi, *Introduction to Homeland Security: Principles of All-Hazards Response*, 3rd ed., (Burlington, MA: Elsevier, 2009) 399-427.

⁷³Charles Perrow, "The Disaster after 9/11: The Department of Homeland Security and the Intelligence Reorganization," *Homeland Security Affairs* 2, no. 1 (April 2006), accessed 11 March 2015, <https://www.hsaj.org/articles/174>.

⁷⁴Department of Homeland Security, *Implementing 9/11 Commission Recommendations: Progress Report 2011* (Washington, D.C. Department of Homeland Security, 2011), 11-64, accessed 26 February 2015, <http://www.dhs.gov/xlibrary/assets/implementing-9-11-commission-report-progress-2011.pdf>.

⁷⁵*Ibid.*, 11.

for the United States.⁷⁶ Since the anthrax attacks in 2001, the DHS established the BioWatch system to detect the intentional release of aerosolized biological agents, which is currently operational in 30 cities and states.⁷⁷ To improve state and local biopreparedness, the DHS instituted sharing of public health and intelligence information with state and local health partners in 2009. In 2010, the DHS conducted a series of biodefense response exercises, including one in each of the ten Federal Emergency Management Agency regions, involving more than one thousand state and local officials. In addition, the DHS has contributed to the physical safety and security of biological select agent facilities by implementing Buffer Zone Plans and Site Assistance Visits, and funding first responders at these facilities.⁷⁸ In order to ensure prompt dispensation of life-saving medical countermeasures to those exposed to aerosolized anthrax spores within 48 hours of exposure, the DHS's OHS implemented an operational concept for a rapid federal response to support state and local jurisdiction plans. To ensure the DHS's mission essential functions, the DHS instituted a program to distribute medical countermeasures to personnel serving in critical roles during an emergency.⁷⁹

For years, some observers and experts had criticized the DHS by pointing to the fact that the creation of the DHS had initially resulted in mission overlaps, policy shortfalls, disorganized roles, disgruntled stakeholders, and negative political pressures. However, a more recent private analysis of this controversial issue had opined that the creation of the DHS was “well worth the

⁷⁶Department of Homeland Security, *Implementing 9/11 Commission Recommendations: Progress Report 2011*, 23.

⁷⁷*Ibid.*, 33-34.

⁷⁸Charles Clark, “Government's Post-9/11 Reorganization Called 'Worth the Effort'.”

⁷⁹Department of Homeland Security, *Implementing 9/11 Commission Recommendations: Progress Report 2011*, 33-34.

effort.”⁸⁰ More significantly, one study elucidated four major findings regarding government reorganization after 11 September. They include: “Chain of command is necessary, but not sufficient,” “The soft stuff is often the hardest to tackle,” “Management is central to mission,” and “While structure is important, the organization’s super system may be more so.”⁸¹ The author also warned that, even though there may be a strong desire due to budget austerity to consolidate agencies to promote efficiency and savings, reorganization of government agencies can be costly, energy draining, severely disruptive, and divert attention from important policy initiatives.

In the heightened security environment following the 11 September terrorist attacks, Congress passed the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PHSBPRA) (PL107-188), which President George W. Bush signed into law on 12 June 2002.⁸² The Act consists of five titles:

Title I - National Preparedness for Bioterrorism and Other Public Health Emergencies;

Title II - Enhancing Controls on Dangerous Biological Agents and Toxins;

Title III - Protecting Safety and Security of Food and Drug Supply;

Title IV - Drinking Water Security and Safety; and

Title V - Additional Provisions.

⁸⁰Charles Clark, “Government's Post-9/11 Reorganization Called 'Worth the Effort',” *National Journal*, accessed 9 December 2014, <http://www.nationaljournal.com/911-anniversary/government-s-post-9-11-reorganization-called-worth-the-effort-20110830>.

⁸¹Charles Clark, “Government's Post-9/11 Reorganization Called 'Worth the Effort'.”

⁸²Food and Drug Administration (FDA), “Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL107-188), Letter from Center Director,” accessed 9 December 2014, <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/FoodDefense/ucm111086.htm>.

The intention of the PHSBPRA is to create new requirements for the registration of select agents and toxins that pose a threat to human, animal, and plant safety and health.⁸³ The PHSBPRA also includes security risk assessments of people who have access to the select agents and toxins. Any individual who falls within the criteria of a “restricted person,” as described in the “Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act” (USA PATRIOT Act) of 2001, is prohibited to access these materials. The criteria of a “restricted person” include individuals under indictment for a crime punishable by imprisonment for one year; a person who has been convicted of a crime punishable by imprisonment for one year; a fugitive from justice; an illegal user of any controlled substance; an undocumented immigrant; a mentally ill person; an alien who is not a permanent resident but a national of Cuba, Iran, Iraq, Libya, North Korea, Sudan or Syria, or any other state that supports terrorism; or a dishonorably discharged veteran of the Armed Services of the United States under conditions.⁸⁴ Thus, the PHSBPRA, along with the USA PATRIOT Act, has empowered federal agencies to disrupt and defeat bioterrorism, and detect and thwart emerging threats.⁸⁵ Since 11 September 2001, the United States has disrupted at least 40 terrorist plots aimed at the United States. According to a RAND database, all categories of terrorist attacks against US targets domestically and overseas have been decreasing gradually since 2005.⁸⁶

⁸³Food and Drug Administration (FDA), “Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL107-188), Letter from Center Director.”

⁸⁴Ibid.

⁸⁵Matt A. Mayer, James Jay Carafano, and Jessica Zuckerman, “Homeland Security 4.0: Overcoming Centralization, Complacency, and Politics,” The Heritage Foundation, accessed 28 February 2015, https://thf_media.s3.amazonaws.com/2011/pdf/sr0097.pdf.

⁸⁶Ibid.

On 28 April 2004, the US government issued the Homeland Security Presidential Directive (HSPD) 10, *Biodefense for the 21st Century*. The directive declares: “The United States will use all means necessary to prevent, protect against, and mitigate biological weapons attacks perpetrated against our homeland and our global interests.”⁸⁷ The HSPD-10 seeks to consolidate the substantial gains garnered in the past and delineates the crucial strategies of US biodefense program.⁸⁸ First, as threat awareness comprises of timely and accurate bioweapons-related intelligence, vulnerability assessments, and the anticipation of future threats, new initiatives will enhance US ability to collect, analyze, and disseminate intelligence on bioweapons and their perpetrators.⁸⁹ Second, recognizing that prevention and protection encompass interdiction and critical infrastructure protection, new initiatives will empower US to detect, interdict, and confiscate weapons technologies and materiel to disrupt the proliferation trade traffic. In addition, these new initiatives will hunt proliferators through enhanced law enforcement cooperation, including through organizations such as Interpol. Third, the United States will employ surveillance and detection procedures to provide early warning and recognition of bioterrorist attacks to facilitate a timely response and effective mitigation of consequences. The United States will also implement new initiatives to ensure the biosurveillance capabilities being put in place as soon as their effectiveness has been validated. Fourth, the United States’ response and recovery will incorporate pre-attack planning and preparedness, building capabilities to treat mass casualty, risk communications, physical control measures, medical countermeasures, and decontamination

⁸⁷Lawrence Livermore National Laboratory, “A U.S. Biodefense Strategy Primer,” by D. Poulin, accessed 11 March 2015, <https://e-reports-ext.llnl.gov/pdf/373212.pdf>

⁸⁸President George W. Bush, “Fact Sheet: President Bush Signs Biodefense for the 21st Century,” accessed 9 December 2014, [http://www.nrt.org/production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/A-21HSPD_10/\\$File/HSPD%2010.pdf?OpenElement](http://www.nrt.org/production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/A-21HSPD_10/$File/HSPD%2010.pdf?OpenElement).

⁸⁹Ibid.

capabilities. The United States will also execute new initiatives to enhance US ability to provide comprehensive mass casualty care and to decontaminate the sites of bioterrorist attacks.⁹⁰

The HSPD-10 attempts to mobilize and synchronize all relevant federal departments and agencies in the national biodefense preparedness and response.⁹¹ The DHS Secretary is designated as the principal federal official responsible for directing and synchronizing federal operations to prepare for, respond to, and recover from domestic incidents or terrorist attacks involving bioweapons. The directive also tasks the DHS Secretary with cooperating, as appropriate, with the chiefs of other federal departments and agencies, to accomplish the mission effectively. The Secretary of State is the principal federal official responsible for responding to terrorist attacks that occur outside of US borders, including US support for foreign consequence management.⁹² The HHS Secretary is the principal federal official responsible for the medical and public health response to mass casualty incidents from bioterrorist attacks. The Secretary of the US Department of Agriculture (USDA) is the principal federal official directing the protection of agriculture and designated food products. The Secretary of Defense (SECDEF) is in charge of military force protection.⁹³

The National Response Framework (NRF) delineates the roles and responsibilities of all relevant federal, state, and local agencies participating in the national biodefense strategy. There has been progress in the implementation of the US biodefense strategy, including the successful development of enhanced medical countermeasures, including a new anthrax vaccine and a

⁹⁰President George W. Bush, “Fact Sheet: President Bush Signs Biodefense for the 21st Century.”

⁹¹Lawrence Livermore National Laboratory, “A U.S. Biodefense Strategy Primer.”

⁹²Ibid.

⁹³Ibid.

promising new vaccine against Ebola virus. There is also an enhanced ability to detect and manage a bioterrorist attack through advanced environmental detection, human health surveillance, and laboratory competences. The NRF has tailored US public health organizations at all levels to detect and respond promptly and effectively to bioterrorist attacks, not just natural disasters.⁹⁴ The NRF also facilitated upgrading the capacity of food, agriculture, and water systems to thwart and mitigate bioterrorism, in addition to fostering capabilities to boost intelligence and law enforcement efforts. Furthermore, the NRF has enhanced the US military capabilities by improving biodetection capabilities and immunizing over 600,000 soldiers and support personnel against smallpox.⁹⁵ In addition to upgrading the BioWatch to monitor the air over major cities for bioweapon releases, the NRF developed the BioShield program, which is a wide-ranging effort to develop and offer modern, effective drugs and vaccines to protect against attack by biological, chemical, radiological, or nuclear weapons.⁹⁶ The NRF also created the Public Health Emergency Medical Countermeasures Enterprise (PHEMCE) under the auspice of the HHS to support the state and local health systems and strengthen their ability to respond to bioterrorism and other major public health crises.⁹⁷ Moreover, the NRF had augmented and helped build up sufficient stocks of smallpox vaccine in the Strategic National Stockpile, which is a medical countermeasure stockpile, for all citizens, in addition to expanding stocks of antibiotics for use against anthrax exposure. The NRF also implemented the Proliferation Security Initiative (PSI) to interdict the trafficking of WMD, including bioweapons. Moreover, the NRF launched

⁹⁴Lawrence Livermore National Laboratory, “A U.S. Biodefense Strategy Primer.”

⁹⁵Ibid.

⁹⁶Ibid.

⁹⁷Ibid.

the Biodefense medical research and development at the National Institutes of Health to enhance biodefense capabilities over the mid- and long-term.⁹⁸ Additionally, the NRF established the National Biodefense Analysis and Countermeasure Center at the DHS to apply pioneering science and technology to the study of biological agents and establish a forensics center.⁹⁹ All these wide-ranging enhancements to the US biodefense capabilities have vastly improved everyday security for the United States, not only against bioterrorist threats, but also for robust response to natural disasters and sporadic epidemics like the bird-flu and severe acute respiratory syndrome.

VA's Role in the Biodefense Strategy

On 7 November 2002, President Bush signed Public Law 107-287 (PL 107-287), "The Department of Veterans Affairs Emergency Preparedness Act of 2002," which required the VA to provide decontamination and personal protection equipment at VA medical facilities and train staffs in the use of such equipment. The PL 107-287 also stipulates that the VA train physicians and other health care personnel in medical matters relating to chemical, biological, and radiological (CBR) attacks. Moreover, PL 107-287 mandates VA address the protection of patients and staff in security evaluations at VA Medical Centers (VAMCs) in case of CBR, terrorist attacks, or other emergencies, in addition to addressing security issues in VA clinical laboratories and research facilities. Thus, as per authorization by the PL 107-287, the VA's role of supporting DOD and DHS in biodefense is nested within a broader program of emergency preparedness, not as a separately focused issue or program. The remainder of this monograph will

⁹⁸President George W. Bush, "Fact Sheet: President Bush Signs Biodefense for the 21st Century."

⁹⁹Ibid.

review the broader scope of VA's emergency preparedness program that is also applicable to biodefense against all bioagents including anthrax.

In compliance with the Public Law 107-287, the VA issued the VA Directive 0320, "VA Comprehensive Emergency Management Program," and updated it on 13 August 2012.¹⁰⁰ The VA Directive 0320 directs the VA to maintain operational capability to provide services to veterans, and to serve as a national asset in times of emergency or disaster, including anthrax attacks. The VA's priorities following an emergency or disaster are personnel accountability (e.g. veterans, employees, contractors, and so forth); establishing and maintaining command, control, and communication; and providing services to veterans.¹⁰¹ As the VA is authorized to implement the whole VA Comprehensive Emergency Management Program that includes bioterrorism like anthrax attacks, the VA focuses on the intended issues and complies with the constraints during the execution of the Public Law 107-287. The VA's Comprehensive Emergency Management Framework addresses all hazards, including the All Hazards Emergency Response Base Framework, and the Incident Specific Annexes. VA also coordinates with other Federal Departments and Agencies to address other issues, such as critical capabilities, strategic assets, and the National Incident Management System / Incident Command System.¹⁰² The VA Integrated Operations Center (VA IOC) maintains an inventory of strategic assets required to meet the critical capabilities in the Department Comprehensive Emergency Management Framework. The VA IOC serves as the VA's fusion center for integrated planning and data

¹⁰⁰Department of Veterans Affairs, "VA Comprehensive Emergency Management Program," accessed 28 February 2015, http://www.va.gov/vapubs/viewPublication.asp?Pub_ID=631&FTType=2.

¹⁰¹Ibid., 3.

¹⁰²Ibid., 3-4.

analysis to present recommendations to VA Senior Leaders and to coordinate with other Federal Departments and Agencies.¹⁰³ The VA IOC provides a central location for the synchronization and coordination of information, intelligence, and threat communication that have the potential to impact the VA. In addition, the VA IOC facilitates timely decision-making by providing situational awareness and fully coordinated recommendations relative to developing and ongoing events. Thus, the VA IOC serves as VA's fusion center for coordinating the agency's ability to perform the Primary Mission Essential Function (PMEF) and the associated supporting Mission Essential Functions (MEFs). Moreover, the VA IOC also serves as the VA's coordination center for emergency management, utilizing the Incident Command System.¹⁰⁴ The VA Crisis Response Team (CRT) serves as the VA senior leadership's emergency management coordination group and consists of the senior leaders and executives of the Administrations, Staff Offices, and Staff Organizations. The Crisis Response Team's subordinate groups are tasked to address specific issues such as anthrax biodefense.¹⁰⁵

The VA has established a Continuity Program in accordance with National Security Presidential Directive 51/Homeland Security Presidential Directive 20 (NSPD51/HSPD20). This Continuity Program has been specifically created to ensure smooth and efficient performance of the VA's Primary Mission Essential Function (PMEF) and Mission Essential Functions (MEFs) as designed under all possible circumstances, including anthrax attacks, with minimal or no

¹⁰³Department of Veterans Affairs, "Veterans Affairs Integrated Operations Center (VA IOC)," accessed 28 February 2015, http://www.va.gov/vapubs/viewPublication.asp?Pub_ID=631&FType=2.

¹⁰⁴Department of Veterans Affairs, "VA Comprehensive Emergency Management Program," 4.

¹⁰⁵Ibid.

disruption.¹⁰⁶ The VA maintains sufficient capabilities to meet essential functions during national emergencies, including the capability to respond to the needs of individuals and State and local governments when required by law or directive. The VA will support the nation during an emergency through the Department's PMEF to "provide medical and hospital services for veterans and, during a disaster or emergency such as anthrax attack, to civilian victims as appropriate."¹⁰⁷ The VA will also support the VA/DOD Contingency System, the National Disaster Medical System (NDMS), and the NRF.

The VA Directive 0324 TTE&E Program is a component of the VA Comprehensive Emergency Management Program.¹⁰⁸ This TTE&E Program utilizes an all-hazards emergency management approach, the purpose of which is to booster the VA emergency management programs and identify any gaps and risks, develop training capabilities, and improve organizational coordination and communication.¹⁰⁹ Furthermore, the TTE&E Program initiates dialogue relative to the VA policy, plans, and procedures that will improve preparedness and response efforts. The VA conducts and supports annual TTE&E Program events, in addition to developing and maintaining a continuity and emergency management-training program.¹¹⁰

The VA's Office of Emergency Management (OEM) retained contractor MTS Technologies, Inc. to provide training for various systems and programs within OEM, with a

¹⁰⁶Department of Veterans Affairs, "VA Continuity Program," accessed 28 February 2015," http://vawww.va.gov/vapubs/viewPublication.asp?Pub_ID=525&FType=2.

¹⁰⁷Ibid.

¹⁰⁸Department of Veterans Affairs, "Test, Training, Exercise, and Evaluation Program," accessed 28 February 2015, http://www.va.gov/vapubs/viewPublication.asp?Pub_ID=613&FType=2.

¹⁰⁹Ibid.

¹¹⁰Ibid.

major focus on the Disaster Emergency Medical Personnel System (DEMPS) Program and the National Emergency Medical Response Teams (NEMRT).¹¹¹ OEM will use the appropriate technology to augment the current training program in an effort to create an engaging, authentic, and productive learning experience. These modalities may include one or a hybrid/combination of face-to-face, web-based training, live meeting, video teleconference, print material, transcription, video, conference call, Blackboard/WebCT, and satellite training.¹¹²

Though the VA has developed a robust emergency preparedness plan, it has never been tested in real emergency. The VA Office of Inspector General (OIG), on 6 January 2006, published the “Emergency Preparedness in Veterans Health Administration Facilities,” an objective, in-depth assessment of VA’s emergency preparedness. The VA OIG reported that the Veterans Health Administration (VHA) had properly addressed emergency preparedness at the national level. Furthermore, many facilities were generally compliant with the VHA, the National Institute for Occupational Safety and Health (NIOSH), and The Joint Commission’s guidelines.¹¹³ However, the VA OIG criticized the VHA’s emergency preparedness because its education and training were not consistently provided to employees at the facility level. In addition, the Facility Hazard Vulnerability Analyses did not demonstrate actual risks to the facility, and some high-risk laboratory safety recommendations from the 2002 OIG report had not yet been executed. For instance, the 2002 OIG report pointed out that some of the VA’s emergency plans failed to

¹¹¹“VA Office of Emergency Management,” MTS Technologies, Inc., accessed 28 February 2015, http://www.mtstech.com/va-office-of-emergency-management/?doing_wp_cron=1425162083.4091169834136962890625.

¹¹²Ibid.

¹¹³ “Emergency Preparedness in Veterans Health Administration Facilities,” VA Office of Inspector General, accessed 11 December 2014, <http://www.va.gov/oig/54/reports/VAOIG-04-03266-51.pdf>.

address the requirements for PPE, different services' training requirements, or shelter requirements. The OIG further noted that these deficiencies in disaster or emergency preparation would likely render the VHA facilities more susceptible to physical damages and personal injuries during emergencies, such as anthrax attacks.¹¹⁴

The VA OIG recommended that the Under Secretary for Health, in conjunction with the VISN, take actions to ensure that all employees undergo regular and role specific emergency preparedness training.¹¹⁵ The VA OIG also recommended all facility emergency plans focus on PPE, staff training, and shelter in place. In addition, VA OIG directed that the Facility Hazard Vulnerability Analyses address actual facility risks and that the OIG high-risk laboratory safety recommendations be implemented. Furthermore, VA OIG endorsed that building security vulnerabilities are assessed and prioritized, and remedial or mitigating actions are completed, as feasible.¹¹⁶

The current "Department of Veterans Affairs (VA)-Department of Defense (DOD) Contingency Plan," which was published on 13 May 2014, describes the current plan of VA-DOD collaboration on general emergency preparedness for all emergencies including anthrax attacks.¹¹⁷ This plan derives its authorization from the VA-DOD Health Resources Sharing and Emergency Operations Act (Public Law 97-174) under which the VA serves as a principal healthcare backup to DOD during and immediately following a period of war or a period of

¹¹⁴"Emergency Preparedness in Veterans Health Administration Facilities," VA Office of Inspector General.

¹¹⁵Ibid.

¹¹⁶Ibid.

¹¹⁷"Department of Veterans Affairs (VA)-Department of Defense (DOD) Contingency Plan," Department of Veterans Affairs, accessed 11 December 2014, http://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=3007.

national emergency such as biological attacks, which would involve the DOD in armed conflict.¹¹⁸ The VA-DOD Contingency Plan is subject to annual review, and it provides the current list of VA assets, which constitute the VA contingency support to DOD.¹¹⁹

In accordance with 38 USC, Section 8111A, the Secretary of Veterans Affairs may unilaterally, or at the request of the SECDEF, provide hospital care, nursing home care, and healthcare services to active members of the Armed Forces during and immediately following a period of war, or a period of national emergency such as anthrax attacks.¹²⁰ The VA Secretary may give higher priority to furnishing care and services to veterans eligible for care and services in VHA medical facilities than to other patients.

Analysis and Discussion

In order to fulfill VA's role in supporting DOD and DHS in biodefense against anthrax attacks, the VA needs to rectify three major institutional problems, namely, the system failures, inadequate leadership, and insufficient medical staff. The system failures can be rectified by implementing the recommendations in the White House Report.¹²¹ Since these recommendations came from the highest authority, they are essentially non-negotiable and have to be implemented. However, the VA needs to continually observe the responses of the VA system during the implementation of those recommendations so as to continually reframe the operational

¹¹⁸“Emergency Preparedness in Veterans Health Administration Facilities,” VA Office of Inspector General.

¹¹⁹Ibid.

¹²⁰Ibid.

¹²¹Richard Simon, “White House report says VA has 'significant' and 'systemic failures!’”

environment and the problem to agilely and creatively adapt the course of action to ensure fulfillment of the President's intent.

To rectify the leadership problem, the VA can expand its leadership training programs. For the last few years, the VA has been facing a significant leadership loss from the baby boomer generation's retirement, resulting in grave talent gaps. In order to establish a continuum of leadership development, the VA implemented a four-tiered leadership development strategy, according to its Succession and Workforce Development Strategic Plan.¹²² The first tier is the Facility LEAD Program; the second tier is the VISN LEAD Program; the third tier is the Health Care Leadership Development Program (HCLDP); and the fourth tier is the Health Care Executive Fellowship (HCEF) Program. The VA National Leadership Council approved and maintains that each VA facility and VISN should establish a leadership development program for selected staff.¹²³ The VA can also alleviate its leadership problem by improving the quality of its various leadership programs, increasing the number of enrollees in each program and offering the leadership program graduates appropriate leadership positions upon graduation. This strategy would assure a continuous source of well-trained, dedicated leaders to lead and direct the VA healthcare system to achieve its mission and also prepare the agency to support DOD in the event of an anthrax attack.

The White House Report characterized the VA's system failure as an "inherent lack of responsiveness and a belief that any issues raised by the public, the VA leadership, or oversight

¹²²Department of Veterans Affairs, "Veterans Health Administration Four Tiered Leadership Development Program: Leadership, Effectiveness, Accountability, and Development (LEAD)," accessed 12 March 2015, http://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=2539.

¹²³Ibid.

entities are exaggerated, unimportant or 'will pass.'"¹²⁴ The former acting VA Secretary Sloan Gibson admitted that the VA had had “unacceptable, systemic problems and cultural issues within our health system” and pledged to “work to earn back the trust of veterans.”¹²⁵ The White House report follows the one by the VA OIG, which identified a systemic problem in scheduling veterans for healthcare in a timely manner, including instances in which VA staffers falsified records to cover up long waits.¹²⁶ The Office of the Special Counsel, which investigates whistleblower complaints, criticized the VA for failing to acknowledge the “severity of systemic problems” that has put patients at risk.¹²⁷ The VA’s system failure was also corroborated by the whistle-blowers at a Congressional hearing.¹²⁸ Among those testifying before the House Committee on Veterans Affairs was Dr. Katherine Mitchell, a physician at the Phoenix VA Health Care System. After telling the committee that the VA system and leadership were so dysfunctional that employees had no faith that they could safely identify flaws, she then became the target of sham investigations, smear campaigns, job transfers, and other reprisals.¹²⁹

Since taking office in 2014, the new VA Secretary Robert McDonald has been aggressively addressing the VA problem of system failure. During an interview with a news reporter, Secretary McDonald announced that he planned to terminate more than 1,000 VA

¹²⁴Richard Simon, “White House report says VA has 'significant' and 'systemic failures!’”

¹²⁵Ibid.

¹²⁶Ibid.

¹²⁷Ibid.

¹²⁸Dennis Wagner, “Whistle-blowers rip VA in congressional hearing,” *The Republic*, accessed 12 March 2015, <http://www.azcentral.com/story/news/politics/2014/07/09/whistle-blowers-rip-va-congressional-hearing/12395177/>

¹²⁹Ibid.

staffers for violating VA values.¹³⁰ Secretary McDonald is also working to restructure health care services for veterans, consolidating management of the VA health care system, and giving veterans a single point of contact to receive care. Secretary McDonald's reforms will also tackle the root cause of the VA's sometimes 90-day-plus wait times.¹³¹

Since the Affordable Care Act has increased access to medical care for millions of previously uninsured patients, the competition for highly skilled medical personnel has intensified. According to Rick Jurgens, the VA needs to hire 20,000 to 30,000 new medical personnel just to provide routine care to the veterans.¹³² VA Secretary McDonald, in congressional testimony in September 2014, confirmed that some 28,000 new employees are needed across the agency to catch up with backlogs in healthcare.¹³³ He also singled out staff shortages as a factor in the VA scandals over the past year, as staff in Phoenix manipulated wait lists to conceal the extent of wait times. Since the VA is not a pay leader in the industry, the VA needs to apply critical and creative thinking to make VA more competitive in a zero-sum game of the medical job market. In 2014, Congress appropriated \$5 billion to hire more VA medical staff and help the department make offers that are more competitive with private industry.¹³⁴ However, a better solution is to expand the pool of medical personnel to avoid further raising the cost of medical personnel by increasing demand from a stagnant pool of supply. One creative way is to

¹³⁰Jeremy Diamond, "VA chief announces restructuring, firings," CNN, accessed 12 March 2015, <http://www.cnn.com/2014/11/10/politics/va-reforms-and-restructuring/>

¹³¹Ibid.

¹³²Rick Jurgens, "VA Seeks Personnel Nationwide," Valley News, accessed 3 March 2015, http://www.whitehouse.gov/sites/default/files/docs/va_review.pdf.

¹³³Adam Ashton, and Hal Bernton, "VA in Healthcare Hiring Spree, but Can it Keep Jobs Filled?" Tacoma News Tribune, accessed 12 March 2015, <http://www.military.com/daily-news/2014/12/22/va-in-healthcare-hiring-spree-but-can-it-keep-jobs-filled.html>.

¹³⁴Ibid.

establish a VA-DOD joint venture of a civilian medical corps that provides full scholarships to highly-qualified medical school applicants to attend the Uniformed Services University of the Health Sciences or other esteemed medical schools with the requirement of 10-20 years of service either in the VA or DOD healthcare facilities. After the initial tenure, the medical personnel would be incentivized to stay on until retirement. The requirement to stay for a certain period of employment is needed to elevate the retention rate of healthcare staff. According to a 2014 VA strategic plan document, the VA loses up to 32 percent of all new employees nationally within the first five years of employment, and more than 20 percent of doctors and nurses leave within their first two years on the job.¹³⁵ The proposed creative joint VA-DOD venture would incentivize extended service to the VA and DOD for recently graduated physicians and doctors.

There are other ways the VA can contribute to biodefense against anthrax attacks. In FY 2014, VA's biodefense research budget was only \$700,000, compared to HHS's \$4.1 billion.¹³⁶ Congress should increase the VA's biodefense research budget in order to make it an active partner within the national biodefense strategy. Furthermore, the VA could use its more than 1,000 facilities to form a syndromic surveillance system to detect early epidemics of specific diseases like anthrax. Joint and separate analyses of VA and DOD outpatient visit data from October 2006 through September 2010 demonstrate two complementary surveillance systems with evident benefits for the national health picture.¹³⁷ These two surveillance systems could

¹³⁵Adam Ashton, and Hal Bernton, "VA in Healthcare Hiring Spree, but Can it Keep Jobs Filled?" Tacoma News Tribune,

¹³⁶Tara Kirk Sell, and Matthew Watson "Federal Agency Biodefense Funding, FY2013-FY2014," accessed 3 March 2015, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3778993/>.

¹³⁷J. A. Pavlin, H. S. Burkom, Y. Elbert, C. Lucero-Obusan, C. A. Winston, K. L. Cox, G. Oda, J. S. Lombardo, and M. Holodniy, "Combining surveillance systems: effective merging of U.S. Veteran and military health data," accessed 3 March 2015, <http://www.ncbi.nlm.nih.gov/pubmed/24386335>.

shorten the warning and response times to future anthrax attacks. Relative timeliness of reporting could be improved in 92 percent of geographic areas with access to both systems, and more information could be provided in areas where only one type of facility exists. Merging DOD and VA data enhances geographic cluster detection capability for anthrax attacks without loss of sensitivity to events isolated in either population and has a manageable effect on customary alert rates. The VA syndromic surveillance system may join existing non-VA syndromic surveillance systems, and can leverage the versatility and networking power of the VA's Computer Patient Record System (CPRS) to monitor the emergence of disease syndromes that may suggest incipient anthrax attacks.¹³⁸ The syndromic surveillance analyzes health-related information, which is associated with a high probability of an anthrax case or an anthrax endemic that would prompt a public health response. Once an incipient anthrax epidemic is suspected, spread of the anthrax infection can be modeled to assess what segments of a population need to be contained to decrease the risk of an anthrax epidemic.¹³⁹ VA can start with the Reed-Frost model, which assesses the propagation of the anthrax infection in the populace due to random sampling. The Reed-Frost model is based on a Markov chain, which can be further fine-tuned by using computer simulation with large number of iterations. The simulation method used is the Monte Carlo method, which is commonly used to assess random processes that cannot be solved using other methodologies. To improve the modeling in a large population, the VA can use the nonrandom model of Kermack and McKendrick.¹⁴⁰ Using initial data from a local anthrax outbreak, one can

¹³⁸Peter Fos, *Epidemiology Foundations: The Science of Public Health*, (San Francisco, CA: Wiley Imprint, 2011), 230-232.

¹³⁹Frank Hoppensteadt, and Charles Peskin, *Mathematics in Medicine and the Life Sciences*, (New York, NY: Springer-Verlag, 1992), 67-77.

¹⁴⁰Ibid.

build a regression model to determine the major determinants governing the severity and spread of the anthrax epidemic so that strategies can be developed to mitigate both the intensity and the propagation of the anthrax epidemic. For standard fitted regression models, the VA can evaluate the precision of estimated regression coefficients, fitted values, and predictions of new observations of anthrax infections.¹⁴¹ After successfully applying remedial measures to improve the accuracy of the regression model for anthrax attacks, the VA can finally proceed to validate the anthrax attack model by checking the model against new independent data from a separate locale of anthrax epidemic.¹⁴²

Conclusion

With knowledge of the major determinants of the velocity and intensity of an anthrax epidemic derived from the modeling and also optimization analysis, VA leaders can focus mitigating efforts on the major variables to efficiently and effectively mitigate, control, and terminate the anthrax epidemic by applying operations research methodology. Operations research is a discipline of quantitative science, which had contributed to war fighting power in WWII, especially in assisting top military decision makers with analyses to support planning for the Operation Overlord.¹⁴³ Operations research empowers the analysts in the application of quantitative methods to decision making in many fields, including transportation, business, logistics, inventory controls, military operations and public health operations like anthrax

¹⁴¹John Neter, Michael Kutner, Christopher Nachtsheim, and William Wasserman, *Applied Linear Statistical Models*, (Chicago, IL: Irwin, 1996), 429.

¹⁴²*Ibid.*

¹⁴³IBS Center for Management Research, "Operations Research: Chapter 6," accessed 3 January 2015, <http://www.icmrindia.org/courseware/Quantitative%20Methods/Operations%20Research.htm>.

biodefense.¹⁴⁴ Due to budgetary constraints, it is less likely that there will be significant increase in VA funding for anthrax biodefense, given competing demands from many worthwhile programs that provide direct healthcare or financial benefits to veterans. Leaders can apply the principles of operations research as a force multiplier to increase the productivity and efficiency of the VA healthcare system. For instance, when an anthrax endemic is detected and mass casualties of anthrax are transferred to local VA medical centers, the entire VA system of 152 medical centers can be activated to provide support via the internet using various types of telemedicine. For example, radiologists from other facilities can use tele-radiology to review and interpret radiographic images via internet connection and CPRS. Medical specialists, including pulmonologists, intensivists, cardiologists, dermatologists, and other subspecialists, can use the CPRS to provide electronic consultations after reviewing patients' electronic medical records in CPRS. VA healthcare volunteers can be recruited and sent to the VA medical centers caring for anthrax attack victims. VA leaders can follow the Harald Buhaugre's recommendations and use operations research methodology as force multiplier to enhance the efficiency of the entire anthrax biodefense response in support of other federal agencies like the HHS, DHS, and DOD.¹⁴⁵ The new revitalized and energized VA leadership can initiate a program evaluation of the entire VA anthrax biodefense program to make better decisions about program activities.¹⁴⁶ VA leaders can also apply the Boyd's OODA spiral as a guide to evaluate the VA's anthrax

¹⁴⁴Richard Chase, Robert Jacobs, and Nicholas Aquilano, *Instructor's Edition: Operations Management for Competitive Advantage, 11th ed.*, (Boston, MA: McGraw-Hill Irwin, 2006), 9.

¹⁴⁵Harald Buhaug, "Operational research needs to be used more often and may provide answers," *BMJ* 2002;324:252, accessed 3 January 2015, <http://www.bmj.com/content/324/7332/252>.

¹⁴⁶James Veney, and Arnold Kaluzny, *Evaluation and Decision Making for Health Services, 2nd ed.* (Ann Arbor, MI: American College of Healthcare Executives, 1991), 6.

biodefense program during all phases of the management cycle, starting with the annual review, strategic planning, re-design stage using adopted alternative approaches, implementation, and outcome analysis.¹⁴⁷ With the implementation of all the above-mentioned recommendations and the rigorous leadership of Secretary McDonald, the VA will be able not only correct its previous system problems, but also transform the VA organization into a learning system, possessing an expanded capacity to adapt and grow.¹⁴⁸ With the unity of aligned efforts of all the dedicated VA staff, Secretary McDonald will be able not only support the DOD in anthrax biodefense, but also fulfill his promise in his open letter to the veterans to “improve the delivery of the care and benefits” to them.¹⁴⁹

¹⁴⁷I James Veney, and Arnold Kaluzny, *Evaluation and Decision Making for Health Services*, 7-9.

¹⁴⁸Margaret Wheatley, *Leadership and the New Science: Discovering Order in a Chaotic World* (San Francisco, CA: Berrett-Koehler Publisher, 1999), 15.

¹⁴⁹Bob McDonald, “An open letter to America’s Veterans from Secretary Bob McDonald,” Official Blog of the U.S. Department of Veterans Affairs, accessed 13 March 2015, <http://www.blogs.va.gov/VAntage/15990/an-open-letter-to-americas-veterans-from-secretary-bob-mcdonald/>.

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