Chapter 30

Strategies of Preparedness Response to Biological Warfare and Bioterrorism Threats

Paul F.
Medical Support Section, Department of Field Support, United Nations Headquarter, New York 10017, USA

Abstract. Risks associated with deliberate use of biological agents against population and the needs for a strong public health system are well recognized. The potential use of biological agents is mounting every day, especially with growing political dissidence as well as social and economical conflicts in several countries. Countries in Eastern Europe have considerable vulnerability because of economical, social and political difficulties they are facing, along with inadequate response capacity and large number of outfits having continuous low intensity conflicts with established administrative system. There are no doubts that preparedness against biological weapons must be integrated in national disaster preparedness plan, as well as strengthen the core competencies of public health and other national and local authorities to respond to biological crisis, along with strong collaboration with other national agencies, like intelligence, defense and police.

Keywords. Bioterrorism, biological agents, preparedness, public health

30.1. Introduction

The use of microorganisms and toxins as weapons of mass destruction has a long history, with examples dating back to before the fourteenth century. Methods used have ranged from deliberately infecting water supplies with diseased cadavers to passing out smallpox infected blankets to "extirpate" Native American tribes in 1763. Other examples include the use of fomites as the Viet Cong did in early 1960s when they smeared sticks with excrements [1].

The nature of terrorism is changing. It is no longer only hijackers and bombs. Nor it is only chemical attack such as the 1995 Aum Shirinkyo sarin gas in Tokyo subway.

Bioterrorism is no longer a hypothetical event. A bioterrorist attack has occurred and could occur again at any time, under any circumstances, and at a magnitude far greater than we have thus far witnessed.

Similar with chemical terrorism in some ways, bioterrorism differs primarily in the lag time between the terrorist event and its medical consequences. It therefore poses its own critical challenges, particularly for the publish health community [2].

C. Dishovsky and A. Pivovarovi (eds.), *Counteraction to Chemical and Biological Terrorism in East European Countries*,

In spite of infrequent occurrences of such episodes the potential use of selected agents, with or without genetic alterations, is mounting everyday especially with growing political dissidence as well as religious and resources conflict in several countries [3].

Several factors make biological threats unique as compared with chemical and nuclear weapons. First, facilities and equipment designed for legitimate applications, and also for research and development can be used to produce biological agents. And they are widespread throughout the world. Secondly, the collapse of former Soviet Union [4] and subsequently reduction in funding its massive biologic warfare infrastructure may have resulted in vulnerability for recruitment by states or terrorist organization trying to establish biological warfare programs. The last but not the least, the incredible advances in biotechnology over the past 15 years can potentially be used for production of biological agents, including genetic engineered pathogens, resistant to antimicrobials and classic vaccines.

30.2. Characteristics of Biological Attack and Bioterrorist Attack

In comparison to chemical and nuclear weapons, biological weapons require less complex technology and low cost allowed even poor countries or terrorist organizations to acquire or to product them.

Usually preparedness to respond to a biological attack or bioterrorist attack was directed on a number of potential agents, in particular anthrax, smallpox, plague, botulinum toxin, tularemia, and viral hemorrhagic fevers. Anthrax is a proven risk and of most immediate concern, although smallpox, because it is capable of person-to-person transmission, engendered an equivalent sense of urgency. However, there is a plethora of potential, credible bioterrorist agents. It should be noted that the Soviet Union is known to have weaponized some 30 different biological agents, including drug-and vaccine-resistant strains.

Theoretically, biological agents are ideal agents to be used as weapons of mass destruction. However not all microbes can be weaponized. Several characteristics are required to make a microorganism an ideal agent that can be used as a potential weapon of mass destruction or bioterrorist agent. These pertain to virulence, infectivity, lethality, ease of production, stability in environmental conditions, and post-dissemination retention of features, availability of a susceptible population and lack or inadequacy of resources and tools to prevent and to treat the diseases. while hundreds of pathogenic microorganisms have been investigated for their potential utility as military weapons, relatively few, around 40, have been found capable of meeting specific requirements, and fewer still have been documented to have been weaponized [5].

The US Centers for Disease Control (CDC) has developed a classification system for biological terror agents [6]. The classification is based on the likelihood of the agent being used and the risk posed by each agent. The agents and the diseases they cause are listed in Table 30.1.

Table 30.1. CDC classification of biological weapons agents. Modified from F. Paul

Category	Diseases/Organism	Characteristics
(a) High-priority agents (pathogens that pose a high risk to national, local security)	Anthrax (*Bacillus anthracis*) Botulism (*Clostridium botulinum* toxin) Plague (*Yersinia pestis*) Smallpox (variola major) Tularemia (*Francisella tularensis*) Viral hemorrhagic fevers (filoviruses [e.g., Ebola, Marburg] and arenaviruses [e.g., Lassa, Machupo]	– Can be easily disseminated or transmitted from person to person – Result in high mortality rates and have the potential for major public health impact – Might cause public panic and social disruption and – Require special action for public health preparedness
(b) Second highest priority (moderately risk and relative low mortality)	Brucellosis (*Brucella* species) *Clostridium perfringens* Food safety threats (e.g., *Salmonella* species, *Escherichia coli* O157:H7, *Shigella*) Glanders (*Burkholderia mallei*) Melioidosis (*Burkholderia pseudomallei*) Psittacosis (*Chlamydia psittaci*) Q fever (*Coxiella burnetii*) Ricin toxin from *Ricinus communis* (castor beans) Staphylococcal enterotoxin B Typhus fever (*Rickettsia prowazekii*) Viral encephalitis (alphaviruses [e.g., Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis]) Water safety threats (e.g., *Vibrio cholerae*, *Cryptosporidium parvum*)	– Are moderately easy to disseminate – Result in moderate morbidity rates and low mortality rates and – Require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance
(c) Third highest priority (emerging pathogens that could be engineered for mass dissemination in the future)	Emerging infectious diseases such as Nipah virus and hantavirus	– Availability – Ease of production and dissemination and – Potential for high morbidity and mortality rates and major health impact

The classical methods for disseminating the agents are through aerosols or by the use of disease carrying vectors. Explosive bomblets in which there is buster, surrounded by biological agent and enclosed in thin case, explode upon impact and disseminate the biological agent as an aerosol. Spray tanks carried by aircraft and missiles may also be utilized for producing aerosol containing the biological agent.

Disease carrying vectors such as mosquitoes, mites, tics and lice may be delivered by aircraft or missiles in containers which rupture on impact. The biological agents may also be introduced into the food chain or water.

30.3. Preparing for Response

Implications of deliberate use of biological agents are very difficult to be predicted. A well-conducted biological terrorist attack will strain almost all public health authorities and medical care facilities. The primary consequence of a large scale biological attack will be a catastrophically large number of casualties [7].

Response system must be capable of providing a complete package of medical care and additional services in order to mitigate the effects of the attack. However the full range of consequences is very difficult to be evaluated, as the pathogen and the amplitude of attack is almost impossible to be foreseen before the event happens. Too many factors may influence the course of biological crisis. Briefly could be mentioned: location of the attack, density of population, characteristics of biological agent, availability of treatment and prophylaxis, residual environmental damages and hazards etc.

Nevertheless a bioterrorist attack is a criminal act and a complex criminal investigation must be performed.

The full spectrum of consequences require an integrated command and control system, extended at those level of authority able to provide in real time the full support for targeted community. That may include local, regional, federal or national authorities, extension of authority at highest level required for a coherent and efficient control and command. In the mean time a multidisciplinary and multiple professional team is requested to support the common effort to mitigate the effects of criminal act.

Countries in East and South East of Europe have considerable vulnerability because of poverty, inadequate response capabilities and capacities and large number of outfits having continuous low intensity conflicts with new established administrative system. However, high prevalence of communicable diseases and relative frequent epidemics has stimulated national health authorities to strengthen their early recognition and response capabilities.

Successful preparation will depend upon the development of a well-orchestrated plan to be used by first responders. For bioterrorism they will be epidemiologists, infectious diseases experts, medical personnel in emergency room, and intensive care units. The most powerful strategy may be to cast bioterrorism defense as a national security issue first and foremost.

An alternative strategy would be to address bioterrorism response preparedness in a coordinated fashion with broad emerging infectious disease issues. For example, propose this effort as a defense system with concurrent substantial benefits for the public health system, as well as microbial and biomedical science.

A good example is how national authorities and international organizations responded to SARS outbreak.

Response strategies for biological attack and bioterrorism must be developed along with devolvement of a real time surveillance system, with enhanced capabilities for identification of biological agents, for isolation and successful treatment of casualties and efficient prophylaxis measures.

That means that the public health infrastructure must be strengthened in order to ensure a rapid, effective response in the event of another bioterrorist attack.

That includes at least:

- Communication and information
- Laboratory capacity
- Surveillance, detection, and diagnosis
- And strengthening the local response

Educate front line healthcare providers so that the astute laboratory clinician, nurse, or doctor who sees the first patient or wave of patients can recognize an attack early and sound the alarm.

A strong public health infrastructure that can detect cases and deliver the appropriate therapeutics in a timely manner requires resources and organization at the community level. However, workshop presenters representing these organizations noted that there are many significant gaps in our local response capabilities. For example, delivering the stockpile to where it is needed is likely the least of our worries. Rather the challenge will be in distributing its contents. There is a need at both the state and local levels to identify emergency authorities and delegate responsibilities.

A strong local response involves not only local public health agencies, but also hospitals, the law enforcement community, and the community at large. It was observed by WHO that there is a striking disparity in public health capacity not only among countries, but also but also among jurisdictions within countries. That can jeopardize the effectiveness of response.

Strengthening local and state public health agencies will require an infusion of resources, including both trained personnel and financial resources.

It was necessary that every country to evaluate its own system, including its legal system, and implement its own plan of action for organizing and strengthening its response capabilities.

However there are many challenges that must be taken in consideration. From our understanding critical challenges are:

- Preparedness programs to be comprehensive and they may that involve all critical players in a crisis situation. Often planners may confuse the role of first responders with expert/ professionals one; this will conduct to a misapprehend that the last are responsible for action as first responders.
- Budgeting and adequate funding for development of effective surveillance and response systems; traditionally funds have been directed to first responders; this is inappropriate initial direction because without technical expertise first response may be inadequate.
- Involvement of all spectrum of specialist/experts in developing and running preparedness programs; that means that for example medical personnel must be involved in this process, as they are first responders for medical care of casualties. Physicians, nurses, other health care professionals must know how to react in case of mass casualty situations, and must became active participants in the preparedness arena.
- Incident command system is another critical challenge for planners and players too. All parties must know the flow of information, chain of command and control and must obey it, to ensure the coherence and unique command “policy’.

- Preparedness programs must be comprehensive, including not only the final phase-first response to crisis, but more important to develop and sustain surveillance system to detect use/ release of a nuclear, chemical or biological agent. Usually there are dedicated plan for each situation. This may create confusion even within first responders or crisis cell; we consider more effective to develop a comprehensive preparedness and response plan, and with different scenarios for each situation; this approach will bring more coherence and effectiveness within local authorities, first responders, local health authorities, communication, transportation etc.
- Surveillance system is a critical asset for any preparedness plan; the most important task of it is warning of an attack, existence of a threat. It is recommended that surveillance system to be integrated with other similar assets; this will allow a continuous monitoring at different levels of authorities, and not only local, but regional, national or international.
- Critical for an effective response in chemical and biological attack is the need for a specific training for health care personnel. Health care professionals must be able to recognize clinical aspects of chemical or biological attack. This will tremendously help to improve the effectiveness and success of treatment.

30.4. Conclusions

Despite the huge pressure on medical system in crisis situation, preparedness activities for response to a bioterrorist attack are responsibility of local and national government.

To ensure an efficient and real-time response there is a need for authorities to develop feasible response plan, including projected costs and probability of effectiveness and to identify also those mechanisms who will ensure the viability and function of the plan in crisis situation.

References

1. Christopher, G.W. et al., Biological Warfare: A Historical Perspective, JAMA 278(5):412, 1997.
2. National Health Policy Forum/Issue Brief No. 731(http:www.nhfp.org, accessed on 03/10/2008).
3. Pliambangchang S., Strategies of Preparedness Against the Threat of Biological warfare and Bioterrorism I South-East Asia, Asian Biotechnology and Development Review 8(1):77–98, 2005.
4. David Franz Testimony to the Senate Judiciary's Subcommittee on Technology, Terrorism, and Government Information, 1994, March 4, *http://www.globalsecurity.org/wmd/library/congress/1998_h*, accessed on 28 September 2008.
5. Horn, J.K., Bacterial Agents Used for Bioterrorism, Surgical Infections 4(3):281–287, 2003.
6. CDC, Biological and Chemical Terrorism: Strategic Plan for Preparedness and Response. Recommendations of the CDC Strategic Planning Group. MMWR 44:RR-4, 2000.
7. Mughal M.A., Biological Terrorism: Practical Response Strategies. CML Army Chemical Review, 34–38, July, 2002.

Disclaimer: The views expressed in this paper are those of the author and do not reflect the official policy or position of the United Nations.