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**History of Biological Weapons and an Analysis of the Actual Threat to the United States**

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Senior Honors Thesis  
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## I. Introduction

The threat of bioterrorism or biowarfare in the United States has come to the public attention in recent years and has raised questions in the health care community concerning our ability to cope with an attack. Experts disagree on the actual danger that these kinds of attacks may pose, since a successful attack would take years of planning and scientific expertise. In the past 10 years, only 10 known deaths have resulted from bioterrorist events (14), but many fear that this number may rise as biological pathogens gain attention in the media.

Historically, biological pathogens have been used in wartime by Germany, Japan, Russia, and possibly the United States (1,9,24). The effects of many of the attacks were not serious, but with increased knowledge about infectious diseases and genetic engineering, the attacks could be increasingly severe. The preparation of the United States for a biological attack is an issue that must be assessed by the military and the private health care community. If a serious risk exists, the government must take strides to protect the health and lives of its people.

## II. History of Biological Weapons

Disease and famine have often influenced the outcome of wars, and many countries have recognized the power of these events to weaken armies. In the 14<sup>th</sup> century, this tactic was used when plague victims were catapulted over the walls during a siege on a city in present-day Crimea (1). Again, in 1754, biological warfare is documented in an attack on the Native Americans during the French and Indian Wars (21). The British forces gave blankets infected with the smallpox virus to the Indians as a gesture of good will. The virus was devastating and had a fatality rate as high as 50% in some tribes

since the virus had never been present in North America (12). In modern history, Germany experimented with anthrax and glanders as early as 1915 (24). The pathogens were used in an attempt to weaken the enemy armies by infecting their horses and mules.

The first organized biological warfare testing program was the Japanese program, which began in 1932 (9). Many of their agents were tested on human subjects, particularly during World War II. Captured Japanese admitted to experimentation with anthrax, dysentery, cholera, and plague on their own prisoners of war (1). Also, the Japanese used plague to wipe out a large population of Chinese. In return for information obtained from these experiments, including dissemination methods and effects on human subjects, the United States offered the scientists immunity from war crimes prosecution for these crimes against humanity (9).

During World War II, the Allies developed biological testing facilities in the United States, Canada, and Great Britain because of fear of German capabilities (1). By the end of World War II, the Allies had the ability to retaliate against aggression with anthrax bombs of their own. They possessed sufficient vaccine dosages for their own soldiers and had access to the newly discovered penicillin. Thus, the Allies could protect their own soldiers (9). It is also possible that the Russian army used pathogens during World War II (1). Epidemiology studies of an outbreak of tularemia among German and Russian soldiers during the Battle of Stalingrad suggested that the disease was intentionally disseminated. The incident occurred in 1942, and in 1941, Russian scientists had created a tularemia weapon. Another outbreak involving Q fever among German soldiers in Crimea in 1943 may also have been a result of Russian biowarfare.

According to records in Chinese archives, the U. S. used biological pathogens against the Chinese army and civilians during the Korean War (9). The U. S. allegedly dropped various objects containing rotten fish, decaying pork, frogs, and rodents during a period in 1952 when encephalitis and anthrax were occurring. Also, various insects were found near Chinese army camps that were infected with cholera and encephalitis. Four of the species had never been seen in Korea and the insects were particularly resistant to the cold. The Chinese used this evidence to accuse the United States of using biological pathogens as weapons, but the reports could be wartime propaganda.

Bioterrorism has also been attempted in recent years, but it is also used frequently as a hoax. The Japanese terrorist group, Aum Shinrikyo, attempted to use biological pathogens several times in 1995 (19). They considered the Ebola virus as a potential weapon in addition to experimenting with anthrax, cholera, and botulin toxin (17). The cult members finally released botulin toxin and anthrax, but only a few pets died as a result of the attacks. The cult's experimentation with biological toxins is attributed to its ability to recruit scientists. The group was well funded, and it is unclear why their attacks were failures. At this point, they used a more traditional method, the nerve gas sarin, which proved to be much more successful (13).

All of the threats that have occurred in the U. S. have been hoaxes; however the psychological effects of bioterrorism are serious and decontamination efforts are debilitating and costly, even in the event of a hoax (15). In 1997, a petri dish found at B'nai B'rith headquarters in Washington, D. C. was labeled to indicate *Bacillus anthracis* and *Yersinia pestis* (15). Though no real threat was present, the situation became chaotic. Several health clinics also received anthrax threats in 1998 (5). The threats either

involved receiving a letter that was supposedly contaminated or receiving a phone call warning that the air vents were contaminated. In that same year, members of the Republic of Texas threatened President Clinton, Attorney General Janet Reno, and other public figures (22). Another individual, Larry Wayne Harris, who had threatened to use bioterrorist attacks bought three vials of *Y. pestis* in 1995. In 1998, he was found with 8 bags of anthrax vaccine in Las Vegas, but he was never capable of a successful attack.

Testing and producing biological weapons has been dangerous, even for countries with organized production methods in the hands of capable scientists. Accidents easily occur when working with microscopic particles. Several Russian scientists have become infected during the course of their experiments, and the deaths have always been concealed (1). One Russian scientist became infected with tularemia, but recovered with antibiotic treatment. Another scientist injected the Marburg virus into his thumb and died after a short illness. The man who performed his autopsy also became infected and died.

One of the more famous accidents involving biological pathogens occurred at a Russian production facility in 1979 and reports from this incidence have resulted in a better understanding of inhalation anthrax (13). On March 30, 1979, the Russians released anthrax into the night air after failing to replace an air filter (1). Since facilities were kept in or near cities to keep from arousing suspicion, the nearby city of Sverdlovsk was affected by the dissemination. The actual number of people who became sick and died is unknown because of the government cover-up, but at least 66 deaths are known to have occurred (7). Ironically, the strain used at Sverdlovsk was obtained as a result of another accident at the Kirov plant in 1953, when a number of rats were accidentally infected. After infecting the rats, the anthrax mutated and was harvested by Russian

scientists in 1956. This new strain of anthrax was much more virulent, so it replaced the old strain of anthrax in the Russian arsenal (1).

Testing the weapons has also been difficult for countries and the areas that they use suffer environmental desolation and will be uninhabitable for years (1,2,13). Gruinard Island, which was used by the Allies as a testing ground during World War II, was contaminated with anthrax for 36 years (13). Efforts to decontaminate it lasted for 8 years and required 280 tons of formaldehyde and 2000 tons of seawater, and the land will be uninhabitable for decades. The Russian scientists used an island in the Aral Sea, Rebirth Island, to conduct bioweapons testing annually. A high level of secrecy was employed and several scientists may have lost their lives during the experiments (1). The United States also established testing grounds early in its biowarfare program: one in Horn Island, Mississippi, and one in Granite Peak, Utah (9).

### III. Biological Pathogens

Several agents have been considered as possibilities for biological warfare, including plague, cholera, tularemia, and Q fever, but smallpox and anthrax have been identified as the most probable pathogens for biological weapons according to United States Army Medical Research Institute for Infectious Diseases (USAMRIID) officials (16). Based on their biological properties, they have the capability to infect large numbers of individuals and cause mass casualties. Criteria for an effective biological weapon are all satisfied by smallpox and anthrax: large-scale production, high infectivity, toxicity, environmental stability, and high mortality (14).

The ability of anthrax to be made in large quantities is demonstrated by the Russian plants that were capable of producing 2 tons of anthrax spores per day (1). Inhalation

anthrax is highly infective and the World Health Organization (WHO) estimates that 100kg of aerosolized anthrax released upwind of Washington, D. C. would result in casualties between 130,000 and 3,000,000 (13). This allows the infection of a large area with relatively few spores, especially when compared to the infectivity of other pathogens. The mortality rate of inhalation anthrax is an indication of its toxicity. Mortality is a result of toxins produced by proliferating bacteria and antibiotic therapy is not beneficial if it is begun more than 48 hours after the appearance of symptoms (13). Therefore, death is guaranteed in the untreated cases and can be as high as 95% if therapy is not started soon after the onset of symptoms (7). The stability of anthrax spores can be demonstrated by the persistence of anthrax spores on Gruinard Island even after many decontamination efforts (13). This makes anthrax very stable in the environment and capable of being stored for years and transported easily.

Inhalation anthrax also has other advantages for use as a biological weapon. One is that it mimics the flu in early stages, so it would be difficult to diagnose without a high level of suspicion (7). The epidemiology combined with microbiological analysis would be required for a definitive diagnosis and this could delay treatment long enough for death to occur (13). Anthrax is also relatively easy to procure, and many facilities sell potentially dangerous agents such as anthrax and plague with few questions asked (21). Anthrax could also be obtained in the natural environment since it is still endemic in some areas. Anthrax attacks can also be more focused since human-human transmission rarely occurs (8). This permits an attack on a specific area, or even a particular building.

Smallpox is also ideal as a biological weapon, and satisfies all of criteria for an effective weapon. While viruses are more difficult to grow in culture than bacteria are,



new production methods are available that allow the mass production of smallpox (1). Smallpox is highly infectious as an aerosol, and unlike anthrax, it can be transmitted from person to person (12). It is estimated that 10 to 20 more individuals can be infected from each primary infection (21). This could greatly increase the area of attack and cause significantly more casualties. The mortality of smallpox is lower than anthrax and traditionally the virus had a 30%-50% mortality rate, but the morbidity rate ranges from 60-90% (1). High morbidity is also important because disabling a population would be beneficial during wartime. These mortality and morbidity rates would be relevant for the entire population because only about half of Americans have ever been vaccinated against smallpox and even these probably no longer possess an effective immunity since vaccinations ceased in 1972 (12). A smallpox attack would also be devastating because an antiviral treatment does not exist for it and it would be difficult to recognize in time to administer the vaccine (4). The vaccine is in short supply currently and would require an estimated 36 months to begin large-scale production again (19). Currently, the only possibility for treatment after the onset of symptoms is an antiviral drug, cidofovir, which was developed after the eradication of smallpox and has never been tested (21).

Smallpox is advantageous as a biological weapon for several other reasons. One is that few doctors practicing have ever seen an actual case of smallpox and vaccination may not be beneficial once the characteristic pox have emerged (12). Smallpox can also develop in different ways to produce two additional forms of the disease, hemorrhagic and malignant. These forms of the disease have a higher fatality rate and a shorter incubation period than normal smallpox infections (12). Certain aspects of smallpox are detrimental to its development as a weapon. For example, smallpox is harder to acquire

than anthrax since it was eradicated in 1977 due to an international effort by WHO (12). After small pox was eradicated, WHO recommended that all remaining stores of the virus be sent to a repository either in Atlanta, Georgia, or Moscow, Russia (21). WHO also recommended that the variola virus be destroyed by June 1999 to prevent the virus ever being used as an agent of biological warfare (2). Since stores of the virus exist officially only in two places, it would be more difficult for small terrorist organizations to acquire this pathogen.

#### IV. Biological Warfare Capabilities

Foreign countries have continued biological weapons testing programs since the Biological Weapons and Toxins Convention in 1972 (13). The former Soviet Union and Iraq, who signed the treaty to ban testing, are now known to have participated in bioweapons research. One of the more advanced biological weapons program was run by the former Soviet Union. Most of the information about the program was supplied by Ken Alibek, who was formerly an administrator of the program (1). Alibek's job was to develop biological weapons that could be mass-produced and were highly pathogenic. A primary focus of his work was to keep ahead of medical advances in antibiotics and vaccines. The first pathogen studied by the Russians as a potential weapon was typhus, but it was abandoned with the advent of antibiotics and a vaccine.

Since the beginning of the Russian program, several different bacteria, viruses, and toxins have been studied in an attempt to weaponize them (1). The Soviet Union established its first factory to produce smallpox weapons in 1947. The strain of smallpox that is currently in their arsenal was obtained in 1967 after an outbreak when a vaccinated man began an epidemic in India. Members of the KGB were sent to harvest this strain

that was more virulent and had a shorter incubation period than the wild type virus. Several other viruses were also used in experiments, including the Marburg virus, and they were initially grown in chicken eggs, until newer methods were developed to culture the viruses. By 1990, the Russians were testing an aerosolized strain of anthrax. Now, they possess a strain of anthrax in their arsenal that is resistant to 5 different antibiotics. The use of this strain would be devastating to most countries, since the current plan for containment is post-exposure antibiotic treatment. The Russians also have a multi-drug resistant strain of *Yersinia pestis*, which causes plague, among their pathogens.

Western countries have also participated in biological research, including Great Britain and the United States. The United States program began in 1942 when the War Research Service (WRS) was created to coordinate biological warfare research (9). This program resulted from fear that the Germans were capable and willing to use biological pathogens as weapons in World War II. The United States military established a base for biological warfare research at Camp Detrick, Maryland. Here, a team of scientists began to study plant and animal diseases, including anthrax, as potential weapons. These efforts were productive and by the end of the war, the Allies had an anthrax bomb cluster that tested successfully (1,9). Since the United States and several other countries signed the Biological Weapons and Toxins Treaty in 1972, the U.S. has maintained facilities designed to protect the U.S. against an attack. The U.S. and other western countries may have continued research on biological pathogens as weapons, but there is not enough evidence to support this fact.

## V. Current Threat of Biological Weapons

Biological weapons have specific advantages for a terrorist organization or a country that would choose to use them. The primary appeal of biological agents is that they do not require the sophisticated production methods that mass casualty weapons such as nuclear weapons would require (23). Many of the biological agents are available widely in 67 nations in 453 known locations (21). Biopreparat, the Soviet Ministry in charge of biological testing, obtained materials for research from university labs and biotechnology firms with ease (1). Many of these will sell potentially dangerous agents such as anthrax or plague with few questions asked. This means that they would be cheaper and more accessible to small terrorist groups or poorer countries. Contamination of the food or water supply would be relatively easy and would not require as much expertise creating aerosolized pathogens(3). These food-borne illnesses would also be difficult to detect and trace to their origins.

Biological weapons would probably also create a delay between the time of the attack and the recognition of an attack. The attack may not be identified for several days until patients begin to present with illnesses, since most of the potential biological pathogens have incubation periods of at least 2-3 days (15). This would reduce the chances that the attacker would be identified. Also, the most probable pathogens, anthrax and smallpox, have initial symptoms that mimic other illnesses and this could further delay detection (7,12). Some diseases may also appear to be a result of a natural outbreak and weeks may pass before the source is investigated.

Biological weapons could attract more attention to the message because the prospect of a biological attack is so terrifying (22). The ability to cause a great deal of panic would be desirable to a terrorist organization that had a political agenda or an enemy

army that wanted to create confusion. Biological weapons have also been described as weapon of mass casualties instead of weapons of mass destruction (15). This is because they have the unique capability of wiping out or debilitating a population while leaving the building infrastructure intact after an attack.

Biological weapons also have distinct disadvantages and one is that they are dangerous to work with (22). Many Russian scientists have fallen ill or died as a result of the accidental release of pathogens (1). Also, the production of effective bioweapons in forms that can be readily disseminated is difficult and can take years (17). Some pathogens, such as smallpox, would be difficult to attain since the disease no longer occurs naturally and the only two reserves are controlled by the United States and Russia (12).

Because of the difficulties with bioweapons research, many experts believe that the actual threat of bioterrorism has been overestimated. Mark Wheelis, a microbiologist at the University of California, believes that a terrorist group would not have the funding to recruit experienced scientists to execute a successful attack (19). A report by the Federal Bureau of Investigation (FBI) states that they do not believe any terrorist groups in the U.S. have the capability or intent to use biological weapons (8). If the threat is nonexistent, an overreaction could be costly and take the focus off more pertinent health care concerns.

## VI. Preparedness of the United States

Biological attacks would produce a sudden demand on health care facilities, including medications, vaccines, and equipment (15). In addition, the attack may be discovered after the incubation period when patients begin to develop illnesses. The United States

military and the public health system should be prepared to cope with any large-scale biological outbreak, whether it is an intentional attack or a natural occurrence. The New York City West Nile virus outbreak is probably an indication of the preparedness of the U.S. health care system (18). Weeks after the outbreak, the diseases were misdiagnosed as encephalitis. Now some people believe that the introduction of the West Nile virus into New York was intentional and it may be the first successful bioterrorist attack in the United States. If this is an indicator of the ability of health authorities to cop with an outbreak, the health care system is completely unprepared for any outbreak. Rare infectious diseases, such as the plague, smallpox, and anthrax, require notification of the CDC and the USAMRIID (2,13). Anthrax and smallpox have been identified as the most probable pathogens for biological weapons so the appearance of these diseases should cause significant alarm (16).

Since anthrax and smallpox have the capability to infect large numbers of individuals and cause mass casualties, physicians should be capable of recognizing and treating these illnesses (16). Recently, journal articles have appeared in medical magazines to educate physicians about these diseases and to alert them to their potentials use as biological weapons (7,12,13). This effort to educate the health care community is an important step in preparing for biological terrorism.

Inhalation anthrax will present problems to the health care community because its initial symptoms mimic the flu and it would be difficult to diagnose without a suspicion of *B. anthracis* (7). The epidemiology combined with a microbiological analysis would be required for a definitive diagnosis. Even lab identification of anthrax is difficult since the presence of a bacillus species would indicate the more common food toxin, *B. cereus*

(13). A delayed diagnosis would almost ensure mortality, because once sufficient anthrax toxins have accumulated in the blood, tissue damage will occur even if antibiotics clear the bacteria (13). Therefore, treatment must begin before high levels of toxins are produced to prevent death. If a possible anthrax exposure has occurred, the recommendations include post-exposure antibiotic prophylaxis that should be continued until anthrax is eliminated as a possibility.

A vaccine for anthrax, the Anthrax Vaccine Adsorbed (AVA), exists and it has been approved by the FDA since 1970 (10). The AVA has recently been required for all U.S. military active and reserve personnel to protect troops against the use of anthrax as a biological weapon (13). There has been controversy over the vaccine, but recent tests have confirmed the possibility of a detoxified *B. anthracis* strain as an alternative. This vaccine could prove to be safer than the one currently in use and decrease objections raised by soldiers (11). The threat of bioterrorism does not justify vaccinating the general population and a large enough supply of the vaccine does not exist to vaccinate in an emergency.

Smallpox will also be a burden to the health care community because it is difficult to diagnose, is communicable, and does not have an effective treatment. Smallpox resembles chickenpox, but still has distinctive characteristics that can be recognized (21). The skin lesions are particular to smallpox and develop in a different pattern than chickenpox. Two more dangerous forms of smallpox, hemorrhagic and malignant, are particularly difficult to diagnose since the symptoms are often mistaken for other disorders (12). Smallpox is also highly infectious from person to person and this will put many primary care physicians at risk for acquiring the disease (4). In an aerosolized

form, the virus is viable for about 24 hours and could infect several patients and workers in a hospital (12). This could be particularly dangerous to an immunodeficient population, which could be at a higher risk of acquiring hemorrhagic and malignant smallpox. The emergence of smallpox is threatening since there are no antiviral agents for the treatment of smallpox, however, receiving the vaccine as late as 4 days after infection may be sufficient to avoid serious illness. To control an outbreak of smallpox, all personnel who may have come into contact with the disease must be vaccinated (2). Also, the patients must be isolated and other potentially exposed patients must be identified to contain the spread of the disease (12).

A vaccination does exist for smallpox and the CDC has a reserve of doses sufficient for 6-7 million people (12). This is not nearly enough to vaccinate the population against the threat of smallpox as a weapon and other countries have this same problem. It would take an estimated 36 months to establish a production facility to manufacture large quantities of smallpox vaccine, so preparations for a smallpox attack would have to be made well in advance of an attack. The smallpox vaccination does have risks associated with it and these risks must be weighed against the actual possibility of an attack(12).

The U.S. government has been taking strides to form new agencies and supply old agencies with funding to assess the risk of a biological attack and to coordinate containment efforts after an attack has occurred. Urban areas are receiving funding for Metropolitan Medical Response Systems (MMRS). This program plans to link medical facilities and aid in the management of disease outbreaks (15). A National Domestic Preparedness Office (NDPO) has been established to assist law enforcement and public health officials in the event of a chemical or biological attack (15). The National Institute



of Health and the Office of Emergency Preparedness along with other agencies are working to assess bioterrorist threats (25). One method to recognize emerging diseases is the Unexplained Deaths Project that was put in place by the CDC (18). The purpose is to continue to study the deaths of previously healthy persons age 1-49 to accurately diagnose him or her. This could link unexplained deaths with an infectious disease and identify new emerging diseases. The CDC has also received funds to prepare for bioterrorist attacks and for FY99, they received \$51 million (16,18). These funds were allocated to establish a stockpile of vaccines and drugs, to improve communication networks, and to support research, including the development of a new smallpox vaccine.(16). The FDA has lightened requirements on the development of drugs and vaccines against potential biowarfare agents and encourages the development of vaccines, treatments, and diagnostic equipment to help counter a biological attack (25).

The public health care community has also been raising awareness about the threat of a biological attack. At Johns Hopkins Medical Center, an annual Symposium on Medical and Public Health Response to Bioterrorism was held for the first time in 1999 (16). The event had a significant response and over 900 were in attendance and others were turned away for lack of space. A physician at Johns Hopkins also tested the preparation of his hospital and reported the findings at the symposium to demonstrate how easy it would be to initially overlook a terrorist attack (21). This scenario was also alarming because three days elapsed before the CDC contacted him concerning his questions about bioterrorism. Two information sources on bioterrorism, the Working Group on Civilian Biodefense and the National Response Center, have also been established as references for the medical community (15). The Working Group on Civilian Biodefense published articles in the

*New England Journal of Medicine* outlining specific steps to be taken if smallpox or anthrax is suspected (12,13). The articles are comprehensive and include procedures to handle the smallpox virus in the laboratory (12).

The military has been making preparations for the event of biological terrorism or biological warfare. Mandatory vaccination for military personnel is one of their preventative measures (10). The USAMRIID is attempting to develop diagnostic techniques to recognize a wide range of biothreat agents, which may include toxins or infectious agents (18). The military, under the supervision of USAMRIID, has an Aeromedical Isolation Team to isolate and treat potential victims of an attack (6). The unit is also available for civilian purposes. It includes trained health care providers that can be mobilized in 6-12 hours. This unit has been used before after an Ebola outbreak in Reston, Virginia and was proven to be successful.

## VII. Conclusions and Recommendations

Considering historical events and the nature of a biological attack, the most probable source of a biological weapons attack will be a small terrorist attack within the United States. Even if an attempt is made to use biological weapons, disseminating the weapons is too difficult to accomplish easily. This would reduce the number of initial infections and make containment easier. Hoaxes will continue to be a problem, but if initial respondents and health care workers follow proper procedures, panic can be minimized. If chaos and fear can be controlled appropriately, future hoaxes or attempts with biological weapons will be reduced because they will lose their appeal.

A biological weapons attack from a major foreign power would be unlikely because similar constraints exist with the use of nuclear weapons. These nations would be

reluctant to use these weapons of mass casualties for fear of retaliation or fear of beginning another world war. To date, the only successful production of biological weapons has been an accomplishment of years of research by a large-scale government effort. So far, only the United States, Great Britain, and Russia are known to have biological weapons with effective dissemination methods. Even smaller countries would have difficulty concealing their research, recruiting experienced scientists, and funding the laboratories. If these smaller countries attempted an attack, the attack would probably only generate a few illnesses and deaths or may fail entirely.

Based on the internal threat, the United States needs to make preparations to identify an attack quickly and deal with it in an efficient and organized manner. Some experts believe the focus should be to reduce the vulnerability of the United States by limiting the capacity and intent of the attackers (20). However, there is really no effective way to prevent an attack from occurring and a terrorist group may succeed in a small-scale attack. Vaccinations cannot be given because of the wide range of pathogens that can be used and a small laboratory and its equipment could be concealed relatively easily. Therefore, the only course of action would be to develop diagnostic techniques, educate first respondents and medical workers about biological weapons, and be prepared to quarantine and treat victims. Many of these actions will also be beneficial in containment of a natural outbreak, so they should be put into practice as a barrier to an outbreak (20).

Diagnostic techniques are currently being developed by USAMRIID, but genetically engineered organisms may be difficult to identify if they originate from two different species (18). This could be a significant obstacle in detection since recombinant viruses and bacteria are increasingly easier to produce. This possibility must be considered if an

attack with biological weapons is suspected. More should be done to produce diagnostic equipment and make new developments available to the health care community.

The first respondents to a biological attack may be any number of officials. When individuals were threatened with anthrax, different agencies were called to respond to the attack (5). Among those contacted were the 911 service, the police department, and the postal inspector. All emergency response services should be trained how to deal with a biological attack to prevent further spread of the disease. The medical community is becoming more familiar with the characteristics of a biological attack and the potential pathogens. However, seminars in bioterrorism should become more common at medical conventions, and include many more civilian doctors.

The treatment of victims must begin almost immediately to prevent mortality, so the disease must be diagnosed quickly. Epidemiological assessment of the outbreak in the early stages could identify potentially infected individuals and determine if quarantine is necessary. To prepare for this, local governments should review statutes concerning quarantines to determine if quarantine is authorized in the event of an emergency (12). The origins of the outbreak should be elucidated to prevent secondary transmission (15). If an infectious disease such as smallpox is spreading, a single hospital should be designated to treat these patients to keep other patients from being infected (12). All health care facilities should develop emergency preparedness plans. These should include recognition of events by personnel, readily available decontamination equipment, and availability of protective equipment (15).

A concerted effort by the military, the government, and the private health care community should provide adequate preparation for an outbreak. While a natural

outbreak from an unknown infectious disease may be a greater threat, these procedures would be similar in the event of a biological attack. The first respondents will be the key to containment and their education and awareness will be a significant factor in controlling an attack and preventing serious death and illness.

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Appendix D - UNIVERSITY HONORS PROGRAM  
SENIOR PROJECT - APPROVAL

Name: Jenni Arlene Kasnake

College: Arts & Sciences Department: microbiology

Faculty Mentor: Dr. Robert Moore

PROJECT TITLE: History of Biological Weapons and an  
Analysis of the Actual Threat to the United States

I have reviewed this completed senior honors thesis with this student and certify that it is a project commensurate with honors level undergraduate research in this field.

Signed: Robert N Moore, Faculty Mentor

Date: 5/9/00

Comments (Optional):

*A detailed and thoughtfully prepared manuscript*