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High-Threat Biological Agents: Characteristics, Effects, and Policy Implications

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Summary

The anthrax mailings in 2001, which culminated in 5 deaths, 22 infections, and contamination of both postal and congressional buildings, intensified concerns about terrorist use of biological agents. This event increased Congressional interest in actions to limit the vulnerability of the United States to such attacks. High-threat biological agents, defined by the Centers for Disease Control and Prevention as Category A pathogens, are considered relatively easy to disseminate, have high mortality, and have the potential for major public health impacts.

High-threat biological agents cause different symptoms in their victims, depending on the pathogen. Since the nature of these agents differs, no single treatment can be given in the case of a biological attack. As a result, treatment of the victims of a biological attack, especially one which is covert, may be difficult. The identification process for many pathogens may be complicated by their incubation period, and the lack of distinct symptoms early in the disease's progress. The difficulties in treating the various high-threat agents may place strain on the resources of the medical system, especially in the case of mass casualties.

Protection from biological agents is an area of active research and development. The range of protection and detection equipment available to first responders has led to questions regarding equipment standardization and state and local preparedness. Development and distribution of vaccines continues to be a contentious issue. Attempts to detect biological releases using sensor technologies, or through analyzing public health data, continue to be implemented, but these technologies are in relatively early stages of development.

It is unclear whether terrorist groups are capable of effectively using biological agents as weapons of mass destruction, but the relatively small amounts of pathogen that may be needed to execute a significant attack is a source of concern. Some suggest that terrorist interest in biological agents is increasing. However, others assert that technical difficulties would make mass casualty attacks unlikely.

Current policies seek to reduce the proliferation of biological weapons by relying on both domestic and international controls, to increase the number of countermeasures available against such pathogens through research and development activities, to improve the nation's ability to detect pathogen releases, and to increase the ability of hospitals and care providers to treat mass casualties.

Policymakers may be called upon to further address potential biological terrorism vulnerabilities, including overseeing the use of atmospheric monitoring equipment for pathogen detection; the direction of continued research and development into biological agent detectors; review of further research into protective equipment, prophylaxis and treatment against high-threat pathogens; and assessment of first responder emergency preparedness. This report will be updated as events warrant.

Contents

High-Threat Biological Agents: Characteristics, Effects, and Policy Implications

Introduction

Since the anthrax mailings of 2001, policymakers have been implementing programs to decrease the vulnerability of the United States to terrorist use of biological weapons. This report discusses high-threat biological agents, focusing on the Centers for Disease Control and Prevention (CDC) definition for Category A pathogens (bacteria and viruses), their treatment and detection, current policies, and possible future approaches to reducing their threat. Terrorist use of biological agents would be a low probability, but potentially high consequence, event. While there is still debate over whether terrorist groups have the ability to effectively use biological weapons as a weapon of mass destruction, the anthrax mailings of 2001 highlighted their potential as a terror weapon. Policy approaches for reducing vulnerability to biological terrorism involve both addressing biological agents as a group, and focusing on specific agents perceived as posing the greatest threat. Treatments for exposed victims vary depending on the nature of the pathogen and experience in treatment of these diseases is limited, due to the rarity of naturally occurring cases.

What Are High-Threat Biological Agents?

Biological agents, for the purposes of this report, are pathogens which can infect and cause serious illness in humans.[1] The level of threat a biological agent may constitute is open to interpretation. Depending on what aspects of a pathogen are considered priorities, different biological agents are likely to be identified as high threat. For example, the National Institute of Justice provides an extensive list of biological agents of concern in their handbook on purchasing protective equipment.[2,3] In comparison, handbooks regarding battlefield treatment of biological weapon

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[1] For an introduction to biological weapons, see CRS Report RL31059, *Biological Weapons: A Primer* by (name redacted).

[2] *An Introduction to Biological Agent Detection Equipment for Emergency First Responders*, NIJ Guide 101-00, National Institute of Justice, December 2001.

[3] The NIJ list includes: Anthrax, Brucellosis, E. coli (O157:H7), Tularemia, Cholera, Diphtheria, Glanders, Melioidosis, Plague, Typhoid Fever, Marburg Virus, Junin Virus, Rift Valley Fever Virus, Smallpox, Venezuelan Equine Encephalitis, Yellow Fever Virus, Dengue Fever Virus, Ebola Virus, Congo-Crimean Hemorrhagic Fever Virus, Typhus, Q Fever, and Rocky Mountain Spotted Fever.

casualties contain a shorter list of agents.[4] The CDC identifies a number of different categories of biological agents, and rank the various biological agents into categories.

Category A diseases — anthrax, plague, smallpox, tularemia, and viral hemorrhagic fevers — are of the highest threat.[5] The CDC views Category A pathogens as easily disseminated or transmitted from person to person; resulting in high mortality rates; having the potential for major public health impact; potentially causing public panic and social disruption; and requiring special action for public health preparedness. This is in contrast to the Category B agents which lack such potential.[6] The Category A pathogens will be discussed in this report.

Anthrax (*Bacillus anthracis*)

Anthrax is a disease caused by the bacterium *Bacillus anthracis*.[7] *Bacillus anthracis* responds to environmental stresses, such as nutrient depletion or oxygen exposure, by forming spores. While the bacterium is dormant in spore form, these spores are very hardy and can remain viable for decades in ideal conditions. Anthrax spores are primarily found in soil, and are endemic to many parts of the world. Anthrax is primarily an animal disease, infecting animals when they ingest *Bacillus anthracis* spores during grazing. Anthrax is not a person-to-person contagious disease.

The forms of anthrax infection are cutaneous, intestinal, and inhalation. The type of anthrax infection depends on how the victim came into contact with the spores. Cutaneous anthrax is the most common form of the disease and occurs when anthrax spores contact broken skin. Intestinal anthrax occurs after consumption of anthrax-spore-contaminated food, usually meat. Intestinal anthrax is less common than cutaneous anthrax. Inhalation anthrax is the least common naturally occurring form of anthrax. Inhalation anthrax occurs when spores are inhaled and germinate in the lungs.

The symptoms usually appear 48 to 72 hours after exposure. The effects of the three forms of the disease, differ from each other drastically. Cutaneous anthrax is marked by a swollen, painless black ulcer where the infection occurred. In contrast, intestinal anthrax is characterized by nausea, vomiting, and fever followed by abdominal pain, vomiting of blood, and severe diarrhea. Inhalation anthrax manifests with symptoms resembling a common cold: fever, fatigue, and a dry cough. The symptoms progress to severe difficulty breathing and shock as the bacteria multiply.

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[4] These include: Anthrax, Brucellosis, Melioidosis, Glanders, Plague, Q Fever, Tularemia, Smallpox, Venezuelan Equine Encephalitis, and Viral Hemorrhagic Fevers.

[5] For information about the categories the CDC uses to define bioterrorism threats, see [http://www.bt.cdc.gov].

[6] Category B diseases include: Brucellosis, Salmonella species, E. coli (O157:H7), Shigella, Glanders, Melioidosis, Psittacosis, Q fever, Typhus fever, Viral encephalitis, Cholera, and Cryptosporidia.

[7] For a summary of technical information on anthrax, see [http://www.cdc.gov/ncidod/dbmd/diseaseinfo/anthrax_t.htm].

The recovery rate for anthrax infection depends both on type of infection and how early treatment begins. Early treatment of anthrax victims is strongly suggested, as late treatment is not as effective in many cases. Cutaneous infection typically has a fatality rate of less than 5% with early treatment, increasing to 20% without any treatment. Intestinal anthrax has a higher mortality rate, with fatalities ranging from 25% to 75% depending on effectiveness of treatment. Some medical experts assert that aggressive early treatment of intestinal anthrax will lower the fatality rate.[8] Untreated inhalation anthrax is almost uniformly fatal. With early treatment within the incubation period, the fatality rate can be dramatically reduced. In the aftermath of the anthrax mailings of 2001, 5 of the 11 people diagnosed with inhalation anthrax died, but historically greater than 90% of inhalation anthrax cases have been fatal, even with treatment.[9]

All forms of anthrax are treated with antibiotics. Several different antibiotics may be used, including ciprofloxacin, penicillin, and doxycycline. Some anthrax strains may be less sensitive to antibiotics and therefore difficult to treat.

Prophylaxis is available to protect against anthrax both via vaccination and post-exposure antibiotic treatment. While a vaccine against anthrax has been licensed by the FDA, it is not currently available to the general public due to vaccine shortage. The Department of Homeland Security, working with the Department of Health and Human Services and other federal agencies, is coordinating development of civilian anthrax vaccine policy. The Department of Defense anthrax vaccination policy, and the amount of vaccine needed to implement this policy, includes vaccination of troops thought to be potentially exposed to anthrax.[10] After the anthrax mailings of 2001, those individuals thought to be potentially exposed to anthrax spores were offered vaccination and antibiotic prophylaxis using the drug ciprofloxacin.

Plague (*Yersinia pestis*)

Plague is a disease caused by the bacterium *Yersinia pestis*. Plague bacteria are sensitive to sunlight and humidity and do not form spores. Instead, plague bacteria naturally reside in host creatures, such as rodents, and are found in many parts of the world, including the United States. Plague usually travels within animal populations, via insect vectors, generally migrating from one animal to another through biting insects such as fleas.

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[8] Thomas V. Inglesby, Donald A. Henderson, John G. Bartlett, *et al.*, "Anthrax as a Biological Weapon: Medical and Public Health Management," *Journal of the American Medical Association*, Vol. 281, May 12, 1999, pp. 1735-1745, and Thomas V. Inglesby, Tara O'Toole, Donald A. Henderson, *et al.*, "Anthrax as a Biological Weapon, 2002: Updated Recommendations for Management," *Journal of the American Medical Association*, Vol. 287, May 1, 2002, pp. 2236-2252.

[9] Arthur M. Friedlander,"Anthrax," *Medical Aspects of Chemical and Biological Warfare*, Office of the Surgeon General, United States Army, Chapter 22, pp. 467-479.

[10] For more information on the anthrax vaccine, see the Department of Defense's Anthrax Vaccination Immunization Program, found online at [http://www.anthrax.osd.mil/].

The three kinds of plague are bubonic, septicemic, and pneumonic. Bubonic plague and septicemic plague occur when plague bacteria enter the body through the bite of an infected insect. Pneumonic plague occurs when plague bacteria are inhaled into the lungs, or develops out of a bubonic or septicemic infection. Pneumonic plague, unlike the other forms, does not have to pass through an insect vector. It is person-to-person contagious.

Bubonic plague is the most well-known form. It is also known as the Black Death, and was responsible for the European plagues of the 14th century. Victims of bubonic plague develop swollen, painfully inflamed lymph glands,[11] and also suffer fever, headache, chills, and general weakness. Septicemic plague occurs in a manner similar to bubonic plague, except the swelling of the lymph glands does not occur. Instead, the bacteria multiply in the blood, causing shock and internal bleeding in addition to the more general symptoms of fever and weakness. The symptoms of pneumonic plague include fever, weakness and cough, possibly combined with severe nausea, abdominal pain, diarrhea, and difficulty breathing.

The recovery rate for treatment of the different forms of plague vary. Naturally occurring plague in the United States has an overall fatality rate of 14%. The majority of these cases are bubonic with some septicemic, and very rarely pneumonic, plague. The fatality rate for septicemic plague is markedly higher than that for bubonic (33% versus 11% between 1980-1984),[12] mainly ascribed to difficulties in diagnosing septicemic plague at an early stage. Pneumonic plague has a much higher fatality rate. It approaches 100% as the time between infection and treatment increases. For effective treatment, therapy must begin within 18 hours or victims are not likely to survive.[13] For untreated forms, the fatality rate is 60% for bubonic plague and 100% for septicemic and pneumonic plague.

All forms of plague are treated using antibiotic therapy. The Food and Drug Administration has approved several antibiotics for treatment of plague, and others not yet approved for such have been shown to be effective. Natural antibiotic resistance in plague bacteria is known, so not all cases can be cured using a single antibiotic.[14]

A plague vaccine has been approved for human use, but its production was discontinued in 1998 because of manufacturing difficulties. Additionally, the

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[11] These are called "buboes" and give rise to the origin of this plague form's name.

[12] Thomas W. McGovern and Arthur M. Friedlander, "Plague," *Medical Aspects of Chemical and Biological Warfare*, Office of the Surgeon General, United States Army, Chapter 23, pp. 479-502.

[13] *Ibid.*

[14] A study has shown that 13% of the *Y. pestis* strains in Madagascar are doxycycline-resistant. Thomas V. Inglesby, David T. Dennis, Donald A. Henderson, *et al.*, "Plague as a Biological Weapon: Medical and Public Health Management," *Journal of the American Medical Association*, Vol. 283, May 3, 2000.

vaccine was not effective against pneumonic plague, limiting its utility. Several Investigational New Drug (IND) vaccines are under development.[15]

Smallpox (*Variola major*)

Smallpox is a disease caused by the virus variola. Naturally occurring variola virus has been eradicated, and the only remaining, legal stocks of the virus are held at secured facilities in the United States and Russia.[16] Smallpox is a person-to-person contagious disease.

Typical victims of smallpox suffer an outbreak of rash, followed by scabbing pustules covering their body. The rash and pustules form over a three week period following an incubation time of approximately one to two weeks. Survivors of smallpox are generally scarred by the disease. The disease has two rare variants; one is known as flatpox, the other hemorrhagic smallpox.[17]

The fatality rates for the forms of the disease differ. For smallpox, the fatality rate is approximately 30%, though in a population lacking natural resistance this rate may increase. Both flatpox and hemorrhagic smallpox have a fatality rate approaching 100%.

Smallpox has no specific treatment, though vaccination after exposure may reduce the severity of the disease. An approved vaccine which protects against smallpox is known, but it is not available to the general public. This vaccine has recently been offered to select first responders and members of the military. For more information regarding the smallpox disease and vaccination, see CRS Report RS21288, *Smallpox: Technical Background on the Disease and Its Potential Role in Terrorism* by (name redacted) and CRS Report RL31694, *Smallpox Vaccine Stockpile and Vaccination Policy* by (name redacted).

Tularemia (*Francisella tularensis*)

Tularemia is a disease caused by the bacterium *Francisella tularensis*. Tularemia bacteria are fairly hardy, surviving for weeks in the environment, and naturally reside in host creatures, such as rodents. Tularemia bacteria are found in many parts of the world, including the United States. Tularemia, like plague, can be transferred between animals via biting insects.

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[15] Mary Beth Nierengarten and Larry I. Lutwick, "Vaccine Development for Plague," *Medscape Infectious Diseases*, Vol. 4, 2002.

[16] The United States maintains its store of smallpox virus at the Centers for Disease Control and Prevention in Atlanta. Russia maintains its store of smallpox virus at Vector in Koltsovo, Novosibirsk.

[17] Another variola strain, variola minor, causes smallpox symptoms. Smallpox from variola minor tends to be much less lethal than that caused by variola major.

Naturally occurring cases of tularemia arise from the bite of an infected insect, eating contaminated food or water, or breathing aerosols of bacteria.[18] Tularemia bacteria are very infectious, requiring very few bacteria to cause disease. The different forms of exposure to tularemia bacteria lead to different symptoms. Those who ingest contaminated food or are bitten by infected insects may develop swollen and painful lymph glands and eyes, sore throat, or skin lesions. Victims exposed to aerosolized tularemia bacteria develop symptoms similar to pneumonia: weakness, fever, aches, cough, and chest pain. Tularemia has an incubation period of 3 to 5 days after exposure.

The recovery rate for tularemia depends on access to proper treatment. Untreated tularemia has a fatality rate of 60%, but with proper treatment the fatality rate can be reduced to 2%.

Tularemia can be treated using antibiotic therapy, but reportedly strains of *F. tularensis* have been successfully engineered to be antibiotic resistant.[19] Several antibiotics are approved by the FDA to treat tularemia, and other antibiotics have been shown to be successful against the disease.

Tularemia lacks an approved vaccine, though several IND vaccines are undergoing testing. One IND vaccine has successfully been used to protect laboratory personnel against inadvertent aerosol exposures.[20]

Viral Hemorrhagic Fevers

Viral hemorrhagic fevers are caused by viruses of the filovirus and arenavirus family. These fevers include Ebola and Marburg.[21] These viruses are rarely encountered and are believed to be found in natural animal reservoirs, though the exact nature of some of the reservoirs is unknown. Viral hemorrhagic fever viruses are not especially hardy, and are generally transmitted through contaminated body fluids, such as blood.[22]

Viral hemorrhagic fever symptoms depend on the exact disease, but most include fever, muscle aches, and exhaustion. Severe cases of viral hemorrhagic fever

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[18] The United States reportedly averaged 124 cases of naturally occurring tularemia in 1999 and 2000. "Rare Rabbit Fever Reported in 3 Men," *The Associated Press*, June 25, 2003.

[19] Ken Alibek, *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World — Told from Inside by the Man Who Ran It*, (New York, NY: Random House) 1999.

[20] Mary Beth Nierengarten and Larry I. Lutwick, "Developing New Tularemia Vaccines," *Medscape Infectious Diseases*, Vol. 4, 2002.

[21] CDC Category A viral hemorrhagic fevers include the viruses which cause: Junin, Machupo, Guanarito, Lassa Fever, Rift Valley Fever, Dengue fever, Ebola, Marburg, and Hantaviruses . Not all diseases exist solely in the hemorrhagic form. For example, 80% of Lassa fever cases are not hemorrhagic in nature.

[22] Cases are known of viral hemorrhagic fever infection following the eating of infected animals.

also involve internal bleeding, or hemorrhage from the mouth, eyes, or ears. Blood loss is not the common cause of death, but rather failure of internal organs.

The recovery rate for viral hemorrhagic fevers varies from 30% to 90%, depending on the exact disease. Since many fevers occur in developing countries, these recovery rates may not be representative of aggressive medical treatment. Viral hemorrhagic fevers encountered in the United States may have a higher recovery rate due to more advanced supportive treatment.

Viral hemorrhagic fevers have no established treatments besides supportive care, though some medications are recommended against specific diseases. For example, animal and clinical studies have shown that ribavirin, an anti-viral drug, has some efficacy against Lassa fever and Crimean-Congo hemorrhagic fever, and could be used under IND status.

Investigation into vaccines for viral hemorrhagic fevers is ongoing.[23] Vaccines have been developed that provide protection against some. With the exception of one for yellow fever, these vaccines are not commercially available in the U.S. Access to these vaccines is limited, and provided under IND protocols.

Protection Against Biological Agents

Protection against biological agents may be achieved through either physical or medical means. Personal physical measures limit exposure by protecting the eyes, lungs, and/or skin from biological contact and preventing contact with insect vectors. Medical protection may be effective when the biological agent responds to drug treatment or when an available, effective vaccine exists.

Physical

Personal physical protection against biological agents includes masks and protective clothing. Protective masks filter the air inhaled by the wearer, removing particles from the air. The most effective filters can remove almost 100% of aerosol particles greater than one micron in size. By blocking inhalation of pathogens, disease is avoided.

Protective garments, in the context of biological agents, are generally designed to minimize inadvertent self-contamination with pathogen. Protective gloves, disposable overgarments, and, in some cases, face shields provide requisite protection from victims of contagious pathogens.

Such personal physical protections are used by medical professionals in the treatment of victims of viral hemorrhagic fevers. Isolation and barrier methods

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[23] See, for example Philip Cohen, "Fast-acting Ebola Vaccine Offers Hope," *NewScientist.com,* August 6, 2003 and Nancy J. Sullivan *et al.*, "Accelerated Vaccination for Ebola Virus Haemorrhagic Fever in Non-human Primates," *Nature*, Vol. 424 (2003) p. 681.

provide medical professionals with protection from infection. In extreme cases, additional precautions to avoid aerosol inhalation may be required.[24]

Medical

Medical protection against pathogens takes two tacks. One is the pre-exposure vaccination of populations potentially at risk. For example, troops in the Middle East have been vaccinated against smallpox and anthrax as protection against potential military use. The other is the prophylactic use of antibiotics following known exposure to a pathogen. This method was used after the anthrax mailings of 2001.

The availability of an effective, licensed vaccine is a requirement for protective pre-exposure vaccination. For the high-threat biological agents found on the CDC Category A listing, few vaccines are available. Licensed vaccines exist for both anthrax and smallpox, but these vaccines are not in public distribution. Due to national security needs, anthrax vaccine is being used to innoculate military personnel, and a sufficient supply of vaccine has not become available to offer vaccination to the general public. Recently, the supply of the smallpox vaccine has become such that, in extremis, the entire population of the United States could be vaccinated. Not all high-threat biological agents have a licensed vaccine, but some have IND-stage vaccines which might be used in emergency situations. Use of IND vaccines might be complicated by supply concerns, as only small amounts of these vaccines exist.

Prophylactic use of antibiotics is only successful against bacteria. Viruses are not sensitive to antibiotics, and so antibiotic use will not provide protection. Because the treatment of many bacteria is most effective when treatment is begun at an early stage, prophylactic use of antibiotics is usually recommended for those potentially exposed.

Detection of Biological Agents

The detection of pathogens, especially in the case of a covert release, is a complicated process. When victims of a release are hospitalized, identification of the causal pathogen may quickly occur, as the combination of symptomatic patients and ready access to large amounts of the pathogen provide much information towards its identification.[25] But, in the instance of suspected, small-scale releases, identification,

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[24] See "Notice to Readers Update: Management of Patients with Suspected Viral Hemorrhagic Fever — United States," *Morbidity and Mortality Weekly*, Vol. 44, June 30, 1995, pp. 475-479, and "Management of Patients with Suspected Viral Hemorrhagic Fever," *Morbidity and Mortality Weekly Report*, Vol. 37, 1988, pp.1-15.

[25] This would only be the case with a known pathogen. As shown by the Sudden Acute Respiratory Syndrome (SARS) outbreak, the cause of an emerging disease may be very difficult to determine. For more information on SARS, see CRS Report RL31937 *Severe Acute Respiratory Syndrome (SARS): Public Health Situation and U.S. Response* by (name redacted) and CRS Report RL32072 *Severe Acute Respiratory Syndrome (SARS): The* (continued...)

and even detection, of a pathogen release may be difficult. Biological agents are difficult to quickly detect, generally requiring laboratory work-up to detect and identify pathogens. It may require several hours, at the minimum, to detect and definitively identify specific pathogens. On the other hand, these laboratory-based, molecular biology techniques are extremely sensitive and can detect very small amounts of pathogen. The methods used to detect pathogens involve analysis of the pathogen's genetic sequence or enzymatic reaction. Scientists are working to develop faster techniques for both detection and analysis.

Atmospheric Monitoring

President Bush, during remarks to new employees of the Department of Homeland Security, announced the establishment of the BioWatch initiative.[26] This initiative consists of deploying early warning sensors in locations across the nation to help detect biological attacks. This prototype atmospheric monitoring system is being put in place using EPA air quality monitors.[27] The monitoring system consists of sampling equipment which collects particles present in the atmosphere. The material collected is brought to a laboratory setting, analyzed, and tested for specific pathogens. In theory, the laboratory results from this process could be available in as little as 12 hours.[28] It is reported that the laboratories which take part in the Laboratory Response Network would be involved in performing detection and analysis of these pathogens.[29] Research and development of further refinements of such monitoring technology is underway.[30]

Other commercial systems have been purchased and installed to detect airborne pathogens and toxins. For example, the city of Honolulu has purchased and deployed six stationary air monitors within the island of Oahu.[31] The U.S. Postal Service is

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[25] (...continued)
International Response by (name redacted) and Tiaji Salaam.

[26] Office of the Press Secretary, "Remarks by the President to the New Employees of the U.S. Department of Homeland Security," The White House, February 28, 2003.

[27] Reportedly, 20 metropolitan areas have been selected for these systems. See Michael Lasalandra, "Boston Joins National Bio-warfare Alert Network," *The Boston Herald*, March 14, 2003, and "BioWatch Program Aims for Nationwide Detection of Airborne Pathogens," *CIDRAP News*, Feb 26, 2003 (revised March 10, 2003), found online at [http://www.cidrap.umn.edu/cidrap/content/bt/bioprep/news/biowatch.html].

[28] Marcus Warren, "Germ Attack Detectors for New York," *The Daily Telegraph (London)*, January 23, 2003.

[29] "Nationwide Monitoring System Planned for Detecting Bioterror Attack," *Associated Press*, January 22, 2003.

[30] For example, Lawrence Livermore National Laboratory is attempting to partner with industry to develop automated pathogen detection systems. See Jim McGee, "Nuclear Lab Wants Partners for Progress in Chem-Bio Detectors," *CQ Homeland Security*, October 20, 2003.

[31] Treena Shapiro, "City To Monitor Events For Dangerous Toxins," *The Honolulu Advertiser*, March 24, 2003.

reportedly testing an indoor system to detect airborne biological agents.[32] If effective, it eventually will be installed in all 282 mail-processing plants nationwide to protect postal workers.

Biological Agent Detectors

The field detection of biological agents is usually performed with screening devices which detect specific pathogens. Typical screening devices use antibody tests or fast, genetic tests using polymerase chain reaction (PCR) to provide a rapid diagnostic for the presence of a given biological agent. Antibody tests are agent specific, so different biological agents require the use of different antibody tests. PCR screens determine if genetic markers are present, linking the test sample to a known pathogen. Screening tests have varying sensitivity. For some highly infectious pathogens, the detectable concentration of pathogen may be significantly greater than the infectious dose.[33] Consequently, such field devices are not generally considered definitive tests for the absence of an agent, but rather are used to confirm the presence of significant quantities of agent. Further development of field devices is ongoing.[34]

Subsequent to an initial screening test, samples are sent to laboratories, where more sensitive laboratory tests are used to ascertain the identity of any pathogen present. In general, samples, even those that test negative through screening tests, require laboratory-based confirmatory analysis. The burden of this process on the public health laboratory system has been heavy.[35]

Public Health Monitoring

Monitoring the public health has emerged as a potentially important method in detecting the covert release of pathogens. The Centers for Disease Control and Prevention, in conjunction with the Department of Defense, the Association of Public Health Laboratories, and others, have upgraded the Laboratory Response Network, which connects hospitals, public health laboratories, and other resources to monitor

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[32] Don Oldenburg, "Detection Devices May Offer An Early Read on the Danger," *The Washington Post*, March 16, 2003, and CRS Report RL31280, *The U.S. Postal Service Response to the Threat of Bioterrorism Through the Mail* by (name redacted).

[33] For example, the public was cautioned during the time of the anthrax mailings that hand-held assays for *Bacillus anthracis* spores were not guaranteed to detect spores at the infectious dose lower limit. Centers for Disease Control and Prevention,"CDC Health Advisory Hand-held Immunoassays for Detection of *Bacillus anthracis* Spores," distributed via Health Alert Network, October 18, 2001.

[34] Tim Starks, "Lab-in-a-Box Detects Chemical, Biological Agents," *CQ Homeland Security*, October 10, 2003.

[35] A poll conducted by the Association of Public Health Laboratories showed that during the anthrax mailings, 98% of the respondents stated they required staff overtime to handle bioterrorism samples and 85% of the respondents stated bioterrorism testing negatively impacted testing of other routine samples. *Public Health Laboratory Issues in Brief: Bioterrorism Capacity*, Association of Public Health Laboratories, October, 2002.

and track disease outbreaks.[36] It has been suggested that the first sign of a covert pathogen release by terrorist groups may be a sudden increase in the number of hospital patients exhibiting symptoms. By analyzing information from such patients, a likely time and location of pathogen release might be discovered and consequence management plans invoked.

Some cities have further expanded these programs by monitoring purchases related to the public health. For example, some cities track pharmaceutical and other medicinal sales, operating on the theory that this will provide even earlier detection than hospital arrivals.[37] It is expected that the early identification of a disease outbreak will increase the treatment success and consequently lower the fatality rate.

Biological Agents as Weapons of Mass Destruction Versus as Weapons of Terror

The likelihood of terrorist use of biological agents as a weapon of mass destruction is an area of great debate. Biological agents have not been used to cause mass casualties in modern times, and are incapable of destroying physical infrastructure. This raises questions about the claim that they would be effective weapons of mass destruction. The technical feasability of terrorist groups disseminating biological agents is also open to question. Some believe that the techniques and technologies required for processing and disseminating biological agents are beyond the capabilities of a terrorist group, while others believe that terrorist groups wishing to use biological weapons could easily do so. In contrast to chemical agents, few biological agents are commercially available in large quantity, and so are not readily available for purchase or theft. On the other hand, biological agents are naturally occurring and self-replicating, which may ease the difficulties of acquiring and manufacturing sizeable quantities.

Because pathogens are self-replicating, very small amounts can cause infection. Large quantities are not required to cause mass casualties. It has been estimated that approximately 100 lbs. of anthrax spores efficiently and uniformly disseminated by airplane under ideal conditions in a metropolitan area could cause 150,000 casualties.[38]

Terrorist groups have shown interest in biological weapons, but few examples of their successful use, and none as a weapon of mass destruction, exist. One well-known example of biological-weapon use within the United States was by the Rajneeshee cult in 1984. There, salmonella bacteria was disseminated through

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[36] *Executive Summary on the Laboratory Response Network,* Centers for Disease Control and Prevention, April 17, 2002.

[37] For example, it has been reported that New York City and Baltimore collect sales data from drugstores to use as a factor in its public health monitoring. See Matt Crenson, "Sneeze May Signal Attack," *Associated Press,* November 4, 2002.

[38] *Health Aspects of Biological and Chemical Weapons*, 1st Edition, World Health Organization, 1970.

intentional contamination of salad bars. Several hundred people were made ill over a number of weeks.[39] The Aum Shinrikyo cult also attempted to develop biological weapons. While more well-known for their chemical weapon attack in the Tokyo subway system in 1995, they cultured and attempted to disseminate *Bacillus anthracis* by aerosolizing a liquid slurry of anthrax culture. The anthrax disseminated was an avirulent strain and consequently no casualties occurred.[40]

Whether terrorist groups would choose biological weapons is unclear. Some have asserted that such use would be incompatible with political goals that terrorist groups have, e.g. formation of a nation-state. Others claim that a new stage of superterrorism has begun, with the attacks of September 11th being indicative of a greater willingness of terrorist groups to intentionally cause mass casualties. For more information on the motivation of terrorist groups with respect to biological and chemical weapons, see CRS Report RL31831, *Terrorist Motivations for Chemical and Biological Weapons Use: Placing the Threat in Context* by (name redact ed).

Weapons of terror, in contrast to weapons of mass destruction, may cause few casualties but rather instill panic because of frightening aspects of their use. Some argue that the use of biological agents as weapons of terror would require little infrastructure and be an effective use of even limited supplies of pathogen. They claim that release of small amounts of biological agent might cause a level of panic disproportionate to the actual amount released, and point to the anxieties raised after the mailings of the anthrax letters of 2001 as emblematic of the type of response that can be generated by small-scale use of biological weapons. Others assert that the significant investment of time, money, and trained personnel which would be required to develop even small amounts of pathogen provides a serious disincentive to terrorist groups. They state that terrorist groups are much more likely to use conventional weapons than any weapon of mass destruction.

The anthrax mailings of 2001 highlighted the vulnerability of the United States to biological attack, and reignited public interest in bioterrorism and domestic preparedness. A series of letters containing freeze-dried anthrax of varying coarseness were sent through the U.S. Postal Service to two U.S. Senators and two news outlets. The anthrax spores contaminated postal equipment during mail processing and subsequently infected postal workers with inhalation anthrax. Questions regarding the identity of the mailer, the motivations of the mailer, and the origin of the anthrax spores remain unanswered. For more information on the anthrax mailings and the US Postal Services response, see CRS Report RL31280, *The U.S. Postal Service Response to the Threat of Bioterrorism Through the Mail* by (name redacted).

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[39] For an overview of the Rajneeshees' use of *Salmonella typhimurium* in Oregon in 1984, see W. Seth Carus, "The Rajneeshees (1984)" in *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons*, Jonathan B. Tucker Ed., (Cambridge MA: MIT Press) 2000.

[40] Kyle B. Olson, "Aum Shinrikyo: Once and Future Threat?," *Emerging Infectious Diseases*, Vol. 5, No. 4, July — August 1999.

Current Policy

Current federal policy regarding biological weapons is a combination of nation-state level controls, increased domestic regulation, and accelerated research and development of medicines, vaccines, and detectors. Additionally, professional societies have increased self-monitoring actions.

Export Control

The United States maintains export policies with respect to selected pathogens and biological dual-use equipment, primarily through the multilateral Australia Group and the Wassenaar Arrangement. U.S. export controls aimed at creating proliferation barriers include Export Administration Regulations and International Traffic in Arms Regulations.[41] These export controls are designed to inhibit nation-state level acquisition and proliferation of biological weapons. Because of the commercial ubiquity of equipment potentially capable of producing biological weapons, experts consider it difficult to block terrorist groups from developing small-scale production capability solely through export controls.[42]

Increased Domestic Regulation

Use, possession, and transfer of high-threat biological agents is now increasingly regulated due to the USA PATRIOT Act (P.L. 107-56) and the Bioterrorism Preparedness and Response Act (P.L. 107-188).[43] Only persons with a bona fide need for them are allowed to possess or use biological agents on the Select Agent list.[44] Additionally, university researchers experimenting on Select Agent pathogens are required to pass a background check by the FBI.[45] Individuals who are citizens of the countries formally declared as sponsors of terrorism are not allowed access to these pathogens.

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[41] Export Administration Regulations can be found at 15 CFR Parts 730-774. International Traffic in Arms Regulations can be found at 22 CFR Parts 120-130. For more information on the export control debate, see CRS Report RL30169, *Export Administration Act of 1979 Reauthorization*, coordinated by (name redacted).

[42] For example, it has been reported that the Defense Threat Reduction Agency was able to successfully build a small-scale facility capable of generating biological agents within the United States. Part of the assembly of this facility included importation of a fermenter from Germany. Judith Miller, Stephan Engelberg, and William Broad, *Germs: Biological Weapons and America's Secret War*, (New York, NY: Simon and Schuster) 2001.

[43] For more information on these laws, see CRS Report RL31377, *The USA PATRIOT Act: A Legal Analysis* by (name redacted) and CRS Report RL31263, *Public Health Security and Bioterrorism Preparedness and Response Act (P.L. 107-188): Provisions and Changes to Preexisting Law* by (name redacted), (name redacted), and Mary E. Tiemann.

[44] The Select Agent list can be found at 42 CFR 72, Appendix A.

[45] "FBI Releases Application Forms for Researchers Working with CDC Select Agents," *Washington Fax*, March 14, 2003.

Faster Drug Authorization

The Food and Drug Administration has altered selected rules governing the degree of testing necessary before approving human-use of drugs.[46] In cases where testing effectiveness on humans would be unethical, drug approval could be made based on the efficacy results from animal testing. Generally, vaccines and medicines used by humans require full human testing. Some have advocated that foregoing human clinical trials would speed development of new treatments against bioterror agents, and potentially increase the amount of private sector research money invested in bioterror defense.[47]

Research and Development

Defense against bioterrorism has spurred research and development activities. The Department of Homeland Security has an active role in biological countermeasure development, while the Department of Health and Human Services continues to be at the forefront of bioterrorism research and development. Research into new treatments and vaccines, detector sensitivity and miniaturization, decontamination, and pathogen properties are being performed.

Biomedical Research. The federal government performs and funds research and development of biodefensive measures. Such research includes discovery of new vaccines and treatments, research into countermeasures against biological weapons, as well as research into more fundamental, basic science, such as pathogen genetics and the origins of virulence. The National Institutes of Health administers the bulk of the Department of Health and Human Services biomedical research funding, while the DARPA Biological Warfare Defense program and the Joint Service Chemical and Biological Defense Program is funded by the Department of Defense. Development of biological countermeasures and efforts to reduce the impact of a biological terror attack is performed through the Department of Homeland Security's Directorate of Science and Technology as well. Federal research on high-threat pathogens is performed at the U.S. Army Medical Research Institute of Infectious Diseases laboratory at Fort Detrick, Maryland, and the Centers for Disease Control and Prevention laboratory in Atlanta, Georgia.

Increasing Detector Accuracy and Sensitivity. Detecting and identifying pathogens is an area of continued research. The ability of first responders to identify biological agents when first encountering them is key to identifying appropriate treatment for victims. Sensitive, rapid detection systems are under development in the private sector as well as the Department of Energy's National Laboratories. New detectors based on different detection methods are being investigated to ascertain their capabilities. The military, while already possessing large, platform-based detection capabilities, is developing a new detection system,

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[46] For the announcement of this rule, see *Federal Register*, Vol. 67, No. 105, May 31, 2002, pp. 37,988-37,998.

[47] Marc Kaufman, "FDA Acts To Speed Bioterror Medicines," *The Washington Post*, May 31, 2002.

the Joint Biological Agent Identification and Diagnostic System (JBAIDS), which will allow for fast, portable detection of biological agents.

Miniaturization. In concert with the need for more sensitive, accurate detectors, reducing the size of such detectors is also an area of current research. Technologies currently employed for analyzing the atmosphere for pathogens tend to be large and complex. The goal of a compact, ideally easily portable, detector system drives research efforts in detector miniaturization. The National Science Foundation, the Department of Energy, and the Department of Defense have all funded programs to develop smaller, handheld instruments to detect biological pathogens in the environment.

Better Understanding of Diffusion of Biological Releases. Understanding how an aerosol release might travel is another area where research occurs. Computer modeling of aerosol properties, wind flow in urban settings and within buildings, and the effects of initial conditions on final particle distribution all may lead to more effective incident response and consequence management. The Department of Health and Human Services uses such modeling in its emergency response command center to help develop and prioritize response to a chemical or biological release.[48] Research in this area is conducted at the National Laboratories, among other places.

Decontamination. After the anthrax mailings, the Hart Senate Office Building required extensive decontamination to remove the residual anthrax spores. Methods for decontaminating office buildings have not been widely tested, and decontamination of the Hart Building using chlorine dioxide cost an estimated $42 million. The cleanup of the contaminated Brentwood facility, in Washington, DC, and the Hamilton Township, New Jersey, facility is reportedly expected to cost over $150 million.[49] Research is underway to develop less costly methods of decontaminating areas from biological agents and to assess the effectiveness of current decontamination methods.

Scientific Publication

The federal government has historically supported the open publication of federally funded research results, but a series of research publications in molecular biology have increased concerns over whether publication of certain federally funded extramural research results could threaten national security because of their possible usefulness to terrorist groups. Some have suggested that federally funded extramural research results should be reviewed for their security implications prior to their publication in the open literature, while others have asserted that such review would be damaging to scientific progress and productivity. If such review is deemed necessary, an open question remains as to who would review these research results and at what point in the research process they would be reviewed. Some publishers

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[48] Tamara Lytle, "Health Official Debuts High-Tech Center," *Orlando Sentinel*, March 12, 2003.

[49] Stephen Losey, "USPS: Mail Center Safe to Reopen After Anthrax Cleanup," *Federal Times*, March 10, 2003.

have begun to implement self-regulatory measures regarding publication of potentially sensitive manuscripts, but such steps have not been applied industry-wide. Others claim that such a review process might be most effective if performed by a federal agency. For more information, see CRS Report RL31695, *Balancing Scientific Publication and National Security Concerns: Issues for Congress* by (name redacted) and CRS Report RL31845, *"Sensitive But Unclassified" and Other Federal Security Controls on Scientific and Technical Information: History and Current Controversy* by (name redacted).

Increases in Public Health

Significant investment in the public health system has been made to prepare the medical community to respond to a bioterror event. This has included additional funding from the CDC for the development of bioterror response plans and increasing the preparedness of hospitals and other facilities for bioterror casualties. Additionally, the National Strategic Stockpile, formerly called the National Pharmaceutical Stockpile, has been expanded to contain antibiotics, medical treatments, and antidotes.[50] While there are still critics of the current state of preparedness for a biological attack,[51] Secretary of Health and Human Services Thompson has stated that the country is well prepared to respond to possible bioterrorism attacks.[52] For a comprehensive overview, see CRS Report RL31719, *An Overview of the U.S. Public Health System in the Context of Bioterrorism* by (name redacted).

Federal Response Teams

Numerous federal response teams could be deployed in the event of biological terrorism. In general, these teams would support local responders in detection, decontamination, or treatment roles.[53] A selection of these federal teams is described below.

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[50] Reportedly, the National Strategic Stockpile now contains enough medicine for 12 million people exposed to anthrax, 100 million people exposed to plague, and 50 million people exposed to tularemia. Denise Grady and Lawrence K. Altman, "Experts See Gains and Gaps in Planning for Terror Attack," *The New York Times*, March 25, 2003.

[51] For example the General Accounting Office has highlighted areas of deficiency in some hospital bioterrorism preparedness and response. See General Accounting Office, *Most Urban Hospitals Have Emergency Plans But Lack Certain Capacities for Bioterrorism Response*, GAO-03-924, August 6, 2003.

[52] Craig Gilbert, "Thompson Says U.S. Ready for Bioterror: Bush Tells Cabinet He Hopes He Won't Have to Use Full Capacity of Military," *Milwaukee Journal Sentinel*, March 20, 2003.

[53] Martin Edwin Andersen, "Urban Teams Readied for Mass Destruction Missions," *CQ Homeland Security*, August 12, 2003.

One response team is the DOD's Chemical/Biological Incident Response Force (CBIRF).[54] CBIRF can be deployed to aid in consequence management after a chemical or biological terror attack. It possesses both decontamination and treatment facilities and can be deployed domestically or internationally at short notice. This rapid response force was on hand for the Atlanta Olympics in 1996 and is equipped with state of the art equipment for dealing with chemical and biological threats. It is located at Indian Head, Maryland, and could be deployed in the case of biological or chemical terrorism.[55]

The FBI maintains a Hazardous Materials Response Unit which, in response to crimes involving biological weapons, would be available to analyze and identify pathogens and other threats present. This unit provided protocols for handling evidence during the anthrax mailings of 2001.[56]

The U.S. Army Technical Escort Unit conducts biological detection, decontamination, and removal of biological devices or hazards woldwide. While commonly deployed to handle and secure discovered biological munitions, they also have been used to provide support to other large national events.[57]

As part of the National Disaster Medical System, Disaster Mortuary Operational Response Teams, Disaster Medical Assistance Teams, and four National Medical Response Teams are available to be deployed to the scene of a national emergency. This program was transferred to the Department of Homeland Security on March 1, 2003.[58]

The National Guard supports several Weapons of Mass Destruction Civil Support Teams. They were established to support local resources in determining the nature and extent of an attack or incident. These teams are able to deploy within four hours of a given alert.

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[54] More information on the Chemical/Biological Incident Response Force can be found online at [http://www.lejeune.usmc.mil/4thmeb/cbirf.htm].

[55] Steve Vogel, "Specialized Marine Unit Readies To Respond to the Unthinkable: Force Trains for Chemical, Biological or Radiological Attacks," *The Washington Post*, February 17, 2003.

[56] *FBI Laboratory 2001 Report*, Federal Bureau of Investigation, 2001.

[57] More information can be found online at [http://teu.sbccom.army.mil/].

[58] For more information see CRS Report RL31791, *Emergency Management Funding for the Department of Homeland Security: Information and Issues for FY2004* by (name redacted), Coordinator, Rob Buschmann, Ben Canada, Wayne Morrissey, (name redacted), and (name redacted).

Policy Implications

Countermeasure Development

A topic of potential interest to policymakers is oversight of the federal government's development of biological countermeasures. Such countermeasures include, but are not limited to, new detectors, treatments, medical prophylaxis, and physical protection from biological agents. While the Department of Health and Human Services has been designated the lead agency in providing bioterrorism research and development, the Department of Homeland Security has been given a role in setting priorities. In FY2004 budget, $266 million has been appropriated for DHS' Science and Technology Directorate's biological countermeasures programs. How the Department of Homeland Security will assist in setting priorities for HHS research, and how the new Homeland Security Advanced Research Projects Agency (HSARPA) will prioritize research it funds, are not currently well understood.

Because high-threat biological agents include both viral and bacterial agents, a single treatment will not be successful against all illnesses. Some have suggested that research into new antiviral and antibiotic compounds for use against biological agents might provide additional health benefits, as these compounds may prove to be effective medications for other, more common illnesses. Because of the shortage of licensed vaccines for many high-threat pathogens, development of new vaccines has been an area of congressional interest. The lack of a civilian market for biological weapon vaccines has inhibited private sector investment and production of these products. Since the natural incidence of disease from biological-weapon pathogens is rare, and disease form is often different than that expected to result from a bioterror attack, there has been little impetus to develop and market these vaccines. Some have suggested that the federal government should take a role in providing research incentives and a guaranteed market for any vaccines against biological weapons. A variety of mechanisms have been suggested, including expedited drug approval processes, tax incentives, liability protections, and expanded procurement practices. A form of expedited drug approval has already been implemented by the FDA for drugs involved in biodefense; it requires fewer animal studies before approval is given for human use.[59] For more information on federal vaccine policies, see CRS Report RL31793, *Vaccine Policy Issues for the 108th Congress* by (name redacted) and CRS Report RS21414, *Mandatory Vaccinations: Precedent and Current Laws* by Angie A. Welborn.

President George W. Bush, in the 2003 State of the Union address, announced a new proposal called Project BioShield. This proposal provides for expedited acquisition authority, non-competitive procurement, and purchase of potential biological countermeasures up to 5 years prior to their licensing. For more

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[59] See CRS Report RL31263, *Public Health Security and Bioterrorism Preparedness and Response Act (P.L. 107-188): Provisions and Changes to Preexisting Law* by (name reda cted), (name redacted), and Mary E. Tiemann and "HHS Accelerates Bioterrorism Research: New Programs Expedite Ideas from Concerned Scientists," U.S. Department of Health and Human Services Press Release, Dec. 6, 2001.

information on Project BioShield, see CRS Report RS21507 *Project BioShield* by (name redacted).

Detection of Biological Release

The deployment of the BioWatch prototype biological agent detector has raised questions about how this system will be used. Such a monitoring system for covert releases of biological agents may provide important early notification of potential danger. Since many pathogens have an incubation period of several days, it is often difficult to begin treatment at an early stage. Early treatment of the inhalation form of these diseases is essential to recovery, and a system that signaled pathogen release before the appearance of symptoms in victims would be likely to increase the ability of victims to receive medication and survive. By employing an array of such sampling devices, a city-wide network might detect pathogen releases in smaller amount and also aid in determining the epicenter of a release. Such information may be important to identify the perpetrators of such an attack.

Since the BioWatch detectors are coupled to EPA air quality monitors, the locations are determined by air quality considerations, and it is not readily apparent that these locations will provide adequate sampling of populated areas. If the air quality monitor is located well above street level, it may not detect the release of biological agents at street level. Additionally, the effectiveness of these detectors in identifying small releases or indoor release of biological agents is not established, and so placement of these detectors may provide a false sense of security. Such a detection system may also detect naturally occurring biological agents which are not virulent. For example, anthrax spores naturally occur in some areas of the United States, and may provide false indications of small-scale covert release. The continued cost of these detectors, reported at $1 million per detector per year, is also of concern.

An unknown aspect of the BioWatch program is the range of detector coverage. It has been reported that each metropolitan area chosen will have 10 to 12 distinct detectors built into different air quality monitors. Also, a reported goal of this program is to provide detection for "80% of the American population by geographic distribution."[60] Since the EPA air quality monitors are not evenly spread throughout the various geographic areas of the country, it is not apparent whether the BioWatch program will be expanded to other sorts of monitoring stations.

Biological Detectors

Development and production of easily portable or handheld biological detection apparatus is another area where a pressing need has been identified. Antibody tests and methods using recognition of pathogen genetic sequences only detect specific pathogens. Unexpected pathogens, either rare or genetically modified, may elude current detection equipment. Consequently, policymakers may decide to direct

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[60] "BioWatch Program Aims for Nationwide Detection of Airborne Pathogens," *CIDRAP News*, Feb. 26, 2003 (revised March 10, 2003), found online at [http://www.cidrap.umn.edu/cidrap/content/bt/bioprep/news/biowatch.html].

funding towards development of either a broad assortment of inexpensive testing equipment or expanding the range of pathogens a given device can detect. As more pathogen-specific detectors become available, the cost of testing per incident may increase, as more pathogens are potentially screened, but may decrease as more detectors are manufactured and distributed.

Monitoring Public Health

Policymakers may choose to address current methods of detecting bioterror events. Tracking potential bioterror releases through monitoring hospital admissions and physician reports may indeed detect a covert pathogen release, but such an approach requires that individuals first fall ill from the pathogen release. Critics claim that in the case of a contagious pathogen, such as pneumonic plague or smallpox, the spread of the disease will occur at a rate greater than the government response, as there will be a time delay due to the incubation period of the disease. Thus, there will be an expanding number of people being infected even as public health workers attempt to determine the epicenter of the release. Such an argument has been made especially in the case of smallpox, as treatment for smallpox, once symptoms have begun to appear, is unavailable. In the smallpox case, the debate over which vaccination method should be used, the ring vaccination model based on identifying the initial outbreak of the disease and then vaccinating contacts of the victims of the initial outbreak, or the mass vaccination model, where people in a geographic area are innoculated if smallpox is detected, has been very lively. Advocates of establishing sensors to detect pathogen releases, before victims begin to seek treatment, claim that the earlier the detection of an outbreak, the more effective treatment will be.

Others have asserted that the current model will be effective in limiting casualties from a pathogen release. They claim that increases in the public health infrastructure have reduced the likelihood that hospitals and care-providers would be overwhelmed by a bioterror event. While not rejecting the utility of developing other detection devices to warn of a covert pathogen release, some scientists modeling pathogen releases have stated that even reducing detection times from 48 to 6 hours after release would not reduce overall casualties as much as an effective, efficient public health response and treatment.[61]

First Responder Equipment

The amount of funds the federal government should provide to first responders and whether all first responders should have standardized equipment is a topic of congressional interest.[62] First responder equipment is currently not nationally standardized, with each jurisdiction purchasing its own equipment. Some first

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[61] Amanda Onion, "Calculating the Unthinkable: New Model Suggests Faster Methods Needed to Deliver Anti-Anthrax Meds," *ABC News.com*, March 18, 2003, and Lawrence M. Wein, David L. Craft, and Edward H. Kaplan, "Emergency Response to an Anthrax Attack," *Proceedings of the National Academy of Sciences*, Vol. 100, 4346-4351 (2003).

[62] Greg Seigle, "'First Responders' to Terrorism Seek Federal Strategy, Equipment," *Global Security Newswire*, March 6, 2002.

responder teams feel well-equipped and prepared for a potential biological attack, while others do not yet have necessary equipment.[63] While the National Institute of Justice has provided a manual outlining the criteria by which biological equipment might be assessed,[64] some first responders have claimed that the federal government has not provided enough oversight and direction regarding such esoteric purchases.[65] Advocates of allowing each community to choose what equipment to provide to first responders point out that the needs of one community may not be the same as the next, and, because of location, population, or previous expenditures, mandating specific equipment purchases may not meet specific locality needs.[66] The Department of Homeland Security is slated to develop a Standards Program to develop test and evaluation criteria and conduct analyses for first responder detection equipment to help provide more guidance for first responder purchases. Policymakers may ultimately determine the adequacy of current first responder equipment and its availability, the amount of funds that first responders should receive to purchase protective equipment, whether proper guidance has been given by the federal government to state and local authorities regarding this equipment, and what steps may be required, through oversight or legislation, to properly equip first responders.

Federal Emergency Response Teams

The use of federal response teams to augment local first responder capabilities has been questioned. While an investigation by the General Accounting Office in 2000 found that "Federal response teams do not duplicate one another,"[67] there have been concerns that the varied teams established by these agencies may be redundant.[68] Also, the general structure of establishing regional teams has been questioned, since there would be a delay in response due to required travel time for a team.[69] On the other hand, others have advocated that parallel civilian and military response teams may be necessary, since military teams might not be available to civilians during wartime.

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[63] Kevin Flynn, "New York City Officials Defend Counterterror Training," *The New York Times*, February 14, 2003.

[64] *An Introduction to Biological Agent Detection Equipment for Emergency First Responders*, NIJ Guide 101-00, National Institute of Justice, December 2001.

[65] Greg Seigle, "'First Responders' to Terrorism Seek Federal Strategy, Equipment," *Global Security Newswire*, March 6, 2002.

[66] For more information on this topic, see CRS Report RL31475, *First Responder Initiative: Policy Issues and Options*, by Ben Canada and CRS Report RL31680, *Homeland Security: Standards for State and Local Preparedness*, by Ben Canada

[67] General Accounting Office, *Combating Terrorism: Federal Response Teams Provide Varied Capabilities; Opportunities Remain to Improve Coordination*, GAO-01-14, November 2000.

[68] Jonathan B. Tucker, "Chemical Terrorism: Assessing Threats and Responses," in *High-Impact Terrorism: Proceedings of a Russian American Workshop*, (Washington, DC: National Academy Press) 2002.

[69] Joshua Green, "Weapons of Mass Confusion," *The Washington Monthly*, May 2001.

Related CRS Products

CRS Report RL31059, *Biological Weapons: A Primer*, by (name redacted).

CRS Report RS21288, *Smallpox: Technical Background on the Disease and Its Potential Role in Terrorism*, by (name redacted).

CRS Report RL31694, *Smallpox Vaccine Stockpile and Vaccination Policy*, by (name redacted).

CRS Report RL31793, *Vaccine Policy Issues for the 108th Congress*, by (name redacted).

CRS Report RL31475, *First Responder Initiative: Policy Issues and Options*, by Ben Canada.

CRS Report RL31791, *Emergency Management Funding for the Department of Homeland Security: Information and Issues for FY2004*, by (name redacted), Coordinator, Rob Buschmann, Ben Canada, Wayne Morrissey, (name reda cted), and (name redacted).

CRS Report RL31263, *Public Health Security and Bioterrorism Preparedness and Response Act (P.L. 107-188): Provisions and Changes to Preexisting Law*, by (name redacted), (name red acted), and Mary E. Tiemann.

CRS Report RL31719, *An Overview of the U.S. Public Health System in the Context of Bioterrorism*, by (name redacted).

CRS Report RL31853, *Food Safety Issues in the 108th Congress*, by (name redacted).

CRS Report RL31831, *Terrorist Motivations for Chemical and Biological Weapons Use: Placing the Threat in Context*, by (name redacted).

CRS Report RL30169, *Export Administration Act of 1979 Reauthorization*, coordinated by (name redacted).