

Bioterrorism: An Introduction

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ABSTRACT

Bioterrorism is a form of terrorism involving the intentional release of biological agents (bacteria, viruses, or germs) to harm people and spread fear. It is carried out by terrorists to create outbreaks of infectious diseases which will cause mass casualties, terror, societal disruption, or economic loss. Such outbreaks of infectious diseases pose a major threat to global health. Bioterrorism is regarded as a great threat to society as it involves the release of an organism without any warning. Bioterrorism and its potential for mass destruction have been subjects of increasing international concern. This paper provides an introduction to bioterrorism.

KEYWORDS: *Bioterrorism, biological warfare, chemical and biological weapons, weapons of mass destruction*

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INTRODUCTION

An act of terrorism refers to an incident involving deliberate or threatened dissemination of biological agents. If released under ideal environmental circumstances, these biological agents can infect thousands of persons and cause many deaths. The biological agents are found in nature and include bacteria, viruses, insects, fungi, or toxins. Terrorists are individuals who are motivated by revenge or monetary gain through extortion, rather than political, ideological, religious or other beliefs. They will use readily available weapons, but some also will adopt tactics that will inflict the most casualties. Terrorists used biological agents as weapons of terror because they are hard to detect and they can be spread through the air, water, or food. The possibility of a successful bioterrorist attack is not high due to the technical difficulties and constraints [1]. Bioterrorism (BT) has claimed few lives as compared with the more traditional forms of terrorism using guns and explosives. Urban or densely populated areas will be at greater risk of a bioterrorism attack. A bioterrorism attack in a public

place is a public health emergency. An example of the result of terrorist act is shown in Figure 1 [2].

Several factors contribute to the growing danger of bioterrorism (BT): Minute amounts of select biological agents can cause mass casualties; agents for biological weapons are easily acquired; technology for production and weaponization is readily available; only limited training are needed to establish a biological weapons program; biological weapons are relatively easy to deliver; and the motivations of terrorists have changed [3]. The threat of bioterrorism is increasing due to the rise of technical capabilities. There is information available on the Internet on how to make biological weapons. Thousands of people worked as bioweaponers, and tons of bioweapons were produced.

WHAT IS BIOTERRORISM?

Bioterrorism is the intentional use of viruses, bacteria, fungi, toxins, or other germs (or biological product that may be engineered as a result of biotechnology) to produce civil unrest, disruption, disease,

disabilities, and death to achieve political or social objectives. It has been regarded as a low-probability risk. Bioterrorism can cause mass casualties, epidemic illness, healthcare worker illness, environmental contamination, and legal issues. It can cause unease within the medical community and the society at large. It occurs in one of two scenarios: overt and covert. It is carried out by terrorists, also called non-state actors.

Scholars and security professionals have distinguished among different types of terrorism. These include international terrorism, domestic terrorism, National terrorism, political terrorism, state terrorism, bioterrorism, agroterrorism, cyber terrorism, eco terrorism, narcoterrorism, nuclear terrorism, religious terrorism, and suicide terrorism [2].

A human-made outbreak of disease is the distribution of pathogens with the intention of disrupting societies. Another term that is frequently associated with bioterrorism is weapons of mass destruction (WMDs). The fear of bioterrorism is strictly linked to the emergence of a perceived danger of WMDs (biological, chemical, radiological, and nuclear agents). The success of bioterrorism is determined by the measure of societal disruption and panic, and not necessarily by the sheer number of casualties.

Biological warfare and bioterrorism are often used interchangeably. We need to differentiate between contagious agents (such as cholera, plague, smallpox, or typhus), which can be transmitted from person to person, and noncontagious agents (such as anthrax, botulism, tularemia, or ricin). Two candidate agents are of special concern—smallpox and anthrax. Smallpox is regarded as the greatest threat if acquired by bioterrorists. Anthrax, primarily a disease of grazing animals, is transmitted to humans who are exposed to animal products in agricultural or occupational settings. Figure 2 shows a scientist testing specimens for the presence of anthrax [4]. Licensed vaccines are currently available for a few threats, such as anthrax and smallpox.

Public health authorities have developed a system to prioritize biological agents according to their risk to national security. The US Centers for Disease Control and Prevention (CDC) recognizes three categories of bioterrorism agent and categorizes them as A, B, and C [3,5].

➤ **Category A:** These agents, the highest priority, represent organisms that: (a) pose a risk to national security because they can be easily disseminated or transmitted person-to-person; (b) cause high mortality, with potential for major

public health impact; (c) might cause public panic and social disruption; and (d) require special action for public health preparedness.

➤ **Category B:** These agents are moderately easy to disseminate and have low mortality rates. These include brucellosis, glanders, Q fever, ricin toxin, typhus fever, and other agents. They require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance. A subset of category B agents includes pathogens that are food- or water-borne.

➤ **Category C:** These agents are emerging pathogens that might be engineered for mass dissemination because of their availability, ease of production and dissemination, high mortality rate, or ability to cause a major health impact. They include Nipah virus, yellow fever, and multidrug-resistant tuberculosis. Preparedness for category C agents requires ongoing research to improve disease detection, diagnosis, treatment, and prevention.

BRIEF HISTORY

Humans have used biological weapons in conflicts for hundreds of years. The use of biological agents for purposes of disseminating such substances to cause public harm and disrupt established structures has been reported throughout history. Until World War II, the number of soldiers dying from disease far outweighed the number killed in combat. The following examples show the use of biological weapons over the years.

Incidents of bioterrorism date back to as early as 600 BC, when the Assyrian armies poisoned enemy wells and other sources of water with infectious substances.

In 1918, Spanish flu (or bubonic plague) epidemic was one of the most deadly pandemics in world history killing between three to five percent of the world's population.

In 1925, the Geneva protocol prohibited the development, production, and use in war of biological and chemical weapons.

During World War II, several nations, including the US, UK, Canada, France, Italy, Poland, Japan, and the former Soviet Union, began to develop biological weapons.

The USA (until 1972) and the former Soviet Union (until 1992) had large biological warfare programs, weaponized to kill or incapacitate humans and to destroy livestock.

In 1975, the Biological Weapons Convention banned the development, stockpiling, acquisition, retention,

and production of biological agents. The United States has accused Iraq, North Korea, Iran, Libya, Syria, and Sudan of having offensive biological weapons programs in violation of the Biological Weapons Convention.

In 1980, the World Health Organization (WHO) announced the eradication of smallpox, a highly contagious virus and incurable disease.

In 1984, 751 people in the state of Oregon ate salad with salmonellosis. The attack infected people with severe food poisoning. The casualties fell sick but did not die.

In June 1993, a religious Japanese terrorist sect Aum Shinrikyo released anthrax on five trains of the Tokyo metro system. The attack was a failure, because not single person was infected.

On September 11, 2001, the devastating terrorists attacked the World Trade Center in New York, damaged the Pentagon in Washington DC, led to the death of approximately 5,000 innocent individuals and 4 commercial airliners. As a result, fear gripped the nation. This was the worst terrorist attack in US history.

In October 2001, letters containing powdered anthrax were sent through the US Postal Service. The attack caused 22 cases of illness, 5 cases of death, and widespread fear.

PREVENTION MEASURES

Although the likelihood of a bioterrorist attack is low, it is crucial to remain vigilant about potential bioterrorism attacks and take proactive measures. Several prevention measures can be taken to reduce the threat of biological terrorism and increase international security. These include preparedness, surveillance, emergency medicine, and active deterrence.

➤ *Preparedness*: This is a main goal that requires constant improvement on the local, regional, national, and international levels. There must be ongoing efforts to improve preparedness for potential bioterrorism emergencies. Preparedness remains a challenge due to coordination of state and federal resources to respond rapidly to an incident. Prevention involves allocation of resources to intelligence agencies, such as Department of Homeland Security, Pentagon, Federal Bureau of Investigation, National Security Agency, to monitor specific activities that could be related to a potential bioterrorism attack [6]. Laboratories are working hard on advanced detection systems to provide early warning. The stockpiling of vaccines for potential

biological threats is an important aspect in preparedness. Preparedness can take the form of education (i.e., trainings, seminars, and lectures on Bioterrorism Ready Plan) and ensuring a good communication system between public health agencies, hospitals, and the civilian population. Programs such as immunization and chronic disease prevention programs should be considered as part of maintaining readiness. Figure 3 shows terrorism drill and preparedness [7].

➤ *Surveillance*: Surveillance systems are available at the state level as well as national guidelines for the syndromic surveillance by health professionals. RODS (Real-Time Outbreak Disease Surveillance) is designed at the University of Pittsburgh to collect data from many data sources and use them to detect a possible bioterrorism event at the earliest possible moment. In Europe, disease surveillance is organized on the continent-wide scale. In the wake of the 9/11 attacks, the New York City developed the Syndromic Surveillance System for use in counterterrorism operation. Biosurveillance is the science of real-time disease outbreak detection. It applies to both natural and man-made bioterrorism. Data from public health surveillance systems can provide useful information about population risks for disease, disability, and death. Surveillance is important in helping law enforcement officials to react swiftly. An increasing number of public health departments are investing in new surveillance systems in order to facilitate rapid detection of a future bioterrorist attack. Some of these surveillance systems are funded by Federal and other agencies.

➤ *Emergency Medicine*: Emergency departments plays an important role in preparedness for bioterrorist attacks. It may also involve training of healthcare professionals in disaster preparedness and preparing hospitals. It is imperative that emergency services medical personnel (including first responders, emergency room physicians, emergency medical technicians, nurses, physician assistants, and laboratorians) who provide emergency medical services be trained and educated on the detection of biological agents to ensure patient and worker safety in the case of threat. They will be on the forefront of diagnosing and providing treatment in response to a bioterrorism event. In case of a bioterrorist event, the clinical microbiology laboratory could be instrumental in helping to detect and identify the biological weapon that was used and in alerting authorities. Early recognition of specific agents

are essential for public health. Every community must become pharmaceutically prepared for an attack. The task of a pharmacist during a bioterrorism attack is to rapidly disseminate antidotes, provide dosage and vaccination schedules for treatment, and counsel patients [8]. The United States, through the Strategic National Stockpile (SNS), currently has sufficient doses of smallpox vaccine for every American if necessary [9].

- *Active Deterrence*: This involves actions and policies preventing a specific opponent from doing something they may wish to do. Traditionally, it involves the application of expressive force to change the policy or character of the target group or government or the threat of inflicting punishing retaliation against some aggressor. Detering bioterrorism is focusing on pathogen security or denying access to the materials necessary to develop biological weapons. Creating a deterrence strategy for bioterrorism is important [10].

These prevention strategies of countering bioterrorism aim to reduce consequences of an attack, afford earlier detection, mitigate human casualties, and minimize vulnerability to bioterrorism attack. They may require dedicating more resources.

CHALLENGES

Terrorism is a thorny issue because of its destructive capabilities. Although many aspects of an effective response to bioterrorism are similar to those for any form of terrorism, bioterrorism presents a unique set of difficulties and challenges, especially when compared to chemical, radiological, or nuclear terrorism. In spite of the tremendous progress made in science, technology, and medicine, bioterrorism and the ability to inflict disease remain among the greatest threats to mankind. This threat posed by bioterrorism is challenging, given the dearth of knowledge in this particular subject by healthcare practitioners. It is very hard and costly to prepare for a global public health disaster due to the fact that bioterrorism preparedness may require administering vaccination programs, distributing prophylactic medication, evacuation, isolation, and quarantine. It is also difficult for historians and microbiologists to differentiate natural epidemics from alleged biological attacks, because truth can be manipulated for political reasons, especially for a hot topic such as bioterrorism. The gravity of the problem, its political propaganda, and issues about military secrecy make the problem particularly difficult to solve [11]. There is also lack of international standards on public health experiments.

One key weakness in emergency response planning is a shortage of vaccine. Many bioweapon disease threats lack a corresponding vaccine; for those that do, it is challenging to use them in an emergency situation. Development of new vaccines and antimicrobial therapies should be a priority. One challenge to licensing vaccines for response to bioweapon threats is the absence of disease agents in the natural world [12].

Because there have been no significant instances of bioterrorism since 2001, the government has become complacent and reduced funding for bioterrorism. Ignoring the threat poses a significant risk to national security and the health of the citizens.

CONCLUSION

Global terrorism is a threat to world security, and it increases the risk of bioterrorism. Bioterrorism is an emerging threat to global health. Its main goal is to threaten and terrorize large groups of humans, governments, armies, or society as a whole. It involves the use of biological agents by all kinds of actors (political or military actors) to create casualties, terror, societal disruption, or economic loss, inspired by ideological, religious or political beliefs.

Although biological weapons have not been frequently used throughout human history, bioterrorism is not likely to go away. As frightening as bioterrorism sounds, the threat is real and it cannot be stopped. Bill Gates warned that bioterrorism could kill more people than nuclear war. Scientists worry that anthrax, Ebola, or smallpox could be used as biological agents. Since the military is not the only population at risk for biological attack, it is expedient that we are all prepared to deal with the consequences if bioterrorism occurs. We should not underestimate the power of the public to respond effectively to disasters. The general population should be educated and be made aware of the threats and risks associated with bioterrorism. July has been designated as the Bioterrorism and Disaster Education and Awareness Month.

More information about bioterrorism can be found in the books in [13-23] and others books available on Amazon.com and books.google.com. One should also consult the following related journals:

- *Journal of Bioterrorism & Biodefense*
- *Annals of Emergency Medicine*
- *Emergence Medicine Clinics of North America*

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Figure 1 An example of terrorist act: Oklahoma City bombing [2].



Figure 2 A scientist tests specimens for the presence of anthrax [4].



Figure 3 Terrorism drill and preparedness [7].