

**Continuing Education
Material:**

**Biological and Chemical
Terrorism**

ABP, Inc

**ABP CONTINUING EDUCATION MATERIAL
BIOLOGICAL AND CHEMICAL TERRORISM**

OBJECTIVES

1. Explain the vulnerability of the U.S. to biological and chemical terrorism.
2. Identify the common biological and chemical agents that could be used for a terrorist attack.
3. Discuss CDC's five key focus areas for dealing with biological and chemical threats.

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INTRODUCTION

The United States must be ready for possible biological or chemical terrorism that might range from food or water contamination to the dissemination of aerosolized viruses or spores. In the past 10 years there has been the sarin gas attack in the Tokyo subway in 1995 and discovery of military bioweapons programs in Iraq after the Gulf War and the former Soviet Union. Biological and chemical weapons are extremely pathogenic to both humans and animals. Their effects can include acute respiratory paralysis, central nervous system disorders, and organ failure with death as the final outcome. Early detection of any terrorism is dependent on a strong public health system not only at the federal level but also at the local and state levels. It will probably be the primary healthcare providers though that will be the first to observe and hopefully report any unusual illnesses.

CONTROL ATTEMPTS

There have been numerous attempts to control the use of biological weapons dating as far back as the 1925 League of Nations' Geneva Protocol. In 1972 the Biological Weapons Convention defined both biological and chemical weapons as instruments of biological warfare and prohibited the development, production and stockpiling of such. There were 118 countries that signed the agreement, but there is no way to enforce the pact.

The United States developed the Biological Warfare Defense Program in 1996. The program focuses on broad-spectrum approaches to neutralizing biological agents and partnering with universities in researching fast, simple methods of identification. This defense program also develops protective gear and ways to destroy organisms. Also, in 1996 Congress passed the Defense Against Weapons of Mass Destruction Act. This act mandated that a program be created to improve the responses of state and local agencies to biological and chemical emergencies. The Defense Department established the Biological Weapons Improved Response Program in which numerous organizations and departments worked together to develop the Biological Weapons Response Template to help city and state governments prepare for a possible attack.

Many experts think that the U.S. is not prepared to handle an attack of bioterrorism at any level of the public health infrastructure. In a simulated biological attack staged in New York, Los Angeles, and Chicago in 1996, it was reported that fireman rushed into the "contaminated" area without protective clothing and that hospitals would have been overwhelmed in the event of an actual attack. After that simulation, the U.S. government appropriated \$800 mill for chemical and biological weapons defense in the fiscal year 1997. In 1999 the Centers for Disease Control (CDC) received \$178 million to prepare against bioterrorism and to establish a network of biological and chemical labs to assist with measurement. They also received \$52 million to establish a pharmaceutical stockpile of drugs, vaccines, prophylactic medicines, chemical antidotes, medical supplies and equipment.

OVERT OR COVERT TERRORIST ATTACKS

Chemical terrorism is considered to be an "overt" attack because the effects of chemical agents absorbed through inhalation or by absorption through the skin or mucous membranes are usually immediate and obvious. Bombings are also considered overt attacks. An overt attack elicits immediate response from police, fire and other first responders.

Biological attacks are considered to be "covert" because it's impact is not immediate because of the delay between exposure and onset of illness. Because of the incubation period especially if a virus is involved, it is likely that the first casualties of a biological attack will be identified by primary healthcare providers. There is only a small window of opportunity that exists between the time that the first cases are identified and a second wave of the population becomes ill through person-to-person contact. During this small window of time, public health officials will need to determine that an attack has occurred, identify the organism, and prevent more casualties through prevention strategies. Disease surveillance systems at state and local health agencies must be capable of detecting unusual patterns of disease or injury. Epidemiologists at the state and local agencies must have expertise and resources for responding to reports of clusters or rare, unusual, or unexplained illnesses.

BIOLOGICAL AGENTS

High priority biological agents include those organisms that pose a risk to national security because they can be easily disseminated or transmitted person-to-person; cause high mortality, with potential for major public health impact; might cause public panic and social disruption; and require special action for public health preparedness.

The US Army Medical Research Institute of Infectious Diseases has a list of the biological agents as the most likely to be used in an attack.

- 1) **Small pox (*variola major*):** The virus is highly infectious when transported by aerosols, is easy to make, and the world population does not have immunity to it. The World Health Organization declared that smallpox was globally eradicated in 1980 and has approved CDC and the Institute for Viral Preparedness in Moscow to hold live cultures of smallpox. In the 1980's the U.S. stopped vaccinating children against smallpox and also stopped vaccinating the military which leaves a good portion of the U.S. are now susceptible to smallpox.
- 2) ***Bacillus anthracis (anthrax)*:** This aerobic, spore-forming, gram positive bacillus is usually found in cattle, sheep, and horses. The infectious, spore form can remain viable in soil, water and direct sunlight.
- 3) ***Brucella sp. (Brucellosis)*:** This gram negative, coccobacillus is highly infectious and only a few bacteria can cause an incapacitating disease after being inhaled. The mortality rate is less than 5%. The disease can also be contracted through unpasteurized dairy products.
- 4) ***Vibrio cholera (cholera)*:** This is a short, curved, motile, anaerobic, gram negative bacillus that produces an enterotoxin that inhibits water absorption in the small intestine. It is transmitted by contaminated water, food, flies or soiled utensils. It can withstand freezing for several days. Cholera is usually diagnosed by the presence of "rice water" stools. Antibiotics do not kill the organism. It can be killed by drying, chlorinating, steaming or boiling water.
- 4) ***Burkholderia mallei (Glanders)*:** Infection of this small, gram negative bacillus is through inhalation or through sores or cracks in the skin. This disease can take several forms: acute localized, septicemia, acute pulmonary, or chronic cutaneous. Most antibiotics have only been tested on animals and therefore there would be a high mortality rate with this disease.
- 5) ***Yersinia pestis (plague)*:** This infection cause by a gram negative, nonmotile, nonsporulating, aerobic bacteria is passed onto humans by fleas. It is the pneumonic form of plague that is suited for being a biological weapon because all people are susceptible. The organism can remain alive in water, meals, and grains for weeks. At near freezing, it can remain alive for months or even years
- 6) ***Francisella tularensis (tularemia)*:** This small, nonmotile, aerobic, gram negative coccobacillus, can survive in water, carcasses, hides, and for years in frozen rabbit meat as well as in soil or water at freezing temperatures. In humans tularemia is ulceroglandular, septicemic, and pneumonic. It is the septicemic form that would be used in a bioterrorist attack. It occurs after intradermal, respiratory, or gastric inoculation of the organism. Tularemia is very difficult to diagnose because it has very nonspecific symptoms.
- 7) ***Coxiella burnetii (Q fever)*:** This is a rickettsia which usually infects sheep, cattle and goats. It is extremely infectious via the infective aerosol route with only a few organisms needed to cause infection when inhaled by humans. The illness is usually self-limiting.
- 8) ***Venezuelan equine encephalitis (VEE)*:** This virus usually affects horses, mules and donkeys and is carried by mosquitoes. It is spread to humans by aerosols or through food and water contamination. VEE causes inflammation in the brain but is fatal in less than 1% of cases. Recovery produces life long immunity.
- 9) ***Viral hemorrhagic fevers*:** This group of RNA viruses target the vascular system and cause changes in vascular permeability. Included in this group are the filoviruses such as Ebola and Marburg and the arena viruses, such as Lassa and Junin. Many of these fevers are spread by mosquitoes or other arthropod vectors. Initial symptoms quickly evolve to shock with generalized mucous membrane hemorrhage which further leads to renal failure and cardiovascular shut down. Mortality rates are very high. Aerosol biological weapons do not, thankfully, exist for some of these viruses although their symptoms could confuse and delay identification of the actual biological weapon.
- 10) ***Staphylococcus aureus*:** This bacteria produces a pyrogenic toxin that causes food poisoning. In a bioterroristic attack, this organism would be introduced as an aerosol. It would not cause a great many deaths but would incapacitate a great number of people who would also require medical treatment. There is no vaccine available that would prevent reaction to this toxin.
- 12) ***T-2 toxins*:** These mycotoxins are produced by a group of filamentous fungi. These mycotoxins are extremely heat stable and resist UV inactivation. If the mycotoxins are ingested, they produce a lethal illness called alimentary toxic aleukia (ATA). Some people believe that these mycotoxins were used in Southeast Asia and Afghanistan in the form of "yellow rain" to produce casualties and deaths among civilians. These toxins can enter the body through the skin, stomach, or lungs and inhibit

protein synthesis. Death may occur in minutes, hours, or days. Exposure can only be prevented by wearing a gas mask and protective chemical gear because there are no antitoxins or antifungals available.

STEPS IN PREPARING FOR BIOLOGICAL ATTACKS

- . Enhance epidemiologic capacity to detect and respond to biological attacks.
- . supply diagnostic reagents to state and local public health agencies.
- . Establish communication programs to ensure delivery of accurate information.
- . Enhance bioterrorism-related education and training for healthcare professionals.
- . Prepare educational materials that will inform and reassure the public during and after a biological attack.
- . Stockpile appropriate vaccines and drugs.
- . Establish molecular surveillance for microbial strains, including unusual or drug-resistant strains.
- . Support the development of diagnostic tests.
- . Encourage research on antiviral drugs and vaccines.

CHEMICAL AGENTS

Chemical agents that might be used by terrorists range from warfare agents to toxic chemicals commonly used in industry. Criteria for determining priority chemical agents include chemical agents already known to be used as weaponry; availability of chemical agents to potential terrorists; chemical agents likely to cause major morbidity or mortality; potential of agents for causing public panic and social disruption; and agents that require special action for public health preparedness. Public health agencies should prepare for chemical terrorism by focusing on treating exposed persons by clinical syndrome rather than by specific agent because of all the new chemicals introduced each month.

Nerve Agents

- . tabun (ethyl N,N-dimethylphosphoramidocyanidate)
- . sarin (isopropyl methylphosphanofluoridate)
- . soman (pinacolyl methyl phosphonofluoridate)
- . GF (cyclohexylmethylphosphonofluoridate)
- . VX (o-ethyl-[S]-[2-diisopropylaminoethyl]-methylphosphonothiolate)

Blood Agents

- . hydrogen cyanide
- . cyanogen chloride

Blister Agents

- . lewisite (an aliphatic arsenic compound, 2-chlorovinyl dichloroarsine)
- . nitrogen and sulfur mustards
- . phosgene oxime

Heavy Metals

- . arsenic
- . lead
- . mercury

Volatile Toxins

- . benzene
- . chloroform
- . trihalomethanes

Pulmonary Agents

- . phosgene
- . chlorine
- . vinyl chloride

Incapacitating Agents

- . BZ (3-quinuclidinyl benzilate)

Pesticides (Persistent and Nonpersistent)

Dioxins, Furans, and Polychlorinated biphenyls (PCBs)

Explosive Nitro compounds and Oxidizers

- . ammonium nitrate combined with fuel oil

Flammable Industrial Gases and Liquids

- . gasoline
- . propane

Poison Industrial Gases

- . cyanides
- . nitriles

Corrosive Industrial Acids and Bases

- . nitric acid
- . sulfuric acid

STEPS IN PREPARING FOR A CHEMICAL ATTACK

- . Enhance epidemiologic capacity for detecting and responding to chemical attacks.
- . Enhance awareness of chemical terrorism among emergency medical service personnel, police officers, firefighters, physicians, and nurses.
- . Stockpile chemical antidotes.
- . Develop and provide bioassays for detection and diagnosis of chemical injuries.
- . Prepare educational materials to inform the public during and after a chemical attack.

CDC STRATEGIC PLAN: FIVE FOCUS AREAS

- 1. Preparedness and Prevention**
 - . CDC will provide public health guidelines, support, and technical assistance to local and state public health agencies as they develop coordinated preparedness plans and response protocols.
 - . CDC will provide self-assessment tools for terrorism preparedness.
 - . CDC will encourage and support applied research to develop tools and strategies to prevent illness and injury caused by biological and chemical terrorism.
- 2. Detection and Surveillance**
 - . CDC will integrate surveillance for illness and injury resulting from biological and chemical terrorism into the U.S. disease surveillance systems, while developing new mechanisms for detecting, evaluating, and reporting suspicious events that might represent covert terrorist acts.
- 3. Diagnosis and Characterization of Biological and Chemical Agents**
 - . CDC and its partners will create a multilevel laboratory response network for bioterrorism (LRNB). The network will link clinical labs to public health agencies in all states, districts, territories, and selected cities and counties and to state-of-the-art facilities that can analyze biological agents.
- 4. Response**
 - . CDC will assist state and local health agencies in developing resources and expertise for investigating unusual events and unexplained illnesses.
 - . CDC will maintain a national pharmaceutical stockpile to ensure the availability, procurement, and delivery of medical supplies, devices, and equipment that might be needed to respond to terrorist caused illness or injury.
- 5. Communication**
 - . CDC will work with state and local health agencies to develop:
 - a) a state-of-the-art communication systems that will support disease surveillance
 - b) rapid notification and information exchange regarding disease outbreaks that are possibly related to bioterrorism
 - c) dissemination of diagnostic results and emergency health information
 - d) coordination of emergency response activities

By implementing CDC's strategic preparedness and response plan, the U.S. public health agencies and healthcare providers will be prepared to mitigate illness and injuries that result from acts of biological and chemical terrorism. Tools developed in response to terrorist threats serve a dual purpose. They help detect rare or unusual disease outbreaks and respond to health emergencies, including naturally occurring outbreaks or industrial injuries that might resemble terrorist events in their unpredictability and ability to cause mass casualties.

REFERENCES

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ABP CONTINUING EDUCATION SELF-ASSESSMENT QUIZ

BIOLOGICAL AND CHEMICAL TERRORISM

Please answer all questions on the Continuing Education Form.

1. The earliest attempt to control the use of biological weapons dates back to:
 - a. Biological Weapons Convention
 - b. Biological Warfare Defense Program
 - c. League of Nations Geneva Protocol
 - d. Biological Weapons Response Template
2. All of the following statements are correct about biological attacks **except**:
 - a. It's impact will be delayed due to an incubation period.
 - b. First casualties are likely to be identified by primary care providers.
 - c. There is person-to-person transmission.
 - d. They are considered to be “overt” attacks.
3. Which biological disease would be killed by antibiotics and diagnosed by the presence of “rice water” stools?
 - a. Brucellosis
 - b. Cholera
 - c. Plague
 - d. Q fever
4. Which biological agent is highly infectious, transmitted by aerosols and was declared globally eradicated?
 - a. Smallpox
 - b. Anthrax
 - c. Glanders
 - d. Plague
5. Which biological agents cause changes in the vascular system and can lead to renal failure and cardiovascular shutdown?
 - a. Brucella
 - b. VEE
 - c. Filoviruses
 - d. T-2 toxins
6. Which group of biological agents inhibit protein synthesis and are believed to have been the cause of “yellow rain” in southeast Asia and Afghanistan?
 - a. Cholera
 - b. VEE
 - c. Filoviruses
 - d. T-2 toxins
7. All of the following are steps in preparing for biological attacks **except**:
 - a. Support the development of diagnostic tests.
 - b. Train healthcare professionals in bioterrorism.
 - c. Make sure that no educational materials are available to the general public.
 - d. Stockpile appropriate vaccines.
8. Which of the following is **not** true about chemical agents?
 - a. The focus should be on treating exposed persons by clinical syndrome.
 - b. Chemical agents are not likely to cause major mortality.
 - c. Chemical agents are considered to be an “overt” attack.
 - d. Chemical attacks require immediate response from police.

9. All of the following are steps in preparing for chemical attacks **except**:
- a. Stockpile chemical antidotes.
 - b. Prepare educational materials to inform the public during and after a chemical attack.
 - c. Enhance awareness of chemical terrorism among emergency medical service personnel only.
 - d. Provide bioassays for diagnosis of chemical injuries.
10. Which of the following is **not** included in one of CDC's focus areas for dealing with biological and chemical terrorism?
- a. A laboratory link between government labs and labs only in selected cities that can analyze biological agents.
 - b. A communication network that will provide rapid notification of disease outbreaks that are possible related to bioterrorism.
 - c. Support of research to development of new mechanisms for detecting chemical and biological terrorism.
 - d. Maintenance of a national stockpile of medical supplies and equipment that might be needed to respond to terrorist caused illness or injury.