The Increasing Risk of a Bioterrorist Attack in the United States: How
Occupational Health Nurses Can Play a Key Role in Early Detection of Disease
Outbreak

By

Thais H. Spence

University of North Carolina at Chapel Hill

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Approved by:

[Signatures]

Advisor

[Signatures]

Reader
Abstract

For over 2500 years disease organisms have been used as weapons. Bioterrorism remains the greatest national security threat to our country. Bioweapons are highly lethal, easily accessible, inexpensive, and with the advances in biotechnology, the ability to alter pathogens into more virulent strains could make bioterrorism agents even more difficult to fight.

In June of 2001, The Johns Hopkins Center for Civilian Biodefense Strategies partnered with other non-military agencies to simulate a national security response to a bioterrorist attack. After the exercise was reviewed by the Hopkins Center, the conclusions reached included significant deficiencies in the United States' ability to manage a bioterrorist attack. A major deficiency is the weak infrastructure of the Public Health System.

As a specialty in public health, occupational health nurses can play a key role in the detection of a disease outbreak associated with a bioterrorism attack. But first, they must be knowledgeable about common bioterrorism pathogens and use epidemiological principles to monitor for unusual patterns of illness that could indicate an outbreak. In addition, they must network with local public departments and report unusual findings to local and state public health authorities immediately.

Occupational health nurses must exercise their roles as leaders, providing guidance to administrators for the development of policies to address bioterrorism threats in the workplace, training programs for emergency response, reporting
procedures for staff, and educational materials and straight foreword information for workers.

This paper will serve to familiarize the occupational health nurse with bioterrorism agents mostly likely to be used as weapons of mass destruction and to describe the occupational health implications of bioterrorism on the workforce and at the workplace.
Acknowledgments

I would like to express my sincere thanks to Dr. Bonnie Rogers for her guidance throughout my Chapel Hill experience. She has inspired me to grow beyond what I thought possible. I'd also like to thank Judy Ostendorf who helped me navigate my way through this endeavor and Carol Shenold who helped me develop the idea for this paper.

I am truly grateful to my family, who has endured in quiet, patient support as I took on yet another project, to my generous employer, who not only encouraged, but supported my efforts, and finally to my colleagues and friends who listened, proofread, and cheered me on.
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CHAPTER I

INTRODUCTION

“Weapon of mass destruction” (WMD) is a term that describes a single weapon that can cause damage equal to hundreds or thousands of conventional explosive or incendiary weapons (U.S. Congress Office of Technology Assessment, 1993). For example, nuclear weapons are weapons of mass destruction, but even before these sophisticated and technologically advanced weapons were discovered, weapons of mass destruction existed. Chemical weapons such as mustard gas were used during World War I and World War II, and continued to be used as recently as the 1990s Gulf War (ASTDR, 1995). Even before World War I, bacteria and viruses (or the toxins they release), were used as weapons. Opposing armies used bacteria and viruses to cause illness and death centuries before they were formally identified. This method of warfare- the malicious incitement of disease- is known as bioterrorism (Lederberg, 1997). The National Institutes of Health (2002) defines bioterrorism as “the use of microorganisms that cause human disease, or the toxins released from them, to harm people or elicit widespread fear or intimidation of society.”

While the use of WMD is not new, events in the Middle East over the last decade have heightened concern regarding vulnerability to attacks of this sort. During The Gulf War in the early 1990s Saddam Hussein, the Iraqi leader, had an arsenal containing the chemical weapons mustard gas, sarin, and tabun. He used one of these weapons against the Kurds in his own country (CNN, 1991). At the end of the Gulf War, several American servicemen complained of vague and
mysterious symptoms. There were some who thought that these symptoms were due to a chemical weapons attack on U.S. troops that occurred during the Gulf War.

While the symptoms experienced by the Gulf War veterans increased our concern about WMD, they didn’t cause panic for most of the country because the episode occurred distantly and the thought that an attack would ever take place on American soil was unimaginable. However, on September 11, 2001, America was attacked on home soil. Two highjacked airliners were used to strike the twin towers of the World Trade Center in New York City. A third highjacked airliner was used to strike the Pentagon, a fourth airliner crashed in Pennsylvania as passengers fought highjackers, preventing them from carrying out their presumably similar plan on the White House or U.S. Capital. Approximately 3,000 people were killed and 7,000 injured in those attacks (Jacobson et al., 2002). A Middle Eastern terrorist organization known as the Al Qaeda network claimed responsibility for the September 11th attacks.

Between October and November of 2001, 10 confirmed cases of inhalation anthrax were diagnosed in Washington, D.C., New York City, New York, Boca Raton, Florida, and Trenton, New Jersey. The anthrax was spread by spore-containing letters that were sent through the mail to U.S. Senators and media personalities. Anthrax spores were found in several governmental and postal facilities and most victims were exposed as letters were processed through the postal system. Potential exposures numbered in the thousands (Jackson et al., 2002).
to inspect Iraq for WMD and have been met with resistance from both Iraq itself and the United Nations Security Council. However, on November 8, 2002, the United Nations Security Council unanimously approved a resolution calling for reentry for inspections for WMD. On November 13, 2002, the Iraqi government reluctantly agreed to allow United Nations weapons inspectors access to their country. "In their nine-page letter, however, the Iraqis seethed with hostility toward the United States, and repeatedly denied President Bush's assertions that they have weapons of mass destruction, setting the stage for further confrontation between Washington and Baghdad" (Preston, 2002). As the situation in the Middle East becomes more tenuous, the American public contemplates the likelihood of further attacks.

Access to information pertaining to bioweapons is vital for the medical and public health communities to prepare for a bioterrorism attack. Without it the medical community will not be prepared to respond with appropriate diagnostic tests and treatments and the public health community will not be infrastructurally prepared and able to adequately initiate contingency safety and security plans.

In light of the various illnesses and manifestations these bioweapons can cause, the agencies, organizations, and researchers with knowledge regarding bioweapons recommend that health care providers and health care workers become familiar with signs and symptoms of the diseases caused by biological weapons, and related diagnostic and management procedures (Woods & Ashford, 2001; CDC, 2001c; Vastag, 2001; Relman & Olson 2002).
While we know who was behind the hijacking of the four airliners causing the World Trade Center (WTC), Pentagon, and Pennsylvania tragedies, almost a year later the origin of the anthrax letters is still unknown. However, the combination of these attacks gave Americans a new fear: weapons of mass destruction at home. In the immediate aftermath of the attacks, private citizens purchased gas masks and other personal protective equipment.

The military has been researching the risks of a bioterrorism attack for decades. The United States Army Medical Research Institute of Infectious Disease (USAMRIID) conducts research to develop vaccines, drugs, and diagnostics for potential bioterrorism pathogens. USAMRIID has also produced a reference manual of potential bioweapons that includes prophylactic treatment and management of bioweapon victims. In addition to the military research, organizations such as the Johns Hopkins Center for Civilian Biodefense Strategies, the University of North Carolina at Chapel Hill, the University of Alabama at Birmingham, and the Centers for Disease Control and Prevention (CDC) have performed research and disaster exercises to increase knowledge about America's preparedness for an attack (USAMRIID, 2002).

Since the terrorist attacks in the fall of 2001, relations between the United States and many Middle Eastern countries have become strained. The U.S. fought in Afghanistan to oust the Taliban, an oppressive government who also aided the Al Qaeda network in their attacks. Pakistan's government was cautious in its response to the terrorist attacks on the U.S. and the Iraqi government expressed pleasure at the attack on America (Sanger, 2001). America has demanded access
Becoming familiar with the most common biological weapon agents, modes of transmission, appropriate isolation precautions, incubation periods, and exposure symptoms, OHNs will be in a position to recognize patterns of symptoms that could signal a disease outbreak. The OHN will have the necessary information to report information to public health authorities responsible for outbreak investigation. Further, OHNs can implement emergency procedures including post-exposure prophylaxis, treatment, and isolation precautions when appropriate. In this manner the OHN can play a key role in early detection and containment of a disease outbreak.

This paper focuses on how occupational health nurses (OHNs) can maximize their roles utilizing the broad background unique to occupational health nursing in order to assist in the monitoring for and detection of unusual patterns of illness associated with a bioterrorist attack.
CHAPTER II

REVIEW OF THE LITERATURE

Historical Examples of Bioterrorism

Examples of the use of disease producing organisms to intentionally cause death and illness date back centuries. Christopher, Cieslak, Pavlin, & Eitzen, (1997) describe an early use of disease as a weapon. In the 1300s, the Tatars (an army of Mongols and Turks) attacked the Genoese settlers at the seaport of Kaffa on the Crimean peninsula (Encyclopedia.com, 2002). When plague infected the Tatars, they used it to their advantage by catapulting the bodies of plague-infected soldiers into the city. The Tatars took Kaffa, and the Genoese infected with plague, retreated from the city by sea and sailed to various ports throughout the Mediterranean. That episode is thought to have contributed to a pandemic outbreak of plague throughout Europe (Christopher et al., 1997).

During the French and Indian Wars (1754-1767), British Commander Sir Jeffrey Amherst proposed the use of disease in reducing unfriendly American native tribes. The soldiers had suffered an outbreak of smallpox. Blankets contaminated with the virus were given to the American natives with the intent of stimulating a smallpox outbreak among them (Christopher et al., 1997).

According to the University of Alabama at Birmingham (2001), some tribes suffered a mortality rate as high as 50% during the outbreaks. Shenold (2001) states that this same strategy had been used by Pizarro in South America during the 15th century.
Many countries began to research biological weapons prior to and during World War II. The Japanese military experimented with plague and anthrax among other pathogens for use as weapons at Unit 731, a biological warfare research facility located near the town of Pingfan. The center of the Japanese biological weapons development program, Pingfan, contained 150 buildings, 5 satellite camps, and a staff of more than 3000 scientists and technicians. Prisoners were intentionally infected with a variety of pathogens. Between the years of 1932 and 1945, 10,000 prisoners died in the Japanese program at Unit 731 (Christopher et al., 1997).

The United States began a biological weapons program in 1942 that continued through the Korean War and the Cold War. The program included a research and development facility at Camp Detrick, Maryland, testing sites in Mississippi and Utah, and a production facility in Terre Haute, Indiana. The U.S. program was expanded during the Korean War and included a program to develop countermeasures, including vaccines, anti-sera, and therapeutic agents to protect U.S. troops from possible biological attack (Christopher et al., 1997).

By the late 1960s, the U.S. military had developed a biological arsenal that included Bacillus anthracis, Botulinum toxin, Francisella tularensis, Brucella suis, Coxiella burnetii, Staphylococcal enterotoxin B, Venezuelan equine encephalitis virus, Rice blast, wheat stem rust and rye stem rust (Christopher et al., 1997).

In 1969 and 1970, President Richard Nixon ordered an end to America’s biological weapons program. In 1971 the U.S.’s offensive biological stockpile
was destroyed. The “Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological and Toxin Weapons and on Their Destruction” was developed in 1972. This was a treaty that was signed by more than 100 countries. In spite of the treaty, several participatory countries, including Iraq continue to attempt to develop biological weapons (Christopher et al., 1997). In 1979 an outbreak of anthrax occurred in Russia as the result of an accidental release of anthrax spores from a biological weapons research facility there. The outbreak killed 66 of the 77 people who became ill (Christopher et al.).

Modern Events of Concern

Although the government of Iraq denies use of biological weapons during the Gulf War, they do admit to having had a biological weapons arsenal during the Gulf War (Christopher et al., 1997). As shown in table 2.1, it is postulated that several other countries have biological weapons, although one can only speculate on what bioweapons a given country possesses. “It's hard to know exactly what a country has in the way of specific bioweapons- they really don't want a potential adversary to know or they might be able to counter the weapon” (Dr. Nelson Couch, personal communication, November 15, 2002).

Cult followers of Bhagwan Shree Rajneesh contaminated drinking glasses and salad bars with salmonella bacteria in Oregon in 1984. Although there were no deaths from this attack, over 750 people became ill with symptoms of salmonella poisoning (Begley, 2001).

By November of 2001, the anthrax spores sent through the U.S. Postal system resulted in 22 known cases of anthrax with 10 confirmed cases of
inhalation anthrax and 12 confirmed cases of cutaneous anthrax (CDC, 2001e). These cases resulted in five deaths (Candiotti, 2002) with the remaining individuals treated for inhalation anthrax. Five of these cases were postal workers who, as of May 2002, had not returned to work due to complaints of continued illness and fatigue. The remaining victim, a 74-year-old Florida man, has returned to work at the tabloid newspaper where the first anthrax victim died ("Victim expresses frustration," 2002).

In addition, U.S. officials remain suspicious that Iraq maintains a biological weapons arsenal, although as previously stated, the Iraqi government has finally agreed to allow United Nations weapons inspectors access to their country (Preston, 2002).

The Greatest National Security Threat

According to Tara J. O'Toole, MD, MPH, Director of the Johns Hopkins University Center for Civilian Biodefense Strategies (2002), bioterrorism is the greatest national security threat for several reasons:

- lethality
- ease of access
- financial feasibility
- advances in biotechnology

The first reason is that bioweapons are highly lethal. The Office of Technology Assessment (now closed) estimated in 1993 that 100 kilograms of anthrax could kill between 130,000 and 3 million people depending on population, weather conditions, and other variables (Henderson, 2001).
Table 2.1

Countries Suspected of Harboring Biological Weapons

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<td>China</td>
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<td>Israel</td>
<td>Taiwan</td>
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<td>Kazakhstan</td>
<td>Vietnam</td>
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(From Cole 1996, Garrett, 2001 as cited in Gwerder, Beaton, & Daniell, 2001)
Relman and Olson (2002) discuss a second reason for the increased threat attributable to a bioweapons attack as the ease of accessibility of these agents:

“They are also easy to obtain (with more than 400 strain repositories around the world, in addition to clinical microbiology laboratories), easy to produce (most undergraduate, graduate and postdoctoral students in microbiology and related fields have the necessary background), easy to conceal, and are becoming increasingly easy to deliver” (p. 25).

Danzig and Berkowsky (1997) discuss a third reason that ranks bioterrorism as a significant threat to national security; it is an effective tactic even for “small groups of people with modest finances.” Relman and Olson (2002) referred to bioweapons as the “poor man’s atomic bomb.” Because of the potential for large numbers of fatalities, enemies who have an inferior military force may still feel confident in attacking larger, superior armies.

A fourth and particularly frightening factor that makes bioterrorism a major threat to national security centers on recent advances in biotechnology. Scientists can now create the Ebola virus from “scratch,” that is, from non-living material (O’Toole, 2002). It is equally frightening to consider creation of more virulent strains of pathogens that already exist. Consider the case of the Australian scientists who, in early 2001, caused the mutation of a rodent virus:

“The lethal mouse virus was the unintended creation of investigators at the Co-operative Research Centre (CRC) for the Biological Control of Pest Animals, Canberra. The researchers, who were attempting to create a contraceptive vaccine to be used for pest control, used mousepox virus as
a vector to introduce genes for mouse egg proteins into mice for the purpose of stimulating anti-egg antibodies to curb fertility. (The types of mice used in the study are normally resistant to mousepox infection.) However, when the researchers introduced another element— a gene for interleukin 4 (IL-4)— into the mousepox vector to help boost antibody production, they made a surprising discovery: instead of having the desired effect, the modified mousepox virus suppressed the animals' cell-mediated immunity and killed all the mice within nine days. The gene alteration also made vaccines that normally protect mice against mousepox less effective" (Stephenson, 2001, p. 278).

While mousepox itself is not harmful to humans, the technology that rendered it lethal to mice could theoretically, be used on viruses that affect humans as well. This ability to engineer lethal pathogens from existing, less virulent strains, presents an alarming prospect. In spite of technological advances, man remains relatively ill equipped to respond efficiently to a mass outbreak of one of these pathogens in either its natural state or technologically altered (O'Toole, 2002).

Finally, global interconnectedness has made the human species more vulnerable to disease. Transmission of any illness that can be spread from person to person will be spread farther and faster than ever before. During the influenza pandemic of 1918, it took approximately six weeks for the illness to circle the globe. Thanks to today's international travel, a bioterrorism attack could circle the globe in a matter of hours or days rather than weeks. Urbanization, intrusion
into remote areas, a global food supply, and antibiotic resistance also increase our vulnerability to a disease outbreak (O'Toole, 2002).

**Dark Winter- An Exercise in Bioterrorism**

In June of 2001, The Johns Hopkins Center for Civilian Biodefense Strategies partnered with several other non-military agencies to simulate a national security response to a bioterrorist attack. During a series of mock “National Security Council” meetings responding to a fictitious smallpox attack, council members debated and acted on a variety of policy options. Decisions made dictated succeeding scenarios (O'Toole & Inglesby, 2001).

After the exercise was completed and analyzed by the Hopkins Center, the conclusions reached revealed significant deficiencies in the United States’ ability to effectively manage a bioterrorist attack. Many major issues revolved around lack of information and lack of resources.

1) **Leaders are unfamiliar with the character of bioterrorist attacks, available policy options, and their consequences.** Senior decision makers were not familiar with the events that would follow a bioterrorism attack. Critical decisions and their implications were dependant on public health strategies and possible mechanisms to care for large numbers of sick people- issues that the national security and defense officials were not experienced in analyzing.

2) **Following a bioterrorist attack, leaders' key decisions would depend on data and expertise from medical and public health sectors.** During the exercise, after the smallpox attack was recognized, decision makers wanted information that was not readily available such as, access to information about the location of
the original attacks, ability to predict the size of the epidemic based on initial cases, how many people were exposed, how many people had been hospitalized, and how to track those vaccinated. The lack of this information illustrated to leaders that there is not a system that can provide a rapid flow of medical and public health information needed in a public health emergency.

3) The lack of sufficient vaccine or drugs to prevent the spread of disease severely limits management decisions. The shortages of the smallpox vaccine adversely affected the ability to contain the epidemic. It contributed to panic as citizens rushed to get vaccinated and had an effect on decisions made by leaders. For example one participant questioned how the decision would be made as to who would get the vaccine and who would not (O'Toole & Inglesby, 2001).

4) The U.S. health care system lacks the surge capacity to deal with mass casualties. During the exercise, hospitals across the country were inundated with demands for care. The demand was highest in the areas where the outbreaks occurred. Some fictional "victims" traveled from areas where outbreaks occurred to other locations prior to becoming symptomatic. This action distributed victims across the country. In addition to the smallpox victims, people who worried that they had been exposed to smallpox requested treatment. Additionally there were those who had common illnesses but thought they had smallpox.

5) To end a disease outbreak after a bioterrorist attack, decision makers will require ongoing medical advice from senior public health and medical leaders. The leaders in Dark Winter faced dwindling supplies of vaccines and an
expanding epidemic. Initiating quarantine was suggested but it was not clear if that would have helped interrupt the transmission of disease.

6) The individual actions of U.S. citizens will be critical in ending the spread of contagious disease- leaders must gain the trust and sustained cooperation of the American People. Participants in the Dark Winter exercise expressed concern that it would be unlikely that vaccination and quarantine of large groups of people would be possible without their cooperation. Officials acknowledged the need to reassure the public that resources were being distributed fairly, that disease containment measures were for the good of society in general, and that the government remained in control (O'Toole & Inglesby, 2001).

**Combating Bioterrorism**

Combating bioterrorism requires a stronger public health infrastructure (O'Toole, 2002). There is not an effective system to the United States Public Health System, but rather “fragmented pattern of activities” related to responding to infectious disease outbreaks (Henderson, 2001).

State and local public health departments are also disjointed. Currently many state and local health departments do not have internet access and are not connected to other public health departments through a strong network. Public health officials will be called upon to lead a response to disease outbreaks as a result of a bioterrorist attack. This will prove difficult with the current system. It
will also be public health departments who will be expected to educate, inform, and reassure the public in the event of this type of disaster (Henderson, 2001).

In an outbreak originating from multiple sites, such as the anthrax that appeared in both Florida and Washington D.C. following the September 11, 2001 attack, information exchange among public health agencies, between public health and our country’s decision markers, the private health care sector, and the public in general will be paramount. The lack of information technology and communication between departments could hinder recognizing and reporting of an illness outbreak, the ability to provide guidance to health care providers, and the access to educate, inform and reassure the public, all important public health functions. Strengthening the communication and cooperation between federal, state, and local health departments, and developing a system-wide plan for responding to such a disaster is vital to a satisfactory outcome should we fall victim to such an attack. (O’Toole, 2002).

Another key issue in the face of a bioweapons attack is that most health care providers are unfamiliar with the presentation of illness and treatments for the pathogens that are likely to be used in such an attack (Waeckerle, 2000; Vastag, 2001; Relman & Olson, 2002). Clinicians must be trained to recognize the symptoms of illness related to the most common bioterrorism pathogens (Danzig & Berkowsky 1997; Simon 1997). They should also be included in community preparedness programs (Waeckerle, 2000). Finally, because clinicians will be in the front line for remediation in the wake of a bioweapons attack, they should be alert to the occurrence of specific syndromes that might
herald an outbreak (CDC, 2001c; Lederberger, 1997; Waeckerle, 2000; Gwerder & Beaton, 2001). The occurrence of such specific syndromes can be the first indication of a bioterrorist attack (Shenold, 2001).

Urgency in reporting findings to the appropriate public health agency is essential. Often diagnostic tests able to confirm these unusual pathogens can take time, delaying reporting and treatment. For example, in October of 2001, a postal worker at the Brentwood facility in Washington D.C., was working near a woman who handled a letter that contained a white powder in it. On October 16, three days after the exposure, the worker began to have symptoms consistent with inhalation anthrax. October 18th, the worker had a culture for anthrax done at his private physician’s office. By October 21, he was seriously ill, but did not yet have the results of his culture tests. Desperate, he called 911 and told the dispatcher that he thought he had anthrax, because his symptoms seemed to be consistent with what he had read. He died of inhalation anthrax later that day (O’Connor, 2001).

**Bioterrorism Agent Categories**

The actions of the bacterial agents are described in USAMRIID’s medical management of biological casualties handbook:

Bacteria generally cause disease in human beings and animals by one of two mechanisms: by invading host tissues, and by producing poisons (toxins).

Many pathogenic bacteria utilize both mechanisms. The diseases they produce often respond to specific therapy with antibiotics (Kortepeter et al., 2001, p. 13).
Viral pathogens, on the other hand do not respond to treatment with antibiotics. Treatments range from supportive measures to antiviral medications.

The CDC (2001a) categorizes potential bioweapons according to the following criteria: 1) public health impact based on illness and death; 2) delivery potential to large populations based on stability of the agent, ability to mass produce and distribute a virulent agent, and potential for person-to-person transmission of the agent; 3) public perception as related to public fear and potential civil disruption; and 4) special public health preparedness needs based on stockpile requirements, enhanced surveillance, or diagnostic needs.

Biological warfare agents and potential biological threat agents were reviewed by the CDC and selected based on the greatest threat to civilian populations. Table 2.2 lists the highest-priority agents in Category A, followed by second and third highest priority agents in categories B and C, respectively (CDC 2001a).

**Specific Bioterrorism Agents**

It is beyond the scope of this paper to outline all known potential bioterrorism agents; therefore this paper will address the key characteristics of the CDC category A agents including pathophysiology, epidemiology, dispersal and transmission, incubation period, symptoms, diagnostic methods, treatment and isolation precautions, and prevention. Table 2.3 lists a brief summary of the category A pathogens; however, the reader is directed to the USAMRIID'S Medical Management of Biological Casualties Handbook, 4th edition for more complete information on clinical features, diagnostics, and medical management of the category A pathogens as well as the category B and C agents.
Table 2.2

Biological Agent Categories

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<th>Category B</th>
<th>Category C</th>
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<td><strong>Agent</strong></td>
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<td><em>Bacillis anthracis</em></td>
<td><em>Brucella species</em></td>
<td>Emerging infectious</td>
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<td><em>Clostridium botulinum</em></td>
<td><em>Epsilon toxin</em></td>
<td>Disease threats such as</td>
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<td><em>Yersinia pestis</em></td>
<td><em>Clostridium perfringens</em></td>
<td><em>Niaph virus and Flantavirus</em></td>
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<td><em>Variola major</em></td>
<td><em>Food safety threats</em></td>
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<td><em>Burkholderia mallei</em></td>
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<td>Viral Hemorrhagic Fevers:</td>
<td><em>Burkholderia psuedomallei</em></td>
<td></td>
</tr>
<tr>
<td><em>Arenoviridae</em></td>
<td><em>Chlamydia psittaci</em></td>
<td></td>
</tr>
<tr>
<td><em>Filoviridae</em></td>
<td><em>Coxiella burnetii</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Ricinus communis</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Staphylococcal EnterotoxinB</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Rickettsia prowazekii</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viral encephalitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water safety threats</td>
<td></td>
</tr>
<tr>
<td><strong>Priority</strong></td>
<td><strong>Priority</strong></td>
<td><strong>Priority</strong></td>
</tr>
<tr>
<td>Highest</td>
<td>Second Highest</td>
<td>Third Highest</td>
</tr>
<tr>
<td><strong>Dissemination</strong></td>
<td><strong>Dissemination</strong></td>
<td><strong>Dissemination</strong></td>
</tr>
<tr>
<td>Easily disseminated or transmitted from person to person</td>
<td>Moderately easy to disseminate</td>
<td>Ease of production and dissemination</td>
</tr>
<tr>
<td><strong>Mortality</strong></td>
<td><strong>Mortality</strong></td>
<td><strong>Mortality</strong></td>
</tr>
<tr>
<td>High Mortality</td>
<td>Low Mortality Moderate Morbidity</td>
<td>Potential for high morbidity and mortality rates and major health impact</td>
</tr>
<tr>
<td><strong>Public Health Considerations</strong></td>
<td><strong>Public Health Considerations</strong></td>
<td><strong>Public Health Considerations</strong></td>
</tr>
<tr>
<td>Might cause public panic and social disruption. Requires special action for public health preparedness.</td>
<td>Requires specific enhancements of CDC’s diagnostic capacity and enhanced disease surveillance</td>
<td>Could be engineered for mass dissemination in the future due to availability.</td>
</tr>
</tbody>
</table>
Table 2.3

Summary of Category A Agents

<table>
<thead>
<tr>
<th>Causative organism</th>
<th>Illness</th>
<th>Incubation Period</th>
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<th>Isolation Precautions</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus anthracis</td>
<td>Inhalational Anthrax</td>
<td>1-6 days</td>
<td>Flu-like symptoms (fever, fatigue, muscle-aches, dyspnea, nonproductive cough, headache) chest pain, possible 1-2 day improvement then rapid respiratory failure and shock. Meningitis may develop.</td>
<td>Gram stain</td>
<td>Ciprofloxacin 400 mg IV q 8-12 h OR</td>
<td>Contact isolated</td>
<td>Vaccine- Michigan Biological Products Institute vaccine (licensed): 0.5mIC at 0, 2, 4 wk and 6, 12, 18 mo, and annual booster.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ag-ELISA</td>
<td>Doxycycline 200mg IV, then 100 mg IV q</td>
<td>isolation for cutaneous anthrax</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Serology</td>
<td>8-12 h OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ELISA</td>
<td>Penicillin 2 million units IV q 2 h PLUS anthrax</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Streptomycin30 mg/kg IM qd (or Garamycin)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutaneous Anthrax</td>
<td></td>
<td>1-12 days</td>
<td>Intense itching followed by painless popular lesion s, then vesicular lesions, developing into eschar surrounded by edema</td>
<td>Peripheral blood smear</td>
<td></td>
<td></td>
<td>Exposure: Ciprofloxacin 500 mg PO bid x 4 wk (if unvaccinated begin vaccine regimen) OR Doxycycline 100 mg PO bid x 4 wk plus vaccination</td>
</tr>
</tbody>
</table>

(table continues)
### Table 2.3

**Summary of Category A Agents (continued)**

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<tr>
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<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Clostridium botulinum</em> toxins</td>
<td>Botulism</td>
<td>1-5 days</td>
<td>Afebrile, excess mucous in throat, dysphagia, dry mouth and throat, dizziness, then difficulty moving eyes, mild papillary dilation and nystagmus, intermittent ptosis, indistinct speech, unsteady gait, extreme symmetric descending weakness, flaccid paralysis, generally normal mental status.</td>
<td>Ag-ELISA</td>
<td>DOD- heptavalent antitoxin for (serotypes A-G) (IND): equine despeciated 1 vial (10 ml) IV CDC- Trivalent equine antitoxin for Serotypes A,B,E (licensed)</td>
<td>Standard</td>
<td>DOD pentavalent toxoid for serotypes A-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mouse neutral</td>
<td>Precautions</td>
<td></td>
<td>E (IND: SC at O, 2, 12 wk, then yearly boosters)</td>
</tr>
</tbody>
</table>

(table continues)
Table 2.3

Summary of Category A Agents (continued)

<table>
<thead>
<tr>
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<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Francisella tularensis</em></td>
<td>Tularemia</td>
<td>2-10 days</td>
<td>Fever, headache, chills, rigors, body aches, sore throat. dry or slightly productive cough and chest pain or tightness, purulent sputum, dyspnea, tachypnea, pleuritic pain, hemoptysis nausea, vomiting, diarrhea, malaise, anorexia, and weight loss</td>
<td>Culture-Serology: agglutination</td>
<td>Streptomycin 30 mg/kg IM qd x 10-14 d OR Gentamicin 3-5 mg/kg/d x 10-14/d</td>
<td>Standard precautions</td>
<td>Live attenuated vaccine (IND) Searification. Exposre: Doxyccline 100 mg PO q12h x 14 d OR tetracycline 2 g/d PO x 14 d</td>
</tr>
</tbody>
</table>

(Table Continues)
### Table 2.3

#### Summary of Category A Agents (continued)

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<thead>
<tr>
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<th>Treatment</th>
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<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variola major</td>
<td>Small Pox</td>
<td>7-17 days</td>
<td>Prodromal period: malaise, fever, rigors, vomiting, headache, and backache...</td>
<td>ELISA, PCR&lt;</td>
<td>Cidofovir (effective in vitro)</td>
<td>Airborne precautions</td>
<td>Wyeth calf lymph vaccinia vaccine (licensed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After 2 - 4 days, skin lesions appear and progress uniformly from macules to papules to</td>
<td>virus isolation</td>
<td></td>
<td></td>
<td>DOD cell culture derived vaccinia vaccine (IND) scarification</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vesicles and pustules mostly on face, neck, palms, soles, and subsequently progress to trunk.</td>
<td></td>
<td></td>
<td></td>
<td>Exposure: Vaccinia immune globulin 0.6 mL/kg IM (within 3 d of exposure: best within 24 hr)</td>
</tr>
</tbody>
</table>
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<th>Prevention</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Greer inactivated vaccine (licensed):</td>
</tr>
<tr>
<td>Yersinia</td>
<td>Pneumonic</td>
<td>2-3 days</td>
<td>High fever, cough, hemoptysis, chest pain, nausea, vomiting, headache. Advanced disease:</td>
<td>Gram or Write-</td>
<td>Streptomycin 30 mg/kg IM qd in</td>
<td>Pneumonic:</td>
<td>1.0 ml then 0.2 ml boost at 1-3 and 3-6</td>
</tr>
<tr>
<td>Plague</td>
<td></td>
<td></td>
<td></td>
<td>Giemsa Stain, Ag-</td>
<td>2 divided doses x 10 day (or Droplet)</td>
<td></td>
<td>10 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ELISA,</td>
<td>Garamycin OR</td>
<td>precaution</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Culture, Serology:</td>
<td>Doxycycline 200 mg IV then</td>
<td>until patient</td>
<td>Exposure:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ELISA, IFA</td>
<td>100 mg IV q 12 h x 10-14 days</td>
<td>treated for 3</td>
<td>Tetracycline 500 mg PO qid x 7 d OR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OR</td>
<td>days</td>
<td>Doxycycline 100 mg PO q12hx7d</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Chloramphenicol 1 g IV q 6 h x</td>
<td>10-14 d</td>
<td>Vector (Rodent) control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bubonic</td>
<td>2-7 days</td>
<td>Eschar at bite mark, painful bubo, fever, headache, prostration, abdominal distress, enlarged lymphnodes, rigors, nausea, vomiting, diarrhea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plague</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Septicemic</td>
<td></td>
<td>(may be bloody) cutaneous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plague</td>
<td></td>
<td>petechiae, DIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(table continues)
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<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arenaviridae</td>
<td>Argentine</td>
<td>6–17 days</td>
<td>fever, headache, myalgia</td>
<td>Serum IgM</td>
<td>Ribavirin for Lassa</td>
<td>Contact</td>
<td>No vaccine</td>
</tr>
<tr>
<td></td>
<td>(AHF)</td>
<td></td>
<td>conjunctival suffusion</td>
<td>Increase in IgG antibody titers</td>
<td>fever or HFRS; precautions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolivian</td>
<td></td>
<td>abdominal pain, axillary</td>
<td>Collected serially or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(BHF)</td>
<td></td>
<td>petechiae, mucosal bleeding</td>
<td>identification of viral antigen in blood or tissue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Venezuelan</td>
<td></td>
<td>thrombocytopenia, platelet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(VHF)</td>
<td></td>
<td>dysfunction, proteinuria,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemorrhagic</td>
<td>shock, encephalopathy,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fevers</td>
<td>tremor, alterations in consciousness,</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(table continues)
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</tr>
</thead>
<tbody>
<tr>
<td><em>Bunyaviridae</em></td>
<td>Hantavirus</td>
<td>1-3 weeks</td>
<td>hypoalbuminemia, thrombocytopenia</td>
<td>Serum IgM and IgG virus</td>
<td>Supportive</td>
<td>Contact precautions</td>
<td>No vaccine</td>
</tr>
<tr>
<td>(HPS)</td>
<td></td>
<td></td>
<td>arterial oxygen desaturation, pulmonary edema</td>
<td>specific antibodies present in early convalescence.</td>
<td></td>
<td>with special attention</td>
<td></td>
</tr>
<tr>
<td>Congo</td>
<td></td>
<td></td>
<td>CCHF- hepatitis, profuse bleeding, fever,</td>
<td>HPS IgM and IgG antibodies are detectible within 48 hours of illness onset</td>
<td></td>
<td>to needle sticks and other hazards posed by laboratory specimens.</td>
<td></td>
</tr>
<tr>
<td>Crimean</td>
<td></td>
<td></td>
<td>headache, myalgia, diffuse capillary leak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemorrhagic</td>
<td></td>
<td></td>
<td>syndrome, bradycardia, petechiae/purpura- skin and mucous membranes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever (CCHF)</td>
<td></td>
<td></td>
<td>RVF- in most cases a self limiting febrile illness- occasionally patients develop hemorrhagic fever with shock and bleeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rift Valley Fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(RVF)</td>
<td></td>
<td></td>
<td></td>
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<tbody>
<tr>
<td><em>Filoviridae</em></td>
<td>Ebola Virus</td>
<td>4 – 6 days</td>
<td>Headache, malaise, myalgia, high fever, diarrhea, abdominal pain, dehydration, lethargy, pleuritic chest pain, dry cough, pharyngitis, maculopapular rash, hematemesis, melena, bleeding from the nose, gums and vagina.</td>
<td>Patients should be isolated until virologic studies indicate they are free of virus, usually 21 days from onset of illness.</td>
<td>Convalescent-Phase serum may be helpful.</td>
<td>Strict Isolation with particular attention to specimen handling.</td>
<td>No vaccine or post exposure prophylaxis</td>
</tr>
<tr>
<td></td>
<td>Marburg Virus</td>
<td>3 – 9 days</td>
<td>As above, + produces lesions in almost all organs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Flaviviridae</em></td>
<td>Dengue Fever</td>
<td>3 – 14 days</td>
<td>Fever, cough, pharyngitis, headache, anorexia, nausea, vomiting, abdominal pain, circumoral cyanosis, petechiae on the forehead and extremities, cyanotic extremities, hypotension.</td>
<td>Serologic testing or viral testing. Both viruses can be isolated from blood obtained in the acute phase of the illness.</td>
<td>Supportive therapy, possibly Interferon.</td>
<td>Standard precautions</td>
<td>Live attenuated virus for yellow fever available at state approved vaccination centers.</td>
</tr>
<tr>
<td></td>
<td>Yellow Fever</td>
<td>3 – 6 days</td>
<td></td>
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</tbody>
</table>
BACILLIS ANTHRACIS (ANTHRAX)

Anthrax is a zoonotic disease caused by the bacteria *Bacillus anthracis*. It occurs primarily in domestic herbivores such as cattle, sheep, goats, swine, and horses. It can be passed from animals to humans through the handling or processing of contaminated wool, hides, and other animal products. *B. anthracis* produces hardy spores, which may persist in a viable state in the environment for years. Anthrax infections present in three forms: inhalation, cutaneous, and gastrointestinal (CDC, 2001a; Franz, et al., 1997). According to Shenold (2001), inhalation anthrax will account for the majority of mortality and morbidity following an intentional release of anthrax. Untreated inhalational anthrax can lead to septicemia and death. Untreated cutaneous anthrax resolves spontaneously in approximately 80% to 90% of cases. The remaining 10% to 20% of untreated cutaneous anthrax cases lead to progressive infection and death (Fauci et al., 1994). Case-fatality rates for inhalational anthrax are thought to approach 90% to 100%. Early treatment of cutaneous anthrax is usually curative (CDC, 2001f).

Pathophysiology

*B. anthracis* is deposited into the alveoli after the inhalation of anthrax spores. Some spores are destroyed by macrophages. Other spores are transported to the mediastinal lymph nodes by the lymphatic system. After a dormancy period of 2 to 43 days, germination occurs followed by the onset of clinical symptoms. *B. anthracis* bacilli release toxins that cause tissue hemorrhage, edema, and necrosis. In cutaneous anthrax, toxins cause local necrosis and
edema, and if severe enough can progress until bacteremia develops (Inglesby et al., 2002).

**Epidemiology**

Naturally occurring inhalational anthrax is rare. Eighteen cases were reported between 1900 and 1976; none have since been reported. Most of the reported cases originated in those working with animal hides or wool with two cases in laboratory workers. Cutaneous anthrax is more common. Approximately 2,000 cases are reported yearly worldwide. Generally cutaneous anthrax is attributable to contact with infected animals. In the U.S. 224 cases of cutaneous anthrax were reported between 1944 and 1994. Inhalational anthrax is expected to account for most of the illness and death following a bioterrorist attack with *B. anthracis*. A single case is significant since it rarely occurs naturally (Inglesby et al., 2002).

**Dispersal and Transmission**

Anthrax can be released as an aerosol, that is, the agent dispersed as a respirable aerosol with particles approximately 1 – 10 μm in diameter. Dispersing a respirable aerosol requires a high energy generating system to produce the small particle size, appropriate weather conditions to assure the aerosol cloud stays near the ground, and adequate infectivity or toxicity of the agent to produce illness or death (Zajtchuk, 1997). The infective dose has been reported as low as 1 - 3 spores and as high as 8,000 to 50,000 spores (Inglesby et al., 2002; Franz et al., 1997). It is also effective as a powder as evidenced by the anthrax cases of 2001. A total of two grams of powder was used, which is reported to have contained
between 100 billion to 1 trillion spores per gram (Inglesby et al., 2002). The outcome was 10 cases of inhalation anthrax and five resultant deaths. Anthrax is not transmitted from person to person. Exposure can occur through contact with contaminated food, water, or through cutaneous contact as well as through inhalation (Franz et al., 1997; Kortepeter et al., 2001).

**Incubation**

The incubation period for anthrax varies from one day to approximately six days (Franz et al., 1997; Kortepeter et al., 2001). According to the CDC, symptoms could begin as long as 60 days post-exposure (CDC, 2001b).

**Symptoms**

The first stage of inhalation anthrax resembles the flu. Initial symptoms include sore throat, mild fever, muscle aches, and malaise. A non-productive cough, and nonspecific chest discomfort follows. Symptoms may improve for two to three days before progressing to the second stage characterized by severe respiratory distress with an abrupt onset, dyspnea, stridor, and diaphoresis (Franz et al, 1997). Shock with meningitis frequently develops (CDC, 2001a). In the second stage cyanosis and hypotension progress rapidly and death can occur within hours (Inglesby et al., 2002).

**Diagnosis**

The most useful test is a standard blood culture, which shows growth in 6 to 24 hours; however, blood cultures must be drawn prior to the initiation of antibiotics. The laboratory should be alerted to the possibility of anthrax, as biochemical testing and review of colonial morphology could provide a
preliminary diagnosis in as little as 12 to 24 hours. Sputum and gram stain are unlikely to be diagnostic of inhalational anthrax. In cutaneous anthrax, gram stain can be performed on the vesicular fluid in addition to performing blood cultures. Nasal swab testing for inhalational anthrax has an unknown predictive value (Inglesby et al., 2002).

**Treatment and Isolation Precautions**

The treatment of choice for inhalation anthrax is Ciprofloxin- a quinalone antibiotic given intravenously. However, following the anthrax attacks of 2001, the CDC recommended the use of two or three antibiotics in combination in persons with confirmed inhalational anthrax. Pleural effusions were present in all of the first 10 patients with inhalational anthrax in 2001. Seven required drainage of their pleural effusions, and three required chest tubes. Future patients with inhalational anthrax should be expected to have pleural effusions that will likely require drainage (Inglesby et al., 2002). Hospitalization for treatment and supportive therapy for airway management, shock, and fluid volume deficit are essential as well (Franz et al., 1997).

**Prevention**

Pre-exposure vaccination is available but recommendations for its use have been limited to the military and other [unnamed] high-risk groups. Recommended post-exposure prophylaxis consists of treatment with ciprofloxacin or other fluoroquinolone initiated in adults with presumed inhalational anthrax infection. Antibiotic resistance to penicillin- and tetracycline-class drugs should be assumed following a terrorist attack until laboratory testing demonstrate
susceptibility. Once the antibiotic susceptibility of the *B. anthracis* strain has been confirmed, the most widely available, effective, and least toxic antibiotic is recommended for persons requiring post-exposure prophylaxis (Inglesby et al., 2002).

**CLOSTRIDIUM BOTULINUM (BOTULISM)**

Botulism is caused by the botulinum toxins, a group of seven related neurotoxins produced by the spore-forming bacillus, *Clostridium botulinum* and two other Clostridia species (Franz et al., 2001). Like *B. anthracis*, this bacterium is found in the soil and forms spores. They grow best in environments with low oxygen content. Approximately 110 cases of botulism are reported in the United States every year. Most often these cases are foodborne or infant botulism (CDC, 2001a.) Infant botulism is the most common form of botulism and occurs when *C. botulinum* colonizes the relatively germ free intestines of infants. A common source of *C. botulinum* in infants is contaminated honey. According to Franz et al., (1997) *C. botulinum* could be delivered by aerosol or via water supplies. In either case the clinical presentation would resemble that of a foodborne infection.

**Pathophysiology**

Botulinum toxin attaches to the synaptic vesicles of cholinergic nerves and blocks the release of acetylcholine. This results in a descending paralysis from the cranial nerves to the extremities. Paralysis of the respiratory muscles also occurs. Once the toxin has entered the synapses, the antitoxin can no longer inactivate it and only intensive, supportive care is useful. Approximately 85% of the victims
who receive such care recover. Most of the cases that result in death are caused by respiratory infections (Cotran, Kumar & Robbins, 1989).

**Epidemiology**

Recognizing a botulism outbreak requires heightened clinical suspicion. Aerosol dissemination may be readily identifiable because the majority of cases will occur in the same location and time period but will not have a common dietary exposure. Botulism and botulinum toxin are not contagious and cannot be transmitted from person to person. However, bacteria intentionally modified to produce botulinum toxin might be contagious.

If food were deliberately used as a vehicle for the toxin, the outbreak would need to be distinguished from naturally occurring foodborne botulism. During the past 20 years, the epidemiology of foodborne botulism has expanded beyond its traditional association with home-preserved foods and now includes non-preserved foods and public eating places—features that could make terrorist use of botulinum toxin more difficult to detect (CDC, 2001f). The case fatality rate for foodborne botulism is approximately 7.5% and is low for infant botulism as well (Fauci et al., 1998).

**Dispersal and Transmission**

The most likely scenario for the dispersal of botulinum toxin in a bioterrorism incident is aerosol dispersal. While it is not as likely, botulinum toxin could be used to contaminate food supplies (Franz et al., 1997). Botulism is not transmitted from person to person (Franz et al., 1997).

**Incubation**
The incubation period for botulism is from one to five days. However, the onset of symptoms is dose-dependant; therefore, a large dose results in rapid onset of severe symptoms.

**Symptoms**

Following ingestion, the onset of symptoms begins with cranial nerve palsies, followed by symmetrical descending flaccid paralysis, with generalized weakness and progression to respiratory failure. Because the symptoms are dose dependant, it may be up to five days after exposure before the onset of symptoms when the exposure is to low doses of toxin (Kortepeter et al., 2001).

**Diagnosis**

The most direct way to confirm the diagnosis of botulism is to demonstrate the botulinum toxin in the patient's serum or stool by injecting serum or stool into mice and looking for signs of botulism in the mice. The bacteria can also be isolated from the stool of persons with foodborne and infant botulism. These tests can be performed at some state health department laboratories and at CDC (CDC, 2001).

**Treatment and Isolation Precautions**

Botulism is treated with an antitoxin. Early administration of the antitoxin is crucial. The antitoxin is only effective against circulating toxins in patients with symptoms that are progressing. Once the toxin enters the synapses the antitoxin cannot inactivate it. Also once symptoms stop progressing, the antitoxin is no longer effective.
Three different antitoxin preparations are available from the CDC via state and local health departments. A trivalent antitoxin contains antibodies against botulinum toxin types A, B, and E, the most common causes of human botulism. If another toxin type were intentionally disseminated, patients could potentially be treated with an investigational heptavalent (ABCDEFG) antitoxin held by the U.S. Army. A human anti-serum for infant botulism is still being evaluated for effectiveness (Kortepeter et al., 2001). Anti-serum is administered by both intravascular and intra-muscular routes (Fauci et al., 1998).

Patients should be hospitalized and monitored closely (Fauci et al., 1998). In addition to antitoxin, treatment including ventilatory support is indicated. In the event of foodborne botulism, removal of contaminated stomach contents is performed by lavage (CDC 2001c).

**Prevention**

Research indicates that botulinum antitoxin is very effective for aerosol exposure if given before the onset of symptoms, as the toxin has not begun to interfere with the release of acetylcholine (Kortepeter, et al, 2001). Prophylactic equine anti-toxin for asymptomatic persons who have ingested a food known to contain botulinum toxin is not recommended due to the risk of hypersensitivity reactions (American Academy of Pediatrics, 1997).

**FRANCISELLA TULARENSIS (TULAREMIA)**

Tularemia is caused by *Francisella tularensis*. It is a highly infectious bacterium, causing flu-like illness with progression to pneumonia and death with
exposure to as few as 10 organisms (Dennis et al., 2001). It is resistant to cold but can be killed by heat or chemical disinfectants.

**Pathophysiology**

*F. tularensis* enters through the skin, mucous membranes, gastrointestinal tract, or lungs. It spreads to the lymph nodes and multiplies, and then spreads to organs throughout the body, predominantly affecting the skin, liver, spleen, and lymph nodes. Bacteremia is common in the early stages of infection. Initially there is a local reaction at the site of infection that becomes suppurative and necrotic. Inhalational exposures develop hemorrhagic inflammation of the airways that can progress to pneumonia. Alveolar spaces fill with an exudate of mononuclear cells. Pleuritis with adhesions and effusion and hilar lymphadenopathy are common radiological and pathological findings (Dennis et al., 2001).

**Epidemiology**

Tularemia has been reported from every state except Hawaii; however, most cases occur in south-central and western states (especially Missouri, Arkansas, Oklahoma, South Dakota, and Montana). Approximately 140 to 310 infections are reported in the U.S. each year, mostly from persons handling rabbits or rabbit skins (Cotran, Kumar, & Robbins, 1987). Ticks and tabanid flies serve as vectors. Animal reservoirs include wild rabbits, squirrels, birds, sheep, beavers, muskrats, and domestic dogs and cats. *F. tularensis* is a hardy organism that can persist for months in mud, water, and decaying animal carcass. Ticks
pass the organism to their offspring via a transovarian route. Tularemia has a fatality rate of 5% if untreated (Fauci et al., 1998).

**Dispersal and Transmission**

The working group on Civilian Biodefense believes that of the various possible ways that *F. tularensis* could be used as a weapon, an aerosol release would cause the greatest adverse medical and public health consequences (Dennis et al., 2001). The organism is present in tick feces and it is transmitted as a tick takes a blood meal in an area contaminated with its feces (Fauci et al., 1998). It can also be contracted through ingestion of contaminated food or water or through inhalation. Human-to-human transmission has not been documented (Dennis et al., 2001).

**Incubation**

The incubation period for tularemia ranges from 2 to 10 days.

**Symptoms**

The onset of tularemia is abrupt, with fever, headache, chills and rigors, myalgias, coryza, and sore throat. A dry or slightly productive cough and substernal pain or tightness may occur. Nausea, vomiting, and diarrhea sometimes occur. Progressive weakness, malaise, anorexia, and weight loss develop with continued illness. If untreated, symptoms can persist for weeks or months causing with progressive disability. Tularemia can also cause pneumonia, sepsis, and, meningitis (Dennis et al., 2001).
Diagnosis

Diagnosis of typhoidal tularemia is difficult as the symptoms are non-specific. The diagnosis can be confirmed by serological testing. In the standard tube agglutination test, a single titer of $\geq 1:160$ is interpreted as a presumptive positive result. A fourfold increase in titer between paired serum samples collected two to three weeks apart is considered diagnostic (Fauci et al., 1998).

Treatment and Isolation Precautions

Streptomycin given intramuscularly or gentamycin given intravenously or intramuscularly are the antibiotics for treatment. Isolation precautions other than universal or standard precautions are unnecessary because tularemia is not spread from person to person. A live attenuated vaccine is currently under review by the Food and Drug Administration. (Franz et al., 1997). The CDC does not list the vaccine’s efficacy.

Prevention

Prevention is based on avoidance of exposure to known vectors. A vaccine made from live attenuated $F. tularensis$ is available from the CDC and is recommend for those at high risk such as game wardens, veterinarians, hunters or people who work with large quantities of cultured organisms. Other considerations include avoidance of the skinning of wild animals, use of gloves for handling animal carcasses, and the use of insect repellant while in endemic areas (Fauci et al., 1998). Post-exposure prophylaxis regimens with oral tetracycline in doses of one gram daily for 28 days or two grams daily for 14 days both provided protection from infection in a research study, when the medication
was begun within 24 hours of exposure to aerosolized *F. tularensis* (Dennis et al., 2001).

**VARIOLA VIRUS (SMALLPOX)**

Smallpox is caused by the *Orthopox virus*, *Variola*. There has not been a naturally occurring case of smallpox reported since 1977 (Franz et al, 1997). In 1980, one year after the World Health Organization officially announced the global eradication of smallpox, the World Health Assembly recommended that all countries cease vaccination (Fauci et al., 1994; Henderson et al, 1999). The level of immunity among persons who were vaccinated is questionable; therefore, no one is considered immune (CDC, 2001a).

**Pathophysiology**

After aerosol exposure, variola travels from the respiratory tract to the lymph nodes where it replicates and causes viral illness followed by a rash. Before onset of pox lesions, variola virus can be detected in the blood. (Franz et al., 1997)

**Epidemiology**

Smallpox was once endemic worldwide. Before vaccination was practiced, almost everyone contracted the disease. The last naturally occurring case of smallpox was reported in 1977 in Somalia. Before the eradication of smallpox, there were two principal forms of the disease. *Variola major* had a mortality rate of 20 to 50% and a much milder form, *variola minor* (or alastrim),
had a mortality rate of less than 1%. Smallpox was a relatively non-contagious disease whose transmission required close contact (Fauci et al., 1998).

**Dispersal and Transmission**

Smallpox is extremely infectious by aerosol route. As few as 10 to 100 organisms is sufficient to cause infection. It is transmitted via aerosol. The mucous membrane lesions shed infectious respiratory secretions during the first few days of illness. These secretions are the most important but not the only means of viral transmission. Variola titers in the throat, conjunctiva, and urine diminish with time, but the virus can be detected in the scabs during the recovery phase of the illness. Therefore, patients should be isolated and considered infectious until all scabs separate. (Franz 1997).

**Incubation**

The incubation period is 7 - 17 days. The average incubation period is 12 days. Progression to vesicular and pustular lesions takes place over one to two weeks.

**Symptoms**

Symptoms include fever, malaise, vomiting, rigors, headache, and backache. Delirium and an erythematous rash are reported by a small percentage of patients. Two to three days later, enanthem appears with a discrete rash on the face, hands, forearms, and oropharyngeal mucosa. Lesions progress from macule to papules to vesicles then to pustular vesicles. Eight to fourteen days after the onset of illness scabs form with subsequent scarring (Franz et al., 1997; Relman & Olson 2002).
Diagnosis

Smallpox infection can be confirmed in the laboratory by electron microscopic examination of vesicular or pustular fluid or scabs. Definitive laboratory identification and characterization of the virus involves growth of the virus in cell culture or on chorioallantoic egg membrane and characterization of strains by use of biologic assays. (Henderson et al., 1999).

Treatment and Isolation Precautions

There is no proven treatment for smallpox but research to evaluate new antiviral agents is ongoing.

Prevention

Although immunization is still available, there is not sufficient quantity of vaccine to inoculate the entire population of the U.S. and so smallpox remains a bioterrorism threat. Persons with suspected smallpox and their close contacts must be placed in strict quarantine with respiratory isolation for 17 days. Current treatment efforts are focused on the evaluation of possible antiviral agents such as cidofovir and its derivatives in the treatment of variola infections (Relman & Olson 2002).

YERSINIA PESTIS (PLAGUE)

*Yersinta pestis* is the bacterium that causes plague, a zoonotic disease of rodents. The disease is transmitted to humans by fleas that live on infected rodents. Symptoms of plague can also develop in domestic pets. Cats who are bitten by infected fleas frequently develop plague and subsequently die; however
dogs often recover. Dogs and cats can transport infected fleas from rodent infested areas to the home environment (Fauci et al., 1998). The bacterium is found worldwide. Plague occurs in humans in three forms: bubonic, septicemic, and pneumonic. In bubonic plague, the site of entry is usually on the leg, a common site for fleabites. It may be marked by a small pustule or ulceration. Regional lymph nodes may enlarge, becoming suppurative, and forming a bubo (Cotran, Kumar, & Robbins, 1989). Septicemic plague is an overwhelming bacterial infection. The infection induces disseminated intravascular coagulation (Fauci, et al., 1998). The pneumonic form of plague would be the most common form of the illness following an intentional release of the pathogen (Franz et al., 1997). It is characterized by a severe confluent, hemorrhagic, and necrotizing bronchopneumonia, often accompanied by fibrous pleuritis (Cotran, Kumar, & Robbins, 1989). Y. Pestis is destroyed by sunlight and drying, but can live in the air for up to an hour, and in water, moist soil, and grain for several weeks (CDC 2001a; Franz et al., 1997).

**Pathophysiology**

In septicemic plague, the kidneys contain fibrin thrombi. Cardiac dilatation may develop and multifocal necrosis of the liver is common as is hemorrhagic splenic necrosis. Disseminated intravascular coagulation (DIC) develops followed by vascular necrosis. Aerosolization would result in an outbreak of pneumonic plague which is spread by inhalation of aerosolized bacilli. Airborne transmission can occur via the cough of a person infected with pneumonic plague.
Epidemiology

There have been significant outbreaks of plague throughout history. In the year 542, a plague pandemic began in Egypt and, within 4 years, had spread around the world. Deaths attributable to plague during those years were 50 to 60 percent. The second plague pandemic began in 1347 and within 5 years had killed more than 40 million people in Europe and China combined.

Plague is still endemic to remote areas in Asia, Africa, the Americas, and southeastern Europe. From 1979 to 1993, 16,320 human plague cases were reported by 20 countries to the World Health Organization. The mortality rate for this time period was 10% (1,668 deaths). During the same time period, there were 227 plague cases with 32 deaths in the United States (14% mortality). From 1950 to 1994, 373 plague cases were reported in the United States. Of these cases, 86% were bubonic plague, 12% were septicemic plague, and 2% were primary pneumonic plague (Fauci, et al., 1998).

Dispersal and Transmission

Naturally occurring plague outbreaks are caused by fleas from infected rodents. The Japanese experimented with releasing plague-infested fleas from airplanes as a means of dispersal, which would result in bubonic plague (Christopher 1997). However, Y. pestis organisms can effectively be dispersed by aerosolization (Johns Hopkins Center for Biodefense Strategies, 2002). The infective dose is 100 to 500 organisms (Franz et al., 1997). Septicemic plague occurs after the direct contact of infected fluid or tissue or from an infected
fleabite in the absence of a bubo. Person to person transmission results from exposure to infective respiratory droplets from a person or cat with respiratory plague or from accidental inhalation of \textit{Y. pestis} in the laboratory (Fauci et al., 1998). Advances in living conditions, public health, and antibiotic therapy make natural pandemics improbable, but plague outbreaks following an attack with a biological weapon do pose a serious threat.

\textbf{Incubation}

According to the Johns Hopkins Center for Civilian Biodefense Studies (2000), a group of cases of pneumonic plague would appear one to two days after the aerosolization exposure. There would be many deaths following the onset of symptoms. The incubation period based on animal studies and human experience is one to six days.

\textbf{Symptoms}

In pneumonic plague, the clinical presentation would include pneumonia, fatigue, malaise, high fever, chills, headache, myalgia, cough with production of bloody sputum and clinical sepsis (Franz et al., 1997).

\textbf{Diagnosis}

Plague should always be considered when a normally healthy person presents with septic shock especially in areas where plague is endemic. Laboratory confirmation of plague depends on the isolation of \textit{Y. pestis} from cultures of body fluids or tissues. Three blood culture specimens taken over a 45-minute period will usually result in isolation of the bacterium (Fauci et al., 1998).
Treatment and Isolation Precautions

Pneumonic plague is usually fatal if treatment is not initiated within 24 hours of the onset of symptoms. Streptomycin, gentamycin, chloramphenicol, and doxycycline have been found to be effective against *Y. pestis*. Supportive therapy includes intravenous fluids, hemodynamic monitoring, and ventilatory support. Droplet precautions should be initiated for any patient with pneumonic plague. A vaccine is available for use against bubonic plague; however, it has not been proven effective against pneumonic plague (Franz et al., 1997).

Prevention

Post-exposure prophylactic treatment with tetracycline, doxycycline, or thrimethoprim-sulfamethoxazole can help prevent development of illness in the event of contact with a person who is known to have plague. Avoidance of sick or dead animals, as well as and avoidance of areas where plague is known to be endemic can help prevent the spread of the disease, as can use of protective clothing and insect repellant when in plague infested areas (Fauci et al., 1998).

HEMORRHAGIC FEVER VIRUSES (HEMORRHAGIC FEVERS)

Hemorrhagic Fever is a category that describes the disease processes resulting from infection by anyone of a number of RNA viruses. Each virus is capable of causing a hemorrhagic fever syndrome. Clinical and epidemiological data related to these viruses are limited; outbreaks are sporadic and unanticipated, and there are few case series or clinical trials involving human subjects (Borio et al., 2002). The viruses are from different viral families. They include *Arenaviridae, Bunyaviridae, Filoviridae*, and the *Flaviviridae* (CDC, 2002).
Although no evidence for weaponization exists for these viruses, they are considered a prospective bioterrorism threat because of their potential for aerosol dissemination or weaponization, or likelihood for confusion with similar agents that might be weaponized (Kortepeter et al., 2001).

**ARENAVIRIDAE**

*Arenaviridae* is family of zoonotic viruses. The natural reservoirs are rodents with each virus associated with a particular type of rodent. The rodent hosts carry the infection but do not develop signs of illness themselves. Various rodent species that carry *Arenaviridae* are found all over the world.


**Pathophysiology**

*Arenaviridae* viral infection begins in the nasal and oropharyngeal mucosa and spreads throughout the body’s cells. The cells are infected but not killed by the viruses. It is thought that these viruses infect the macrophages and cause them to erroneously produce inflammatory cytokines. These cytokines cause leaking of the blood vessels which progresses to hemorrhage (Dr. J. Aronson, personal communication, October 14, 2002). Hemorrhage is aided by the prevention of platelet aggregation, caused by a circulating platelet inhibitor and thrombocytopenia. Disseminated intravascular coagulation is not a central pathogenic mechanism. Lassa fever appears to be terminated by a cellular, not
humoral, immune response, whereas in New World Arenaviruses, recovery is preceded by cellular and humoral immune responses (Borio et al., 2002)

**Epidemiology**

The geographic distribution and habitats of the specific rodents that are the hosts of the virus determine the endemic area and groups of at risk. Argentine, Bolivian, and Venezuelan Hemorrhagic fevers occur in the countries for which they are named at a rate of several hundred cases per year. Lassa fever is endemic to West Africa and where thousands of cases are seen each year. Each virus is carried by a specific rodent species. According to Dr. Aronson (personal communication, October 14, 2002), approximately 1% of those that contract Lassa fever actually die, although during an epidemic in Nigeria in 1969 the case fatality was as high as 50%.

**Dispersal and Transmission**

* Arenaviridae viruses are transmitted through inhalation of aerosols present in rodent urine and feces, by ingestion of food contaminated with rodent waste, or by direct contact of rodent waste with non-intact skin and mucous membranes. Person-to-person transmission of these viruses occurs predominantly by direct contact with infectious blood and bodily fluids. Nosocomial outbreaks have been documented as well and are suspected to have contributed to the Nigerian outbreak in 1969 (Borio et al., 2002).

**Incubation**
The incubation period varies in length depending on the virus in question. Incubation rates range from 6 - 17 days (American Academy of Pediatrics, 1997).

**Symptoms**

The signs and symptoms vary by the type of virus but initial signs and symptoms often include marked fever, muscle aches, headaches, and abdominal pain. In addition, exudative pharyngitis is seen in Lassa fever. In severe cases, vascular damage, platelet dysfunction, and thrombocytopenia cause mucosal bleeding and shock (American Academy of Pediatrics, 1997).

**Diagnosis**

Diagnostic tests for the illnesses caused by the *Arenaviridae* viruses include demonstrating virus specific IgM, an increase in IgG antibody titers in serial serum specimens, viral isolation, or by identifying the viral antigen in blood or tissues (American Academy of Pediatrics, 1997).

**Treatment and Isolation Precautions**

There is no treatment or established cure for viral hemorrhagic fevers other than supportive care. Ribavirin, an anti-viral drug, has been effective in treating some individuals with Lassa fever or HFRS. Treatment with convalescent-phase plasma has been used with success in some patients with Argentine Hemorrhagic Fever, reducing the associated mortality from 15 to 30% in untreated patients to less than 1% in those receiving appropriate quantities (CDC Special Pathogens 2002; American Academy of Pediatrics, 1997). Contact
precautions are recommended as well as consideration for additional precautions in the event of massive hemorrhage (Franz et al., 1997).

**Prevention**

There is no licensed vaccine to prevent transmission of any of the viruses caused by the *Arenaviridae* viruses however, there is limited experimental evidence that post-exposure prophylaxis with Ribavirin will delay onset of disease (Borio et al., 2002; American Academy of Pediatrics, 1997).

**BUNYAVIRIDAE**

Like the *Arenaviridae* viruses, the *Bunyaviridae* family is made up of viruses each having a distinct endemic area and reservoir. Hantavirus has a rodent reservoir but no arthropod vector, whereas *Bunyavirus, Nairovirus*, and *Phlebovirus* involve animal or bird reservoirs and arthropod vectors. Hemorrhagic fever with renal syndrome (HFRS), Hemorrhagic fever with pulmonary syndrome (HFPS), Crimean-Congo hemorrhagic fever (CCHF), Rift Valley fever (RVF), and Hantaan virus are all members of the *Bunyaviridae* virus family (North Dakota Department of Health, 2002).

**Pathophysiology**

Like all Hemorrhagic Fever agents, the *Bunyaviridae* viruses are small RNA viruses with lipid envelopes. According to the Working Group on Civilian Biodefense (2002), data on the pathogenesis of these agents is incomplete. What is known is that the viruses lead to thrombocytopenia, and in the case of RVF reduced levels of coagulation factors may lead to disseminated intravascular
coagulation. RVF, unlike the Arenaviridae viruses destroy the cells they infect. A hypothesis regarding RVF is that it causes a combination of vasculitis and hepatic necrosis. Research using Interferon Alfa as a post-exposure prophylaxis is underway, but still in the primate phase (Borio et al., 2002)

Epidemiology

HFRS occurs throughout Europe, Asia, and the Balkan states. Hantaan virus causes infections in specific species of mice that then leave behind infectious waste products. When the aerosols from these wastes are inhaled, the disease is acquired. The most severe form of the disease is found in rural Asia and the Balkans. Laboratory workers have reported cases after having contacted infected rodents (American Academy of Pediatrics, 1997).

The Hantavirus is associated with HFPS from rodent waste and was first identified in the Southeastern United States in 1993. It is endemic to the United States, Canada, and regions of South America (American Academy of Pediatrics, 1997).

Crimean-Congo Hemorrhagic Fever (CCHF) is a tick-borne virus that was first isolated in Africa and later in the former Soviet Union. It is now found commonly in sub-Saharan Africa, the Middle East, West and Central Asia, and Eastern Europe. Nosocomial infections are a serious risk related to this illness (American Academy of Pediatrics, 1997).

RVF also occurs throughout sub-Saharan Africa and has caused an epidemic in Egypt in 1977 affecting over 200,000 people, and killing over 600 of
them. It is an arthropod-borne virus transmitted from animals to humans by mosquito vectors (American Academy of Pediatrics, 1997).

**Dispersal and Transmission**

There are over 300 members of the *Bunyaviridae* family that are arthropod-borne, with mosquitoes or ticks serving as vectors. The *Hantavirus* genus is an exception in this family of viruses as it does not have an arthropod vector but rather is spread in the same manner as the * Arenaviridae* virus, that is, through inhaled aerosols released from the urine and feces of infected rodents (North Dakota Department of Health, 2002).

CCHF is transmitted by tick and occasionally at an animal slaughter. The arthropod vector for RVF is the mosquito. Like CCHF it can be transmitted during the slaughter of animals.

**Incubation**

The incubation period for CCHF and RVF ranges from 2 – 10 days. For HFRS the incubation period can be as long as 9- 40 days. HPS is thought to have an incubation period of one to three weeks although it has not been definitively established (American Academy of Pediatrics, 1997).

**Symptoms**

The clinical presentation varies depending on the viral agent. Symptoms of HFRS include fever flushing conjunctival injection, abdominal pain, lumbar pain, hypotension, oliguria, vascular instability, and renal insufficiency (American Academy of Pediatrics, 1997).
Respiratory failure and shock are late signs of HFPS. Earlier symptoms include nonspecific signs such as fever and myalgia, gastrointestinal disturbances, dizziness, hemoconcentration, hypoalbuminemia, thrombocytopenia, arterial oxygen desaturation, and pulmonary edema (American Academy of Pediatrics, 1997). Fever, headache, and myalgia, followed by capillary leak syndrome with resultant facial suffusion, conjunctivitis and proteinuria are symptoms of CCHF. Bradycardia, hypotensive crisis and diffuse hemorrhage from the GI tract, the mouth, nose and uterus follow (American Academy of Pediatrics, 1997).

Unlike the more severe CCHF, HFPS and HFRS, RVF is usually a self-limiting febrile illness. Patients occasionally develop hemorrhage, shock, bleeding, encephalitis, retinitis, or hepatitis (American Academy of Pediatrics, 1997).

**Diagnosis**

The causative virus for CCHF and RVF can be recovered from the blood and tissues of infected patients. Serum IgM and IgG antibodies develop during the convalescent phase of these viruses. IgM and IgG antibodies are usually detectable within 48 hours of the onset of the illness in HPS and HFRS. Neutralizing antibody tests are also useful for diagnosis as they provide greater virus strain specificity (American Academy of Pediatrics, 1997).

**Treatment and Isolation Precautions**

The treatment for the viral illness caused by the *Bunyaviridae* viruses varies according to the viral strain. For example, HFRS is treated with supportive
therapy aimed at preservation of the kidneys. Treatments include prevention of over hydration with crystalloids, dialysis of complications of renal failure, supportive care for shock, control of hypertension during the oliguic phase, and avoidance of transportation of patient (American Academy of Pediatrics, 1997).

Treatment for HFPS is similar to HFRS except that the primary focus is on the pulmonary system including prevention of hypoxemia, maintenance of adequate tissue perfusion without exacerbation of pulmonary capillary leak syndrome. Treatment for CCHF is supportive. Ribavirin, when given intravenously is helpful in reducing symptoms especially in HFRS. Controlled studies are lacking on the efficacy of Ribavirin in the treatment of RVF and CCHF (American Academy of Pediatrics, 1997).

**Prevention**

There is no licensed vaccine for any of the hemorrhagic fever viruses (Borio et al., 2002). Spread of the disease can be decreased by the use of strict isolation precautions in patient care, specimen collection, and specimen transportation (Fauci, et al., 1994).

**FILOVIRIDAE**

*Filoviridae* is the family of viruses containing the Marburg and Ebola viruses. There are four subtypes of Ebola virus: Ivory Coast, Zaire, Sudan, and Reston. These viruses cause severe hemorrhagic fever illnesses to humans. Primates are susceptible to these viruses as well. Ebola Reston subtype, which
does not cause serious illness in humans, is fatal to Primates (North Dakota Department of Health, 2002).

**Pathophysiology**

*Filoviridae* are RNA viruses that may appear in many shapes and have lipid envelopes. The replication of the virus is not completely understood. Marburg and Ebola virus disease are clinically similar. Marburg virus produces lesions in almost every organ. Necrosis can be seen in the lymphoid tissue. Damage to platelets and endothelial cells may lead to the hemorrhagic component and visceral organs necrose after damage to microcirculation. *Filoviridae* viruses, unlike the * Arenaviridae* viruses, kill the cells they infect. Disseminated intravascular coagulation develops (Borio et al., 2002).

**Epidemiology**

*Filoviridae* virus was first recognized in Germany and Yugoslavia in 1967 in laboratory workers who were working with green monkeys. The virus was named Marburg for the site of one of the outbreaks. During that outbreak, 31 cases were reported, 7 of them were fatal (North Dakota Department of Health, 2002).

Since 1967, 18 outbreaks of Ebola or Marburg viruses have been reported with approximately 1,500 cases of illness. Most of these cases have occurred in Africa. Epidemiologic investigations have shown that these cases occurred after contact with infectious body fluids or tissues from infected humans or primates (Borio et al., 2002).
Dispersal and Transmission

It is not known how the virus is transmitted from its natural reservoir to humans. In fact, the natural reservoir of the Filoviridae virus is unknown. As previously noted these viruses can be spread through close personal contact and of course, noscomially (North Dakota Department of Health, 2002).

Incubation.

The incubation period ranges from three to nine days for Marburg Virus. Ebola Virus has an incubation period that ranges from four to six days.

Symptoms

Ebola and Marburg viruses have similar clinical manifestations. The onset is characterized by fever, malaise, headache, diarrhea, abdominal pain, dehydration, and lethargy. Pharyngitis, dry cough, and pleuritic chest pain soon follow, as does maculopapular eruption with desquamation. Hemorrhagic sequelae ensue leading to blood loss, shock, and death.

Diagnosis

Viremia coincides with the febrile state of the disease. Diagnostic tests include isolation of virus in paired serum samples. The virus can be isolated from essentially all body fluids.

Treatment and Isolation Precautions

Serum of convalescing patients has been used to treat Marburg virus; however, its efficacy is questionable, as similar outcomes have been documented from patients who did not receive the serum. Other treatments focus on
supportive measures. Patients should be treated in accordance with strict isolation precautions. Pharmacologic research has not yielded effective treatments (Fauci, et al., 1994). Additionally specimens should be handled as recommended by the World Health Organization guidelines for infectious material (Fauci et al., 1994).

**Prevention**

There is no effective post-exposure prophylaxis recommended for persons with known or suspected exposures to the *Filoviridae* virus. According to the Working Group on Civilian Biodefense, Ribavirin has no utility against *Filoviridae* virus (Borio et al., 2002).

**FLAVIVIRIDAE**

**Pathophysiology**

Like the other viruses that cause hemorrhagic fevers, little is known regarding the pathogenesis of the *Flaviviridae* virus. The yellow fever virus, unlike the *Arenaviridae* virus, leads to destruction of infected cells. Hepatocyte infection and degeneration is a late sign and is associated with an absence of inflammation. Even as neutralizing antibodies clear symptoms of viremia, the second phase of the illness begins and the patients develop hemorrhage and shock (Fauci et al., 1994).

**Epidemiology**

Yellow fever appears in epidemic proportions in the tropical and subtropical regions of Asia, Latin and Central America, Africa, Indonesia, and
Northern Australia. Annually there are officially reported 5,000 to 6,000 cases in Africa and 300-500 cases in Latin America. In 1990 an outbreak in Cameroon caused 20,000 cases with 1,000 case fatalities (North Dakota Department of Health, 2002).

**Dispersal and Transmission**

The *Flaviviridae* viruses are transmitted in cycles involving animals that serve as reservoir, arthropods that serve as carriers and humans that serve as the final host. In yellow fever, the mosquito vector can serve as a reservoir as well.

**Incubation**

The incubation period for yellow fever is 3 – 13 days. Dengue fever symptoms have an immediate onset.

**Symptoms**

The initial symptoms of the *Flaviviridae* Dengue, include high fever, headaches, and myalgia, followed by increased myalgia and bone pain, anorexia, nausea, vomiting, skin rashes, and weakness. After two to five days it worsens and symptoms include restlessness, irritability, tachypnea, tachycardia, and hypotension. Finally spontaneous hemorrhage and death occur. (North Dakota Department of Health, 2002).

Yellow Fever, a disease caused by the *Flaviviridae* virus, begins abruptly with fever, chills, anorexia, nausea, vomiting, and minor bleeding. After three days jaundice, dehydration, and severe hemorrhages appear. Death usually occurs during the 7th to 10th day of illness as a result of extensive liver damage. This final
stage is generally preceded by deepened jaundice, uncontrolled hemorrhages, rising pulse, agitated delirium, and coma (North Dakota Department of Health, 2002).

**Diagnosis**

Diagnosis is made by serologic testing or viral isolation, techniques that are only available in a few states, research, and reference labs (American Academy of Pediatrics, 1997). Additionally, the World Health Organization has established criteria for the diagnosis of Dengue Hemorrhagic Fever (Fauci et al., 1994).

**Treatment and Isolation Precautions**

Treatment is support, the main goal being prevention of circulatory collapse by infusion of crystalloids. Transfusion of blood is not recommended, although plasma or plasma volume expanders can be used. Oxygen should be administered. During an epidemic in Cuba in 1981, Interferon was used with some indication of efficacy, although controlled studies have not been performed for this treatment modality (Fauci, et al., 1997). Antibiotics are not recommended.

**Prevention**

With the exception of yellow fever vaccine, there is no licensed vaccine for any of the HFVs. The yellow fever vaccine is not useful for post-exposure prophylaxis because its incubation period is shorter than the time it would take for the body to develop antibodies after immunization (Borio et al., 2002). Vector control is the only method available to prevent hemorrhagic fevers.
CHAPTER III

Bioterrorism and The Role of Occupational Health Professionals

The Role of Occupational Health

Each day, an average of 9,000 U.S. workers sustain disabling injuries on the job, 16 workers die from injuries sustained at work, and 137 workers die from work-related diseases (NIOSH, 2002). Occupational health, as a specialty of public health, strives to protect workers’ health and to ensure a safe work environment. Policies and interventions to meet these goals are implemented on population levels and organization levels impacting and protecting groups or aggregate populations. Two organizations created to improve the safety of the work environment and to protect the health of workers are the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA). NIOSH is an agency that works to improve the safety of workers by conducting research and recommending interventions that prevent work-related illness and injury. It is an agency of the Centers for Disease Control and Prevention (CDC). NIOSH conducts research, investigates hazardous working conditions, make recommendations on how to prevent work related illness, injury, and disability; and provides training to occupational safety and health professionals. OSHA, a division of the United States Department of Labor (DOL), develops standards designed to protect workers from hazards, enforces the standards, and provides consultation to employers to assist in becoming compliant with the standards. They also perform inspections when requested to do so by employees, or when there has been an incident such as a
death or 'near miss' (an incident that could have resulted in a death or severe injury). These two organizations are the governmental entities that lead the field of occupational health. Occupational health is made up of professionals from a variety of disciplines such as occupational health nursing, industrial hygiene, toxicology, occupational safety, ergonomics, and occupational medicine. Each of these fields strives to ensure safe working conditions. For example, when anthrax spores were found in government buildings and postal facilities, the contaminated buildings were closed for investigation and decontamination measures. NIOSH then published recommendations for protecting workers from anthrax. (NIOSH, 2001). Work site evaluations established which processes were likely to result in an exposure and, control measures were determined based on those evaluations. Occupational health professionals carried out each of these activities. Cooperative efforts among disciplines were required to investigate the large volume of suspected exposures.

The Role of the Occupational Health Nurse

The OHN has a distinctive education, encompassing a combination of fields that provide a valuable range of services to the worker population she or he serves. This philosophy and education work together to qualify the OHN to play an important role in relation to a potential bioterrorism attack. Beaton and Murphy (2002) stated:

“OHNs are uniquely qualified to help during a biochemical warfare (BCW) event by virtue of their health care training and by their preparatory course work in toxicology. Furthermore, they are positioned
in the community to assess the risk of BCW terrorist event at their workplaces” (p. 187).

An awareness of the signs and symptoms of the common bioterrorism agents, a working knowledge of epidemiology principles, ability to monitor for patterns of illness, and a working relationship with public health officials in community preparedness and disaster management all enable the OHN to recognize a potential bioterrorism event and report it to the appropriate agency. Additionally, the leadership and management responsibilities associated with the role, oblige the OHN to implement policies and training aimed at preventing injuries and illness in the event of a disaster.

Occupational health nursing practice expertise is broad and dynamic. Rogers (1998) describes nine essential elements of occupational health services, each of which has implications for bioterrorism. These elements include: Worker/workplace assessment and surveillance, occupational health care and primary care, case management, health promotion and protection, counseling, management and administration, community orientation, research/trend analysis, legal and ethical monitoring.

**Worker/Workplace Assessment**

Assessment and surveillance of the workplace is essential to identify potential hazards (Rogers, 1998). Worker assessment should include the educational level of the workforce to determine what would be the most appropriate method to present information to the workers (Rogers, 1994). It is important that the OHN educate the workforce about the risks of a bioterrorism
attack in a manner that is concise, straightforward, and appropriate to their level of understanding. The OHN should also know the general health of the worker population and whether or not there are any employees that have special physical needs who may require extra assistance during an evacuation. Since older workers or workers with decreased immune systems may be more susceptible to infections, the OHN should make note of the presence of these special populations (Sue Willis, personal communication, October 15, 2002).

An assessment should also be made of the physical environment including location of emergency exits and evacuation routes. The ventilation system is a principle consideration with respect to bioterrorism since most bioweapons can be disseminated via aerosolization. The location of the intake duct should be noted and it should be in an area that is protected from access by the general public. Determination of airflow through the facility is an important part of the workplace assessment. It will be necessary to move workers toward fresh air in the event of an attack. Oscillating fans may be helpful and should be easily accessible. If such an attack were made via the ventilation system, workers should be moved away from areas of high airflow. Sufficient personal protective equipment such as masks and gloves should be available for the entire employee population and should be stored in an easily accessible area (Sue Willis, personal communication, October 15, 2002).

While most organizations do not present a likely target for a terrorist attack, certain industries, corporations, and sites might be targeted for terrorist attacks based on their symbolic value, the products they manufacture, or the
service they provide (Beaton & Murphy 2002). For example, the location of the facility can increase its vulnerability to attack. Being in close proximity to a sensitive facility such as a military instillation, government agency, or storage location for weapons increases the risk of being affected by a bioterrorism attack. The Office of the Governor of North Carolina Crime Control offers a self-assessment tool to allow organizations to assess their risk of being targeted for a terrorist attack (NC Office of the Governor 2002) (Appendix A). This form can be adopted for use in any organization as a starting point for the OHN to perform risk assessment and plan ways to reduce risk through preparation.

**Occupational Health Care and Primary Care**

As a clinician, the OHN provides direct care including treatment, follow-up, referral for medical care, and emergency care to the population of workers within the employing facility (Rogers 1994). Many of the diseases resulting from biological agents have incubation periods of several days and present with similar, non-specific symptoms. Because these illnesses do not necessarily have an acute onset, it is feasible that people will first display symptoms in the workplace. It is also possible that non-emergency health care providers [such as OHNs] will be the first to see this type of evidence of a biological attack (Franz et al., 1997).

Specific activities of the OHN during any patient encounter include taking a thorough history of the patient’s present illness, a review of systems, a problem focused examination, diagnostic tests as available, and treatment, referral, or post-exposure prophylaxis as appropriate. These activities should be performed in accordance with written medical and nursing protocols consistent with state legal
requirements (Rogers 1994). Clusters of unusual symptoms or large numbers of persons with "flu-like" illness could be indicative of a bioterrorism attack. These occurrences should be reported to the local board of health for initiation of outbreak investigation.

**Case Management**

The OHN role in case management is to assist employees in returning to work from both occupational and non-occupational illness and injury (Tourigian, 2002). Key post injury and illness case management activities include: immediate medical management, obtaining a supervisors report of injury of illness, ongoing communication with employee, supervisor, and health care provider, and timely referral to a specialist when appropriate.

When the employee is able to work, a transitional duty program may be needed to allow the worker to return to a safe and productive environment. Transitional duty is an interim step allowing the employee to work in a modified capacity (Haag & Kalina 2002). Work hardening and physical reconditioning can prepare the employee to return to the workplace after a long or debilitating illness. Reduced working hours and lifting limits are examples of job modifications that can enable the employee to work safely in a productive but less demanding capacity. For example, all but one of the workers who developed inhalation anthrax after exposure to contaminated mail in October 2001 remained off work for at least six months. During their absences, the case managers' role would include monitoring their progress and assisting them in negotiating the worker's compensation system. As they return to their workplaces, OHN case managers
should transition them back into their positions through plans tailored specifically to their individual abilities, and revising the plan as the employees’ conditions allow or dictate until they are able to return to unrestricted duty.

The OHN must also consider the other employees’ risk of exposure due to contact with a worker who has developed an illness and whether the workforce needs prophylactic treatment such as cipro for anthrax, or preventive immunizations based on communicability and transmission of the illness. In addition the OHN has access to absence and illness data for the worker population either through policies that designate the OHN as the appropriate person to notify if one is absent due to illness, or by working with those who handle disability and sick calls, for example, the human resources department or employees’ direct supervisors. Access to this information is vital in the detection of patterns of illness. For example workers exposed to anthrax may ‘call in sick’ to work and report flu-like symptoms. A large number of employees who report similar symptoms within a short period of time should trigger suspicion of an outbreak and a call to the local health department (Shenold, 2001).

Health Promotion and Protection

Health promotion and protection strategies are aimed at individual, group, and population levels. They are designed to guard the individual or group against illness or injury. Health protection is achieved through a total range of preventive efforts incorporating primary, secondary and tertiary prevention strategies (Rogers, 1994).
Primary prevention approaches are aimed at eliminating or reducing disease risk through specific protective actions (Rogers, 1998). Educational programs are primary prevention activities. A posted evacuation route to train employees to follow a safe evacuation is a primary prevention activity. Information on bioterrorism agents presented to the occupational health unit staff is primary prevention. This can be facilitated through the use of available literature such as the University of North Carolina at Chapel Hill’s wall chart of Bioterrorist Agents (Appendix B).

Immunizations and personal protective equipment are classic examples of primary prevention activities. Identification of workplace hazards through workplace assessments, disaster drills, and training about what to do in case of an emergency, such as evacuation procedures are also primary prevention activities.

Secondary prevention is aimed at early detection and diagnosis of individuals with disease so prompt interventions can be implemented to halt disease progression and limit disability. Medical and health surveillance and screening activities such as nasal swabbing for anthrax and pharyngeal swabbing for smallpox in patients who have been exposed but are symptom-free are examples of secondary prevention. (Rogers, 1998). Again, syndrome surveillance is an important concept for the OHN.

Tertiary prevention is directed at restoration and rehabilitation of individuals to an optimal level of health with the limits of the disabling conditions (Rogers, 1994). Tertiary care involves a return to work program that can allow restrictions to be tailored to the employees’ level of functioning. For example,
after contracting an illness resulting from a bioterrorist attack such as anthrax, an employee may have recovered sufficiently to return to work although it is likely that the employee may need modified job duties such as reduced number of hours in the workday, permission to sit or stand intermittently as tolerated, or perhaps sitting work only until the employee has regained sufficient strength to perform pre-illness job duties. Employees can work with the OHN to determine appropriate work restrictions when returning from an illness.

Counseling

According to Beaton and Murphy, (2002) disaster research has found mass violence to be the most psychologically disturbing type of disaster and that as many as 67% of those exposed are impaired to some degree with any one of a number of maladaptive psychosocial responses and symptoms. There are few research studies evaluating the effectiveness of psychological interventions following episodes of mass violence such as a bioterrorism attack; however, research from other types of traumatic events indicate that early, brief, focused psychotherapeutic intervention can reduce distress in the bereaved, that selected cognitive behavioral approaches may help reduce incidence, duration, and severity of acute and post-traumatic stress disorders and depression in survivors, and that early interventions do not consistently reduce the incidence of the development of post-traumatic stress disorder later (National Institute of Mental Health, 2002).

Techniques for psychosocial intervention such as crisis intervention, critical incident stress debriefing, and stress reduction can be initiated in the
workplace by the OHN trained in these techniques. Sessions could be arranged for workers and their families in groups or individually. Traumatic events affect people in a variety of ways. Not only are there differences in how individuals react, but also certain categories of people have special needs in regard to counseling after a disaster. These include women, children, the elderly, the disabled, and refugees (Ehrenreich, 2001). The formation of support groups in the work place to meet the needs of these special populations may be indicated.

The U.S. Department of Justice, Office of Victims of Crime (2001) describes an array of emotions that victims of terrorism are likely to experience including shock and numbness, intense emotion, fear, guilt, anger and resentment, depression, panic, inability to resume normal activity, and delayed reactions. These reactions are outlined in their publication along with practical coping strategies aimed at individuals. This easy to read publication can be made available to workers as a resource. The OHN may benefit from a more in-depth resource that outlines techniques such as critical incident stress debriefing and crisis intervention. OHNs have the training and communication skills needed to reassure ‘the worried well’ and their families and to recognize the signs and symptoms of more serious psychiatric disorders in workers resulting from a bioterrorism threat or actual episode (Beaton & Murphy, 2002). OHNs can offer individual or group counseling when appropriate, or for those workers having a more difficult time adjusting, referral through Employee Assistance Program or other available resource is appropriate.
Management and Administration

The OHN performs leadership functions in communicating the need for appropriate policies and interventions to administrators and workers alike. The OHN will need to ensure that medical directives are in place and signed by the medical director. Directives should include considerations for infection control, diagnostic testing procedures such as nasal swabbing for anthrax, and post-exposure prophylaxis such as distribution of medications if available. Policies pertaining to bioterrorism should be drafted based on an authoritative source such as the CDC (Centers for Disease Control and Prevention), should be approved the medical director, and should be reviewed and updated yearly as recommendations are continually revised (Rogers, 1994). Policies should include specific criteria for notifying authorities of a suspected outbreak as well as what specific agency and department to notify.

The occupational health unit staff needs to be trained regarding the common bioterrorism pathogens, their symptoms, diagnostic tests, prevention, prophylaxis, treatment, and isolation precautions. There are many resources available that provide this information in table form, such as from the University of North Carolina at Chapel Hill (see Appendix B). The OHN should form a bioterrorism or disaster committee of persons from several disciplines within the workplace. Plant engineering or maintenance would be valuable because they will be most familiar with the physical layout of the facility and with the ventilation system. Safety and industrial hygiene representatives should be involved as should the first responders or first-aid team and the occupational
health unit because they are all familiar with health measures, proper usage of personal protective equipment, and the importance of evacuation from a contaminated area to a safer area. There should be a member of the management team or administration, and from the general work population on the committee so that decisions can be approved quickly (Sue Willis, personal communication, October 15, 2002).

The Association for Professionals in Infection Control and Epidemiology (2002) published a bioterrorism readiness plan called the template for healthcare facilities, and a mass casualty disaster plan checklist that can both be downloaded off their website free of charge. These plans can be tailored to non-healthcare organizations and can provide direction for the OHN and the disaster committee to form a company specific plan. The specific disaster response plan formulated by this committee should be instituted as policy. The plan should be disseminated to the worker population and evaluated by performing disaster drills, which could be critiqued by the disaster committee for effectiveness. For example, did the workers respond to the alarm/notification promptly, did they evacuate or report to the designated area in a timely manner, was personal protective equipment used, was the area secured by the security officers, were notifications made to the health department, etc. The frequency of the drills could be based on the outcome of the vulnerability assessment performed. For example, a highly vulnerable facility may institute quarterly drills where as a facility that scored low on the vulnerability assessment may choose to perform an annual disaster drill.
Community Orientation

According to Rogers (1994) the field of occupational health nursing has incorporated the concepts and principles of public health, focusing on prevention, education, management, and mitigation of workplace and community health hazards. The field of occupational health nursing has continued to use knowledge gained from public health and nursing to improve worker health through preventive and health promotion activities.

It is essential that OHNs network with the public health agencies in their communities. Most communities have an emergency management team or disaster team. Generally this is a cooperative effort lead by the public health department, that includes local hospitals, emergency service agencies, law enforcement, and fire prevention (D. Oeding, personal communication, October 17, 2002). The Red Cross, universities, and sometimes the local school systems are involved in these task forces as well.

The OHN should contact the public health department and insure that a designated member of the occupational health unit staff’s name is on the community’s “call down list” or emergency notification list. This helps to ensure that the OHN is notified in the event of a health disaster that might threaten the workplace. Additionally the OHN should attend the disaster team meetings and know what the chain of command is in the community, and if possible, participate in countywide disaster drills. OHNs should also network with other companies’ OHNs to help disseminate information.
OHNs should learn about the community’s contingency plans for a bioterrorist attack, and what health care facility and emergency medical services are central to the coordinated effort of the community, what facility will be used for a quarantine hospital if needed, what will be used for a temporary morgue, and what mode of transportation will be used to transport mass casualties. In such a disaster, all clinicians, regardless of specialty, will be essential in partnering with public health to provide assistance.

**Research/Trend analysis**

As previously stated, the military has been performing research on bioterrorism weapons for many decades. The Johns Hopkins Center for Biodefense Strategies was founded in 1990s “to guide policy and practice that will reduce the likelihood that biological weapons are used, and, should prevention fail, lessen the suffering and consequences that would result from their use” (Center for Civilian Biodefense Strategies, 2002). Between these two sources alone, abundant information on bioterrorism exists. Current research in nursing literature suggests that there are numerous nursing implications for bioterrorism such as becoming familiar with bioterrorism agents, their symptoms, prophylaxis, prevention, and treatment, disaster preparedness for a bioterrorism attack, crisis management, and participation with community disaster response teams (Gwerder, Beaton & Daniell, 2001). Additionally, new research should be conducted to find ways to minimize potential hazards involved in a bioterrorism attack.
The National Occupational Research Agenda’s research priorities include areas pertinent to bioterrorism, for example, infectious disease, emerging technologies, in-door environments, control technology and personal protective equipment, and risk assessment methods. It is essential that OHNs take advantage of the information that exists and learn what they can about bioterrorism: the company’s risk for an attack, the signs and symptoms of the illnesses related to an attack, who to contact if they suspect an attack, and how to help those who have been the victim of an attack. One specific need is information regarding scarification - the technique used to give the smallpox vaccine. Because this vaccine was discontinued in the 1970s and no other routinely given vaccine is administered using this technique, there are currently very few practicing nurses familiar with it. If public health leaders determine that it is necessary to immunize the public against smallpox, thousands of people will have to be inoculated in a matter of days using a technique unfamiliar to most nurses (D. Oeding, personal communication, October 16, 2002). This is important information that OHNs and all nurses need to be reviewing now.

OHNs must be familiar with the principles of epidemiology in order to assimilate all of the available illness and injury data and monitor for patterns or trends in illness. OHNs must utilize their knowledge of epidemiological principles related to monitoring for illness including surveillance by syndrome. OHNs must make it a priority to learn the common bioterrorism agents, their symptoms, incubation periods, modes of transmission, and methods of dispersal. According to Franz, et al (1997),
"Many, if not most, diseases caused by weaponized biological agents present with nonspecific signs and symptoms that could be misinterpreted as natural occurrences. The disease pattern that develops is an important factor in differentiating between a natural and a terrorist or warfare attack. In most naturally occurring epidemics, there is a gradual rise in disease incidence, as people are progressively exposed to an increasing number of patients, vectors, or fomites that spread the pathogen. In contrast, those exposed to a bioweapons attack would all come in contact with the agent at approximately the same time" (p. 409).

By understanding the epidemiological presentations of a natural outbreak versus a terrorist attack the OHN has objective information to report to the local health department and will likely have a rapid response by officials who will investigate the outbreak.

**Legal and Ethical Monitoring**

Ethical issues abound in the workplace under normal circumstances but the OHN faces even more challenges in ethical decision-making during times of crisis. Guided by a code of ethics, the nurse is obliged to act in the best interest of the individuals and larger society (Rogers 1998). For example, confidentiality is an important consideration. If workers are exposed to a communicable disease at work such as smallpox, the OHN must protect confidentiality in the workplace of those exposed as well as the exposing party.

Another ethical consideration is making sure that employees who have been exposed to a pathogen are notified that they have been exposed and that an
informed consent is obtained prior to diagnostic and treatment procedures.

Informed consent is not only an ethical issue but also a patient’s legal right (University of Washington, 1998). If the treatment is an investigational drug, the risks and benefits of its use must be thoroughly explained to the patient. Further, exposed parties must be informed of the risks posed to their family members if they don’t follow through with reporting symptoms and complying with treatment.

Thorough teaching by the OHN regarding the pathogens that are likely to be used in a bioterrorism attack presented to the workforce can give an introduction to the importance of reporting symptoms and complying with treatment. Diseases that can be transmitted from person to person, such as smallpox may result in the quarantine of workers who are suspected of having been exposed. Only the health department has the authority to quarantine and this order must come from County Health Officer (D. Oeding, personal communication, October 16, 2002). Unless the OHN has obtained instruction from the state to initiate a quarantine order, the rights of others will be violated.

The OHN is an important asset to employers and employees alike. The OHN is often the first provider workers seek out for healthcare; however, as illustrated in the preceding discussion, occupational health nursing is not limited to treating work injuries and preventing illnesses. This role is broad and dynamic, involving many facets. With evolving threats such as bioterrorism, OHNs are realizing even more workplace implications.
The OHN has an opportunity to identify unusual trends of illness that might signal a potential bioterrorism attack through the application of OHN principles. Knowledge of the signs and symptoms of the common bioterrorism agents, epidemiology principles, symptom surveillance, and a working relationship with local public health officials in community preparedness and disaster management enable the OHN to contribute to the recognition of a potential bioterrorism event. Additionally, well thought out and implemented policies and training programs can prevent injuries and illness in the event of a disaster.
CHAPTER IV
DISCUSSION AND RECOMMENDATIONS

A bioterrorism attack involving the release of any one of a number of pathogens may manifest in an insidious manner in the workplace. Due to prolonged incubation periods, those exposed may not display symptoms until days or even weeks later. Even then, the symptoms may be vague and general. Victims may continue to work possibly exposing coworkers to illness. They may report their symptoms to the OHN at work before seeking treatment elsewhere. OHNs must be aware of this new threat in the workplace and utilize the broad background unique to occupational health nursing to address the occupational health implications of bioterrorism.

The essential components of occupational health nursing practice can enable the OHN to contribute to the timely recognition of a bioterrorist attack. It is important that the OHN understand the implications of such an attack and apply their knowledge to prepare and respond appropriately. This means that as occupational health nursing practice relates to bioterrorism it is recommended that the OHN be engaged in several ways including:

1) Knowledge acquisition of bioterrorism and bioterrorism agents

2) Familiarization with resources available at federal, state, and local levels

3) Participation in disaster planning and preparedness activities both at the workplace and within the community, including volunteerism
4) Education of workers, management, and colleagues regarding bioterrorism pathogens, disaster preparedness, and appropriate response to such an occurrence

5) Assistance to smaller worksites that do not have medical or nursing services on site or otherwise available to help them prepare for a bioterrorism attack

6) Support of legislation that increases funding to strengthen the public health ability to respond to a bioterrorism disaster

7) Utilization of current research regarding bioterrorism and its implications

First, the OHN must become familiar with the pathogens that are the most likely to be used as bioweapons including signs and symptoms, incubation periods, dispersal and transmission, epidemiology, pathophysiology, diagnostic tests, treatments, prophylaxis, and prevention. Nurses and other health care providers will be the “on the front lines” in recognition of these pathogens. Equally important, OHNs must perform symptom surveillance utilizing principles of epidemiology. The OHN has an advantage over most caregivers by working with a population of people on a regular basis. This allows the OHN to monitor the health of that population for the sometimes subtle, early symptoms associated with most of the pathogens in question. In an actual bioterrorism attack, the OHN will speed up the recognition of an illness outbreak by the timely reporting of unusual patterns of illness. Additionally the OHN must be vigilant in surveying the worksite for potential threats. For example, taking note of people at the
worksite who are not authorized to be there, observing suspicious bags or parcels left unattended or in unusual places, or identifying unusual odors, each of these events could indicate an attack is taking place. The importance of these activities cannot be overstated.

A second important recommendation is that OHNs locate available resources essential in the contingency plan for a bioterrorist attack. Resources are available on federal, state, and local levels.

The most important federal level governmental resource with regards to bioterrorism is the Centers for Diseases Control and Prevention (CDC), a division of the U.S. Department of Health and Human Services. The CDC works to promote health through disease prevention. Over a dozen centers, institutes, and offices make up the CDC. It plays a critical role in controlling diseases by performing outbreak investigations and conducting research related to infectious disease. The CDC has an abundance of information pertaining to bioterrorism and bioterrorism agents on their website, including a separate site, the Special Pathogens Branch, which deals primarily with the pathogens that cause the viral hemorrhagic fevers. Telephone numbers for contacting the CDC are also available on their website.

The Federal Bureau of Investigations (FBI) must be notified in the event of a suspected bioterrorism attack. One division of the FBI is the Counterterrorism Division. One of its branches is the National Domestic Preparedness Office (NDPO). This office coordinates all federal efforts to assist
state and local first responders with planning, training, and equipment needed for response to attacks involving any variety of weapons of mass destruction.

Another important federal resource is the Federal Emergency Management Agency (FEMA). FEMA is an independent agency reporting directly to the President of the United States, in charge of responding to, planning for, recovering from, and minimizing the effects of disasters. Since the terrorist attacks of September 11, 2001 the agency has focused on issues of national preparedness including the training and equipping the nation's first responders to deal with weapons of mass destruction. They have published a tool to assist in planning for a terrorist incident. Health and medical needs are only one section of this comprehensive planning tool, which address all forms of terrorism. The OHN could use this tool in place of or in addition to the Terrorism Vulnerability Assessment previously discussed. The OHN will need to become knowledgeable about the Office of Homeland Security and how occupational health and safety interacts with this newly created agency.

The OHN should also have contact numbers for state resources including the State Department of Health, which may encompass many smaller offices and agencies such as the State Epidemiologist's Office, the State Emergency Management Agency, and State Laboratories.

The State Department of Health will be in charge of coordinating the efforts of various state level agencies in response to a bioterrorism attack. For example, the State Epidemiologist's office will be responsible for outbreak investigation, and state laboratories will conduct specialized tests to confirm
diagnoses that local laboratories do not have the capability to conduct. Other state level resources available include written guides such as Indiana's "State Public Health Emergencies Manual" and North Carolina's Vulnerability Assessment Tool.

The OHN should have formal contact with the community through the local health department and with the local emergency management agency. The local health departments will be responsible for coordinating all local health agencies' efforts in response to a bioterrorism attack and will work closely with state level public health agencies. The local emergency management agency will work closely with health departments. Establishing temporary medical facilities, alternative modes of transporting the victims, and alternative means of communication are all important considerations in disaster/mass casualty preparedness that will be arranged by these two agencies.

Third, the OHN should be familiar with and an active participant in the local disaster plan. The OHN should be knowledgeable about voluntary community agencies that are important to any disaster planning and relief such as the American Red Cross, the Community Emergency Response Team (CERT), and Citizen Corps Councils. The CERT program helps train people to respond to emergency situations in their communities, supporting to first responders, assisting victims, organizing volunteers at disaster sites, and collecting disaster intelligence to support first responder efforts. Citizen Corps programs guide local citizens' participation by coordinating and developing community action plans, assessing possible threats, and identifying local resources. Attendance at county
disaster team meetings as well as participation in the local disaster drills and volunteer activities will keep the OHN informed of local plans and procedures in the event of a disaster. The American Red Cross, the National Disaster Medical System, and the Medical Reserve Corps all provide volunteer opportunities in which the OHN could participate.

The OHN should be knowledgeable regarding the location of area medical facilities in order to be able to direct victims to the appropriate facility. Hospitals, trauma centers, emergency rooms, and urgent care centers will all participate in the care of victims of a bioterrorist attack. Victims should be triaged and directed to the appropriate care facility.

After assessing risks, gathering appropriate emergency notification information related to bioterrorism, and participating in disaster planning within the community, the OHN should formulate a disaster response plan for the workplace utilizing a multidisciplinary team approach. The plan should be outlined in written policies. Emergency equipment must be readily available and contingencies must be made for alternative power sources, modes of communication, and evacuation. This plan must be disseminated to employees and evaluated through periodic disaster drills.

A fourth recommendation is education of workers, management, and colleagues. Workers should be informed about threats at the workplace and how to respond appropriately through their company disaster response plan as stated, but they should also be encouraged to make some preparations for their families and homes such as a specific plan of where to meet or gather in the event of a
bioterrorist attack (Urbano, 2002). They should also be encouraged to assemble a
family emergency kit with battery-powered radio, batteries and other emergency
supplies. FEMA has a section on their web site that can help with family disaster
planning. This planning kit can be found at

Education is important for management as well. While managers and
administrators need to be familiar with the disaster plan at the workplace, safe
evacuation, use of personal protective equipment, emergency notifications and the
other factors involved in the actual management of a disaster, they should also be
educated about the aftermath of a disaster. Managers must be educated regarding
the potential flood of emotional difficulties that employees may have after such an
occurrence and allow for work-sponsored crisis debriefing, counseling, support
groups and time away from work as needed.

Professional education for colleagues is important as well. It has been
stated multiple times in the current literature that nurses and other primary care
providers are going to be “on the front lines” in the war against bioterrorism and
must know the signs and symptoms of the common pathogens (Dr. J. Aronson,
personal communication, November 14, 2002, O’Toole 2002). In addition, OHNs
should be trained how to effectively contribute during a disaster. They must be
trained to triage, perform first aid, and organize other workers on the scene during
the chaotic aftermath of a bioterrorism attack.

Fifth, the OHN should consider offering to assist in the disaster planning
for worksites that do not have occupational health and / or safety services. The
formulation of emergency polices, assembling of a list of federal, state, and local contacts, and the training of employees with regard to how to respond in the event of a suspected bioterrorism event are valuable training programs the OHN could offer.

A sixth important recommendation is that of legislative acumen. The OHN must become familiar with and support the legislation that increases funding to strengthen the public health ability to respond to a disaster, such as Public law 107-108, the “Public Health Security and Bioterrorism Preparedness and Response Act of 2002.” This law makes provisions for funding and outlines governmental responsibility in response to a bioterrorism attack from the federal to the local level. This type of legislation may need to be carried into state and local levels and the OHN will want to be a proactive community member in support of these endeavors.

Finally, OHNs must make use of research that is currently being disseminated regarding bioterrorism in both the nursing literature as well as medical and other related literature.

The OHN is positioned within the structure of most companies to assume the principal lead in disaster preparation activities with regards to a bioterrorism attack. Knowledge of bioterrorism and bioterrorism agents, federal, state, and local resources, current legislation related bioterrorism, and current research related to bioterrorism and its implications all help the OHN prepare for the role as the bioterrorism authority at the workplace. Thorough disaster planning at the
worksite, and education of workers, management, and colleagues, assist the OHN in preparing others to meet and survive this catastrophe as well.
References


Centers for Disease Control and Prevention (2001d). Notice to Readers: Interim recommendations for protecting workers from exposure to *Bacillus anthracis* in work sites in which mail is handled or processed. *MMWR weekly, 50,* 961.


http://www.cdc.gov/ncidod/dbmd/diseaseinfo/default.htm

http://www.ncidod/dvrd/spb/mnpages/dispages/vhf.htm


http://www.mhwwb.org/CopingWithDisaster.pdf


Victim expresses frustration with continuing illness


Appendix A

Office of the Governor

TERRORISM VULNERABILITY SELF-ASSESSMENT

This vulnerability self-assessment is intended to help your organization determine if it is vulnerable to terrorism and to assist law enforcement in assessing the overall vulnerability of the state. It provides a vulnerability self-assessment worksheet that can be customized to your specific organization. The worksheet is intended to be a general guide. It may not include all issues that would be considered in your specific situation. Therefore, it is imperative that you consider the unique character of your organization: its functions, its general public image, and its overall public visibility. Consider both who may work in your organization and what your organization does. Assess the symbolic value of your organization to the public or within your own industry. This assessment does not replace any current reporting requirements.

Most organizations or activities do not present a likely target for terrorism. Others’ activities may make them a more likely terrorist target. Answering this self-assessment is a subjective process. It should be completed by the person(s) that best knows your organization and can best answer the questions. There are no firm guidelines on how to score a category. The score can best be determined by the person selected to complete the self-assessment, based on the uniqueness of your organization or facility. Since the questions are subjective, give your “best estimate” when scoring each question.

It is important to remember that the most important threat reduction measure is vigilance on the part of your organization’s staff, their awareness of anything out of the ordinary and their prompt communication of that information to your organization’s security team or management.

The Vulnerability Self-Assessment will also be used by law enforcement to assist in preventing criminal acts committed by terrorists. Preparation of a Threat Vulnerability Self-Assessment:

- is required for State agencies and must be provided to the law enforcement agency which has primary first responder responsibility for each location of an agency office and to the Secretary of the N.C. Department of Crime Control and Public Safety;

- is strongly recommended for local governments and, if completed, should be provided to the law enforcement agency that has primary first responder responsibility for each location of a local government office; and

- is strongly recommended for private businesses and should be submitted to the law enforcement agency which has primary first responder responsibility only if the Threat Assessment level is High Risk or if there are other significant factors warranting law enforcement’s attention.

Vulnerability Self-Assessments completed by or provided to State or local government agencies will be used to prevent crime and are exempt from disclosure under the Public Records
Local health departments and hospitals have a dual role in vulnerability assessment. They are both potential targets and have roles in early detection and control. Unlike the tragic terrorist attacks of September 11, 2001, a covert bio-terrorism attack may occur undetected, grow quietly and spread widely before health officials can piece together the chain of events. The best defense against bio-terrorism is early detection and prompt public health and emergency response to minimize the effect. The local capacity to perform the core public health function of disease reporting and surveillance must be assessed and strengthened for North Carolina to adequately protect its citizens and respond to these potentially devastating attacks. To be effective, the public health assessment must involve a wide range of health care providers in each county who are likely to have the first indication that a bio-terrorism attack has occurred.

The Vulnerability Self-Assessment should be conducted at least annually and again if there is an increased threat of a terrorist event or whenever there is a significant change to your organization’s facilities or activities.

Each law enforcement agency Sheriff, Chief, or head, or his designated representative is requested to review the Vulnerability Self-Assessments they receive and forward to the Secretary of the N.C. Department of Crime Control and Public Safety, 4701 Mail Service Center, Raleigh, N.C. 27699-4701, all Vulnerability Self-Assessments or other threat reports that they deem to be significant or which reveal immediate danger. The data must be submitted by hand or U.S. Mail in either digital form or hard copy and must not be submitted by e-mail.

Local health departments and hospitals are asked to report all vulnerability self-assessment results to the North Carolina Division of Public Health Bio-Terrorism Coordinator, Epidemiology Section, 1902 Mail Service Center, Raleigh, N.C. 27699-1902 and with local law enforcement. The North Carolina Division of Public Health will provide copies of health related Vulnerability Self-Assessments or other threat reports that they deem to be significant or which reveal immediate danger to the Secretary of the North Carolina Department of Crime Control and Public Safety.

**Circle** your evaluated score on each scale. Then total the scores and enter the total on the last page.

### 1. Potential Terrorist Intentions

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<thead>
<tr>
<th>Low Vulnerability</th>
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<tr>
<td>1 2 3 4 5 6 7 8 9</td>
<td>10 11 12 13 14 15 16 17 18 19 20</td>
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</table>

Issues to be considered in selecting your score:
• Are you aware of any terrorist threat to your organization?

• Are you aware of a history of terrorist activity in your area or your specialty?

• Are you aware of the level of capability of any suspected terrorist, which you believe poses a threat to your organization?

2. Specific Targeting

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</table>

Issues to be considered in selecting your score:

• Have you obtained current information from law enforcement or other sources that your organization has been targeted by terrorists?

• What is the reliability of these information sources?

• What is your organization’s public visibility?

• Does the nature of your organization’s activity lead you to think it may be targeted?

• Are there activities that indicate possible terrorist preparations in your area or specialty?

3. Visibility of your Facility/Activity within the Community

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</table>

Issues to be considered in selecting your score

• Is your organization well known in the community?

• Do you regularly receive media attention?

• Is your organization nationally prominent in your field or industry?

• Is your location and the nature of your activity known generally to the public?

• Have you ever had an event or accident with potential health risks that attracted public attention to your facility?

• Does your facility work with animals that may make it a target of radical groups?

4. On-Site Hazards

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</tbody>
</table>
Issues to be considered in selecting your score:

- Are hazardous materials, explosives or other dangerous items on your site?
- Do you store or use biologic or chemical materials that have the potential to be used as a threat or weapon?
- Do you store or use radioactive material at your site?
- Do you have a system to control access to hazardous materials, explosives or any other dangerous materials at your site?
- Can any products stored or used on your site be used as, or in the manufacture of a mass casualty weapon?
- Can any products stored or used on your site cause extensive environmental damage?

5. Population of Site/Facility/Activity

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</table>

Issues to be considered in selecting your score:

- Do you have more than 250 people normally present at your site?
- Do you have more than 1,000 people normally present at your site?
- Do you have more than 5,000 people normally present at your site?
- Do you hold events at your site that attracts large crowds?
- Do you conduct public tours of your facilities?

6. Potential for Mass Casualties

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Issues to be considered in selecting your score:

- Do materials stored or used at your site have the potential to create mass casualties on-site?
- Do materials stored or used at your site have the potential to create mass casualties within 1 mile of your site?
- How many people live or work within one mile of your site: 500; 1,000; 2,000; 5,000; more than 5,000?

7. Security Environment & Overall Vulnerability to Attack

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Issues to be considered in selecting your score:

- Does your organization have effective internal security procedures?
8. How Critical are your Products of Services?

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Issues to be considered in selecting your score:

- What is the importance of your organization to the community?
- What is the importance of your organization to your industry?
- Is your organization critical to the local population, economy or government?
- Is your organization critical to the continuity of basic services or utilities infrastructure in your area?
- Is your organization critical to state or national commerce?
- What would be the effects of a terrorist act against your organization?
- What would be the social, economic or psychological ramifications of a terrorist attack against your organization?
- What is the nature of your assets: hazardous materials, uniqueness, potential danger to others, etc?
- How long would it take to restore your critical services/functions?

9. High Risk Personnel

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Issues to be considered in selecting your score:
• Do you have personnel that are critical to the continuing function of State or local
government, basic services, utilities infrastructure, the community, the economy, or of
inherent value to your business or agency?
• Do you have personnel that are critical for responding to a terrorist act?
• What would be the effect of a terrorist act against these high risk personnel?

10. Organization Communications

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Issues to be considered in selecting your score:
• Do you have a Mass Notification System (public address system, intercoms, alarms)?
• Do you have a secure communications network that can be relied upon during a crisis?
• Do you have a crisis response team?
• Is your crisis response team trained?
• Do you conduct regular exercises?
• Do local/regional emergency responders participate in your exercises?
• Does your Crisis Response Team have its own portable communications system?
• Can your Crisis Response Team communicate directly with emergency responders?
• Do you have an emergency law enforcement notification system such as a hot line, panic button or something similar?
• Is your alarm system tied into the local law enforcement department or do you have an alarm service?
• Are your systems tested regularly?

11. Security and Response

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Issues to be considered in selecting your score:
• Are your security forces' staffing and training levels adequate?
• Do you have the capability to maintain a security presence in a high threat situation?
• Are additional security personnel available if requested?
• Are there affiliated agency/industry/organization support services available?
• Do you have trained disaster response teams within the organization?
• Do you have necessary specialty detection, monitoring, hazard assessment devices on hand and are they functional?
• Are local/regional law enforcement forces adequate and can they respond rapidly?
• Are local emergency responders familiar with your facility and its contents?
• Do you keep records on who visits your facility and where they go within the facility?

12. Policy/Procedures/Plans

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Issues to be considered in selecting your score:
• Do you have a current crisis response/disaster plan?
• Does your plan include the types of crises you are most likely to encounter (e.g., fire, explosion, chemical release)?
• Are your employees familiar with the plan?
• Have you conducted crisis response and disaster drills and were they effective?
• Have you identified the critical functions of your workplace and do you have a plan for continuation of operation during an emergency?

13. Security Equipment

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Issues to be considered in selecting your score:
• Do you have a security system and is it current technology?
• Do you have an intrusion monitoring motion detector or an alarm system?
• Do your systems have back-up if power is cut or fails?
• Do you have security equipment that would detect leaks or ruptures of potentially hazardous materials?
• Do you have personnel protective equipment for your emergency response team appropriate for the hazardous materials at your facility?
• Is such equipment in working order and has it been inspected recently?


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Cyber-crime, including cyber-terrorism, involves attacks against your organization's computer systems and data.

Issues to be considered in selecting your score:
- Is your site dependent on information technology such as computers and networks to accomplish its daily business activities?
- Is the information stored in your computer systems valuable?
- Do you have back-up power available for your computer systems?
- Do you make back-up copies of your data?
- Is your back-up data securely stored?
- Does your site have computers or networks connected to the Internet?
- Have you experienced problems with computer security incidents, such as computer viruses, worms, web-site defacements and/or denial of service attacks in the past?
- Do you have staff in place who are adequately trained and are available to monitor security warnings and take protective measures, such as loading system patches?
- Do you have technology security tools in place such as firewalls, intrusion detection systems or anti-virus software to protect your computer systems?
- Do you have a computer security policy, plan and procedure that includes a computer security incident response team?

15. Suspicious Mail And/Or Packages

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Issues to be considered in selecting your score:
- Is the mail for your facility opened in a secured area or an area isolated from the majority of personnel?
- Have the personnel who open mail received training on the recognition of suspicious mail and/or packages?
- Do you have specific procedures on how to handle suspicious mail and/or packages, including possible facility evacuation?
- Do you have a secure and contained location where any unusual or suspect deliveries or mail can be stored until proper authorities can evaluate the suspect items?

16. Telephone, Bomb And Other Threats

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Issues to be considered in selecting your score:
- Has your staff received training on how to handle bomb and other threat calls?
• Does your staff have a checklist of questions to ask the caller in case of a bomb or other threatening call?
• Does your facility have a plan on how to handle bomb and other threatening calls?
• Does your bomb threat plan include a system whereby your personnel would search your facility to identify suspicious objects to point out to emergency response personnel?
• Does your plan include a decision making process on whether to evacuate the facility?
• Are personnel familiar with the plan? Have evacuation drills been conducted?
• Is your plan coordinated with local law enforcement and the local phone company?

17. Employee Health & the Potential for Bio-Terrorism

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<th>Low Vulnerability</th>
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Issues to be considered in selecting your score:
• Do you have an employee occupational health specialist on staff?
• Do you have an occupational health safety program in place?
• Do you have a health professional working at your facility?
• Do you have a procedure in place to track the health of each employee and know if more than one employee has the same symptoms?
• Do you monitor the health status of employees on sick status or absent otherwise?
• Are employees encouraged to keep supervisors informed on any unusual health related event or condition?
• Are employees required to report any unusual conditions or substances encountered in the course of their normal duties, such as strange substances or odors from packaging or mail?
• Do employees know the proper procedures for emergency operation or shut-off of air handler, air circulating or ventilation systems?
• Do you keep a current list of employees, home addresses and emergency contact information?
• Do you have an emergency notification plan for employees (e.g. calling tree)?

Note: Sections #18 and #19 are to be completed by Local Health Departments

18. Capacity to Recognize a Bio-Terrorism Event

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Issues to be considered in selecting your score:
• Do you regularly notify the state or local health department of all reportable diseases and conditions when they occur in your facility?
• Do you have personnel trained in recognizing the clinical signs and symptoms of potential victims of biologic or chemical events?
• Do you have a plan for responding to suspected Bio-Terrorism events?
• Do you regularly exchange information about unusual symptoms or patterns of disease with other health care facilities in your area or the local health department?

19. Capacity to Respond to a Bio-Terrorism Event

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Issues to be considered in selecting your score:

Do you have a Bio-Terrorism response plan for your facility?
• Have you coordinated your Bio-Terrorism response plan with the local emergency operations team including law enforcement and other health care facilities?
• Do you have a system for knowing the bed (or care) capacity of your facility at any given time?
• Do you have a current inventory of your medical supplies and pharmaceuticals that may be required during an emergency event?
• Do you have a plan for contacting and deploying health care personnel during an emergency?
• Do you have plans for how to best utilize your facility during a mass casualty event?
• Do you have decontamination facilities?
• Do you have a protocol for treating contaminated patients?
• Do you have a plan for how to utilize volunteers from other areas and facilities during an emergency? (e.g. Scheduling, Training, Credentialing, etc.)

Remarks/Unusual or Significant Issues:

Please list any important remarks you think should be made concerning your self-assessment. Also, please list any unusual or significant findings that you developed during your self-assessment, list significant hazardous materials that might be used as a terrorist weapon or any significant impact a terrorist act against your site may cause to the community.

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

Attach an additional sheet if necessary.

Group Performing Self-Assessment: ______________________
Type of Business/Facility: _____________________________
OHN ROLE IN DETECTING BIOWEAPONS DISEASE OUTBREAK

Contact Person: ____________________________
Address: ______________________________________

Phone No: ________________________________
Fax No: ________________________________
E-Mail Address: ______________________________________
(For information sharing ONLY)

Who is Your Local Law Enforcement Contact?

You should coordinate with your local law enforcement agency regarding the results of your self-assessment. If your self-assessment indicates that your score is in the High Risk category, or if you believe your organization presents significant or unusual vulnerability or risk factors, you should provide a copy of this self-assessment to your local law enforcement office.

Total Score: __________________

Self-Assessment Evaluation:

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<tr>
<td>20</td>
<td>Low Risk</td>
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<td>86</td>
<td>Low Caution</td>
<td>170</td>
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<tr>
<td>171</td>
<td>High Caution</td>
<td>255</td>
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<tr>
<td>256</td>
<td>High Risk</td>
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Health Professionals Only

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<td>171</td>
<td>High Caution</td>
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<tr>
<td>256</td>
<td>High Risk</td>
<td>380</td>
</tr>
<tr>
<td>Disease</td>
<td>Signs &amp; Symptoms</td>
<td>Incubation Time (Range)</td>
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<tr>
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<tr>
<td>Anthrax</td>
<td>Flu-like symptoms (fever, fatigue, muscle aches, dyspnea, nonproductive cough, headache), chest pain; possible 1-2 day improvement then rapid respiratory failure and shock.</td>
<td>1 to 6 days (up to 6 weeks)</td>
</tr>
<tr>
<td>Anthrax</td>
<td>Intense itching followed by painless papular lesions, then vesicular lesions, developing into eschars surrounded by edema.</td>
<td>1 to 12 days</td>
</tr>
<tr>
<td>C. Gastrointestinal (GI)</td>
<td>Abdominal pain, nausea and vomiting, severe diarrhea, GI bleeding, and fever.</td>
<td>1 to 7 days</td>
</tr>
<tr>
<td>Botulism</td>
<td>Altered, excess mucus in throat, dysphagia, dry mouth and throat, dizziness, then difficulty moving eyes, mild purplish dilation and nystagmus, intermittent ptosis, indistinct speech, unstable gait, extreme symmetric descending weakness, flaccid paralysis; generally normal mental status.</td>
<td>Inhilation: 12-80 hours Foodborne: 12-72 hours (2-8 days)</td>
</tr>
<tr>
<td>Pneumonic Plague</td>
<td>High fever, cough, hemoptysis, chest pain, nausea and vomiting, headache. Advanced disease: purpuric skin lesions, copious watery or purulent sputum production; respiratory failure in 1 to 6 days.</td>
<td>2-3 days (2-6 days)</td>
</tr>
<tr>
<td>Smallpox</td>
<td>Prodromal period: malaise, fever, rigors, vomiting, headache, and backache. After 2-4 days, skin lesions appear and progress uniformly from macules to papules to vesicles and pustules, mostly on face, neck, palms, soles, and subsequently progress to trunk.</td>
<td>12-14 days (7-17 days)</td>
</tr>
</tbody>
</table>
### Notification Procedures in the Event of a Bioterrorist Incident

1. First call the Public Health Officer at your local health department; after hours contact local Health Director via 911.
2. If criminal activity is suspected, call your local law enforcement and the FBI in your state.

### Decontamination for All of These Agents

1. Place clothing from suspected victims in airtight impervious (e.g., plastic) bags and save for law authorities (e.g., FBI, SBI).
2. Use soap and water for washing victim.
3. For environmental disinfection for all of the above, use bleach (standard 6.0% - 6.15% sodium hypochlorite) in a 0.6% concentration (1 part bleach to 9 parts water). For botulism, plague and smallpox an alternative is to use an EPA-approved germicidal detergent.
4. For smallpox, all bedding and clothing must be autoclaved or laundered in hot water and bleach.
5. Healthcare worker should wear PPE (gowns, gloves and mask) during decontamination of anthrax, plague, and smallpox.

### Detection of Outbreaks

**Epidemiologic Strategies**

- A rapidly increasing disease incidence
- An unusual increase in the number of people seeking care, especially with fever, respiratory, or gastrointestinal symptoms
- An endemic disease rapidly emerging at an uncharacteristic time or in an unusual pattern
- Lower attack rate among persons who had been indoors
- Clusters of patients arriving from a single locale
- Large numbers of rapidly fatal cases

Any patient presenting with a disease that is relatively uncommon and has bioterrorism potential must be notified to the bioterrorism team.

### References


### Chart developed by:

North Carolina Statewide Program for Infectious Control and Epidemiology (SPICE)  
email: spice@unc.edu

KK Hoffmann, DJ Weber, EP Clontz, WA Rutala

Support provided by:

The North Carolina Institute for Public Health and The North Carolina Center for Public Health Preparedness, in the School of Public Health at The University of North Carolina at Chapel Hill

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Appendix C

Bioterrorism Resources

Each one of these bioterrorism websites contains valuable information.

Most of them contain reading lists and/or lists of other resources.

http://www.aaohn.org/practice/advisories/bioterrorism.cfm

http://www.apic.org/bioterror/

http://www.cdc.gov/ncidod/diseases/bioterror.htm

http://www.hopkins-biodefense.org

http://www.hsl.unc.edu.bioterrorism/

http://www.ncidod/dvrd/spb/mnpages/dispages/vhf.htm

http://www.niaid.nih.gov/dmid/bioterrorism/