

An Overview of Bioterrorism and Preparedness for Bioterrorism Attack

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Abstract

In a very horrible and frightening dimension where terrorism has somewhat become the order of the day globally, it is essential that people are enlightened about bioterrorism which is a form of terrorism. The thrust of this paper is on bioterrorism and preparedness in the event of a bioterrorist attack. An overview of bioterrorism was taken and some of the biological agents which can be used for bioterrorism attacks were highlighted. Some historical facts about bioterrorism as well as some diseases which can result from the use of various biological agents were discussed. Preparedness for a bioterrorism attack was discussed with a focus on health facilities and families. Recommendations made include the need to sensitize and educate people about bioterrorism and that all tiers of government, private and public organizations should always have bioterrorism readiness plan in place.

Keywords: Bioterrorism, biological agents, preparedness

Conceptual Framework

There is a slight difference between terrorism and bioterrorism, however both of them may result in the death of a large group of a population. Terrorism as argued by Mathur (2011) becomes bioterrorism when biological weapons are used to kill people. Mathur asserted that bioterrorism can be defined as the use of biological substances or pathogens to threaten a nation or region or group of people of different religion, faiths and nationality with the aim to kill them or create terror.

Bioterrorism attack is the deliberate release of viruses, bacteria or other germs (agents) used to cause illness or death in people, animals or plants. These agents are typically found in nature, but it is possible that they could be changed to increase their ability to cause disease, make them resistant to current medicines or to increase their ability to spread into the environment (Center for Disease Control (CDC), 2014). Mathur (2011) opined that bioterrorism can affect millions of people through their spread via water supply, through air spread and through contamination of food. English et al., (1999) pointed out that 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 Agents

Omicsonline (2015) stated that bioterrorism agents are living organisms such as bacteria, viruses, fungi or toxins that are deliberately used to sicken or kill. They may be used by terrorists partially because they can be deadly, are easy to distribute, are a relatively inexpensive weapon and are difficult to detect. Omicsonline stated further that bioterrorism agents have been used in acts of warfare for thousands of years. This was included dipping arrows into toxins, poisoning food and water, supplies and deliberately spreading deadly infections into the air or drinking water, introduced into crops and livestock. Biological agents have the ability to adversely affect human health in a variety of ways ranging from relatively mild allergic reactions to serious medical conditions including death.

Categories or types of Bioterrorism agents

Bioterrorism agents can be classified as chemical weapons, bacterial weapons, viruses, toxins and nuclear or ionic (Mathur, 2001) Wikipedia (2015) asserted that bioterrorism agents can be separated into three categories (ABC) depending on how easily they can be spread and the severity of illness or death they cause.

Category A

These are high priority agents which include organisms or toxins that pose the highest risk to the public and national security because:

- They can be easily spread or transmitted from person to person
- They result in high death rates and have the potential for major public health impact.
- They might cause public panic and social disruption
- They require special action for public health preparedness

Wikipedia (2015) remarked that some agents and diseases under this category include Francisellatularensis bacterium which causes tularaema or “rabbit fever”. This disease can be contracted through contact with the fur, inhalation, ingestion of contaminated water or insect bites.

Anthrax caused by a spore-forming bacterium *Bacillus anthracis* is also a disease under this category. Other diseases in this category include small pox- a highly contagious disease which is transmitted easily through the atmosphere and has a high mortality rate (20-40%). Small pox as a biological weapon is dangerous because of the highly contagious nature of both the infected and their pox. It occurs only in humans and has no external holts or vectors (Wikipedia, 2015). Smallpox however was eradicated in the world in the 1970s (CDC, 2009).

Also in this category are Botulinum toxin, one of the deadliest toxins known and is produced by the bacterium *Clostridium botulinum*. Botulism causes death by respiratory failure and paralysis (CDC, 2006).

Plague, a disease caused by *Yersinia Pestis* bacterium, is also a disease under this category. Rodents are the normal host of plague and the disease is transmitted to humans by fleas bites and occasionally by aerosol in the form of pneumonic plague. (CDC, 2012). The disease has a history of use in biological warfare dating back many centuries and is considered a threat due to its ease of culture and ability to remain in circulation among local rodents for a long period of time.

Viral haemorrhagic fevers caused by members of the family Filoviridae (Marburg virus and Ebola virus) and by the family Arenaviridae (for example Lassa virus and Machupo virus belong to category A agents too. Wikipedia (2015) observed that Ebola virus disease in particular has caused high fatality rates ranging from 25-90% with a 50% average and that no cure currently exists. Although vaccines are in development. Death from ebola virus disease is commonly due to multiple organ failure and hypoglycaemic shock. Marburg virus was first discovered in Marburg Germany; no treatments currently exists aside from supportive care.

Category B

CDC (2014) stated that category B consists of agents that are the second highest priority because:

- They are moderately easy to spread
 - They result in moderate illness rates and low death rates
 - They require specific enhancements of CDC’s laboratory capacity and enhanced disease monitoring.
- Some of the agents in this category among others include *Brucella* species which can cause Brucellosis, *Burkholderia mallei*, which causes glanders, *Salmonella* species which cause salmonellosis, *Shigella* which causes shigellosis, *Salmonella typhi* which causes typhoid fever and *Vibrio cholera* which cause cholera.

Category C

Category C agents as shown in Wikipedia (2015) are emerging pathogens that might be engineered for mass dissemination because of their availability, ease of production and dissemination, high mortality rate, or ability to cause a major health impact. These agents include emergency infections diseases such as Nipah virus, Hanta virus, severe Acute Respiratory Syndrome (SARS, H1N1 (a strain of influenza) flu and HIV/AIDS.

Warning Signs of Bioterrorism Attack

Although the search for an early detection system for biological chemical and radiation terrorist attacks has continued, none of these systems have been perfected. Fishbein (2014) however pointed out that the medical community is advised to look out for unusual diseases not typically seen in the area. Other potential clues that raise suspicion for a bioterrorism attack as declared by the same author include new types of antibiotic resistance in bacteria because some biologic agents are modified (weaponised) to make them more lethal, unusual numbers of cases of a disease, and a typical presentation of diseases. Events that might suggest an attack include a large number of oil or dead people in a small geographical area, multiple dead animals of different species and patients with multiple different disease indicating a mixed attack.

Some Historical Facts about Bioterrorism

The deliberate large scale use of chemicals as poison gas weapons as stated in the World Health Report 2007 by the World Health Organization (WHO) (2007) dates back to the first World War, when tear gas, mustard gas and phosgene were employed against troops in the trenches of European battle fields to deadly and disabling effect. Estimates according to the same report range from about 1.17 to 1.25 million gas casualties on all sides, including between 85,000 and 91,000 fatalities, but exclude those who died from gas related injuries years after the end of the war.

In the 19th century, an American Indian was infected with smallpox through donated blankets (Mathur, 2011). Mathur (2011) also revealed that the first weapon of mass destruction was used during the second world war by United States against Japan in Hiroshima and Nagasaki; the after effects of this atomic explosion are still

manifested after decades in the form of malignancies, gene and chromosomal defects which are likely to continue in the future. In 1972, police in Chicago arrested two college students who had planned to poison the city's water with typhoid and other bacteria (Carus, 2000).

Anthrax was used in a series of attacks on the offices of several United States senators in late 2001, the anthrax was in a powder form and it was delivered by mail (Dewan et al, 2001). The WHO (2007) reported that the largest chemical weapons attack against a civilian population in modern times occurred in 1988 when Iraqi military forces repeatedly used mustard gas and other chemical agents on Kurds in northern Iraq and there was large scale dumping of toxic chemical in Cote d'Ivoire in 2006.

In the worst attack on the Kurdish city of Halabja in March, 1988, groups of aircraft flying many sorties repeatedly dropped chemical bombs. About 5,000 people were killed and 65,000 others suffered severe skin and respiratory diseases and other consequences such as birth defects and cancer (Mustard gas, 2006 and Gosden, 2001).

Having taken an overview of bioterrorism and its agents, some important issues regarding preparedness for bioterrorism attack are discussed below. The scope of this paper does not provide an exhaustive guideline on bioterrorism preparedness. It however highlights preparedness for health facilities and for families generally.

Preparedness for Bioterrorism Attack

In the event of a suspected bioterrorism attack, information should be disseminated to all stakeholders, agencies, security agencies, organizations, health care providers, health facilities, individuals and the general public. When such information is promptly disseminated, individuals will be more cautious and this will help to prevent rapid transmission and spread of the disease if it is an infectious one. Moreover, providing information and education to the public can significantly reduce the impact of bioterrorism. English et al (1999) averred that health care facilities may be the initial site of recognition and response to bioterrorism events. The latter authors pointed out that if a bioterrorist event is suspected, notification should immediately include local infection control personnel and the health care facility administration and prompt communication with the local and state health departments, Federal Bureau of Investigation (FBI) field office, local police centre for disease control and prevention (CDC) and medical emergency services. Health facility should have a telephone directory with the numbers of these various agencies and organizations in its readiness plan.

Provision of Adequate Vaccines, Drugs and Equipment for first Respondents

Provision of adequate vaccines, drugs and equipment should be ensured as these are paramount in readiness plan in event of a bioterrorist attack: Hylton (2011) opined that the occurrence of vaccines and treatments for potential biological threat also known as medical countermeasures has been an important aspect in preparing for a potential bioterrorist attack.

As much as adequate provision of the aforementioned is ensured, efforts should also be made to ensure that there is adequate distribution of these materials to protect an affected community. Stocks of antibiotics should be handy for immediate distribution in case of any possible attack. Adequate provision of materials such as handgloves (clean, disposable, and sterile) face masks, disposable face masks, aprons, gowns, caps and eye goggles should be included in the readiness plan process especially for first responders and for the management of the first possible victims or casualties of bioterrorist attack. However, as most of these items have a limited "shield life" before they lose their strength and efficacy, they may not necessarily be hoarded or stockpiled but most importantly, they should be readily available in case of any bioterrorism attack.

Adequate Manpower and Laboratories

All necessary manpower or professionals and health personnel whose services will be needed in case of bioterrorism attack should be readily available and accessible. These include infection control officers, medical laboratory scientists, doctors, veterinary officers, health educators, public health officers, nurses, environmental health officers, agricultural officers, military officers, safety officers etc. All these professionals will need to work in unison for the common good of curbing the impact of a bioterrorist attack on the general populace. Rapid responses from all these officials in the event of a bioterrorist attack will help to identify the onset and sources of the biological agent. Laboratory services and materials needed for testing specimens such as water and soil to detect any form of contamination should also be in existence for use readily when there is bioterrorism attack. In other words, a team of bioterrorist response and preparedness specialists should be put in place to immediately swing into action in case of such attack.

Funding

Adequate funding should be readily available for immediate use in case of a bioterrorist attack. As bioterrorism is a form of security threat, budget allocation for security purposes should be accessed in the event of such an attack.

Biosurveillance

Biosurveillance as defined by Wikipedia (2015) in the science of real time disease outbreak detection, its principles apply to both natural and man-made epidemics (bioterrorism). In the application of biosurveillance, data which potentially could assist in early detection of a bioterrorism event include many categories of information. Health related data such as that from hospital computer systems, clinical laboratories, electronic health record systems, veterinary medical record systems could be of help. Therefore, these records should be kept properly so that in case there is deviation in the incidence or increase in the incidence of a particular disease or prevalence of a particular agent a quick notification to all stakeholders can be made to reduce the impact of any possible attack. Other records to consider according to Wikipedia (2015) among others include those generated by food processors, drinking water systems and school attendance.

Other forms of preparedness

The plan starts long before there is an attack. People must have appropriate supplies stored in a safe place in their house, where they work and even in their cars.

In addition to the above, since bioterrorism is a form of disaster (man-made) some guidelines by Fishbein (2014) as part of preparation for a bioterrorism attack are

- Water: 3 gallons for each person who would use the emergency supply kit and an additional 4 gallons per person or pet for use if confined to home.
- Food: a three-day supply in the kit and at least an additional Four-day supply per person or pet for use at home (stocking a two-week supply of food and water at home may be considered.
- Items for infants including formula, diapers, bottles, pacifiers, powdered milk and medications not requiring refrigeration.
- Items for seniors, disabled people or anyone with serious allergies including special foods, denture items, extra eye glasses, hearing aid batteries, drugs that are regularly used etc.
- Kitchen accessories such as manual can opener, plates, knives etc
- A portable battery-powered radio or television and extra fresh batteries.
- Several flashlights and extra fresh batteries
- A fresh aid kit
- One complete change of clothing and footwear for each person including work shoes, rain gear, items for the season such as hats and gloves, dust masks etc
- Blankets or sleeping bag for each person
- Sanitation and hygiene items such as shampoo, deodorant, toothpaste, toothbrushes, comb and brush, soap, toilet paper, hand sanitizer, liquid detergent, feminine supplies, disinfectant etc.
- Other essential items such as a paper, pencil, needles, thread, small A-B-C type fire extinguisher, medicine dropper, whistle, emergency preparedness manual.
- Entertainment including games, books, dolls and stuffed animals for children.
- A map of the area marked with places one can go and their telephone numbers.
- An extra set of keys and IDs including keys for cars and any properties owned and copies of driver's licenses, passports and work-identification badges.
- Cash, coins and copies of credit cards as the case may be.
- Copies of medical prescriptions
- Matches in a water proof container
- A small tent, compass and shovel

Conclusion

Bioterrorism is a form of terrorism in which there is intentional release of biological agents such as virus, germs or bacteria to cause harm to or kill people. It is an act that can be carried out anytime, covertly and can be very deadly. Some of the diseases that can result from bioterrorism include anthrax, small pox, tularaemia, brucellosis, botulism, ricin toxin poison, cholera, plague, typhoid fever, viral encephalitis, shigellosis etc.

In the event of a bioterrorism attack, if adequate attention is given to issues raised above, the effect of such an attack on any affected group of people or population will be minimized to a large extent even if not totally eliminated.

Recommendations

In view of the fact that bioterrorism can occur anytime, anybody covertly and deadly for that matter, the following recommendations are suggested:

There may be need to sensitize and educate people about bioterrorism and preparedness because it seems many people may not be aware of what bioterrorism is all about.

In the face of terrorism happening around the world, nowadays, all and sundry should constantly be vigilante for bioterrorism.

All stakeholders including individuals, health care providers, medical practitioners, health educators, safety experts, medical laboratory scientists, technologists, nurses all emergency management agencies which exist at various governmental levels, non governmental agencies such as the red cross should constantly be on the watch and be alert to bioterrorism attack and be able to effect a rapid response and also to promptly identify its onset.

All tiers of government, national, regional, state and local governments as well as private and public organizations and agencies should always have bioterrorism readiness plan in place to forestall or reduce the impact of any bioterrorist attack.

All health care facilities if possible should also have readiness plan in place.

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