A biological attack is the intentional release of a pathogen (disease-causing agent) or biotoxin (poisonous substance produced by a living organism) against human, animals, or plants. An attack against people could be used to cause illness, death, loss, societal disruption, and economic damage. An attack on agricultural plants and animals would primarily cause economic damage, loss of confidence in the food supply, and possible loss of life. It is useful to distinguish between two kinds of biological agents:

- Transmissible agents that spread from person to person (e.g., smallpox, infectious diseases spread from person to person), animal to animal (e.g., foot and mouth disease), or from person to environment.
- Agents that may cause adverse effects in exposed individuals but do not make those individuals contagious to others (e.g., anthrax, botulinum toxin).

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The Centers for Disease Control and Prevention (CDC) lists the biothreat agents considered to pose the highest threat (see Table 1). Once obtained, agents must be cultured or grown in quantity and then processed for use in an attack (‘converting’). Agents can be:

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**How Biological Agents Could Be Disseminated**

For an attack on people, biological agents could be disseminated in one or more of the following ways:

- Aerosol dissemination is the dispersal of an agent in air from sprayers or other devices. This agent must be cultured and processed to the proper size to maximize human infections, while maintaining the agent’s stability and pathogenicity (ability to produce illness). An aerosol attack might take place outdoors in a populated area or through ventilation systems of buildings contaminated with anthrax. In some cases, liquid decontaminants to kill the agent. For example, chlorine dioxide gas was released to kill anthrax spores. This needs to be done quickly to prevent the agent from spreading. After a biological agent has been identified, officials will take steps to characterize how long the agent will persist. Clean-up within buildings may entail the use of gas or liquid decontaminants, with the goal of killing the agent. For example, chlorine dioxide gas was released to kill anthrax spores. This needs to be done quickly to prevent the agent from spreading.

**WHAT IS IT?**

A fact sheet from the National Academies and the U.S. Department of Homeland Security—Available from: http://www.nap.edu:

**BIOLOGICAL ATTACK**

Human pathogens, biotoxins, and agricultural threats

**WHAT ARE THE LONG-TERM CONSEQUENCES?**

**LONG-TERM HEALTH CONSEQUENCES FOLLOWING EXPOSURE**

- How the space will be used following clean-up.
- How far the agent has spread.
- The amount of agent released.
- The signs and symptoms of the disease, if medications or vaccinations are available.

**MONITORING AND CLEAN-UP**

Methods to control contagious disease include isolation, quarantine, barrier methods (e.g., masks), and antivirals to treat viral infections. Vaccines can prevent some diseases, although there are a few specific medications to treat viral infections. Table 2 lists general medical treatments for several biothreat agents. In general, bac-

**ECONOMIC IMPACT OF AN AGRICULTURAL ATTACK**

If people become aware of a suspicious substance nearby, they should:

- Follow instructions of health care providers and other public health officials.
- Stay away from the suspected substance.
- Do not touch, test, move, or disturb any contaminated objects or areas.
- Wash hands and other exposed skin thoroughly with soap and water.
- Cover their mouths and noses with layers of fabric that can filter the air but still allow breathing.
- Learn what steps officials have taken and practice good hygiene and cleanliness to avoid spreading germs.
- Seek emergency medical attention if they become sick.
- Contact authorities.
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In 2001, the anthrax attacks through the U.S. mail infected 11 people with inhalational anthrax, of which the additional 10 people died. The biological attack was the first act of terrorism that targeted civilians using a biological agent.

In 1995, the cult Aum Shinrikyo destroyed more than 5000 lives in Tokyo, allegedly in an attempt to eradicat the city as a nuclear threat.

In 1984, the cult followers of Rajneesh (now Raj.Percent of people who were in flies were infected with anthrax. Of those infected, 20 were fatal.

In 2001, the anthrax letters, a biological attack, will probably first be detected by local health care workers observing a pattern of illness. Unlike a chemical or nuclear attack, a biological attack may go undetected for hours, days, or potentially weeks (depending on the agent used, and likelihood of additional releases. Laboratory scientists will work quickly to identify the specific agent.

Finding the Cause and Source of Illness

The Area Affected

Infectious refers to the ability of the agent to cause disease in other organisms when introduced. Infectious is different from contagious, which refers to the ability of an individual to transmit the disease if he or she becomes ill. Infectious Is Different

Table 2. Result, Health Impacts, and Treatments for Some Agents of Concern

<table>
<thead>
<tr>
<th>Disease Agent</th>
<th>Incubation Period</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plague (Bacillus anthracis)</td>
<td>typically 1–6 days, but up to 14 days</td>
<td>fever, cough, prostration, hemorrhage, respiratory failure</td>
</tr>
<tr>
<td>Cholera (Vibrio cholerae)</td>
<td>typically 1–6 days, but up to 5 days</td>
<td>vomiting, diarrhea</td>
</tr>
<tr>
<td>Smallpox (variola major)</td>
<td>typically 14 days</td>
<td>variolation, rash, generalized bleeding in severe cases</td>
</tr>
<tr>
<td>Marburg (Marburg virus)</td>
<td>typically 3–7 days</td>
<td>fever, headache, rash, hemorrhage</td>
</tr>
<tr>
<td>Ebola (Ebola virus)</td>
<td>typically 2–21 days</td>
<td>fever, headache, rash, hemorrhage</td>
</tr>
<tr>
<td>Anthrax</td>
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**WHAT IS THE DANGER?**

**Psychological Impact**

The viral hemorrhagic fevers and cholera are spread by direct contact with body fluids or feces. People infected with contagious diseases may widely disseminate the agent. Agents are contagious to the extent that they can be transmitted from person to person (e.g., smallpox, measles) or by contact with an infected animal or animal product (e.g., anthrax, plague). The viral hemorrhagic fevers and cholera are spread by direct contact with body fluids or feces. People infected with contagious diseases may widely disseminate the agent. Agents are contagious to the extent that they can be transmitted from person to person (e.g., smallpox, measles) or by contact with an infected animal or animal product (e.g., anthrax, plague)."
Laws and Treaties Governing

The Australia Group is a loose association of nations formed in 1986 to prevent the proliferation of biological weapons. The Biological and Toxins Weapons Convention (BTWC) of 1972 is the first arms control treaty to forbid states from producing, stockpiling, or retaining biological and toxin weapons.

In the 1340s, Europeans threw plague-infected people from voting in an election. In World War II, Unit 731 in Japanese-occupied Manchuria produced biological weapons such as anthrax, botulinum, and glanders. In 1984, the cult followers of Baghwan Shree Rajneesh sickened 751 people in Oregon by placing salmonella bacteria in the water supply. In 2001, the anthrax attacks through the mail in the United States killed five people and sickened 22. The viraemia of infectious diseases can spread through respiratory contact with infected sputum or exhalation.

**IMPLICATIONS OF biological agents as weapons**

1. **Route of exposure (inhalation, ingestion, insect bite).**
2. **Duration of exposure.**
3. **Type and amount of agent taken into the body.**

**HOW LONG WILL biological agents remain active?**

- **No (only skin form spreads)**
- **Moderate**
- **Moderate (inhalation)**
- **No**

**HOW MIGHT biological threats be distributed?**

- **Physically distributed**
- **Insects**
- **Infected animals**

**What does the Area Affected mean?**

- **The Area Affected**
- **The Area Affected – 41 days**
- **Area**

**WHAT IS THE DANGER?**

During a biological attack, the area affected would depend on the quantity of agent released, whether the release is indoors or outdoors, and weather conditions. Agents released outdoors would disperse rapidly in the direction of the prevailing wind and could degrade with sunlight and die out from environmental exposure. Agents released indoors could initially have a higher concentration. Sometimes agents can be re-accelerated by machinery, foot traffic, or other means.

**FINDING THE CAUSE AND SOURCE OF INFILTRATION**

There may be uncertainties about crucial facts such as the exact location or extent of the initial release, the type of biological agent used, and likelihood of additional release. Laboratory scientists will work quickly to identify the specific agent. Epidemiologists will attempt to trace the path of inhalation back toward a single person, vector (insect or animal), vehicle (tried or not), or other point of origin. Attribution of a biological attack is typically much more difficult than attribution of a conventional terrorist attack.

---

**Spread potential (in persons)**

<table>
<thead>
<tr>
<th>Lethality</th>
<th>Estimated Persistence of Exposure</th>
<th>Vaccine Status (as of March 2005)</th>
<th>Medical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Very stable (in soil)</td>
<td>Very stable (in soil)</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Moderate</td>
<td>For avg 5 yr in soil, 2 yd deep, for longer in water, for longer in soil</td>
<td>Not curable</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>No</td>
<td>Very stable (in soil)</td>
<td>Very stable (in soil)</td>
<td>Supportive only</td>
</tr>
<tr>
<td>No</td>
<td>No (only skin form spreads)</td>
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<td>Supportive only</td>
</tr>
<tr>
<td>Moderate</td>
<td>High in moisture (high load)</td>
<td>Very stable (in soil)</td>
<td>Supportive only</td>
</tr>
<tr>
<td>No</td>
<td>High potential/low load</td>
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**Medical Treatment**: Depending on the agent, the treatment can vary from supportive to specific, such as antibiotics for anthrax or anti-agents for botulinum. The timing of administration is critical, as the effectiveness of treatment decreases as the duration of exposure increases.
**WHAT IS THE DANGER?**

**Impact on Human Health**

Biological agents have the potential to produce a life-threatening illness. Bacteria are essentially poisons that can be fed at high enough doses. Table 2 lists health impacts and medical treatments for the Category A and some Category B agents. Even a small amount of some bioterror agents released in an area could result in significant loss of life, depending on a number of factors that include the:

- Infectivity of the agent (how many particles are needed to cause illness).
- Latency of the agent.
- Length of time it takes to detect and treat those who are exposed or have become ill.

**Dose Response in Humans**

The exact infectious dose (the number of organisms needed to make one sick) of most biological agents is unknown; approximate doses are extrapolated from animal studies. Whether a person becomes ill after exposure to a biological agent depends on a number of factors including:

- Type and amount of agent taken into the body.
- Duration of exposure.
- Route of exposure (inhalation, ingestion, insect bite).
- "Host" factors (e.g., age, immune status, other illnesses of the person exposed).

**Differences in Intentional vs. Natural Outbreaks of Disease**

Naturally occurring outbreaks of category A agents have become rare because of improved living standards, hygiene, and health services in developed nations. For example, human bubonic plague, which was transmitted by rats and fleas to humans in past centuries, resulting in large losses of life, has virtually been wiped out. However, agents used in an aimed attack may act differently than naturally occurring outbreaks and could produce a form of the disease under a shorter time frame of illness, making timely diagnosis, treatment, and containment more difficult.

**Spread of Diseases**

Some transmissible (contagious) diseases can spread through respiratory droplets from coughing and sneezing or when a person comes in contact with a surface harboring a virus or bacteria and then touches their mouth or nose. The viral hemorrhagic fevers and cholera are spread by direct contact with body fluids or feces. People infected with contagious diseases may widely disseminate the disease by travel.

**Psychological Impact**

Psychological responses following a bioterrorism event may include anger, fear, and social isolation. Following the 2001 anthrax attacks, thousands of people who thought they were infected sought treatment. Trying to distinguish those who haven’t been infected could complicate medical context’s ability to treat those who have been exposed and infected, especially when diagnosis is unclear.

**WHAT SHOULD PEOPLE DO TO PROTECT THEMSELVES?**

**Practical Steps**

During a declared bioterror emergency:

1. People in the group or area that authorities have linked to exposure who haven’t been infected could complicate medical centers’ ability to treat those who have been exposed and infected, especially when diagnosis is unclear.

**Infection in Different From Contagious**

The term “infectious” and “contagious” are often used interchangeably to refer to the manner of particle spread or organism needed to affect an individual. The lower number of particles needed to infect an individual, the easier it is for the agent to contaminate the air and could degrade with sunlight and by drying out from environmental exposure. Agents released indoors could initially have a more limited distribution, but even relatively crude devices could have an impact. It takes expertise to process biological agents to maximize their effects.

**Medical Impact**

Medical impacts are classified by the infectivity and lethality of the agent used in the attack. Infectious agents are divided by their potential impact into three categories: Category A, B, and C.

**Category A**

Category A agents are serious biological threats that have the potential to produce a catastrophic impact if released in the United States. The exact infectious dose (the number of organisms needed to make one sick) of most biological agents is unknown; approximate doses are extrapolated from animal studies. Whether a person becomes ill after exposure to a biological agent depends on a number of factors including:

- Type and amount of agent taken into the body.
- Duration of exposure.
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- "Host" factors (e.g., age, immune status, other illnesses of the person exposed).

**Category B**

Category B agents are serious biological threats that have the potential to produce a significant impact if released in the United States. Even a small amount of some bioterror agents released in an area could result in significant loss of life, depending on a number of factors that include the:

- Infectivity of the agent (how many particles are needed to cause illness).
- Latency of the agent.
- Length of time it takes to detect and treat those who are exposed or have become ill.

**Category C**

Category C agents are less serious biological threats that have the potential to produce a minimal impact if released in the United States. Even a small amount of some bioterror agents released in an area could result in significant loss of life, depending on a number of factors that include the:

- Infectivity of the agent (how many particles are needed to cause illness).
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**Thresholds of Agent Usage**

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- Infectivity of the agent (how many particles are needed to cause illness).
- Latency of the agent.
- Length of time it takes to detect and treat those who are exposed or have become ill.
2. Use common sense, practice good hygiene and cleanliness to avoid spreading germs.
3. People who are potentially exposed should:
   1. Follow instructions of health care providers and other public health officials.
   2. Expect to receive medical evaluation and treatment. Be prepared for long lines. If the disease is contagious, patients exposed may be quarantined.

If people become aware of a suspicious substance nearby, they should:
1. Quickly get away.
2. Cover their mouths and noses with layers of fabric that can filter the air but still allow breathing.
3. Wash with soap and water.
4. Contact authorities.
5. Watch TV, listen to the radio, or check the Internet for official news and information including the signs and symptoms of the disease, if medications or vaccinations are being distributed, and when to seek medical attention if they become sick.

Medical Treatment

Table 2 lists general medical treatments for several biothreat agents. In general, bacterial illnesses are treated with antibiotics, and viral illnesses are treated with symptomatic care, although there are a few specific medications to treat viral infections. Bioagents are transmitted with antitoxins or antivenoms. Available vaccines can prevent or mitigate the effects of a disease. The multidose vaccine may provide protection even if given 1–4 days after exposure, and the anthrax vaccine can be given after inhalation exposure if accompanied by treatment with antibiotics for a number of weeks.

Controlling the Spread of Contagious Diseases

Methods to control contagious diseases include isolation, quarantine, barrier methods (gloves, filter masks, eye protection), and hand washing. Rapid identification of potentially infected persons increases the effectiveness of these methods.

WHAT ARE THE LONG-TERM CONSEQUENCES?

Monitoring and Clean-up

After a biological agent has been identified, officials will take steps to characterize how long the agent will persist. Clean-up within buildings may entail the use of gas or liquid decontaminants to kill the agent. For example, chlorine dioxide gas was released through ventilation systems of buildings contaminated with anthrax. In some cases, multiple rounds of decontamination may be necessary. Decisions regarding how much clean-up is necessary will depend on:
• The amount of agent released.
• How far the agent has spread.
• How the space will be used following clean-up.

Long-term Health Consequences Following Exposure

The long-term health consequences for those who survive exposure to biological attack agents are unknown. A long-term medical surveillance program would likely be established to monitor potential health effects of those exposed.

Economic Impact of an Agricultural Attack

Once detected, an act of agricultural bioterrorism may quickly halt the movement and export of livestock or the affected crop, resulting in potentially severe economic consequences for producers, shippers, and consumers. It may also disrupt normal trade and commerce.

<table>
<thead>
<tr>
<th>Category A: Agents That May Cause Severe or Life-threatening Disease</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus anthracis (anthrax)</td>
<td></td>
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</table>
Monitor and Clean-up

Potentially infected persons increases the effectiveness of these methods. (gloves, filter masks, eye protection), and hand washing. Rapid identification of exposure if accompanied by treatment with antibiotics for a number of weeks. If given 1–4 days after exposure, and the anthrax vaccine can be given after inhalation.

Biotoxins are treated with antidotes or antitoxins, if available. Vaccines can prevent i.ive care, although there are a few specific medications to treat viral infections.

People who are potentially exposed should:

1. Use common sense, practice good hygiene and cleanliness to avoid spreading germs.
2. Wash with soap and water.
3. Watch TV, listen to the radio, or check the Internet for official news and information.

The Centers for Disease Control and Prevention (CDC) lists the bio-

3. Synthesis of smallpox virus

4. Isolation of smallpox virus

5. Export of livestock or the affected crop, resulting in potentially severe economic con-

6. Synthesized or genetically manipulated in a laboratory.

7. Acquired from laboratories or bioweapons stockpile.

8. Isolated from sources in nature.

A long-term medical surveillance program would likely be a critical element in effectively be a future threat. (not all-inclusive)

Examples are Nipah virus and Hantavirus

Emerging infectious diseases that could be a future threat. (not all-inclusive)