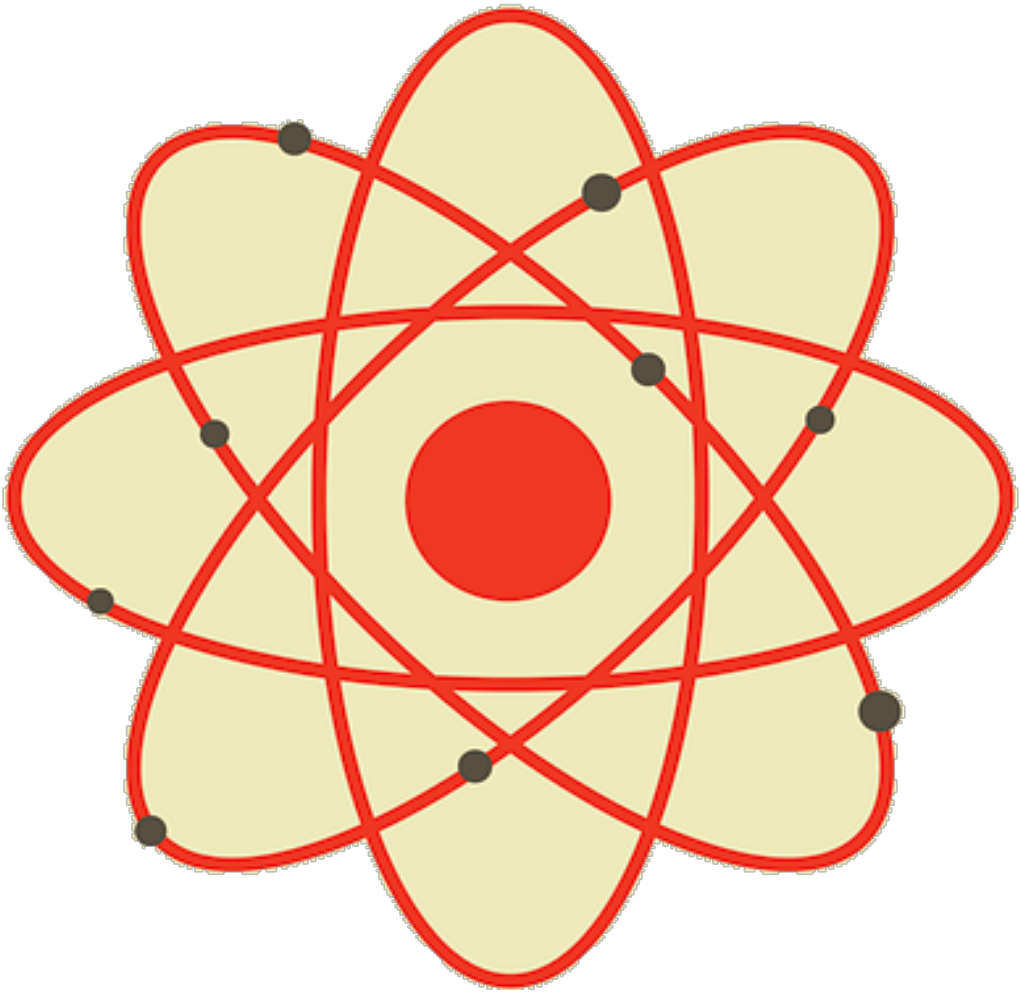
Care CEU's
Continuing Education for Nursing Home Administrators

Bioterrorism: A Comprehensive Review for Health Care Professionals



Introduction

Bioterrorism attacks are very real possibilities in today's global climate. Bioterrorism attacks may occur without warning and can lead to disruptions, disturbances and outright chaos. Moreover, a bioterrorism attack may lead to mass infection, disease and serious, life-threatening conditions. As a result, health care professionals are often required to administer health care to those victimized by bioterrorism attacks. Therefore, health care professionals must possess an understanding of bioterrorism-related concepts to safely and effectively administer health care those in need. This course will review bioterrorism and bioterrorism-related concepts in order to provide health care professionals with the relevant knowledge necessary to safely and effectively administer health care to those victimized by a bioterrorism attack.

Section 1: Bioterrorism

Case 1

A 52-year-old male patient presents to a hospital's emergency department. The patient is experiencing flu-like symptoms and is sweating excessively. The patient is also having trouble breathing. Due to a recent report from local law enforcement, it is believed the individual is suffering from anthrax exposure. An immediate chest x-ray and computed tomography (CT) scan are ordered for the patient. While waiting for the results, the health care team treating the patient cannot help but speculate how the patient possibly became exposed to anthrax. Subsequently, the health care team begins to become concerned and considers the possibility that other individuals in the area may have also been exposed to anthrax. With that notion in mind, the team of health care professionals begins to brace themselves for the possibility that additional patients may be presenting with anthrax exposure symptoms. The team of health care professionals also begins to question how to best treat patients suffering from potential anthrax inhalation.

Case 2

Law enforcement identifies a possible terrorist cell in a local community. It is believed that the terrorist cell has contaminated the community's water supply with an unknown chemical agent. Representatives from the law enforcement department contact the major hospitals in the area and advise them to prepare for a possible influx of individuals suffering from exposure to an unknown chemical agent. The hospitals begin to prepare for possible patient exposure - however, many of the health care professionals are unaware of the types of symptoms that patients may have if exposed to a chemical agent.

Case 3

Dozens of patients begin to stream into the emergency department of a regional hospital. All of the patients seem to be suffering from the same symptoms which include: severe diarrhea, fever and abdominal cramps. After some investigation, it is believed that the vast majority of the patients suffering from the same cluster of symptoms ate at the same restaurant in the previous 12 - 24 hours. The restaurant is contacted. The restaurant's manager reports that a small group of suspicious individuals were witnessed congregating around the restaurant's buffet a little over 24 hours ago. The restaurant manager also reports observing the individuals loitering in the restaurant parking lot. The police where contacted - however, the small group dispersed before an officer arrived on the scene. After receiving the aforementioned details, it is believed that a group of unidentified individuals may be intentionally contaminating the food supply of area restaurants with Salmonella. Local law enforcement agencies are contacted.

Unfortunately, the scenarios highlighted in the above case studies are very real possibilities in today's health care climate. Since September 11, 2001 threats of terrorism and acts of terrorism have been on the rise in the United States of America and across the globe. In the United Sates, the term terrorism can refer to any unlawful use of force, violence or fear against persons or property to further personal of political agendas[1]. Terrorism may present itself in many distinct forms and can include: hostage situations, active shooters and the use of weapons of mass destruction. The term weapon of mass destruction can refer to any weapon capable of causing widespread death and destruction[1].

Although weapons of mass destruction can be incredibly devastating and concerning to the general public, the most relevant form of terrorism to the individual health care professional may be bioterrorism. Bioterrorism can refer to any act involving the intentional release of toxic biological agents to further personal or political agendas[2]. The reason bioterrorism is the most relevant form of terrorism to the individual health care professional is because it presents some of the most unique challenges in terms of administering care to victims of a terrorist attack. Therefore, health care professionals must have a fundamental understanding of the key aspects surrounding bioterrorism and bioterrorism attacks.

The Differences Between Bioterrorism and Other Forms of Terrorism

The first key aspect surrounding bioterrorism centers around understanding the differences between bioterrorism and other forms of terrorism. There are three major differences between bioterrorism and other forms of terrorism. The first major difference relates to the materials needed to carry out a bioterrorism attack. Unlike other forms of terrorism, the materials required to carry out a bioterrorism attack are readily available, inexpensive to produce and require very little specialized knowledge to weaponize[2]. In other words, any individual, with little to no training, can easily obtain the materials necessary to initiate a bioterrorism attack and carry it out at will. The materials required to carry out a bioterrorism attack can be stolen or purchased from laboratories, hospitals or manufactures. Additionally, materials needed to carry out a bioterrorism attack could be isolated from natural sources or simply synthesized. Once the necessary materials are procured, they can simply be released into the environment or injected into an innocent bystander at any given time.

Another point of consideration regarding the materials needed to carry out a bioterrorism attack is that a relatively small amount of biological material can be used to inflict maximum damage on unsuspecting populations[2]. For example, a minimal amount of biological agent may be exposed to only one individual - however, due to the nature of the agent, thousands of individuals in a local area could become infected and, ultimately, victimized by a bioterrorism act initially involving only one individual. In other words, bioterrorism attacks possess the

potential to cripple large portions of the country with minimal effort, exposure and materials.

The second major difference between bioterrorism attacks and other forms of terrorism relates to the ability to detect an attack. Unlike with other forms of terrorism, it may be very difficult for government agencies to detect bioterrorism attacks and distinguish them from naturally occurring outbreaks[2]. For example, hundreds of individuals could present to a city hospital with infection symptoms. Unless a terrorist group identifies themselves and verifies they are the source of the outbreak, it could take government agencies days, weeks or even months to determine if the outbreak is related to bioterrorism or is simply a natural occurrence. The previous example reveals another reason why health care professionals must have a fundamental knowledge of bioterrorism and bioterrorism attacks. Often the first evidence of a bioterrorism attack will be found in hospital settings[2]. Thus, health care professionals must be prepared to identify, diagnose and administer health care to patients victimized by bioterrorism.

Finally, the third major difference between bioterrorism attacks and other forms of terrorism relates to the nature of the damage of the attack. With other forms of terrorism, the potential size and scope of the damage caused by an attack may be, at least in part, somewhat immediately apparent. However, with a bioterrorism attack that may not necessarily be the case. Due to the nature of some of the agents and materials used in bioterrorism attacks it could take several days for the true size and scope of an attack to be realized - the reason being, is that some of the agents/materials used in bioterrorism attacks have incubation periods. The term incubation period may refer to the time it takes for the signs and symptoms of a disease to appear after exposure[2,3]. Some bioterrorism agents/materials have incubation periods of days or weeks, which means if a bioterrorism attack were to occur it could take up to a week, depending on the incubation period of the agents/material used, before it is realized that an attack even occurred. After the incubation period is complete, it could take additional time to fully understand how the bioterrorism attack is affecting the public. Once data is collected on potential infection and patient morbidity and mortality rates related to the bioterrorism attack, the potential bioterrorism-related agent could continue to spread, compounding the issue and

making it increasingly difficult to determine the true size and scope of the attack.

The bottom line when it comes to bioterrorism attacks is that they do differ from other forms of terrorism. They present different challenges and may be much more difficult to detect. A bioterrorism attack can strike without warning and it could take several days to fully realize the size and scope of an attack. Health care professionals should be well aware of the aforementioned differences between bioterrorism attacks and other forms of terrorism to best care for patients exposed to bioterrorism agents/materials.

Motivations Behind Bioterrorism Attacks

As previously mentioned, the typical motivation or goal behind acts of terrorism is to further personal or political agendas[1]. An act of terrorism my come from an international threat or a domestic threat[1]. Acts of terrorism may directly affect individuals or they may be carried out on government and/or personal property to create death, destruction as well as social or economical disruption. The overarching motivations and/or goals of terrorism may apply to bioterrorism. Bioterrorism may be carried out to destroy human life, food and water supplies as well as agricultural plants and animals[2]. Independent of the target, those carrying out bioterrorism attacks aim to incite illness, fear, death and disruption to progress their own agendas. Whatever the specific goals of a bioterrorism attack may be, health care professionals must work to limit the effects of an any attack that may occur.

Weapons of Mass Destruction and Bioterrorism

As previously mentioned, the term weapon of mass destruction may refer to any weapon capable of causing widespread death and destruction[1]. When considering bioterrorism, it is important to understand that weapons of mass destruction may also be used in a bioterrorism attack. Typically, weapons of mass destruction used in a bioterrorism attack include weaponized biological agents/materials designed to cause wide spread or maximum, illness, death disruption and/or destruction.

How are Bioterrorism Agents/Materials Disseminated

Bioterrorism dissemination may refer to the process used to spread or release a biological agent/material in order to inflict illness, death, disruption and/or destruction[2]. There are six main ways bioterrorism dissemination may occur, the first of which is aerosol dissemination.

Aerosol dissemination may refer to the process of the dispersal of a bioterrorism agent/material from sprayers or other devices[2]. Aerosol dissemination may occur outdoors in populated areas such as a public park or city square[2]. Aerosol dissemination may also occur indoors, e.g. office buildings, planes, trains and subway platforms[2].

The second main way bioterrorism dissemination may occur is via public food and water supplies, as highlighted in Case Study 2 and Case Study 3. In a bioterrorism attack involving public food and water supplies, typically, ready-to-eat foods such as vegetables and salad bars as well as public water supplies are targeted[2]. Often the aforementioned sources of public consumption are contaminated with a bioterrorism agent/material to cause widespread illness, death, disruption and/or destruction within a specific community or area.

Human carriers are another potential means for bioterrorism dissemination. When human carriers are used for bioterrorism dissemination the goal is often to spread transmissible agents through individual populations via coughing, bodily fluids and/or contaminated surfaces[2]. Additionally, an individual may be directly injected with a bioterrorism agent/material in order to spread a biological agent.

Animal carriers may also be used for bioterrorism dissemination. In the case of animal carriers, an animal or animals are infected with a bioterrorism agent/material. The bioterrorism agent/material is then spread to human populations via contact with infected animals[2]. The bioterrorism agent/material may also be spread to human populations by the consumption of contaminated animal products.

Along the same lines as animal carriers, insect carriers may also be used for

bioterrorism dissemination. Insects may cause individuals to become ill through contact with infected animals or animal product[2].

Lastly, bioterrorism agents/materials may be physically distributed. The physical distribution of bioterrorism agents/materials may occur via the United States postal service or by any other means of physical delivery[2]. For example, a bioterrorism agent may be included in a letter or package which is mailed to an intended destination. Once the letter or package is opened at the intended destination the bioterrorism agent may have an opportunity to spread or infect one or more individuals.

Determining The Impact of a Bioterrorism Attack

The impact of a bioterrorism attack may be multifaceted and layered. As previously mentioned, a bioterrorism attack may target or affect humans as well as animals. A bioterrorism attack may also affect both food and water supplies. Due to the wide scope of bioterrorism targets, determining the initial impact of a bioterrorism attack may be challenging. However, through the careful observations and analysis of laboratory scientists and health care professionals, determining the impact of a bioterrorism attack can be accomplished. Data collection and infection rates, as well as patient-related morbidly and mortality rates, can help officials grasp the impact of a bioterrorism attack. Any information a health care professional can provide regarding patients victimized be a bioterrorism attack may aid in the process of determining the impact of such an attack. During the aftermath of a bioterrorism attack, health care professionals should identify individuals and officials associated with bioterrorism data collection and should provide those individuals and officials with any information pertinent to the attack.

Areas Targeted by Bioterrorism Attacks

Those individuals initiating a bioterrorism attack typically choose well populated areas. As previously, mentioned, a bioterrorism attack may occur indoors or outdoors. Bioterrorism attacks which occur outdoors may be affected by environmental factors such as wind speed and direction. Indoor attacks may be influenced by components of the structure itself, e.g. a buildings ventilation

system, and/or the number of individuals within the structure. Hospitals and other health care facilities may also be targeted by bioterrorism attacks.

The Effects of a Bioterrorism Attack

The effect or impact of a bioterrorism attack may include social disruption, economic turmoil and the destruction of personal property. However, the biggest impact of bioterrorism attacks may be on individuals' health. A bioterrorism attack may cause both physical and psychological trauma to those affected by an attack. Individuals can become severely ill and their lives may be threatened. A small amount of a bioterrorism agent/material used in a bioterrorism attack may be lethal and incredibly detrimental to the public's physical health, overall well-being and quality of life. Furthermore, a bioterrorism attack may lead to psychological trauma which could last for years after an attack. Bioterrorism attacks are designed to cause mass fear. The initial trauma and the extreme fear caused by a bioterrorism attack may lead to long-term psychological effects such as post traumatic stress disorder, anxiety, and depression. Those individuals victimized by a bioterrorism attack should be encouraged to seek health care to address any physical or psychological issues that may arise from a bioterrorism attack.

Major Concerns After a Bioterrorism Attack

The initial concerns of a bioterrorism attack may be relatively straightforward to determine and include individuals' health, safety and the administration of health care to those in need. However, the long-term concerns after a bioterrorism attack may be a little more difficult to determine - the reason being, is because the long-term concerns of a bioterrorism attack often depend on the bioterrorism agent/material used, the number of individuals affected by the attack and the area affected by the attack. With that said, the long-term concerns of a bioterrorism attack often center around clean-up, the economic impact of the attack and public health[2,3].

Clean-up, in the context of a bioterrorism attack, may refer to the process by which an area or physical structure is decontaminated[2,3]. The clean-up after a bioterrorism attack may take days, weeks or even months. It is completely

dependent on the bioterrorism agent/material used in an attack. The goal of a clean-up is to make the area or structure affected by a bioterrorism attack safe for use by both humans and animals, especially livestock. Often a clean-up uses specific agents and methods designed to kill bioterrorism agents/materials[2,3]. After a clean-up agent is used, a safety check should take place to determine if the affected area or structure is safe for public use[2,3]. Unfortunately, due to the nature of some of the bioterrorism agents/materials, it could take several clean-up attempts to ensure the safety of any area affected by a bioterrorism attack.

The next major long-term concern of a bioterrorism attack is the economic impact of the attack[2]. A bioterrorism attack can cripple the economic structure of a region or country, especially if the bioterrorism attack involves agriculture and/or livestock. If a bioterrorism attack leads to the destruction of major sources of crops and/or livestock, it could have dire economic consequences that could extend well beyond the agricultural fields and farms affected. The following example will highlight the previous concepts: a bioterrorism attack on major sources of crops and livestock occurs which ultimately devastates a region's ability to produce food for the country of which it is a part. As a result, thousands of farmers and agricultural organizations have to file for bankruptcy due to an inability to produce a product for distribution. Consequently, the distributors of agricultural products also begin to suffer financially due to a halt in product movement. Eventually, those distributors have to close their businesses, resulting in hundreds for employees losing their jobs. Due to the decrease in agricultural products, food prices begin to increase. Over time, the increase in food prices reaches an all time high and, as a result, the average family cannot afforded to feed themselves. As food prices increase, individuals begin to become desperate and crime escalates. Ultimately, thousands of individuals lose their jobs, food prices reach an all-time high and crime rates steadily increase as individuals resort to desperate measures to provide for their families. The entire economy of the region and country involved in the attack begins to falter before it utterly collapses, all due to a bioterrorism attack.

Although the previous example is fictional, the concepts it touches upon are very real possibilities. Essentially, the economic toll of a large scale bioterrorism attack could devastate a country for years, leading to social disruption and destruction. Economics may not be the first things that comes to mind when

considering bioterrorism attacks or other forms of terrorism - however, the economic impact of a bioterrorism attack or other form of terrorism can be just as devastating as the attack itself and could extend into health care.

The health care system is not immune to economic instability and it is a possibility for health care organizations to be negatively affected by the economic toll of an act of terrorism.

The economic impact of a bioterrorism attack may be a concern for health care professionals and organizations - however, the more pressing long-term concern after a bioterrorism attack is often centered around public health. Unfortunately, the long-term effects of exposure to a bioterrorism agent/material are not well known[2]. Therefore, any individual victimized by a bioterrorism attack must be monitored and undergo routine examinations to assess the potential long-term damage to his or her health. In attacks involving wide scale, mass exposure to bioterrorism agents/materials, long-term medical surveillance programs are often initiated to monitor the health effects of those exposed[2]. It is possible for health care professionals to take part in such programs.

Infections versus Contagious

After, or perhaps during, a bioterrorism attack, the terms infectious and contagious may be used by officials and other health care professionals. Infectious may refer to the number of particles required to infect an individual[2]. Contagious may refer to bioterrorism agents which spread from person to person[2]. Often the aforementioned terms are confused. It is important for health care professionals to understand the difference between infectious and contagious to best serve patients in need.

Bioterrorism Agents

Many different types of biological agents may be used in a bioterrorism attack including: bacteria, viruses and biotoxins. Bacteria, in the context of bioterrorism, may refer to single-celled organisms which may lead to disease[2]. A virus may refer to a biological agent which requires other host cells to replicate[2]. A virus can infect many forms of life including humans, plants and animals. The

term biotoxin may be used to refer to a poisons substance produced by a living organism[2,3]. Biotoxins can range in toxicity and can affect different forms of life in distinct ways. Unfortunately, all of the aforementioned agents may be lethal to humans.

Categories of Bioterrorism Agents/Diseases

There are a wide range of bioterrorism-related agents which may be used in a bioterrorism attack. Each bioterrorism agent possesses distinct characteristics and threat levels. Fortunately, the Centers for Disease Control and Prevention (CDC) has developed categories for bioterrorism agents/diseases to help health care professionals and officials identify the characteristics and threat levels associated with specific bioterrorism agents/diseases.

The first major category for bioterrorism agents/diseases is category A. Category A agents pose the most significant danger to national security and health. Therefore, bioterrorism agents found in category A are considered the highest-priority among bioterrorism agents[3]. The reason bioterrorism agents included in category A pose such a significant threat to the American public's security and health is due to their specific shared characteristics. Category A agents are typically easily disseminated or transmitted from person to person; they can result in high mortality rates and possess the potential for a major public health impact; they can lead to public panic and disruption; and they require special action for public health preparedness[3]. In other words, bioterrorism agents included in category A pose the most significant threat level to the United States because they possess the potential to cause maximum and/or widespread illness, death, disruption and destruction.

The next related CDC category is referred to as category B. Bioterrorism agents included in category B are also extremely dangerous and pose the second highest threat level, when compared to bioterrorism agents found in category A, to the America public. Bioterrorism agents included in category B possess the following characteristics: they are moderately easy to disseminate; they may result in moderate morbidity rates and relatively low mortality rates; they require specific enhancements to the CDC's diagnostic capacity; and they require enhanced disease surveillance[3].

The last major CDC category for bioterrorism agents is category C. Category C is comprised of the third highest priority bioterrorism agents. The bioterrorism agents included in category C represent emerging pathogens that could be engineered for mass destruction in the future[3]. Characteristics of category C bioterrorism agents include the following: they are relatively readily available; they may be easily produced and disseminated; and they possess the potential for high morbidly and mortality rates as well as the potential for a major health impact[3].

Each bioterrorism agent used in an attack may pose a distinct threat and level of danger to those involved in the attack. Also, each bioterrorism agent used in an attack may present distinct challenges and requirements for all those involved in administering health care to those victimized by a bioterrorism attack. To best serve patients in need, health care professionals should possess a fundamental understanding of the aforementioned categories. In the potential confusion of a bioterrorism attack, having a working fundamental knowledge of the CDC's bioterrorism agent/disease categories could mean the difference between life and death.

Section 1: Summary

Terrorism may refer to any unlawful use of force, violence or fear against persons or property to further personal of political agendas[1]. Unfortunately, terrorism may present itself in many different forms, including bioterrorism.

Bioterrorism is different from other forms of terrorism in several distinct ways. First and foremost, bioterrorism involves the intentional release of toxic biological agents, which may be readily available and relatively easy to use. Secondly it may be difficult for officials to determine when and if a bioterrorism attack actually occurred. Lastly, it may be initially challenging for officials to grasp the full size and scope of a bioterrorism attack.

Bioterrorism targets can vary and both outdoor and indoor areas may be affected by a bioterrorism attack. Bioterrorism agents used in an attack may be disseminated in a variety of ways including: aerosol dissemination, the contamination of public food and water supplies, as well as the use of human, animal

and insect carriers[2]. Also, bioterrorism agents may be physically distributed[2]. The physical distribution of bioterrorism agents may occur via the United States postal service.

The effects or impact of a bioterrorism attack may include social disruption, economic turmoil and the destruction of personal property. However, the biggest impact of a bioterrorism attack may be on individuals' health. A bioterrorism attack may cause both physical and psychological trauma to those affected by an attack. Those individuals victimized by a bioterrorism attack should be encouraged to seek health care to address any physical or psychological issues that may arise from a bioterrorism attack.

The initial concerns of a bioterrorism attack may be relatively straightforward to determine and include individuals' health, safety and the administration of health care to those in need. However, the long-term concerns after a bioterrorism attack may be a little more difficult to determine - the reason being, is that the long-term concerns of a bioterrorism attack often depend on the bioterrorism agent/material used, the number of individuals affected by the attack and the area affected by the attack. With that said, the major, long-term concerns after a bioterrorism attack may include the following: clean-up, economic impact and public health[2].

There are a wide range of bioterrorism agents which may be used in a bioterrorism attack. Fortunately, the CDC has developed categories for bioterrorism agents to help health care professionals and officials identify the characteristics and threat levels associated with specific bioterrorism agents. The three bioterrorism agent/disease categories developed by the CDC include: category A, category B and category C. Bioterrorism agents included in category A represent the highest-priority bioterrorism agents which may be the most dangerous to the American public's security and health[3].

To best serve patients in need, health care professionals should possess a fundamental understanding of the key aspects surrounding bioterrorism and bioterrorism attacks.

Section 1: Key Concepts

• Since September 11, 2001 threats of terrorism and acts of terrorism have been on the rise in the United States of America and across the globe.

• Bioterrorism can present unique challenges to health care professionals when administering care to victims of an attack.

• The typical motivations or goals behind acts of bioterrorism are to further personal or political agendas[1].

• Bioterrorism agents used in an attack may be disseminated in a variety of ways including: aerosol dissemination, the contamination of public food and water supplies as well as the use of human, animal and insect carriers[2]. Also, bioterrorism agents may be physically distributed2. The physical distribution of bioterrorism agents may occur via the United States postal service.

• It may take officials days, weeks or months to determine the full size and scope of a bioterrorism attack.

• Bacteria, viruses and biotoxins may be used in bioterrorism attacks.

• The CDC has developed categories for bioterrorism agents/diseases to help health care professionals and officials identify the characteristics and threat levels associated with specific bioterrorism agents.

• The bioterrorism agent/disease categories developed by the CDC include: category A, category B and category C. Bioterrorism agents included in category A represent the highest-priority bioterrorism agents[3].

Section 1: Key Terms

Terrorism - any unlawful use of force, violence or fear against persons or property to further personal of political agendas[1]

Weapons of mass destruction - any weapon capable of causing widespread death and destruction[1]

Bioterrorism - any act involving the intentional release of toxic biological agents to further personal or political agnedas[2]

Incubation period - the time it takes for the signs and symptoms of a disease to appear after exposure[2,3]

Aerosol dissemination - the process of the dispersal of a bioterrorism agent/material from sprayers or other devices[2]

Clean-up (in the context of a bioterrorism attack) - the process by which an area or physical structure is decontaminated[2,3]

Infectious - the number of particles required to infect an individual[2]

Contagious - the ability of a biological or bioterrorism agent to spread from person to person[2]

Bacteria (in the context of bioterrorism) - single-celled organisms which may lead to disease[2]

Virus - a biological agent which requires other host cells to replicate[2]

Biotoxin - a poisonous substance produced by a living organism[2,3]

Section 1: Personal Reflection Question

How is bioterrorism different from other forms of terrorism and why is bioterrorism relevant to health care professionals?

Section 2: Bioterrorism Agents/Diseases

It has been well established that bioterrorism attacks can be extremely dangerous to the American public's security and overall health. The reason bioterrorism attacks can be so dangerous is related to the bioterrorism agents used in attacks. As previously alluded to, there are a wide range of bioterrorism agents which may be used in a bioterrorism attack. Each bioterrorism agent possesses distinct characteristics and threat levels. Fortunately, the CDC has developed categories for bioterrorism agents/diseases to help health care professionals and officials identify the characteristics and threat levels associated with specific bioterrorism agents/diseases. The three bioterrorism agent/disease categories developed by the CDC include: category A, category B and category C, with category A consisting of the highest-priority bioterrorism agents[3]. It is important for health care professionals to possess a fundamental knowledge of the aforementioned CDC categories. It is also important for health care professionals to possess a working knowledge of the bioterrorism agents/diseases which may be found in each CDC category. This section will highlight specific bioterrorism agents/diseases along with corresponding treatment information. Each bioterrorism agent/disease is highlighted and broken down into further informational segments to outline various points of interest, such as prevention and treatment methods.

Anthrax

Background information: Anthrax is one of the most widely known diseases related to bioterrorism. Anthrax is caused by a gram-positive, rod-shaped bacteria referred to as bacillus anthracis[2,3]. Anthrax may result from inhalation,

physical contact, ingestion and/or injection of bacillus anthracis or related spores or lesions[3]. The incubation period for anthrax is approximately 1 - 6 days[2,3]. However, the incubation period for anthrax could be as long as 2 months[2,3]. Anthrax is typically diagnosed via a chest x-ray[2,3]. Without effective treatment, anthrax may be fatal.

CDC bioterrorism agent/disease category: Category A

Symptoms: The symptoms of anthrax can vary depending on the method of dissemination. That being said anthrax symptoms may include: fever, chills, chest discomfort, shortness of breath, confusion, dizziness, cough, nausea, vomiting, abdominal discomfort, headache, drenching sweats, skin sores, fatigue and body aches[2,3].

Prevention: Ciprofloxacin and doxycycline may be used to prevent anthrax in individuals who have been exposed to bacillus anthracis[2,3]. However, in order for the aforementioned antibiotics to be effective in preventing anthrax, they must be administered before symptoms appear[3].

Treatment: Individuals who develop symptoms of anthrax may be treated with antibiotics and/or antitoxin[2,3]. The antibiotics which may be used to treat anthrax include: penicillin, ciprofloxacin and doxycycline[2,3]. Individuals suffering from anthrax may also require supportive care.

Botulism

Background information: Botulism is an illness caused by toxins produced by a bacteria referred to as Clostridium botulinum[2,3]. The bacteria which produce botulinum toxin can be found in many places[2,3]. Botulism may result from the inhalation or ingestion of botulinum toxin or related bacteria and spores[2,3]. The incubation period for botulism is about 12 hours - 5 days[2,3]. Without effective treatment, botulism may be fatal.

CDC bioterrorism agent/disease category: Category A

Symptoms: The symptoms of botulism may include: muscle weakness, excess

mucous in the throat, a thick-feeling tongue, dry mouth, difficulty swallowing, double vision and blurred vission[2,3].

Prevention: Some forms of botulism may be prevented by injections of botulinum toxin or related toxoids[2,3].

Treatment: Individuals who develop symptoms of botulism may be treated with antitoxin[2,3]. Individuals suffering from botulism may also require supportive care.

Plague

Background information: Plague may refer to the deadly disease caused by the bacteria known as Yersinia pstis[2,3]. The plague may be well know to health care professionals. It was responsible for killing millions of individuals in the Middle Ages. The plague is typically spread by rodents, or more specifically, the fleas rodents carry[3]. A human may be infected with the plague if they are bitten by a flea carrying Yersinia pstis[3]. Unfortunately, the plague is still around today and may be used in bioterrorism attacks. The incubation period for plague is approximately 2 - 6 days[2,3].

CDC bioterrorism agent/disease category: Category A

Symptoms: The symptoms of plague may include: fever, chest pain, nausea, vomiting, headache, weakness, skin lesions and swollen lymph nodes[3].
Prevention: Ciprofloxacin and doxycycline may be used to prevent the plague from developing in individuals who have been exposed/bitten by Yersinia pstis carrying fleas[2,3].

Treatment: Individuals diagnosed with plague may be treated with antibiotics[2,3]. The antibiotics which may be used to treat plague include: streptomycin, gentamicin, ciprofloxacin and doxycycline[2,3].

SmallPox

Background information: Smallpox is a disease caused by the variola virus. Smallpox is contagious - meaning it can be spread from person to person. There is a vaccine for Smallpox, thus the last known naturally occurring outbreak of smallpox in the United States was 1949[2,3]. The incubation period for smallpox is approximately 7 - 17 days[2,3]. Individuals diagnosed with smallpox may recover, however smallpox may be fatal.

CDC bioterrorism agent/disease category: Category A

Symptoms: The symptoms of smallpox may include: high fever, headache, body aches, nausea, vomiting, rash, sores and pustules[2,3].

Prevention: Smallpox vaccine.

Treatment: Individuals diagnosed with smallpox should receive supportive care. Cidofovir may be used to treat smallpox[2,3].

Tularemia

Background information: Tularemia is a disease caused by the bacteria referred to as Francisella tularensis[3]. Tularemia may affect both humans and animals. Humans may become infected with tularemia via tick bites, fly bites, skin contact with an infected animal, ingestion of contaminated water and inhalation of contaminated aerosols[3]. The incubation period for tularemia is approximately 1 - 21 days[2,3]. Tularemia may be life-threatening.

CDC bioterrorism agent/disease category: Category A

Symptoms: The symptoms of tularemia may include: skin ulcer, sore throat, swelling of lymph glands, chest pain and difficulty breathing[3]

Prevention: Tularemia may be prevented by avoiding infected animals, insects and contaminated water supplies.

Treatment: Individuals diagnosed with tularemia may be treated with antibiotics. The antibiotics which may be used to treat tularemia include: streptomycin, gentamicin, ciprofloxacin and doxycycline[3].

Filoviruses

Background information: Filoviruses belongs to a virus family called Filoviridae and can cause severe hemorrhagic fever[3]. Some forms of Filoviridae may even lead to Ebola. Filoviruses can affect both humans and nonhuman primates[2,3]. Once a human is infected, the virus may spread by person-to-person transmission[3]. The incubation period for Ebola is approximately 4 - 21 days[2,3]. Ebola may be fatal.

CDC bioterrorism agent/disease category: Category A

Symptoms: The symptoms of Ebola may include: fever, headache, muscle pain, weakness, fatigue, nausea, vomiting, diarrhea, abdominal pain and unexplained hemorrhages[2,3].

Prevention: There is currently no vaccine licensed by the U.S. Food and Drug Administration (FDA) to protect people from the Ebola virus[3]. However, a few Ebola vaccine options are in development.

Treatment: Treatment for Ebola consists of supportive care, including fluids and oxygen therapy[3].

Brucellosis

Background information: Brucellosis is an infectious disease caused by a bacteria. Individuals may become infected with brucellosis when they come in contact with infected animals or contaminated animal products. The incubation period for brucellosis is approximately 5 - 60 days[3].

CDC bioterrorism agent/disease category: Category B

Symptoms: The symptoms of brucellosis may include the following: fever, sweats, malaise, fatigue, headaches and muscle/joint pain[3].

Prevention: Brucellosis may be prevented by avoiding infected animals or contaminated animal products.

Treatment: Treatment for brucellosis may include supportive care and antibiotics[3].

Salmonella

Background information: Salmonella is a bacterial infection which typically affects the intestinal tract[2,3]. Contaminated food may lead to salmonella. The incubation period for salmonella is approximately 12 - 72 hours[2,3]. Salmonella typically lasts about 4 - 7 days and individuals usually recover without treatment[2,3].

CDC bioterrorism agent/disease category: Category B

Symptoms: The symptoms of salmonella may include: a fever, abdominal cramps and diarrhea[3].

Prevention: There is currently no vaccine available for salmonella. However, individuals can prevent salmonella by avoiding infected foods.

Treatment: Supportive care may be necessary for individuals suffering from salmonella.

Glanders

Background information: Glanders is a disease caused by the bacteria referred to as Burkholderia mallei3. Glanders is primarily a disease of horses. However, it can infect humans. Individuals may become infected with glanders when they come in contact with infected animals' fluids or tissue3. The incubation period for glanders is approximately 1 - 14 days[2,3].

CDC bioterrorism agent/disease category: Category B

Symptoms: The symptoms of glanders may include: fever, chills, sweats, chest pain, muscle tightness, headaches, nasal discharge, light sensitivity, as well as

ulcers in the nose, mouth and throat[2,3].

Prevention: There is currently no vaccine available for glanders. However, individuals can prevent glanders by avoiding infected animals.

Treatment: Individuals who develop glanders may be treated with antibiotics. The antibiotics which may be used to treat glanders include: streptomycin, gentamicin, ciprofloxacin[2,3]. Individuals suffering from glanders may also require supportive care.

Melioidosis

Background information: Melioidosis, also known as Whitmore's disease, is an infectious disease caused by the bacterium referred to as Burkholderia pseudomallei[3]. Melioidosis can affect both humans and animals and can be transmitted through contact with contaminated water and/or soil[3]. The time between exposure to Burkholderia pseudomallei and the emergence of symptoms is not clearly defined, but may range from 1 day to years[3].

CDC bioterrorism agent/disease category: Category B

Symptoms: The symptoms of melioidosis may include: fever, ulcerations, cough, chest pain, headache, anorexia, abdominal discomfort, joint pain and respiratory distress[3].

Prevention: Individuals can prevent melioidosis by avoiding contact with contaminated water and soil supplies[3].

Treatment: Melioidosis treatment typically begins with intravenous antimicrobial therapy for 10 - 14 days, followed by 3 - 6 months of oral antimicrobial therapy[3].

Psittacosis

Background information: Psittacosis is a disease caused by the bacteria referred to as Chlamydia psittaci3. Psittacosis can affect humans and, more commonly, birds. Individuals may become infected with psittacosis when they

come in contact with infected birds[3]. Symptoms of psittacosis typically develop within 5 -14 days after exposure[3]. Psittacosis can be deadly.

CDC bioterrorism agent/disease category: Category B

Symptoms: The symptoms of psittacosis may include: fever, chills, headache, muscle aches and a dry cough[3].

Prevention: Individuals can prevent psittacosis by avoiding infected birds.

Treatment: Individuals who develop psittacosis may be treated with antibiotics[3].

Q Fever

Background information: Q fever is a disease caused by the bacteria referred to as Coxiella burnetii[2,3]. Coxiella burnetii may infect both humans and animals such as goats and cattle[3]. Humans can become infected through breathing in dust and other materials contaminated by infected animals[3]. The incubation period for Q fever is approximately 7 - 41 days[2,3].

CDC bioterrorism agent/disease category: Category B

Symptoms: The symptoms of Q fever may include: fever, chills, fatigue, headache, muscle aches, nausea, vomiting, diarrhea, chest pain, stomach pain and weight loss[2,3].

Prevention: There is currently no vaccine available for Q fever. However, individuals can prevent Q fever by avoiding infected animals.

Treatment: The recommended therapy for Q fever is doxycycline[2,3]. However, individuals affected by Q fever typically recover without antibiotic therapy[3].

Ricin

Background information: Ricin is a poison found naturally in castor beans[3]. It often accumulates as "waste" when castor oil is produced3. Once collected, ricin can be made into a powder, mist or pellet and used to poison individuals through inhalation or ingestion[3]. Symptoms of ricin poisoning may develop 4 - 24 hours after exposure[2,3]. Ricin can lead to organ failure and death[2,3]. Death from ricin poisoning can occur within 36 - 72 hours after exposure3.

CDC bioterrorism agent/disease category: Category B

Symptoms: Symptoms of ricin poisoning can depend on the route of exposure and may include: fever, cough, cheat pain, difficulty breathing, abdominal pain, nausea, vomiting and diarrhea[2,3].

Prevention: There is currently no antidote available for ricin poisoning.

Treatment: Treatment for ricin poisoning typically involves supportive care and methods to remove ricin from the individuals exposed to the poison[2,3].

Staph Food Poisoning

Background information: Staph food poisoning is an illness of the gastrointestinal track caused by the bacterium referred to as Staphylococcus aureus[3]. Staphylococcus aureus can be used to contaminate food and food supplies. Individuals infected with Staphylococcus aureus can develop symptoms within 30 minutes[3]. However, some individuals can take up to 8 hours to develop symptoms3. Symptoms of staph food poisoning typically last 24 hours - however, severe illness is possible[3].

CDC bioterrorism agent/disease category: Category B

Symptoms: Symptoms of staph food poisoning may include: fever, stomach cramps, nausea, vomiting and diarrhea[3].

Prevention: Staph food poisoning may be avoided by utilizing proper hand hygiene techniques and avoiding contaminated food and/or food supplies[3].

Treatment: As previously mentioned, most individuals recover from staph food poisoning within 24 hours of exposure[3]. In rare cases, individuals exposed to Staph food poisoning may have to be hospitalized due to sever diarrhea and/or dehydration. In those cases, supportive care may be necessary.

Typhus Fevers

Background information: Typhus fevers can refer to a group of diseases caused by bacteria from lice, fleas and chiggers3. Chiggers may refer to a form of mite[3]. Symptoms of typhus fevers typically develop within 2 weeks of exposure[3].

CDC bioterrorism agent/disease category: Category B

Symptoms: The symptoms of most typhus fevers include: fever, chills, headache, body aches, rapid breathing, confusion, rash, nausea and vomiting[3].

Prevention: Individuals can prevent typhus fevers by avoiding infected lice, fleas and chiggers.

Treatment: Individuals who develop symptoms of most types of typhus fevers may be treated with antibiotics. The recommended antibiotic for most types of typhus fevers is doxycycline[3].

Nipah Virus

Background information: Nipah virus is a member of the family Paramyxoviridae, genus Henipavirus[3]. Nipah virus can affect both humans and animals, especially bats and pigs[3]. Humans can become infected with nipah virus through contact with infected animals. Symptoms of the nipah virus may appear within 5 - 14 days after exposure[3]. The symptoms of nipah virus can progress to a coma within 24 - 48 hours[3]. Nipah virus may be fatal.

CDC bioterrorism agent/disease category: Category C

Symptoms: The symptoms of nipah virus may include: fever, headache, drowsiness, disorientation, mental confusion and coma[3]. The aforementioned

symptoms of the nipah virus are progressive - meaning, the symptoms may start with a fever and/or headache and then escalate to mental confusion followed by a coma[3].

Prevention: Individuals can prevent nipah virus by avoiding infected animals.

Treatment: Treatment of nipah virus is limited to supportive care[3].

Hantavirus

Background information: Individuals infected with hantavirus may develop hantavirus pulmonary syndrome[3]. Individuals may become infected with hantavirus through contact with infected rodents or infected rodents' urine and/or fecal matter[3]. Symptoms of hantavirus pulmonary syndrome may develop within days of exposure[3]. Hantavirus pulmonary syndrome may be fatal.

CDC bioterrorism agent/disease category: Category C

Symptoms: The symptoms of hantavirus pulmonary syndrome may include the following: fever, fatigue, headaches, muscle aches, chills, dizziness, nausea, vomiting, diarrhea and shortness of breath[3].

Prevention: Individuals can prevent hantavirus pulmonary syndrome by avoiding infected rodents and infected rodents' urine and/or fecal matter[3].

Treatment: Treatment for hantavirus pulmonary syndrome typically involves supportive care, including oxygen threapy[3].

Radioactive Agents and Attacks

Along with the previously highlighted bioterrorism agents/diseases, radioactive agents may also be used in an attack. As with the bioterrorism agents/diseases, health care professionals should possess a working knowledge of the fundamental aspects of radioactive agents to best serve patients in the event of an attack. The information found within the remainder of this section was derived from materials provided by the CDC3.

Background information: A radioactive, or radiation, attack may refer to the intentional release of radioactive agents/materials. A radioactive attack may present itself in many forms including: a nuclear emergency, a dirty bomb attack and a radiological exposure device attack.

A nuclear emergency can refer to an emergency involving the explosion of a nuclear weapon or device. During a nuclear emergency, the explosion of a nuclear weapon and/or device typically produces an intense pulse of heat, light, air pressure and radiation, all of which may be deadly to those victimized by a radiation attack. Nuclear explosions can also produce fallout. Fallout may refer to the radioactive materials that can be carried long distances by wind. The main concerns of a nuclear emergency include the following: injury or death as a result of the initial blast, flash blindness, moderate to severe burns, radiation sickness and contaminated food and/or water supplies.

A dirty bomb, otherwise referred to as a radiological dispersal device, can refer to any mixture of explosives with radioactive agents/materials. When a dirty bomb is set off, it typically carries radioactive material into the surrounding area. However, it cannot create an atomic blast. The main concerns of a dirty bomb attack include the following: injury or death as a result of the initial blast, the spread of radioactive materials and contaminated food and/or water supplies.

Finally, a radiological exposure device, also called a hidden sealed source, may refer to any source or device which contains radioactive agents/materials for the purposes of exposure. Unlike with the two previous methods of radiation attacks, when a radiological exposure device is utilized there is no explosion. The device is simply intended to expose individuals to radiation. Typically, the radiological exposure device is hidden from sight and placed in public areas such as: subways or other forms of public transportation, shopping areas and/or government buildings. In most cases, a radiological exposure device is placed in one or more of the aforementioned areas with the goal to expose individuals to radiation as they pass by or come in contact with the device. The main concerns of an attack with a radiological exposure device may include the following: the amount of radioactive material included in the device, individuals' exposure time and what parts of victims' bodies were exposed to the radioactive material included in the device.

Symptoms: Exposure to radiation or radioactive agents/materials may lead to: fever, nausea, vomiting, diarrhea, fatigue, skin irritation, radiation burns, seizures and coma. The long-term effects of radiation exposure may include both cancer and death.

Prevention: The best prevention for a radiation attack or exposure to radioactive agents/materials is observation and reporting. Individuals should report any observed suspicious individuals, packages and/or materials to appropriate officials. In the case of a radiation attack, individuals should be advised to "get inside and stay inside" - meaning individuals should get inside a building or shelter and stay inside until otherwise noticed. When inside a building or shelter individuals should be advised to move towards the middle of the building or basement away from windows, remove clothing if possible and shower or rinse exposed areas if applicable. Individuals should also attempt to obtain relevant news and information. In addition, in the event of a radiation attack, individuals should be advised to avoid contaminated food and water supplies.

Treatment: The treatment for radiation exposure often depends on the individual's presenting symptoms. However, the overall goals of radiation treatment focus around the removal of radiation contamination from victims' bodies, especially in cases of internal contamination. Internal contamination may refer to the results of taking radioactive materials into the human body via inhalation, ingestion or through open wounds. Internal contamination can be deadly, therefore it is essential for health care professionals to remove internal contamination from a victim's body as soon as possible. Fortunately, there are medical treatment options available to help health care professionals limit or remove internal contamination from a patient's body. The treatment options available to help health care professionals limit or remove internal contamination from a patient's body include: potassium lodide, Prussian blue and diethylenetriamine pentaacetate, otherwise referred to as DTPA.

Potassium lodide is a salt of stable iodine that can help block radioactive iodine from being absorbed by the thyroid gland, thus protecting that particular gland from radiation injury. Potassium lodide is available in both tablet and in liquid form. Both formulations may be taken by mouth after exposure to radioactive iodine. The typical adult dose of potassium lodide is 130 mg. A single dose of potassium lodide can protect the thyroid gland for 24 hours. Typical side effects

of potassium lodide include: gastrointestinal upset, rashes and inflammation of the salivary glands. Allergic reactions from potassium lodide may also be possible. Patients should be monitored for any signs of an allergic reaction after potassium lodide is administered.

Another option which may be used by health care professionals to limit or remove internal contamination from a patient's body is Prussian blue. Prussian blue is a pill that can help remove radioactive cesium and thallium from a victim's body. Essentially, Prussian blue traps radioactive cesium and thallium in the intestines and prevents them from being re-absorbed by the human body. Prussian blue is available as a 500 mg capsule that can be swallowed whole. It may be safe for most adults to take Prussian blue. Individuals ranging from 2 -12 years of age may also take Prussian blue. Additionally, Pregnant woman may take Prussian blue. Possible side effects of Prussian blue include: upset stomach, constipation and blue feces. The medical formulation of Prussian blue is not the same as the dye referred to as Prussian blue. Individuals exposed to radioactive cesium and thallium should be advised that the medical formulation of Prussian blue is not the same as the dye referred to as Prussian blue when applicable.

Finally, diethylenetriamine pentaacetate, otherwise referred to as DTPA, may be used to limit or remove internal contamination from a patient's body. DTPA is a medication that can bind to radioactive plutonium, americium, and curium. DTPA is used to decrease the amount of time it takes to remove the aforementioned radioactive agents/materials from the human body. DTPA products can, typically, be administered by direct injection or from a bag intravenously. Possible side effects of DTPA include: nausea, vomiting, diarrhea, fever, itching and muscle cramps. DTPA should only be administered by a doctor.

In addition to the previously highlighted treatment options, Neupogen may also be administered to patients suffering from internal contamination or radiation exposure. Neupogen is a medication, typically administered to cancer patients, to help them produce white blood cells. However, Neupogen may also be used in cases of internal contamination or cases of radiation exposure to help victims increase white blood cell counts in order to defend against possible infections. Unlike the previously highlighted treatment options, Neupogen cannot help a patient in eliminating or blocking the absorption of radioisotopes or any radioactive material from inside the body. As previously mentioned, it is mainly

administered to patients victimized by radioactive agents to minimize the incidence of infections. Neupogen is available in single-dose vials and prefilled syringes. It may be administered to adults and children. Neupogen falls into Pregnancy Category C. Possible side effects of Neupogen include the following: bone pain, fever, diarrhea, skin rash and weakness. Allergic reactions from Neupogen may also be possible. Patients should be monitored for any signs of an allergic reaction after Neupogen is administered.

Section 2: Summary

There are a wide range of bioterrorism agents which may be used in a bioterrorism attack. Each bioterrorism agent possesses the potential to lead to a serious illness and/or disease. Some bioterrorism agents may even lead to deadly infections. Fortunately, many of the infections, diseases and/or illnesses caused by bioterrorism agents may be prevented and/or effectively treated through the use or antibiotics, antitoxins and the administration of supportive care.

Along with bioterrorism agents/diseases, radioactive agents may also be used in an attack. A radiation attack may present itself in many forms including: a nuclear emergency, a dirty bomb attack and a radiological exposure device attack. Radiation attacks may be extremely dangerous to individuals health and overall well-being. Therefore, it is essential for victims of a radiation attack to receive treatment.

The treatment for radiation exposure often depends on the individual's presenting symptoms. However, the overall goals of radiation treatment center around the removal of radiation contamination from victims' bodies, especially in cases of internal contamination. Medical treatment options are available to help health care professionals limit or remove internal contamination from a patient's body. The medical treatment options available to limit or remove internal contamination from a patient's body include the following: potassium lodide, Prussian blue and DTPA. Neupogen may also be administered to patients suffering from internal contamination or radiation exposure. Much like with bioterrorism agents/diseases, possessing a fundamental knowledge of radiation treatment can help health care professionals best serve patients in need.

Section 2: Key Concepts

• A wide range of bioterrorism agents may be used in a bioterrorism attack.

• Bioterrorism agents may be extremely dangerous to individuals' health and overall well-being.

• Some bioterrorism agents may lead to deadly infections/diseases/illnesses.

• Many of the infections/diseases/illnesses caused by bioterrorism agents may be prevented and/or effectively treated through the use or antibiotics, antitoxins and the administration of supportive care.

• Radioactive agents may be used in an attack.

• A radiation attack may present itself in many forms including: a nuclear emergency, a dirty bomb attack and a radiological exposure device attack.

• The overall goals of radiation treatment center around the removal of radiation contamination from victims' bodies and treating patients' symptoms.

• The medical treatment options available to limit or remove internal contamination from a patient's body include the following: potassium lodide, Prussian blue and DTPA3. Neupogen may also be administered to patients suffering from internal contamination or radiation exposure[3].

Section 2: Key Terms

Plague - the deadly disease caused by the bacteria known as Yersinia pstis[2,3]

Typhus fevers - a group of diseases caused by bacteria from lice, fleas and chiggers[3]

Chiggers - a form of mite[3]

Radioactive (radiation) attack - the intentional release of radioactive agents/materials[3]

Nuclear emergency - an emergency involving the explosion of a nuclear weapon or device[3]

Fallout - the radioactive materials that can be carried long distances by wind[3]

Dirty bomb (radiological dispersal device) - any mixture of explosives with radioactive agents/materials[3]

Radiological exposure device (hidden sealed source) - any source or device which contains radioactive agents/materials for the purposes of exposure[3]

Internal contamination - the results of taking radioactive materials into the human body via inhalation, ingestion or through open wounds[3]

Section 2: Personal Reflection Question

What bioterrorism-related infections may result from an attack?

Section 3: Preparation

Bioterrorism attacks can be devastating. They can threaten public health as well as cause destruction, social disruptions and economic turmoil. Furthermore, they possess the potential to cripple a city and/or an entire region of the country. Therefore, it is essential to prepare for bioterrorism attacks, especially when it comes to health care. Health care professionals must be prepared for bioterrorism attacks. As previously mentioned, the scenarios outlined in the case studies presented above are very real possibilities in today's global climate; thus, health care professionals must be prepared to handle the many possible and plausible challenges presented by bioterrorism attacks. Fortunately, there are methods for health care professionals to prepare for bioterrorism attacks. One of the most effective methods for health care professionals to prepare for potential bioterrorism attacks is to review key points of interest, such as organizational policies and procedures.

Policies and Procedures

A health care organization's policies and procedures address the specific needs of the individual health care facility. They generally cover everything from the administration of medications to computer systems, fire codes, patient safety protocols, health care equipment, personal conduct and, most relevant in this case, bioterrorism emergency procedures. Essentially, a health care organization's policies and procedures outline the rules, codes, protocols and standards of each specific facility. It has been said that almost everything a health care professional needs to know and understand about how to effectively administer health care in his or her own given facility can be found within the organization's policies and procedures. For example, organizational policies and procedures routinely outline how health care professionals should administer health care to patients in times of power outages and emergency situations. Exactly what to do, who to report to, who is in command, how to administer medications, patient safety, etc. are commonly addressed within the organization's policies and procedures. If a health care professional has a question on what to do or how to administer health care during a power outage or an emergency situation, they can, typically, find the answer within the organization's policies and procedures. Much of what is covered within a given organization's policies and procedures centers around doing what is best for the patient and the uninterrupted, continuation of patient health care. Typically, great lengths are taken by health care organizations to establish how it can best serve patients. Patients' health, safety and individual rights are of the utmost importance to a health care organization. Doing what is best for the patient is a goal for many health care organizations and the implementation of their policies and procedures is a way to achieve that goal. Organizational policies and procedures are routinely updated and improved upon to best accommodate patients' health and safety. They are also continually updated and improved to provide health care professionals with the best possible methods to administer health care at any given time, independent of outside variables such as bioterrorism attacks and/or emergencies. In short, organizational policies and procedures provide a map health care professionals can use to efficiently and effectively administer health care, no matter the situation. Thus, to best prepare for a bioterrorism attack, health care professionals should, first and foremost, review their respective health care organization's policies and procedures. Doing so, can provide health

care professionals with the guidance they may require to optimize the administration of health care during a bioterrorism attack.

Bioterrorism Readiness Plan

Along with organizational policies and procedures, health care professionals should also review their facilities' Bioterrorism Readiness Plan. A Bioterrorism Readiness Plan may be included within a health care organization's polices and procedure, or it may exist on its own. If a health care organization does not have a bioterrorism readiness plan, health care administrators should consider developing one. A bioterrorism readiness plan template may be found in Figure 1. The Bioterrorism Readiness Plan template outlines sections that may be included in a Bioterrorism Readiness Plan. Additional sections may be included or added to a health care organization's Bioterrorism Readiness Plan depending on the specific needs and requirements of the facility. The information found within Figure 1 was derived from materials provided by the CDC4.

Figure 1: Bioterrorism Readiness Plan

Reporting Requirements and Contact Information
Health care facilities may be the initial site of recognition and response to bioterrorism events. If a bioterrorism event is suspected, local emergency response systems should be activated. Notification should immediately include local infection control personnel and the healthcare facility administration, and prompt communication with the local and state health departments, FBI field office, local police, CDC, and medical emergency services. Each health care facility should include a list containing the contact information of relevant parties in its readiness plan.

Detection of Outbreaks Caused by Agents of Bioterrorism
Bioterrorism may occur as covert events, in which persons are unknowingly exposed and an outbreak is suspected only upon recognition of unusual disease clusters or symptoms. Bioterrorism may also occur as announced events, in which persons are warned that an exposure has occurred. A health care facility's Bioterrorism Readiness Plan should include details for management of both types of scenarios: suspicion of a bioterrorism outbreak potentially associated with a

covert event and announced bioterrorism events or threats. The possibility of a bioterrorism event should be ruled out with the assistance of the FBI and state health officials.

Syndrome-based Criteria

Rapid response to a bioterrorism-related outbreak requires prompt identification of its onset. Because of the rapid progression to illness and potential for dissemination of some of the bioterrorism agents, it may not be practical to await diagnostic laboratory confirmation. Instead, it will be necessary to initiate a response based on the recognition of high-risk syndromes. Thus, it may be pertinent for health care organizations to include syndrome-based criteria within their Bioterrorism Readiness Plan.

Epidemiologic Features

Epidemiologic principles should be used to assess whether a patient's presentation is typical of an endemic disease or is an unusual event that should raise concern. Features that should alert health care professional to the possibility of a bioterrorism-related outbreak include:

- A rapidly increasing disease incidence (e.g., within hours or days) in a normally healthy population.
- An epidemic curve that rises and falls during a short period of time.
- An unusual increase in the number of people seeking care, especially with fever, respiratory, or gastrointestinal complaints.
- An endemic disease rapidly emerging at an uncharacteristic time or in an unusual pattern.
- Lower attack rates among people who had been indoors, especially in areas with filtered air or closed ventilation systems, compared with people who had been outdoors.
- 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 (e.g., pulmonary anthrax, tularemia, or plague).

Epidemiologic features and principles may be included in a health care organization's Bioterrorism Readiness Plan to increase awareness and best serve patients.

Infection Control Practices for Patient Management

The management of patients following suspected or confirmed bioterrorism events must be well organized and rehearsed. Strong leadership and effective communication are paramount. Furthermore, all patients in health care facilities, including symptomatic patients with suspected or confirmed bioterrorism-related illnesses, should be managed utilizing Standard Precautions. Standard Precautions are designed to reduce transmission from both recognized and unrecognized sources of infection in health care facilities, and are recommended for all patients receiving care, regardless of their diagnosis or presumed infection status Thus, infection control practices, including the use of Standard Precautions, for patient management should be clearly identified in a Bioterrorism Readiness Plan.

Patient Placement

In small-scale events, routine facility patient placement and infection control practices should be followed. However, when the number of patients presenting to a health care facility is too large to allow routine triage and isolation strategies (if required), it will be necessary to apply practical alternatives. These may include cohorting patients who present with similar syndromes, i.e., grouping affected patients into a designated section of a clinic or emergency department, or a designated ward or floor of a facility, or even setting up a response center at a separate building. Thus, patent placement during a bioterrorism attack should be clearly outlined in a Bioterrorism Readiness Plan.

Patient Transport

In general, the transport and movement of patients with bioterrorism-related infections, as for patients with any epidemiologically important infections (e.g., pulmonary tuberculosis, chickenpox, measles), should be limited to movement that is essential to provide patient care, thus reducing the opportunities for transmission of microorganisms within health care facilities. Therefore patient transport requirements should be included in a Bioterrorism Readiness Plan.

Cleaning, Disinfection, and Sterilization of Equipment and Environment

Principles of Standard Precautions should be generally applied for the management of patient-care equipment and environmental control. Each facility should have in place adequate procedures for the routine care, cleaning, and

disinfection of environmental surfaces, beds, bedrails, bedside equipment, and other frequently touched surfaces and equipment, and should ensure that these procedures are being followed. Additionally, rooms and bedside equipment of patients with bioterrorism-related infections should be cleaned using the same procedures that are used for all patients as a component of Standard Precautions, unless the infecting microorganism and the amount of environmental contamination indicates special cleaning. In addition to adequate cleaning, thorough disinfection of bedside equipment and environmental surfaces may be indicated for certain organisms that can survive in the inanimate environment for extended periods of time. The methods and frequency of cleaning and the products used should be determined by facility policy.

Discharge Management

Ideally, patients with bioterrorism-related infections will not be discharged from a health care facility until they are deemed noninfectious. However, consideration should be given to developing home-care instructions in the event that large numbers of persons exposed may preclude admission of all infected patients. Depending on the exposure and illness, home care instructions may include recommendations for the use of appropriate barrier precautions, hand washing, waste management, and cleaning and disinfection of the environment and patient care items. Further requirements for discharge management should be included in a health care organization's Bioterrorism Readiness Plan.

Post-mortem Care

Pathology departments and clinical laboratories should be informed of a potentially infectious outbreak prior to submitting any specimens for examination or disposal. Thus, a section outlining post-mortem care should be included in a health care organization's Bioterrorism Readiness Plan.

Decontamination of Patients and Environment

The need for decontamination often depends on the suspected exposure to a bioterrorism agent. The goal of decontamination after a potential exposure to a bioterrorism agent is to reduce the extent of external contamination of the patient and contain the contamination to prevent further spread. Decontamination procedures should be included in a health care organization's Bioterrorism Readiness Plan.

Prophylaxis and Post-exposure Immunization

Health care facilities should ensure that policies are in place to identify and manage health care workers exposed to infectious patients.

Triage and Management of Large Scale Exposures and Suspected Exposures

Health care facilities should incorporate into their Bioterrorism Readiness Plan processes for triage and safe housing and care for potentially large numbers of affected individuals. Facility needs will vary with the size of the regional population served and the proximity to other health care facilities and external assistance. Triage and management planning for large-scale bioterrorism events or related emergencies may include:

- Establishing networks of communication and lines of authority required to coordinate onsite care.
- Planning for cancellation of non-emergency services and procedures.
- Identifying sources able to supply available vaccines, immune globulin, antibiotics, and botulinum anti-toxin (with assistance from local and state health departments).
- Planning for the efficient evaluation and discharge of patients.
- Developing discharge instructions for patients determined to be non-contagious or in need of additional on-site care, including details regarding if and when they should return for care or if they should seek medical follow-up.
- Determining availability and sources for additional medical equipment and supplies (e.g., ventilators) that may be needed for urgent large-scale care.
- Planning for the allocation or re-allocation of scarce equipment in the event of a large-scale event (e.g., duration of ventilator support of terminally afflicted individuals).
- With assistance from the Pathology service, identifying the institution's ability to manage a sudden increase in the number of cadavers on site.

Psychological Aspects of Bioterrorism

Following a bioterrorism-related event, fear and panic can be expected from both patients and health care professionals. Psychological responses following a bioterrorism event may include horror, anger, panic, unrealistic concerns about infection, fear of contagion, paranoia, social isolation, or demoralization. When developing the facility Bioterrorism Readiness Plan, consider the following to address patient and general public fears:

• Minimize panic by clearly explaining risks, offering careful but rapid medical evaluation/treatment, and avoiding unnecessary isolation or quarantine.
• Treat anxiety in unexposed persons who are experiencing somatic symptoms (e.g., with reassurance, or diazepam-like anxiolytics as indicated for acute relief of those who do not respond to reassurance).

Consider the following to address health care professionals' fears:

• Provide bioterrorism readiness education, including frank discussions of potential risks and plans for protecting healthcare providers.
• Invite active, voluntary involvement in the bioterrorism readiness planning process.
• Encourage participation in disaster drills.

Fearful or anxious health care workers may benefit from their usual sources of social support, or by being asked to fulfill a useful role (e.g., as a volunteer at the triage site).

Laboratory Support and Confirmation

A section regarding laboratory support and related information should be included in health care organization's Bioterrorism Readiness Plan.

Patient, Visitor, and Public Information

Clear, consistent, understandable information should be provided (e.g., via fact sheets) to patients, visitors, and the general public. During bioterrorism-related outbreaks, visitors may be strictly limited. A well-designed health care facility Bioterrorism Readiness Plan should clarify the lines of authority and flow of communication. To minimize the anticipated responses of fear, confusion and anger, health care facilities should plan in advance the methods and channels of communications to be used to inform the public. The health care organization communication plan may be include the facility's Bioterrorism Readiness Plan.

Agent-Specific Recommendations

A Bioterrorism Readiness Plan may also include bioterrorism agent specific sections or supplemental materials with bioterrorism agent specific recommendations. Examples of bioterrorism agent specific sections of a Bioterrorism Readiness Plan may be found below.

Anthrax

Etiology - Anthrax is an acute infectious disease caused by Bacillus anthracis, a spore forming, gram-positive bacillus. Associated disease occurs most frequently in sheep, goats, and cattle, which acquire spores through ingestion of contaminated soil. Humans can become infected through skin contact, ingestion, or inhalation of B. anthracis spores from infected animals or animal products (as in "woolsorter's disease" from exposure to goat hair). Person-to-person transmission of inhalational disease does not occur. Direct exposure to vesicle secretions of cutaneous anthrax lesions may result in secondary cutaneous infection.

Clinical features - Human anthrax infection can occur in three forms: pulmonary, cutaneous, or gastrointestinal, depending on the route of exposure. Of these forms, pulmonary anthrax is associated with bioterrorism exposure to aerosolized spores. Clinical features for each form of anthrax include:

Pulmonary -

• Non-specific prodrome of flu-like symptoms follows inhalation of infectious spores.
• Possible brief interim improvement.
• Two to four days after initial symptoms, abrupt onset of respiratory failure and hemodynamic collapse, possibly accompanied by thoracic edema and a widened mediastinum on chest radiograph, suggestive of mediastinal lymphadenopathy and hemorrhagic mediastinitis.
• Gram-positive bacilli on blood culture, usually after the first two or three days of illness.
• Treatable in early prodromal stage. Mortality remains extremely high despite antibiotic treatment if it
is initiated after onset of respiratory symptoms.

Cutaneous -

• Local skin involvement after direct contact with spores or bacilli.
• Commonly seen on the head, forearms or hands.
• Localized itching, followed by a papular lesion that turns vesicular, and within 2-6 days develops into a depressed black eschar.
• Usually non-fatal if treated with antibiotics.

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Gastro-intestinal -
• Abdominal pain, nausea, vomiting, and fever following ingestion of contaminated food, usually meat.
• Bloody diarrhea, hematemesis.
• Gram-positive bacilli on blood culture, usually after the first two or three days of illness.
• Usually fatal after progression to toxemia and sepsis.

Infection Control Practices for Patient Management Symptomatic - patients with suspected or confirmed infections with B. anthracis should be managed according to current guidelines specific to their disease state. For up-to-date information and recommendations for therapy, contact the local and state health department and the Bioterrorism Emergency Number at the CDC Emergency Response Office.

Isolation precautions - Standard Precautions are used for the care of patients with infections associated with B. anthracis. Standard Precautions include the routine use of gloves for contact with non-intact skin, including rashes and skin lesions.

Patient placement - Private room placement for patients with anthrax is not necessary. Airborne transmission of anthrax does not occur. Skin lesions may be infectious, but requires direct skin contact only.

Patient transport - Standard Precautions should be used for transport and movement of patients with B. anthracis infections.

Cleaning, disinfection, and sterilization of equipment and environment - Principles of Standard Precautions should be generally applied for the management of patient-care equipment and for environmental control.

Discharge management - No special discharge instructions are indicated. Home care providers should be taught to use Standard Precautions for all patient care (e.g., dressing changes).

Post-mortem care - Standard Precautions should be used for post-mortem care. Standard Precautions include wearing appropriate personal protective equipment, including masks and eye protection, when generation of aerosols or splatter of body fluids is anticipated.

Decontamination of patients/environment - The risk for re-aerosolization of B. anthracis spores appears to be extremely low in settings where spores were released intentionally or were present at low or high levels. In situations where the threat of gross exposure to B. anthracis spores exists, cleansing of skin and potentially contaminated fomites (e.g. clothing or environmental surfaces) may be considered to reduce the risk for cutaneous and gastrointestinal forms of disease.

Patient, Visitor, and Public Information - Fact sheets for distribution should be prepared, including explanation that people recently exposed to B. anthracis are not contagious, and antibiotics are available for prophylactic therapy along with the anthrax vaccine. Dosing information and potential side effects should be explained clearly. Decontamination procedures, i.e., showering thoroughly with soap and water; and environmental cleaning, i.e., with 0.5% hypochlorite solution (one part household bleach added to nine parts water), can be described.

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Botulism

Etiology - Clostridium botulinum is an anaerobic gram-positive bacillus that produces a potent neurotoxin, botulinum toxin. In humans, botulinum toxin inhibits the release of acetylcholine, resulting in characteristic flaccid paralysis. C. botulinum produces spores that are present in soil and marine sediment throughout the world. Foodborne botulism is the most common form of disease in adults. An inhalational form of botulism is also possible. Botulinum toxin exposure may occur in both forms as agents of bioterrorism.

Clinical features - Foodborne botulism is accompanied by gastrointestinal symptoms. Inhalational botulism and foodborne botulism are likely to share other symptoms including:

• Responsive patient with absence of fever.
• Symmetric cranial neuropathies (drooping eyelids, weakened jaw clench, difficulty swallowing or speaking).
• Blurred vision and diplopia due to extra-ocular muscle palsies.
• Symmetric descending weakness in a proximal to distal pattern (paralysis of arms first, followed by respiratory muscles, then legs).
• Respiratory dysfunction from respiratory muscle paralysis or upper airway obstruction due to weakened glottis.

Infection Control Practices for Patient Management Symptomatic - Symptomatic patients with suspected or confirmed botulism should be managed according to current guidelines. For up-to-date information and recommendations for therapy, contact CDC or state health department.

Isolation precautions - Standard Precautions are used for the care of patients with botulism.

Patient placement - Patient-to-patient transmission of botulism does not occur. Patient room selection and care should be consistent with facility policy.

Patient transport - Standard Precautions should be used for transport and movement of patients with botulism.

Cleaning, disinfection, and sterilization of equipment and environment - Principles of Standard Precautions should be generally applied to the management of patient-care equipment and environmental control.

Discharge management - No special discharge instructions are indicated.

Post-mortem care - Standard Precautions should be used for post-mortem care.

Decontamination of patients/environment - Contamination with botulinum toxin does not place persons at risk for dermal exposure or risk associated with re-aerosolization. Therefore, decontamination of patients is not required.

Patient, Visitor, and Public Information - Fact sheets for distribution should be prepared, including explanation that people exposed to botulinum toxin are not

contagious. A clear description of symptoms including blurred vision, drooping eyelids, and shortness of breath should be provided with instructions to report for evaluation and care if such symptoms develop.

Standard Precautions

Another key point of interest which should be reviewed by health care professionals in preparation for a bioterrorism attack is Standard Precautions. Standard Precautions may refer to the minimum infection prevention practices that apply to all patient care, independent of the suspected or confirmed infection status of a patient, in any setting health care is administered[3]. The goal of Standard Precautions is to prevent the spread of infections. Standard Precautions typical include the following elements: the use of personal protective equipment, hand hygiene, respiratory hygiene, sharps safety, safe injection practices, sterile instruments and devices as well as methods to clean and disinfect environmental surfaces[3]. In the face of a bioterrorism attack, Standard Precautions are absolutely necessary in the administration of health care in order to prevent the spread of potentially devastating infections among patients as well as health care professionals. That being said, health care professionals should utilize Standard Precautions when administering health care in any situation.

Personal Protective Equipment

While reviewing the elements of Standard Precautions, health care professionals should gather information regarding personal protective equipment (PPE). PPE can refer to equipment designed to protect, shield and minimize exposure to hazards that may cause serious injury, illness and/or disease[3]. PPE can be an essential component of administering health care during a bioterrorism attack and in some cases the proper use of PPE can mean the difference between life and death. Due to the importance of PPE, health care professionals should possess a fundamental understanding of the individual types of PPE. The remainder of this subsection will review the individual types of PPE. The information found in the remainder of this subsection was derived from materials developed by the CDC[3].

Gown

Background information: The gown is one of the most recognizable pieces of PPE. The purpose of a gown is to protect an individual's torso and arms from potential contamination. Gowns are typically clean or sterile and often resistant to fluids.

Donning PPE: When putting on a gown a health care professional should make sure the gown completely covers his or her torso from the neck to the knees. The gown should also completely cover a health care professional's arms and writs. Additionally, a gown should be wrapped around the back and fastened at the back of the neck and waist.

Removing PPE: To effectively remove a gown a health care professional should unfasten the gown's ties and pull the gown away from the neck and shoulders. When the gown is removed from the body it should be rolled or folded and placed in the appropriate waste container. Health care professionals should wash their hands or use an alcohol-based hand sanitizer after removing all PPE.

Mask

Background information: The mask is another very recognizable piece of PPE. The purpose of a mask is to protect a health care professional's face from potentially infectious materials.

Donning PPE: When putting on a mask, a health care professional should make sure a mask completely covers his or her mouth and nose. A health care professional should also ensure a mask fits snug to the face and below the chin. Often masks can be secured to the head and neck via separate ties.

Removing PPE: To effectively remove a mask, a health care professional should untie the bottom ties, if applicable, followed by the upper ties. The mask should then be pulled off and discarded in the appropriate waste container. A health care professional should not touch a contaminated mask. Health care professionals should wash their hands or use an alcohol-based hand sanitizer after removing all PPE.

Goggles

Background information: Goggles are typically worn with a mask. The purpose of goggles is to protect the eyes from potentially infectious materials.

Donning PPE: When putting on goggles, a health care professional should make sure the goggles fit snuggly around the eyes. If a health care professional wears personal prescription lenses, the goggles should fit snuggly around his or her personal prescription lenses. Furthermore, goggles should be properly adjusted on the face to maximize vision and protection.

Removing PPE: To effectively remove goggles from the face, a health care professional should take off the goggles from the back by lifting the goggle's band and pulling them forward. If the goggles are not reusable they should be placed in the appropriate waste container. A health care professional should not touch contaminated goggles. Health care professionals should wash their hands or use an alcohol-based hand sanitizer after removing all PPE.

Face Shields

Background information: A face shield can be worn in place of goggles. The purpose of a face shield is to protect the eyes, nose and mouth from potentially infectious materials.

Donning PPE: When putting on a face shield health care professionals should make sure the face shield covers the forehead, extends below the chin and wraps around the side of the face.

Removing PPE: To effectively remove a face shield, a health care professional should take off the face shield from the back by lifting the face shield's band and pulling it forward. If the face shield is not reusable, it should be placed in the appropriate waste container. A health care professional should not touch a contaminated face shield. Health care professionals should wash their hands or use an alcohol-based hand sanitizer after removing all PPE.

Respirator

Background information: The purpose of a respirator is to protect a health care professional from hazardous and/or infectious aerosols. There are many types of respirators available to health care professionals including: particulate respirators, half-face elastomeric respirators, full-face elastomeric respirators and powered air purifying respirators. The most common type of respirators used by health care professionals are particulate respirators. When selecting a type of respirator, health care professionals should consider the type of exposure risk associated with the bioterrorism attack and/or applicable emergency. A "fit test" may be required to determine the appropriate size respirator need for each individual health care professional. Health care professionals may also require training regarding how and when to use a respirator.

Donning PPE: When putting on a respirator, a health care professional should make sure the respirator completely covers his or her mouth and nose. Health care professionals should also ensure the respirator fits snug to the face and below the chin. Additionally, a health care professional should be sure the respirator is properly sealed.

Removing PPE: To effectively remove a respirator, a health care professional should unite the bottom ties, if applicable, followed by the upper ties. The respirator should then be pulled off and discarded in the appropriate waste container. A health care professional should not touch a contaminated respirator. Health care professionals should wash their hands or use an alcohol-based hand sanitizer after removing all PPE.

Gloves

Background information: Gloves are often the most common piece of PPE used by health care professionals. The purpose of gloves is to protect the hands from contamination. When wearing gloves, health care professionals should avoid touch contamination. Touch contamination may refer to touching one's self and/or other surfaces such as tables, light switches and doors while wearing gloves. Touch contamination may lead to contamination and/or the passing of potentially infectious materials. Health care professionals should also remember

to change their gloves as they administer care to different patients, i.e. a new patient means a new pair of gloves.

Donning PPE: When putting on a pair of gloves, a health care professional should make sure the gloves extend to cover the wrists of isolation gowns. Gloves are often the last piece of PPE donned when putting on required PPE.

Removing PPE: To effectively remove a pair of gloves, a health care professional should use one gloved hand to grasp the palm area of the other gloved hand. Once the health care professional has a firm grip on the palm of one gloved hand, the health care professional should then peel off the first glove. After removing the first glove, the health care professional should then hold that glove in one hand. Using his or her fingers, the health care professional should slide the fingers off his or her ungloved hand under the reaming glove at the wrist and peel off the second glove right over the first glove. Both gloves should then be placed in the appropriate waste container.

Heath care professionals may also remove their gloves when they are removing their gowns. To do so, health care professionals should peel off each glove as they roll or fold their gowns before disposal. Both the gloves and the gown should then be discarded in the appropriate waste container. When removing a pair of gloves with a gown, health care professionals should ensure they do not touch the gloves or the gown with their bare hands. Health care professionals should wash their hands or use an alcohol-based hand sanitizer after removing all PPE.

Hand Hygiene

Along with gathering information regarding PPE, health care professionals should also review concepts related to effective hand hygiene. Hand hygiene may refer to the process of cleaning hands in order to prevent contamination and/or infections[3]. The simple truth is that germs are everywhere and some of them may be spread through contact. To help prevent the transmission of infectious agents through contact, health care professionals should always practice effective hand hygiene, especially in the case of a bioterrorism attack. As previously highlighted, some bioterrorism agents may lead to serious illness and/or death.

Therefore, it is paramount for health care professionals to use effective hand hygiene techniques to limit or prevent infectious bioterrorism agents from spreading and, ultimately, causing potentially devastating effects.

Hand hygiene is most effective when dirt, soil, microorganisms and other contaminates are removed from the hands[3]. To carry out effective hand hygiene, health care professionals should follow the following steps using soap and water[3]:

• Step 1 - Health care professionals should wet their hands with water.
• Step 2 - Health care professionals should then apply soap to their hands. In doing so, enough soap should be applied to the hands to cover all hand surfaces.
• Step 3 - Once soap is applied to the hands, health care professionals should rub their hands together in a circle to create a lather.
• Step 4 - When a lather is created, health care professionals should put one palm on top of the other hand and rub soap up and down.
• Step 5 - Next, health care professionals should place their palms and fingers together and rub up and down.
• Step 6 - Then health care professionals should put the fingers of both hands together and rub soap up and down.
• Step 7 - Health care professionals should be sure to clean their thumbs and palms.
• Step 8 - Rinse hands thoroughly with water.
• Step 9 - Dry hands completely using a piece of paper towel.
• Step 10 - Finally, using a piece of paper towel, health care professionals should then turn off the faucet or running water source and dispose of the paper towel in the appropriate waste container.

The previous hand hygiene steps should be used before eating or preparing food, after administering health care to a patient, after touching garbage, after going to the bathroom, after removing all PPE, etc[3]. If soap and water is not readily available to a health care professional, he or she may use an alcohol-based hand sanitizer by applying the alcohol-based hand sanitizer to the hands and then rubbing the hands together for 20 seconds[3]. When using an alcohol-based hand sanitizer, health care professionals should not rinse or wash off the hand sanitizer before it dries to maximize its effects[3].

Effective hand hygiene may appear trivial, however it is a crucial step to the safe and effective administration of health care. Hand hygiene should be a routine part of health care administration and must be utilized during a bioterrorism attack. Effective hand hygiene can prevent the spread of infection and the destructive diseases and/or conditions caused by bioterrorism agents.

Syndromic Surveillance

Lastly, in preparation for a bioterrorism attack, health care professionals should become familiar with syndromic surveillance. Syndromic surveillance may refer to the systematic process of collecting nonspecific health-related data that precedes diagnosis to identify an outbreak or the presences of a bioterrorism-related disease[3]. In other words, syndromic surveillance is the use of data to identify and predict health-related trends as they are occurring to best serve the public in the event of a bioterrorism attack, outbreak or related health care emergency. Syndromic surveillance can be essential in determining if a outbreak is occurring and what actions may be required to respond to an outbreak. What sets syndromic surveillance apart from other forms of data collection is that syndromic surveillance brings together a variety of data sources to provide a more holistic approach to trend analysis[3]. The use of syndromic surveillance is relatively new in health care and strategies are currently being implemented to maximize its impact on health care as well as the detection and response to bioterrorism attacks. That being said, syndromic surveillance is currently being used across the country to protect public health.

Section 3: Summary

It has been argued that health care professionals must be prepared for bioterrorism attacks. In order to prepare for bioterrorism attacks, health care professionals should review the following key points of interest: health care organization's policies and procedures, Bioterrorism Readiness Plans, Standard Precautions and concepts related to PPE, hand hygiene and syndromic surveillance.

A health care organization's policies and procedures address the specific needs of the individual health care facility. They generally cover everything from the administration of medications to computer systems, fire codes, patient safety protocols, health care equipment, personal conduct and bioterrorism emergency

procedures. Essentially, organizational policies and procedures outline the rules, codes, protocols and standards of each specific organization. Almost everything a health care professional needs to know and understand about how to effectively administer health care in his or her own given facility can be found within the organization's policies and procedures. In addition to policies and procedures, health care professionals should also familiarize themselves with their facility's Bioterrorism Readiness Plan, which should highlight specific details regarding the administration of health care during a bioterrorism attack and/or related emergency.

Standard Precautions may refer to the minimum infection prevention practices that apply to all patient care, independent of the suspected or confirmed infection status of a patient, in any setting health care is administered[3]. The goal of Standard Precautions is to prevent the spread of infections. When reviewing concepts related to Standard Precautions, health care professionals should focus their attention on PPE and hand hygiene, both of which are essential to the administration of health care during a bioterrorism attack. When gathering information related to PPE, health care professionals should be sure to review how to effectively put on and remove PPE.

Lastly, in preparation for a bioterrorism attack, health care professionals should become familiar with syndromic surveillance. Syndromic surveillance may refer to the systematic process of collecting nonspecific health-related data which may indicate an outbreak or bioterrorism-related disease before a diagnosis is made[3]. Due to its current and potential future applications, health care professionals should be familiar with the fundamental concepts of syndromic surveillance.

Section 3: Key Concepts

• In order to prepare for bioterrorism attacks health care professionals should review key points of interest including the following: health care organization's policies and procedures, Bioterrorism Readiness Plans, Standard Precautions and concepts related to PPE, hand hygiene and syndromic surveillance.

• A health care organization's policies and procedures along with Bioterrorism Readiness Plans can provide health care professionals with the guidance they may require to optimize the administration of health care during a bioterrorism attack.

• The goal of Standard Precautions is to prevent the spread of infections.

• PPE can be an essential component of administering health care during a bioterrorism attack. Thus, health care professionals should know how to effectively put on and remove PPE.

• Hand hygiene is most effective when dirt, soil, microorganisms and other contaminates are removed from the hands[3].

• Syndromic surveillance may be used to identify and predict health-related trends, as they are occurring, to best serve the public in the event of a bioterrorism attack, outbreak or related health care emergency[3].

Section 3: Key Terms

Standard Precautions - the minimum infection prevention practices that apply to all patient care, independent of the suspected or confirmed infection status of a patient, in any setting health care is administered[3]

Personal protective equipment (PPE) - equipment designed to protect, shield and minimize exposure to hazards that may cause serious injury, illness and/or disease[3]

Touch contamination - touching one's self and/or other surfaces such as tables, light switches and doors while wearing gloves[3]

Hand hygiene - the process of cleaning hands in order to prevent contamination and/or infections[3]

Syndromic surveillance - the systematic process of collecting nonspecific health-related data that precedes diagnosis to identify an outbreak or the presence of a bioterrorism-related disease[3]

Section 3: Personal Reflection Question

How can health care professionals prepare for a bioterrorism attack?

Section 4: Action

Preparation is essential for the safe and effective administration of health care during a bioterrorism attack. Health care professionals may prepare for a bioterrorism attack in a variety of ways including reviewing key points of interest such as: health care organization's policies and procedures, Bioterrorism Readiness Plans, Standard Precautions and concepts related to PPE, hand hygiene and syndromic surveillance. With that said, health care professionals must also understand what actions may be necessary during a bioterrorism attack. Due to the nature of bioterrorism attacks, specific actions may be required from health care professionals to help diagnosis patients, limit infection rates, obtain information from patients, report relevant information and data, reduce social disorder and disruptions, and, perhaps most importantly, administer health care to those victimized by an attack. Often health care professionals are on the front lines of treatment in the aftermath of a bioterrorism attack. Knowing what actions may be required of them and understanding how to carry out those actions can aid health care professionals in their efforts to respond to whatever challenges are put forth by a bioterrorism attack. Appropriate, efficient and effective actions by health care professionals during a bioterrorism attack can help them improve upon patient care, maximize health care outcomes, limit the impact of a bioterrorism attack and, ultimately, save lives. With the previous sentiment in mind one question remains: what are the essential elements of action that may be required from health care professionals during and after a bioterrorism attack?

Infection Control

Infection control may be one of the most important elements of action that may

be required from health care professionals during and after a bioterrorism attack. Infection control may refer to the process of prevention which aims to prevent the spread of infection and/or biological materials[3]. Infection control may impact every aspect of patient care. Often the infection control methods utilized to prevent the spread of infection during a bioterrorism attack depend on the bioterrorism agent used in the attack. Therefore, health care professionals should be familiar with their health care organization's bioterrorism agent specific polices and procedure and/or Bioterrorism Readiness Plans. Examples of infection control methods for specific bioterrorism agents can be found in Figure 2 and Figure 3. Figure 2 outlines infection control methods for the bioterrorism-related disease referred to as the plague. Figure 3 outlines infection control methods for the bioterrorism-related disease referred to as smallpox. The information found in each figure is broken down into distinct elements of patient care such as: isolation precautions, patient placement, patient transport, cleaning, disinfection, and sterilization of equipment and environment, as well as discharge management and post-mortem care. The information found in each figure was derived from materials provided by the CDC[4].

Figure 2: Infection Control Methods for the Plague

Isolation Precautions for the Pneumonic Plague

Droplet Precautions should be used in addition to Standard Precautions.

- Droplet Precautions are used for patients known or suspected to be infected with microorganisms transmitted by large particle droplets, generally larger than 5µ in size, that can be generated by the infected patient during coughing, sneezing, talking, or during respiratory-care procedures.
- Droplet Precautions require healthcare providers and others to wear a surgical-type mask when within 3 feet of the infected patient. Based on local policy, some healthcare facilities require a mask be worn to enter the room of a patient on Droplet Precautions.
- Droplet Precautions should be maintained until patient has completed 72 hours of antimicrobial therapy.

Patient Placement

Patients suspected or confirmed to have pneumonic plague require Droplet Precautions. Patient placement recommendations for Droplet Precautions include:

• Placing infected patient in a private room.
• Cohort in symptomatic patients with similar symptoms and the same presumptive diagnosis (i.e. pneumonic plague) when private rooms are not available.
• Maintaining spatial separation of at least 3 feet between infected patients and others when cohorting is not achievable.
• Avoiding placement of patient requiring Droplet Precautions in the same room with an immunocompromised patient.

Patient Transport
• Limit the movement and transport of patients on Droplet Precautions to essential medical purposes only.
• Minimize dispersal of droplets by placing a surgical-type mask on the patient when transport is necessary.

Cleaning, Disinfection, and Sterilization of Equipment and Environment
Principles of Standard Precautions should be generally applied to the management of patient-care equipment and for environmental control.

Discharge Management
Generally, patients with pneumonic plague would not be discharged from a healthcare facility until no longer infectious (completion of 72 hours of antimicrobial therapy) and would require no special discharge instructions. In the event of a large bioterrorism exposure with patients receiving care in their homes, home care providers should be taught to use Standard and Droplet Precautions for all patient care.

Post-mortem Care
Standard Precautions and Droplet Precautions should be used for post-mortem care.

Figure 3: Infection Control Methods for Smallpox

Isolation Precautions
For patients with suspected or confirmed smallpox, both Airborne and Contact Precautions should be used in addition to Standard Precautions.

• Airborne Precautions are used for patients known or suspected to be infected with microorganisms transmitted by airborne droplet nuclei (small particle residue, 5μ or smaller in size) of evaporated droplets containing microorganisms that can remain suspended in air and can be widely dispersed by air currents.
• Airborne Precautions require healthcare providers and others to wear respiratory protection when entering the patient room. (Appropriate respiratory protection is based on facility selection policy; must meet the minimal NIOSH standard for particulate respirators, N95).5,15
• Contact Precautions are used for patients known or suspected to be infected or colonized with epidemiologically important organisms that can be transmitted by direct contact with the patient or indirect contact with potentially contaminated surfaces in the patient's care area.
• Contact precautions require healthcare providers and others to:
  - Wear clean gloves upon entry into patient room.
  - Wear gown for all patient contact and for all contact with the patient's environment. Based on local policy, some healthcare facilities require a gown be worn to enter the room of a patient on Contact Precautions. Gown must be removed before leaving the patient's room.
  - Wash hands using an antimicrobial agent.

Patient Placement

Patients suspected or confirmed with smallpox require placement in rooms that meet the ventilation and engineering requirements for Airborne Precautions, which include:
• Monitored negative air pressure in relation to the corridor and surrounding areas.
• 6 – 12 air exchanges per hour.
• Appropriate discharge of air to the outdoors, or monitored high efficiency filtration of air prior to circulation to other areas in the healthcare facility.
• A door that must remain closed.

Healthcare facilities without patient rooms appropriate for the isolation and care required for Airborne Precautions should have a plan for transfer of suspected or confirmed smallpox patients to neighboring facilities with appropriate isolation rooms. Patient placement in a private room is preferred. However, in the event of a large outbreak, patients who have active infections with the same disease (i.e., smallpox) may be cohorted in rooms that meet appropriate

ventilation and airflow requirements for Airborne Precautions.

Patient Transport

• Limit the movement and transport of patients with suspected or confirmed smallpox to essential medical purposes only.
• When transport is necessary, minimize the dispersal of respiratory droplets by placing a mask on the patient, if possible.

Cleaning, Disinfection, and Sterilization of Equipment and Environment

A component of Contact Precautions is careful management of potentially contaminated equipment and environmental surfaces.
• When possible, noncritical patient care equipment should be dedicated to a single patient (or cohort of patients with the same illness).
• If use of common items is unavoidable, all potentially contaminated, reusable equipment should not be used for the care of another patient until it has been appropriately cleaned and reprocessed. Policies should be in place and monitored for compliance.

Discharge Management

In general, patients with smallpox will not be discharged from a healthcare facility until determined they are no longer infectious. Therefore, no special discharge instructions are required.

Post-mortem Care

Airborne and Contact Precautions should be used for post-mortem care.

Effective Communication

Effective communication is another essential element of action that may be required from health care professionals during and after a bioterrorism attack. A bioterrorism attack may create disruption, disturbances and outright chaos. Therefore, health care professionals must use effective communication to ensure the safe and effective administration of health care to those in need. Effective communication, or simply communication, may refer to the two-way process of exchanging messages and/or ideas in order to transmit and obtain meaning[5]. During a bioterrorism attack, health care professionals may require effective communication to exchange vital information with patients, other

health care professionals, hospital administrators, law enforcement and government officials. In order to ensure effective communication occurs, health care professionals should utilize active listening.

Active listening, as it relates to health care, can refer to the process in which a health care professional gathers information from individuals by engaging in a style of two-way communication which fosters a clear and mutual understanding of information[5]. In other words, active listening is the process of listening with the intent to obtain meaning[5]. That being said, how can health care professionals ensure they are actively listening to various individuals, including patients, during a bioterrorism attack and/or emergency? There are several steps health care professionals can take to ensure they are effectively engaging in active listening.

The first step health care professionals can take towards active listening is to give other individuals their full attention when they are actively communicating[5]. Often when individuals engage in conversation, one individual speaks while the other individual simply waits for his or her turn to talk. The words are being heard, however individuals are not focused on what is being said. Instead, they are thinking about what they want to say next. The previous style of listening can be referred to as passive listening. Two people are engaged in a conversation, however neither one of them is focused on what the other person is saying. There is little to no intent to obtain meaning when two individuals are engaged in passive listening. Therefore, the first step towards active listening should always be to focus and concentrate on what the other individual is saying. Making a concerted effort to focus on what the other person is saying when engaged in a conversation can increase the ability of each party to understand the meaning of what is being communicated. It can also help individuals improve their recall of the conversation. If an individual is focused on what another individual is saying, he or she is more likely to remember what is said. Health care professionals should always make an effort to avoid passive listening during a bioterrorism attack or related emergency.

The next step towards active listening is to make eye contact[5]. Eye contact can let an individual know that an individual is really listening to what he or she is saying. It can foster trust and encourage individuals to open up and fully articulate what they want to say.

The third step towards active listening is to provide individuals with the opportunity to say what they would like to express[5]. Limiting interruptions when others are speaking and allowing for periods of silence can further open up the conversation to allow for a greater expression of ideas.

The next step to active listening is to respond to what is being said[5]. From time to time, health care professionals should respond to what other individuals are saying. Repeating what individuals say or paraphrasing other individuals' words can reinforce that they are truly being heard and listened to, which can make them more likely to further engage in conversation. After all, everyone likes to know they are being heard.

Making an effort to understand the emotions behind an individual's words can be another step towards active listening. Talking about one's experience during a bioterrorism attack can be an emotional experience. It can open up the stress and horrors of the attack and can leave individuals feeling vulnerable. Being empathetic to the difficult emotions behind the words can make individuals feel at ease and allow them to continue to discuss their experience.

Asking open-ended questions and clarifying what is said can also help individuals ensure they are engaging in active listening[5]. At times during the administration of health care, health care professionals will need to ask their patients questions about their symptoms, past medical history, etc. Keeping questions open, as opposed to closed, can allow information to flow more freely. Therefore, it may be advantageous for health care professionals to avoid yes and no questions and focus on how, what, where and why questions. For example, instead of asking a patient, "does sitting up make your symptoms worse" a health care professional may ask, "what makes your symptoms worse?" The second version of the question is open-ended and possesses much more potential, when compared to the first question, to allow for a free-flowing exchange of ideas. Yes and no questions can limit the expression of ideas, while open-ended questions can expand the expression of ideas. In addition, health care professionals should not be afraid to clarify what is said during a conversation with patients or other individuals, including health care professionals. An individual may quickly pass over an important detail in an exchange of information. Slowing down the conversation to clarify what is said can benefit both parties in the long run.

Finally, to fully achieve active listening, health care professionals can provide words of encouragement, especially when communicating with their patients[5]. As previously mentioned, talking about one's experience during a bioterrorism attack can be difficult for a patient. Using words of encouragement such as "you are being very brave" or "you have been courageous during this difficult situation" can go a long way to motivate patients to express themselves. Additionally, words of encouragement can bring a human aspect to the process of administering health care during a bioterrorism attack or related emergency. They can let patients know and understand that the health care professionals administering their care are empathetic to their situation and have their best interests at hand. In essence, active listening is a process that promotes understanding, recall and clarity. It is a way for individuals to obtain meaning and it can be a means to ensure the safe and effective administration of health care.

In addition to employing active listening, health care professionals should also use health care documentation to ensure effective communication occurs during a bioterrorism attack or related emergency. Health care documentation can refer to a digital or an analog record detailing the administration of health care to patients[6,7]. Documentation is a vital component of effective communication in health care settings. Furthermore, it has been said, that adequate health care documentation is essential to the safe and effective administration of health care, especially in the face of a bioterrorism attack. That being said, what makes documentation effective?

Health care documentation may be considered effective when its two major objectives or functions are achieved. The first objective or function of health care documentation is communication. As previously highlighted, communication is essential to the administration of health care. That being the case, health care documentation can be a means or a method of communication among health care professionals. The goal of communication is to convey information and an understanding of information in a manner which achieves a shared meaning among two or more individuals[8,9]. If health care documentation achieves the previous goal of communication, then it may be considered effective.

The second major function of health care documentation is to establish a detailed record of health care administration, which can be easily accessed and/or understood by intended parties. In other words, health care

documentation must provide an accessible account of health care administration, which can be used to track and/or obtain information regarding the administration of health care to patients. If health care documentation is clear, easily understood and can be used to establish continuity among necessary health care professionals over time, then it may be considered effective.

In short, in order for health care documentation to be considered effective it must be a viable form of communication as well as a means to establish a detailed record of health care administration. With that being the case, how can health care professionals ensure their health care documentation is effective? There are many different forms of health care documentation; however, if health care professionals include specific characteristics in their documentation, they can ensure that no matter what form of health care documentation they are completing, it may be used as a viable form of communication and as a means to establish a detailed record of health care administration, and thus be considered effective.

The first characteristics of effective documentation are objectivity and accuracy. Health care documentation should include objective information free of subjective judgment, bias or opinion. Health care documentation should also be accurate - meaning it should include information which can be measured or verified by another individual.

Additional characteristics of effective health care documentation include clarity and completeness. Clarity, as it relates to health care documentation, can refer to a quality which enables multiple health care professionals to obtain meaning from recorded data and/or information relating to health care. Completeness, as it relates to health care documentation, can refer to a state where all of the necessary components and/or parts are present. Only when clarity and completeness are achieved can health care documentation be considered effective.

Finally, the information found within health care documentation should be readily accessible and available to all those who require it. Thus, health care professionals must include accurate times and dates of health care administration when completing their health care documentation to further its effectiveness.

The importance of effective communication during a bioterrorism attack or related emergency cannot be understated. It is absolutely necessary to safely and effectively administer health care to victims of an attack. Furthermore, health care professionals may use effective communication to exchange vital information with patients, other health care professionals, hospital administrators, law enforcement and government officials. In order to ensure effective communication occurs during a bioterrorism attack or related emergency, health care professionals should utilize active listening and effective health care documentation.

Reporting

The next essential element of action that may be required from health care professionals during and after a bioterrorism attack is reporting. In the context of a bioterrorism attack or related emergency, reporting can refer to the process of providing appropriate individuals with information and/or data related to a bioterrorism attack. Due to the nature of bioterrorism attacks, hospitals or other health care organizations may be some of the first facilities where vital bioterrorism-related information and/or data can be gathered. As victims of bioterrorism attacks enter hospitals or other health care facilities, health care professionals may be able to collect important information regarding patient symptoms, diagnoses and possible treatment options. Additionally, victims of a bioterrorism attack may provide health care professionals with specific details related to an attack including descriptions of suspicious individuals and devices. Any relevant information obtained by a health care professional related to a bioterrorism attack should be reported, in a timely manner, to appropriate individuals such as: managers, hospital administrators, law enforcement officials and government representatives. Even the most trivial pieces of information should be reported by health care professionals. Any information relevant to a bioterrorism attack may be useful in providing insight into an attack or related emergency. Health care professionals should be familiar with their specific health care organization's bioterrorism reporting channels, standards, mechanisms and methods.

In conjunction with reporting, health care professionals may also be required to access the Health Alert Network. The Health Alert Network is the CDC's method

of sharing cleared information about urgent public health incidents, including bioterrorism attacks, with public information officers; federal, state, territorial, tribal, and local public health practitioners; clinicians; and public health laboratories3. Essentially, in the event of a public health incident, such a bioterrorism attack, a health care professional may access the CDC's Health Alert Network to obtain relevant information and updates regarding the incident. To provide individuals with the most pertinent and applicable incident-related information the CDC's Health Alert Network provides various message types. The Health Alert Network's specific message types can be found within Figure 4. Additionally, health care professionals may register with the Health Alert Network to receive email updates regarding public health incidents.

Figure 4: The Health Alert Network's Message Types[3]

Health Alert: provides vital, time-sensitive information for a specific incident or situation; warrants immediate action or attention by health officials, laboratorians, clinicians, and members of the public; and conveys the highest level of importance.

Health Advisory: provides important information for a specific incident or situation; contains recommendations or actionable items to be performed by public health officials, laboratorians, and/or clinicians; may not require immediate action.

Health Update: provides updated information regarding an incident or situation; unlikely to require immediate action.

Info Service: provides general public health information; unlikely to require immediate action.

Treatment

Finally, health care professionals may be required to administer treatment to victims of a bioterrorism attack. As previously highlighted, bioterrorism-related treatment often depends on the bioterrorism agent used in an attack. That being said, bioterrorism-related treatment options may include the

administration of antitoxins and supportive care. However, one of the most widely used bioterrorism-related treatment options is antibiotics. The remainder of this section will review some of the most common antibiotics used in the administration of bioterrorism-related health care. The information found in the remainder of this section was derived from materials provided by the FDA[10].

Penicillin

Medication notes: Penicillin is a beta-lactam antibiotic. Penicillin exerts a bactericidal action against penicillin-sensitive microorganisms during the stage of active multiplication. Penicillin is indicated in the treatment of mild to moderately severe infections due to penicillin-sensitive microorganisms.

Safety notes: Health care professionals should be aware that penicillin may lead to hypersensitivity reactions, especially when administered intravenously. Health care professionals should always double check to make sure patients do not have a known allergy to penicillin before penicillin is administered. Patients allergic to penicillin may experience swelling of the face, mouth, and throat, difficulty breathing, itching, or rash if they are administered penicillin. Health care professionals should also be aware that penicillin may lead to the following side effects: abdominal pain, nausea, vomiting, diarrhea, headache, sore throat and fever. Penicillin should be used with caution in individuals with histories of significant allergies and/or asthma.

Considerations for special patient populations: Penicillin falls into FDA pregnancy category B.

Ciprofloxacin

Medication notes: Ciprofloxacin is an antibiotic that belongs to a class of medications known as fluoroquinolones. Fluoroquinolones may be used to treat bacterial infections. Fluoroquinolones work by killing or stopping the growth of bacteria that may cause illness.

Safety notes: Health care professionals should note the following FDA warning regarding fluoroquinolones: fluoroquinolone antibiotics may cause significant

disturbances in blood sugar and certain mental health side effects. The mental health side effects caused by fluoroquinolone may include: disturbances in attention, disorientation, agitation and memory loss. Additional side effects of ciprofloxacin may include: abdominal pain, nausea, vomiting, diarrhea, dizziness, fatigue, hearing loss, muscle pain/stiffness, joint pain and nightmares. Health care professionals should also be aware that ciprofloxacin has a FDA Boxed Warning highlighting the potential for the following serious side effects: tendinitis, tendon rupture, neuropathy, central nervous system effects and exacerbations of myasthenia gravis.

Considerations for special patient populations: Health care professionals should take note when administering ciprofloxacin to patients with diabetes. Health care professionals may be required to monitor blood sugar levels more frequently when administering ciprofloxacin to patients with diabetes. Health care professionals should be aware of the following signs of hypoglycemia, otherwise referred to as low blood sugar: dizziness, lightheadedness and fatigue. Health care professionals should also take note that hypoglycemia may lead to coma. Ciprofloxacin should be avoided in patients with a known history of myasthenia gravis. Ciprofloxacin falls into FDA pregnancy category C.

Doxycycline

Medication notes: Doxycycline is an antibiotic which belongs to a class of medications known as tetracyclines. Doxycycline is a broad-spectrum antibiotic, which means it may be used against a wide range of bacteria. Doxycycline works by inhibiting bacterial protein synthesis.

Safety notes: Doxycycline is contraindicated in individuals who have shown a hypersensitivity to any of the tetracyclines. Side effects of doxycycline may include: anorexia, nausea, vomiting, diarrhea, rash, photosensitivity, urticaria and hemolytic anemia. Absorption of doxycycline may be impaired by antacids containing aluminum, calcium, or magnesium, bismuth subsalicylate and iron-containing preparations. Patients who are on anticoagulant therapy may require downward adjustment of their anticoagulant dosage when receiving a doxycycline regimen. Concurrent use of tetracycline may render oral contraceptives less effective. Avoid coadministration of tetracyclines with penicillin.

Considerations for special patient populations: Health care professionals should consider the following age-related warning associated with doxycycline and other tetracyclines: the use of drugs of the tetracycline class during tooth development (last half of pregnancy, infancy and childhood to the age of 8 years) may cause permanent discoloration of the teeth (yellow-gray-brown). Doxycycline falls into pregnancy category D. Doxycycline use during nursing should be avoided if possible.

Streptomycin

Medication notes: Streptomycin belongs to a class of medications referred to as aminoglycoside antibiotics. Streptomycin is indicated for the treatment of individuals with moderate to severe infections. The use of streptomycin should be limited to the treatment of infections caused by bacteria which have been shown to be susceptible to the antibacterial effects of streptomycin and which are not amenable to therapy with less potentially toxic agents.

Safety notes: Streptomycin is contraindicated in individuals who possess a clinically significant hypersensitivity to streptomycin. Health care professionals should be aware of the following streptomycin warning regarding ototoxicity: both vestibular and auditory dysfunction can follow the administration of streptomycin. The degree of impairment is directly proportional to the dose and duration of streptomycin administration, to the age of the patient, to the level of renal function and to the amount of underlying existing auditory dysfunction. The ototoxic effects of the aminoglycosides, including streptomycin, are potentiated by the co-administration of ethacrynic acid, mannitol, furosemide and possibly other diuretics. Health care professionals should also be aware of the following streptomycin-related side effects: nausea, vomiting, vertigo, paresthesia of face, rash, fever, urticaria, angioneurotic edema, eosinophilia, muscle weakness and amblyopia.

Considerations for special patient populations: Health care professionals should consider the following streptomycin warning when administering streptomycin to patients with impaired renal function: the risk of severe neurotoxin reactions is sharply increased in patients with impaired renal function. Streptomycin falls into pregnancy category D. Additionally, health care professionals

should consider the following age-related warning: when administering streptomycin to patients older than 60 years of age, the drug should be used at a reduced dosage due to the risk of increased toxicity. Health care professionals should also consider the following precaution related to nursing mothers: because of the potential for serious adverse reactions in nursing infants from streptomycin, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother.

Gentamicin

Medication notes: Gentamicin belongs to a class of medications referred to as aminoglycoside antibiotics. Gentamicin works by inhibiting protein synthesis susceptible bacteria.

Safety notes: Gentamicin is contraindicated in individuals who possess a clinically significant hypersensitivity to gentamicin. A history of hypersensitivity or serious toxic reactions to other aminoglycosides may contraindicate use of gentamicin because of the known cross-sensitivity of patients to drugs in the aforementioned medication class. Health care professionals should be aware of the following gentamicin-related Boxed Warnings: patients treated with aminoglycosides should be under close clinical observation because of the potential toxicity associated with their use. As with other aminoglycosides, Gentamicin Injection is potentially nephrotoxic. The risk of nephrotoxicity is greater in patients with impaired renal function and in those who receive high dosage or prolonged therapy. Neurotoxicity manifested by ototoxicity, both vestibular and auditory, can occur in patients treated with gentamicin, primarily in those with pre-existing renal damage and in patients with normal renal function treated with higher doses and/or for longer periods than recommended. Aminoglycoside-induced ototoxicity is usually irreversible. Other manifestations of neurotoxicity may include numbness, skin tingling, muscle twitching and convulsions. Renal and eighth cranial nerve function should be closely monitored, especially in patients with known or suspected reduced renal function at onset of therapy, and also in those whose renal function is initially normal but who develop signs of renal dysfunction during therapy. Urine should be examined for decreased specific gravity, increased excretion of protein, and the presence of cells or casts. Blood urea nitrogen (BUN), serum creatinine, or creatinine clearance should be dete

mined periodically. When feasible, it is recommended that serial audiograms be obtained in patients old enough to be tested, particularly high-risk patients. Evidence of ototoxicity (dizziness, vertigo, tinnitus, roaring in the ears or hearing loss) or nephrotoxicity requires dosage adjustment or discontinuance of the drug. As with the other aminoglycosides, on rare occasions changes in renal and eighth cranial nerve function may not become manifest until soon after completion of therapy. Serum concentrations of aminoglycosides should be monitored when feasible to assure adequate levels and to avoid potentially toxic levels. When monitoring gentamicin peak concentrations, dosage should be adjusted so that prolonged levels above 12 mcg/mL are avoided. When monitoring gentamicin trough concentrations, dosage should be adjusted so that levels above 2 mcg/mL are avoided. Excessive peak and/or trough serum concentrations of aminoglycosides may increase the risk of renal and eighth cranial nerve toxicity. In the event of overdose or toxic reactions, hemodialysis may aid in the removal of gentamicin from the blood, especially if renal function is, or becomes, compromised. The rate of removal of gentamicin is considerably less by peritoneal dialysis than by hemodialysis. In the newborn infant, exchange transfusions may also be considered. Concurrent and/or sequential systemic or topical use of other potentially neurotoxic and/or nephrotoxic drugs, such as cisplatin, cephaloridine, kanamycin, amikacin, neomy- cin, polymyxin B, colistin, paromomycin, streptomycin, tobramycin, vancomycin, and viomycin, should be avoided. Other factors which may increase patient risk of toxicity are advanced age and dehydration. The concurrent use of gentamicin with potent diuretics, such as ethacrynic acid or furosemide, should be avoided, since certain diuretics by themselves may cause ototoxicity. In addition, when administered intravenously, diuretics may enhance aminoglycoside toxicity by altering the antibiotic concentration in serum and tissue. Aminoglycosides can cause fetal harm when administered to a pregnant woman.

Considerations for special patient populations: Aminoglycosides, such as gentamicin, should be used with caution in patients with neuromuscular disorders, such as myasthenia gravis, since these drugs may aggravate muscle weakness because of their potential curare-like effects on the neuromuscular junction. When administering gentamicin to patients with impaired renal function health care professionals should be aware of the following precaution: gentamicin dosages must be adjusted in patients with impaired renal function to assure therapeutically adequate but not excessive, blood levels. Gentamicin falls into pregnancy category D.

Section 4: Summary

A bioterrorism attack can occur without warning. It can lead to disruptions, disturbances and chaos. A bioterrorism attack may also lead to mass infections, diseases and serious, life-threatening conditions. Due to the nature of bioterrorism attacks, health care professionals are often on the front lines of care during and after a bioterrorism attack occurs. Knowing what actions may be required of them and understanding how to carry out those actions can aid health care professionals in their efforts to respond to whatever challenges are put forth by a bioterrorism attack. Appropriate, efficient and effective actions by health care professionals during a bioterrorism attack can help them improve upon patient care, maximize health care outcomes, limit the impact of a bioterrorism attack and, ultimately, save lives. The essential elements of action that may be required from health care professionals during and after a bioterrorism attack may include the following: infection control, effective communication, reporting and treatment.

Infection control may be one of the most important elements of action that may be required from health care professionals during and after a bioterrorism attack. Infection control may refer to the process of prevention which aims to prevent the spread of infection and/or biological materials[3]. Infection control may impact every aspect of patient care. Often the infection control methods utilized to prevent the spread of infection depends on the bioterrorism agent used in an attack. Therefore, health care professionals should be familiar with their health care organization's bioterrorism agent specific polices and procedure and/or Bioterrorism Readiness Plans to best serve victims bioterrorism of an attack.

Effective communication is another essential element of action that may be required from health care professionals during and after a bioterrorism attack. As previously mentioned, a bioterrorism attack may create disruption, disturbances and outright chaos. Therefore, health care professionals must use effective communication to ensure the safe and effective administration of health care to those in need. Effective communication, or simply communication, can refer to the two-way process of exchanging messages and/or ideas in order to transmit and obtain meaning[5]. During a bioterrorism attack health care professionals may require effective commutation to exchange vital information with

patients, other health care professionals, hospital administrators, law enforcement and government officials. In order to ensure effective communication occurs, health care professionals should be sure to utilize active listening and effective health care documentation.

The next essential element of action that may be required from health care professionals during and after a bioterrorism attack is reporting. Hospitals or other health care organizations may be some of the first facilities where vital bioterrorism-related information and/or data may be gathered. As victims of bioterrorism attacks enter hospitals or other health care facilities, health care professionals may be able to collect important information regarding patient symptoms, diagnoses and possible treatment options. Additionally, victims of a bioterrorism attack may provide health care professionals with specific details related to an attack including descriptions of suspicious individuals and devices. Any relevant information obtained by a health care professional related to a bioterrorism attack should be reported, in a timely manner, to appropriate individuals such as: managers, hospital administrators, law enforcement officials and government representatives.

Finally, health care professionals may be required to administer treatment to victims of a bioterrorism attack. Bioterrorism-related treatment options may include: the administration of antitoxins, supportive care and the use of antibiotics. Health care professionals should be familiar with the most common antibiotics used in bioterrorism-related treatment to safely and effectively administer health care to patients in need.

Section 4: Key Concepts

• The essential elements of action that may be required from health care professionals during and after a bioterrorism attack may include the following: infection control, effective communication, reporting and treatment.

• Infection control may impact every aspect of patient care.

• Often the infection control methods utilized to prevent the spread of infection depend on the bioterrorism agent used in an attack.

• Any relevant information obtained by a health care professional related to a bioterrorism attack should be reported, in a timely manner, to appropriate individuals. Even the most trivial pieces of information should be reported by health care professionals. Any information relevant to a bioterrorism attack may be useful in providing insight into an attack or related emergency.

• Health care professionals may be required to access the Health Alert Network. The Health Alert Network is the CDC's method of sharing cleared information about urgent public health incidents, including bioterrorism attacks, with public information officers; federal, state, territorial, tribal, and local public health practitioners; clinicians; and public health laboratories[3].

• Bioterrorism-related treatment often depends on the bioterrorism agent used in an attack.

• Bioterrorism-related treatment options may include the administration of antitoxins, supportive care and the use of antibiotics.

Section 4: Key Terms

Infection control - the process of prevention which aims to prevent the spread of infection and/or biological materials[3]

Effective communication (communication) - the two-way process of exchanging messages and/or ideas in order to transmit and obtain meaning[5]

Active listening (as it relates to health care) - the process in which a health care professional gathers information from individuals by engaging in a style of two-way communication which fosters a clear and mutual understanding of information[5]

Health care documentation - can refer to a digital or an analog record detailing the administration of health care to patients[6,7]

Reporting (in the context of a bioterrorism attack) - reporting can refer to the process of providing appropriate individuals with information and/or data related to a bioterrorism attack

Section 4: Personal Reflection Question

How can effective communication ensure the safe and effective administration of health care to victims of a bioterrorism attack?

Case Review

The following cases were presented at the beginning of this course to highlight possible bioterrorism scenarios. The cases will now be revisited to review the concepts found in this course.

Case 1

A 52 year-old male patient presents to a hospital's emergency department. The patient is experiencing flu like symptoms and is sweating excessively. The patient is also having trouble breathing. Due to a recent report from local law enforcement, it is believed the individual is suffering from anthrax exposure. An immediate chest x-ray and computed tomography (CT) scan are ordered for the patient. While waiting for the results, the health care team treating the patient cannot help but speculate how the patient possibly became exposed to anthrax. Consequently, the health care team begins to become concerned and considers the possibility that other individuals in the area may have also been exposed to anthrax. With that notion in mind, the team of health care professionals begins to brace themselves for the possibility that additional patients may be presenting with anthrax exposure symptoms. The team of health care professionals also begins to question how to best treat patients suffering from potential anthrax inhalation.

What challenges does the bioterrorism-related scenario outlined in Case 1 present to the team of health care professionals?

The bioterrorism-related scenario in Case 1 presents many challenges to the team of health care professionals. One of the challenges relates to the treatment of anthrax. Health care professionals should be familiar with bioterrorism-related treatment options for specific bioterrorism related diseases, infections and/or conditions such as anthrax. Individuals who develop symptoms of anthrax may be treated with antibiotics and antitoxin[2,3]. The antibiotics which may be used to treat anthrax include: penicillin, ciprofloxacin and doxycycline[2,3]. Individuals suffering from anthrax may also require supportive care.

The second, and perhaps the most serious, challenge presented to the team of health care professionals in Case 1 is the potential for an influx of patients suffering from anthrax exposure due to a bioterrorism attack.

How can the team of health care professionals address the challenges put forth by the scenario presented in Case 1?

There are many strategies health care professionals can use to overcome the challenges put forth by the scenario presented in Case 1. In regards to the patient potentially suffering from anthrax exposure, the team of health care professionals could focus their attention on effectively diagnosing the patient and treating him with antibiotics and/or supportive care. In regards to the more serious challenge of a potential influx of patients suffering from anthrax exposure due to a bioterrorism attack, the team of health care professionals could address the possible challenge by adequately preparing. Possible preparation strategies which may be used by the team of health care professionals may include: reviewing their facility's Bioterrorism Readiness Plan, organizing PPE and contacting the facility's pharmacy to obtain relevant information regarding antibiotics currently in stock. The team of health care professionals could also access the CDC's Health Alert Network to gather information related to the potential bioterrorism attack and to receive any updates which may provide insight into the size and scope of the possible attack.

Case 2

Law enforcement identifies a possible terrorist cell in a local community. It is believed that the terrorist cell has contaminated the communities' water supply with an unknown chemical agent. Representatives from the law enforcement

department contact the major hospitals in the area and advise them to prepare for a possible influx of individuals suffering from exposure to an unknown chemical agent. The hospitals begin to prepare for possible patient exposure, however many of the health care professionals are unaware of the types of symptoms that patients may have if exposed to a chemical agent.

What challenges does the bioterrorism-related scenario outlined in Case 2 present to the health care professionals preparing for the potential bioterrorism attack?

The bioterrorism-related scenario outlined in Case 2 presents many challenges to the health care professionals preparing for the potential bioterrorism attack, the first of which is related to the possible presence of an unknown chemical agent. Many different agents may be used in a bioterrorism attack. Health care professionals should be familiar with specific agent/disease symptoms as well as the CDC's bioterrorism agent/disease categories.

Much like with Case 1, the second challenge presented to the health care professionals in Case 2 is the potential for an influx of patients suffering from exposure to a bioterrorism-related agent. However, unlike with Case 1, the health care professionals in Case 2 are unaware of the specific agent used in the attack.

How can the team of health care professionals address the challenges put forth by the scenario presented in Case 2?

There are many strategies health care professionals could use to overcome the challenges put forth by the scenario presented in Case 2. In regards to the possible presence of an unknown chemical agent, health care professionals could visit the CDC's website to gather relevant information related to bioterrorism agents'/diseases' symptoms to help them effectively identify the chemical agent and treat its effects on the victims of the attack. Additionally, health care professionals could employ active listening when victims of the attack begin entering health care facilities. Active listening could help the health care professionals obtain vital information related to the chemical agent and the attack itself. All information gathered by health care professionals should be reported to appropriate individuals and/or applicable syndromic surveillance channels.

In regards to preparation, along with the methods highlighted in the previous case, health care professionals could review their facilities' polices and procedures regarding a bioterrorism attack and their facilities' infection control procedures for an unknown chemical agent.

Case 3

Dozens of patients begin to stream into the emergency department of a regional hospital. All of the patients seem to be suffering from the same symptoms which include: severe diarrhea, fever and abdominal cramps. After some investigation it is believed that the vast majority of the patients suffering from the same cluster of symptoms ate at the same restaurant in the previous 12 - 24 hours. The restaurant is contacted. The restaurant's manager reports that a small group of suspicious individuals were witnessed congregating around the restaurant's buffet a little over 24 hours ago. The restaurant manager also reports observing the individuals loitering in the restaurant parking lot. The police where contacted- however, the small group dispersed before an officer arrived on the scene. After receiving the aforementioned details, it is believed that a group of unidentified individuals may be intentionally contaminating the food supply of area restaurants with Salmonella. Local law enforcement agencies are contacted.

What challenges does the bioterrorism-related scenario outlined in Case 3 present to the team of health care professionals?

The bioterrorism-related scenario in Case 3 presents many challenges to the health care professionals treating patients at the regional hospital. One of the challenges relates to the treatment of Salmonella. Salmonella is a bacterial infection which typically affects the intestinal tract[3].

The second challenge relates to reporting. The potential bioterrorism attack occurred in a public restaurant. Therefore, those victimized by the attack may have observed the suspects during the attack, and thus may possess vital information which could be used to detain and/or arrest potential suspects before additional restaurants in the area are affected.

How can the team of health care professionals address the challenges put forth by the scenario presented in Case 3?

There are many strategies health care professionals could use to overcome the challenges put forth by the scenario presented in Case 3. In this particular case the bioterrorism agent used in the attack lead to Salmonella. Salmonella typically lasts about 4 - 7 days and individuals usually recover without treatment[3]. However, some patients may require supportive care. Thus, health care professionals should assess the severity of the infection in each patient to determine treatment strategies. When assessing patients, health care professionals should be sure to effectively document patient symptoms and treatment.

Regarding the second challenge related to reporting, health care professionals may obtain essential information regarding the attack and those individuals involved in the attack. Any information relevant to a bioterrorism attack should be reported to appropriate individuals.

Course Review

The following questions are presented below to further review the concepts found in this course. By reviewing these questions health care professionals can obtain practical knowledge which may be used to safely and effectively administer health care to those individuals victimized by a bioterrorism attack.

What are the differences between bioterrorism and other forms of terrorism?

It has been argued that there are three major differences between bioterrorism and other forms of terrorism. The first major difference relates to the materials needed to carry out a bioterrorism attack. Unlike with other forms of terrorism the materials required to carry out a bioterrorism attack are readily available, inexpensive to produce and require very little specialized knowledge to weaponize[2].

The second major difference between bioterrorism attacks and other forms of terrorism relates to the ability to detect an attack. Unlike with other forms of terrorism, it may be very difficult for government agencies to detect

bioterrorism attacks and distinguish them from naturally occurring outbreaks[2].

Finally, the third major difference between bioterrorism attacks and other forms of terrorism relates to the nature of the damage of an attack. With other forms of terrorism the potential size and scope of the damage caused by an attack may be, at least in part, somewhat immediately apparent. However, with a bioterrorism attack that may not necessarily be the case. Due to the nature of some of the agents and materials used in bioterrorism attacks, it could take several days for the true size and scope of an attack to be realized.

What are weapons of mass destruction?

Weapons of mass destruction may refer to any weapon capable of causing widespread death and destruction[1]. Weapons of mass destruction may be used in a bioterrorism attack. Typically, weapons of mass destruction used in a bioterrorism attack include weaponized biological agents/materials designed to cause wide spread or maximum, illness, death disruption and/or destruction.

How are bioterrorism agents/materials disseminated?

Bioterrorism agents/materials may be disseminated in the following ways: aerosol dissemination, dissemination via public food and/or water supplies, physically distribution and dissemination via human, animal and insect carriers[2].

What is the difference between infections versus contagious?

After or perhaps during a bioterrorism attack the terms infections and contagious may be used by officials and other health care professionals. Infectious may refer to the number of particles required to infect an individual[2]. Contagious may refer to bioterrorism agents which spread from person to person[2].

What are the CDC's categories of bioterrorism agents/diseases?

The CDC has developed three bioterrorism agent/disease categories which include the following: category A, category B and category C. Bioterrorism agents included in category A represent the highest-priority bioterrorism agents which may be the most dangerous to the American public's security and health[3].

Bioterrorism agents included in category B are also extremely dangerous and pose the second highest threat level, when compared to bioterrorism agents found in category A[3]. Category C is comprised of the third highest priority bioterrorism agents[3].

What are the symptoms of radiation exposure?

The symptoms of radiation exposure may include: fever, nausea, vomiting, diarrhea, fatigue, skin irritation, radiation burns, seizures and coma[3]. The long-term effects of radiation exposure may include both cancer and death[3].

What is personal protective equipment (PPE)?

PPE can refer to equipment designed to protect, shield and minimize exposure to hazards that may cause serious injury, illness and/or disease[3].

What is Syndromic surveillance?

Syndromic surveillance may refer to the systematic process of collecting nonspecific health-related data that precedes diagnosis to identify an outbreak or the presence of a bioterrorism-related disease[3].

What is the primary goal of active listening?

The primary goal of active listening is to obtain meaning. Health care professionals may use active listening skills to effectively assess patients during a bioterrorism attack or related emergency.

What is an open-ended question?

An open-ended question is a question designed to obtain viable information from an individual; open-ended questions are used to avoid "yes" and "no" answers. Health care professionals can use open-ended questions when assessing patients. An example of an open-ended question is as follows: "what makes your pain worse?"

What are characteristics of effective health care documentation?

Characteristics of effective health care documentation may include the following: objectivity, accuracy, clarity, completeness and the inclusion of actual times and dates of health care administration.

What is the Health Alert Network?

The Health Alert Network is the CDC's method of sharing cleared information about urgent public health incidents, including bioterrorism attacks, with public information officers; federal, state, territorial, tribal, and local public health practitioners; clinicians; and public health laboratories3. In the event of a public health incident, such a bioterrorism attack, a health care professional may access the CDC's Health Alert Network to obtain relevant information and updates regarding the incident.

What therapeutic options may be used for bioterrorism-related treatment?

Often bioterrorism-related treatment depends on the bioterrorism agent used in an attack. That being said, bioterrorism-related treatment may include a variety of different therapeutic options such as: the administration of antitoxins, supportive care and/or antibiotics.

Conclusion

Terrorism may refer to any unlawful use of force, violence or fear against persons or property to further personal of political agendas[1]. Unfortunately in today's global climate, terrorism may present itself in many different forms, including bioterrorism.

Bioterrorism is different from other forms of terrorism in several distinct ways. First and foremost, bioterrorism involves the intentional release of toxic biological agents, which may be readily available and relatively easy to use. Secondly, it may be difficult for officials to determine when and if a bioterrorism attack actually occurred. Lastly, it may be initially challenging for officials to grasp the full size and scope of a bioterrorism attack or the impact of bioterrorism attack.

The impact of bioterrorism attacks may include social disruption, economic turmoil and the destruction of personal property. However, the biggest impact of a bioterrorism attack may be on individuals' health. A bioterrorism attack may cause both physical and psychological trauma to those affected by an attack. Those individuals victimized by a bioterrorism attack should be encouraged to seek health care to address any physical or psychological issues that may arise from a bioterrorism attack.

There are a wide range of bioterrorism agents which may be used in a bioterrorism attack. Fortunately, the CDC has developed categories for bioterrorism agents/diseases to help health care professionals and officials identify the characteristics and threat levels associated with specific bioterrorism agents/diseases. The three bioterrorism agent/disease categories developed by the CDC include: category A, category B and category C. Bioterrorism agents included in category A represent the highest-priority bioterrorism agents that may be the most dangerous to the American public's security and health[3].

Along with bioterrorism agents/diseases, radioactive agents may also be used in an attack. A radiation attack may present itself in many forms including: a nuclear emergency, a dirty bomb attack and a radiological exposure device attack. Radiation attacks may be extremely dangerous to individual's health and overall well-being. Therefore, it is essential for victims of a radiation attack to receive treatment.

Due to the nature of bioterrorism, health care professionals must be prepared for a bioterrorism attack. In order to prepare for bioterrorism attacks, health care professionals should review the following key points of interest: health care organization's policies and procedures, Bioterrorism Readiness Plans, Standard Precautions and concepts related to PPE, hand hygiene and syndromic surveillance.

Preparation is essential for the safe and effective administration of health care during a bioterrorism attack. With that said, health care professionals must also understand what actions may be necessary during a bioterrorism attack. The essential elements of action that may be required from health care professionals during and after a bioterrorism attack may include the following: infection control, effective communication, reporting and treatment.

Finally, bioterrorism attacks are very real possibilities. They can lead to disruptions, disturbances and outright chaos. Moreover, a bioterrorism attack may lead to mass infection, disease and serious, life-threatening conditions. In short, bioterrorism attacks can create many potential challenges for health care professionals. However, with a clear understanding of bioterrorism, bioterrorism agents/diseases, as well as bioterrorism preparation and essential elements of action health care professionals can safely and effectively administer health care to those individuals victimized by a bioterrorism attack.

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