Chapter Six: Conclusion

The agreed definition of biological warfare involves the intentional use of microorganisms, and toxins, generally, of microbial, plant or animal origin to produce disease or death in humans, livestock and crops. The attraction for bioweapons in war and their likely use in terrorist attacks remains a possibility because of their low production costs, their easy access to a wide range of bio agents, problem in their detection by routine security systems, and their easy transportation from one location to another. Then, their properties of covert use and possibility of use by non state actors mainly, make their non-proliferation next to impossible. Therefore it remains a major challenge to create a comprehensive and potential defence against their use especially by non-state actors. We also cannot ignore their possible use in future in battlefields because of the tremendous advancements in technologies that have made them very sophisticated and smart to achieved limited objectives.

This threat from bioweapons increases with the increasing number of countries that are engaged in the research and development of such technologies i.e. from about four in the mid-1970s to about seventeen today (see chapter two, Norms against Bioweapons). These states could also sponsor non-state actors to use new and advanced bio weapons. Today, it is very difficult to say that a state or a non-state actor cannot use bio weapon on moral grounds however it is a general belief. Other than the threat of use of bioweapons in war and against civilians, there is also an alarming issue of environmental problems resulting because of research and testing of new technologies associated with bioweapons.

Although use of conventional weapons such as explosives is still considered as the most likely means by which terrorists could harm civilians, the current trend of using completely surprising means like cyber attack, aeroplane or anthrax, show that there is an increasing risk and probability for the use of unconventional weapons. Indeed, the use of biological agents as small and large-scale weapons has been actively
explored by many nations and terrorist groups. However, small-scale bioterrorism events may actually be more likely in light of the lesser degrees of complexity to be overcome, we must prepare for the possible large-scale incident that could lead to disastrous consequences.

Most evaluations of potential risk agents for biological warfare or terrorism have historically been based on military concerns and criteria for military protection. However, several characteristics of civilian populations differ from those of military populations, including a wider range of age groups and health conditions, so that lists of military biological threats cannot simply be adopted for civilian use. These differences and others may greatly increase the consequences of a biological attack on a civilian population. Civilians may be more vulnerable to food or water born terrorism, as it is an easy way to target large number of population. Therefore, there seems an important need for vigilance in protecting food and water supplies. Overall, many other factors must be considered in defining and focusing multi agency efforts to protect civilian populations against bioterrorism.

Category A agents are being given the highest priority for preparedness. For Category B agents, public health preparedness efforts will focus on identified deficiencies, such as improving awareness and enhancing surveillance or laboratory diagnostic capabilities. Category C agents would be further assessed for their potential to threaten large populations as additional information would become available on the epidemiology and pathogenicity of these agents. In addition, special epidemiologic and laboratory surge capacity would be maintained to assist in the investigation of naturally occurring outbreaks due to Category C which are comparatively new or emerging agents. Various programs for food safety, emerging infections diseases, and unexplained diseases would expand the overall bioterrorism preparedness efforts especially for Category B and C agents. (See annexure I)

However, the categories for these bioagents could not be considered definitive. Agents in each category may change as new information is achieved or new assessment methods are established. Disease elimination and eradication efforts may result in new
agents being added to the list of categorized bio agents as populations lose their natural or vaccine-induced immunity to these agents. Conversely, the priority status of certain agents may be reduced as the identified public health and medical deficiencies related to these agents are addressed. For example, once adequate supplies of smallpox vaccine and improved diagnostic capabilities are established, its rating within the category of special preparedness needs would be reduced.

To meet with the changing response and preparedness challenges presented by bioterrorism, a standardized evaluation process could be used to evaluate and prioritize currently identified critical bio agents, as well as new agents that may emerge as threats to civilian populations and thus for the national security. Attempts to regulate the conduction of warfare and the development of weaponry using harmful substances such as poisons and poisoned weapons are enshrined in conventions drawn up with respect to the laws and customs on land. These early instruments of war-prevention measures, and eventual confidence-building and peace-building measures, have evolved from normal practices and characteristic usages established amongst, civilized peoples; from the basic laws of humanity; the tenets of long established and widely accepted faiths, and the dictates of public conscience.

In that context, the conventions outline steps and measures to safeguard buildings and historic monuments dedicated to art, religion and science, and to clinics and hospitals housing the sick and wounded, provided they are not engaged in combat. Use of such personnel in experiments designed to enhance the lethality of weaponry containing harmful substances such as poisons, disabling chemicals and ethical pharmaceuticals is implicitly and strictly prohibited

**Norm-Building:**

Norms building has been considered as an important measure to check the use of bio weapons. Various experts are intended to strengthen the treaty regime and to ensure that progress in the fields of bioscience is not applied to the development and use of powerful mass destruction. To ensure this, the scientist community is also
expected to contribute to make a moral responsibility of not using new techniques for dual purposes. Some aspects of biotechnology have raised deep ethical questions especially because of the dual use dilemma of these technologies.

Agreements to restrict or eliminate the production and use of biological weapons date back to the Geneva Convention of 1925. The Biological Weapons Convention was the first international agreement to put a ban on entire category of weapons. It was established three years after a unilateral decision in 1969 by the US to eliminate its own biological arsenal. Most major powers including the former Union of Soviet Socialist Republics (USSR) and the US had become parties to the biological treaty when it went into force in 1975. Later, more countries joined in the agreement and the world appeared about to be rid of germ weapons. (See Annexure II)

However, countries were still on the way to work on new technologies to enhance bioweapons. In 1979, international medical experts learned of a mysterious outbreak of respiratory anthrax in the soviet city of Sverdlovsk, the site of numerous secret military facilities. More than 60 civilians and an unknown number of military personnel died. After the break up of the Soviet Union in 1991, the Russian government revealed that the Sverdlovsk anthrax outbreak had resulted from an accident at an illegal biological weapons facility. (See Chapter One, Introduction)

In the 1991 Persian Gulf War, the US and other coalition leaders worried that Iraqi president Saddam Hussain might unleash chemical and bio weapons against them. Although he did not, the experience again prompted efforts to strengthen international agreements against these weapons. One result was the 1993 Chemical Weapons Convention, which contains an intrusive inspection system. Parties to the treaty have to allow outside monitors to visit suspected sites. By June 2001, 174 nations had signed the chemical treaty. To go into effect, the national legislature of most countries must ratify, or approve the treaty. As of June 2001, 143 of the signing countries had ratified or acceded to the treaty and had become binding parties to the agreement. The US signed the treaty in 1993, and the US Congress ratified it in 1997. (See Chapter Two, Norms against Biological Weapons)
In 1993, representatives from 160 nations approved the Chemical Weapons Convention. This agreement banned production, use, sale, and storage of all chemical weapons. It also mandated destruction of existing stocks of weapons by the year 2005. The US ratified this convention in 1997, despite concerns about the proliferation of chemical weapons among nations such as Libya, Syria, Iraq and the North Korea that were not signatories to the agreement.

Despite of serious efforts to enforce BTWC to ensure international peace and security, various countries are still involved in research and development of biological weapons capability. (See Table 2.1, Chapter Two, Norms against Biological Weapons)

Basically the BTWC is weak, as it lacks much in the way of enforcement measures, and it has been widely violated in practice. There have been efforts towards adding such measures, in the form of inspections of suspect sites where an inspection team can arrive without prior notice at any time, with no right of refusal. However, it needs high-level cooperation and trust. Then the other problem with BTWC is its ambiguity on the legality of bio agents. If they were not used in a war or for offensive purposes, and were used with the consent of the country in which the bio agents were dispersed, that would be perfectly legal under the regime of the treaty. However, this ambiguity could set a dangerous precedent for the future. (SIPRI 1999: 117)

There are various research and development institutes and pharmaceutical companies that may necessitate compliance declaration with the protocols of the Biological and Toxin Weapons Convention. However, in the absence of a systematized infrastructure, the administrative, educational, economic and legal costs are important matter of concern. Compliance declarations and regimes are of direct consequence with institutions that are engaged in routine and genetically-engineered research with specialized groups of microbial pathogens and toxins that possess high-level containment facilities and laboratories and that are engaged in the design and engineering of high-production capacity bioreactors and that do contract research for government and industry with biological agents that could serve as potential triggers of biological warfare and bioterrorism.
The BTWC should be strengthened and State Parties encouraged providing responses to agreed politically binding CBMs and to participate in devising an appropriate verification regime to deter states from considering acquisition of bio weapons. An incentive for such increased participation by states in BTWC should stem from the benefits in improved standards for microbiological containment, health and safety, pollution, biosafety, genetic manipulation and good laboratory and good manufacturing practice which would provide increased confidence that a facility in a developing country is not being misused for a prohibited purpose.

Research restrictions are necessary in certain situations, for example, in cases where a military abuse appears to be imminent, where no effective multilateral arms control or non proliferation are presently feasible, and where other technical avenues to reach the same scientific goal are potentially available. These criteria apply specifically to the production of bioactive compounds like pharmaceuticals, vaccines in edible crops and chemicals used in medicines and pesticides. With this, full transparency in all aspects of biomedical research and developments in biochemistry should be guaranteed.

The increasing threat of bioterrorism highlights the importance for the development of a stringent verification protocol. Appropriate control measures in combating bioterrorism, and the proliferation of bio weapons could involve:

- Ratification of laws in states to criminalize the production, stockpiling, transfer and use of bioweapons
- Ratification of norms that monitor the use of various toxins and chemicals that can be used to produce bio-weapons
- Establishment of national and international monitoring units to check the transfer of various toxins and chemicals to be used as bio weapons by terrorist organizations, to ensure their use for peaceful purposes, and their licensed availability in national, regional and international markets (See Chapter Two, Norms against Bioweapons)
The Biological Weapons Convention also needs to be strengthened through multilaterally agreed, legally binding verification measures. There are various issues which create hindrance in ratifying the Convention. International cooperation is needed to meet with these challenges.

An effective implementation of all these normative measures would contribute in diminishing the threat of bio weapons, and support the global efforts in disarmament. A cooperative approach is needed which would be imperative to detect any biological proliferation relevant activities. Current norms that are designed to check the use of bio warfare agents need strengthening and international cooperation. In particular, methods of verification need to be agreed, like to those used for verifying compliance with chemical weapon treaties because adherence to the Biological and Toxin Weapons Convention, reinforced by confidence-building measures is indeed, an important and necessary step in reducing and eliminating the threats of biological warfare and bioterrorism.

Actually there are various understandings of bio weapons to be used by state and non-state actors and the problems of outlawing them and creating a proper defence against them. There are various ways by which proper defence can be created against use of bio weapons. Two major aspects are technologies that can be helpful in detecting a bio weapon attack and norms building which can outlaw them. Today, the major threats of use of bio weapons come from terrorist organizations. They can spread contagious agents by various means like food or water contamination and they can also spread an agent through air in aerosol form. Therefore, with this possibility, latest technologies could provide a strong defence. However, if any terrorist organization thinks of launching a bio weapon attack, the purpose could be mass disruption rather than mass destruction and in this case, only technology based defence would not be sufficient enough to check bio weapon attack.
New Technologies:

The newly developed technique to stockpile bio weapons increases their possibility of use in battlefield as well as against civilians. During the past several years, research and development industry has shown a growing interest in bio warfare agents. Until 1970s, bio warfare agents had been regarded as being of little importance, even they were very potent. But since that time the potential for the development and use of bio weapons has radically changed. This is mainly a result of introduction of genetic engineering, protein engineering and other biotechniques.

Because of sophisticated bio weapons and smarter users, the aim of use of bio weapons is not limited to create havoc among a target population by directly using a particular agent against them. The bio weapon attack could be planned for undermining and destruction of economic progress and stability also. Because of highly advanced techniques in the field of biotechnology and genetic engineering, there are various bio agents which can be used against economic targets such as crops, livestock and ecosystems. Then, such attack can easily be carried out under the alleged reason that such traumatic occurrences are the result of natural circumstances that lead to outbreaks of diseases and disasters of an epidemic.

The reason for the widespread ability and interest of non state actors to engage in using bio weapons is linked directly can be because of easy access to technological knowledge world wide. They can easily misuse freely available electronic data and knowledge concerning the production of antibiotics and vaccines, and of latest technologies available to modify a particular bio agent.

There are several other factors that make bio agents more attractive for weaponization, and to be used by terrorist organizations. Production of bio weapons has a higher cost efficiency factor as the financial investments are not as massive as those required for the manufacture of chemical and nuclear weapons. Then, casualty encountered with bigger payloads of chemical and nuclear weapons is lesser in contrast to the much higher numbers of the dead that result from the use of bio weapon.
Popular scenarios of bioterrorism, that could have some fictional base and cinematic links, include the use of various bio agents to contaminate food, the use of toxins and poisons for targeted political assassinations, attack on the target population with potential biological cloud bombs, use of dried viral agents in spray powders, and delivery of genetically-engineered bio agents by missile launchers adding more destruction and havoc.

Pioneered research and development in the field of antibiotics, antisera, toxoids and vaccines to neutralize and eliminate a wide range of diseases and genetic engineering have lead to the development of some spectacular breakthroughs which have dual use possibility:

- Vaccines against a wide variety of bacteria and viruses identified in core control and warning lists of biological agents used in biowarfare
- Rapid detection, identification and neutralization of bio warfare agents
- Antidotes and antitoxins for use against venoms, microbial toxins, and aerosol sprays of toxic bio agents
- Development of genetically-modified organisms
- Development of poisons e.g. ricin, and contagious elements like viruses, bacteria
- Development of antianimal agents to check the growth of a particular animal species in a target area.
- Development of antiplant agents to check the growth of unwanted plant species in a target area. (see Chapter One, Introduction)

This dual use dilemma is one of the potential characteristics of bio weapons which increase the possibility of their use by terrorist organizations. Then, they can be easily produced in a laboratory with minimal resources. Research and development of a vaccine to combat and control the outbreak of disease could be intentionally used with the aid of genetic engineering techniques to produce vaccine resistant agents for terrorist or warfare purposes.
Therefore, the dual use dilemma is creates the inability to differentiate between offence and defence oriented research and development work concerning infectious diseases and toxins. The progress in immunology, medicine, and genetic engineering are dependent on research on the very same agents of infectious diseases. However, bans and non-proliferation treaties are associated with the research and production of offensive bio weapon agents but the problem of dual use dilemma is still not resolved.

Genetic engineering and information are increasingly open to misuse in the development and improvement of infective agents as bio weapons. Such misuse could be envisaged in the development of antibiotic resistant micro-organisms, and in the enhanced destruction capacity of agents. Resistance to new and potent antibiotics constitutes a weak point in the bio-based arsenal designed to protect urban and rural populations against lethal bioweapons. An attack with bio weapons using antibiotic-resistant strains could initiate the occurrence and spread of communicable diseases, such as anthrax and plague, on an epidemic scale. (See Chapter Three New Technologies)

Indeed, the relative ease of acquiring these weapons has increased their attractiveness to proliferant states that cannot afford to acquire advanced conventional or nuclear weapons or lack the necessary technical capabilities. Moreover, history has shown that both state suppliers and unscrupulous companies are willing to sell sensitive technologies and materials to customers willing to pay.

Any state with medical research facilities or any fermentation based industry can easily produce bio weapons. As a result of global industrialization and economic integration developing more and more technologies will be in the hands of large number of states. Increasing role of regional powers, non state actors and multi national corporations in world politics increases the possibility of not only transfer of new technologies, but also the possibility of increasing risk of their use against civilians. Strengthened biological weapons export controls are needed to ensure biosecurity at international level but it is not very easy. Therefore, it becomes important to increase
general awareness about the whole issue and also to build up a prominent defence for civilians against bio weapon use.

**Bio-terrorism Threats:**

In the past, most planning for emergency response to terrorism has been concerned with overt attacks where the attack is very much clear and identification of the attack and attacker is also not very difficult. For example, an attack in which chemical agents are used would mostly be overt because the effects of chemical agents absorbed through inhalation or by skin are usually immediate and recognized. Such attacks draw immediate response.

In contrast, attacks with bio agents are more likely to be covert. They present different challenges and require an additional dimension of emergency planning that involves strong enough public and community health systems to identify them and to respond against them. Covert attack of a bio agent at target population will not have an immediate impact because of the time taken between exposure and occurrence of symptoms.

Therefore, the first casualties of a covert attack probably will be identified by physicians or other public health care workers. It can be understand by taking an example of a bio weapon attack. For example, in the event of a covert release of the contagious variola virus, patients would go to hospitals during the first or second week after first occurrence of symptoms. Initial symptoms would mainly include fever, back pain, headache, nausea, and other symptoms of what firstly might appear to be an ordinary viral infection. When the disease would reach to the second stage, infected people will develop rashes like they appear in early stage smallpox. (See Chapter One, Introduction)

Therefore, it would be difficult for doctors to recognize the virus attack immediately. By the time the rashes would become deadly and patients begin to die, the terrorists would be far away and the disease would spread through the large population by person to person contact. There is a possibility of the identification of bioterrorist
attack between the time the first infected cases are identified and second group of population becomes infected. During this short time period, public health officials would need to identify that an attack has occurred, identify the particular agent used in the attack, and prevent more casualties through prevention measures like mass vaccination or antibiotic treatment. If the attack is not identified and proper respond measures are not followed, the transmission could carry infection to other areas and the problem could become worse.

Recognition of covert release of bio warfare agents requires a continued state of awareness of the possibility of abnormal disease patterns in humans, animals, and plants. Clinicians, microbiologists, and public health doctors should be observant for unusual pathogens in disinfected sites or for unusual patterns of sickness. Awareness should be high if previously healthy young adults are affected, especially if mortality is high or there is clustering of cases. Immediate notification of suspect cases or outbreaks should prompt rapid epidemiological investigation with a level of laboratory investigation and empirical prevention measures appropriate to the determined risk. Early prevention measures can be taken by using antimicrobial medicines and vaccines. These measures should also include educating people about such risks. Such measures are increasingly becoming popular by the efforts of different international organizations with assistance of local level NGOs and governments especially in developing countries where the risk of use of bio weapons is very high. (See Chapter Five, Implications of Non-State Actors)

Health security and national security needs have common goals. If a state prepares to combat and defeat bio weapon attack, its public health system would be better prepared for the unpredictable and potential natural threats. For emergency medical response, patients need rapid and efficacious treatment, whether the source of an outbreak of disease is intentional or natural. Medical research needs medicines that treat disease rapidly after symptoms become apparent. Medicines which could treat same symptoms generated by different pathogens are also needed to be developed. Potential vaccines are also needed to be developed and their production units should be established specially in developing countries. Effective and safe multipurpose and
specific medicinal treatments would help in the battle against both naturally occurring and intentional use of infectious disease.

Vulnerability and capability can be taken as two important aspects of bioterrorism. Enhancing emergency medical preparedness and supporting advanced pharmaceutical research for multipurpose medicines, among other measures, could help us in preparing a defence against both, deliberate and naturally occurring pathogen releases, as well as increase the general health and well-being of the population. The intentions of potential attackers are difficult to identify. Therefore, limiting our vulnerability could be a more capable way to prevent or mitigate bio weapon attacks.

The threat of use of bio agents against civilians highlights the need to enhance our capacity to detect and control terrorist acts. There is a strong need to develop a potential defence against an extensive range of critical biological and chemical agents, including some that have been developed and stockpiled for military use. Even without threat of war, investment in national defence ensures preparedness and acts as a deterrent against hostile acts. Similarly, investment in the public health system provides the best civil defence against bioterrorism.

Tools developed in response to terrorist threats serve a dual purpose. They help detect rare or unusual disease outbreaks and respond to health emergencies, including naturally occurring outbreaks or industrial injuries that might resemble terrorist events in their unpredictability and ability to cause mass casualties. The development of a public health communication infrastructure, a multilevel network of diagnostic laboratories, and an integrated disease surveillance system would improve our ability to investigate rapidly and control public health threats that emerge in the twenty first century.

Public attention and concerns, in recent times, have been focused on the dangers of bioterrorist threats. This concern is valid given the significant differences between the speed at which an attack results in illness and in which a medical intervention is made, the distribution of affected persons, the nature of the first response, detection of the
release site of the weapon used, decontamination of the environment, and treatment of patients and victims. The use of bio weapons is dependent upon several stages. These involve research, development and demonstration programs, large-scale production of the bio agent, developing and testing of efficiency of appropriate delivery systems, and maintenance of lethal and pathogenic properties during delivery, storage and stockpiling. (See Chapter Three, New Technologies)

Fundamental research and development continue to focus on determining the minimum infective dose of the bio agent required to infect target population, the time period involved to cause disease immediately or over a long period of time, and the exploitation of the entry mechanisms such as inhalation, ingestion, use of vectors, and the contamination of natural water supplies and food stocks.

By infecting food resources, bio weapons can cause food insecurity which could be very dangerous not only for human life but also for economic stability. Human health, food security and the management of the environment are could easily be threatened at local regional or international level by deteriorating water resources. Deliberately contaminated food containing herbicide, pesticide or heavy metal residues, and use of genetic engineering to modify particular crops to spread diseases are not impossible today. Terrorist organizations could use these ways easily against civilians. Then, new and emerging plant diseases can also affect food security as they can disturb agricultural stability, to create the situation of malnutrition and leave the target population more prone to various diseases. Various bio agents can be released to destroy cash crops and thus effecting economic stability of the target state. (See Chapter one, Introduction)

Advancements in the field of biotechnology and genetic engineering and is of crucial significance to both, developed and developing countries. Developing countries that possess latest technologies associated with cash crops could defend against anticrop bio weapons in a better way. However, the use of such technologies for enhancing crop productions and food security could also result in the development of
more effective anticrop weapons using genetically modified agents that are antibiotics resistant.

This new and potential threat arising from the uncontrolled development and exposure of genetically modified organisms becomes an important issue of concern. The likelihood of genetically engineered micro-organisms contributing to the emergence of new infections cannot be ignored. Genetically engineered crops are also a new threat to international security as it creates a potential danger for environmental safety. The uncertainty accompanying the potential outbreaks of new disease is another complicating factor. Increasing public awareness and understanding of safety issues could help to overcome such fears and misconceptions, and to secure confidence through a state of preparedness. On such strategies, a ready and effective response exists to combat against outbreaks of new diseases.

The use and development of Biological weapons has been banned by BTWC. However, accumulation of biological weapons still exists, and their illegal use in military operations cannot be ignored entirely.

However, the threat of biological warfare seems quite exceptional in the battlefield because of the moral constraints and norms against the use of bio weapons. States would not prefer to use bio weapons openly. In contrast, the threat of bioterrorism, in which biological agents are used by terrorists as weapons against civilian populations, could become real. Although the likelihood of a bioterrorist attack is difficult to predict, the consequences of a successful attack could be devastating and cannot be ignored. Unlike attacks involving conventional or even chemical weapons, which could be readily detected and limited to a specific geographic area, an attack with a biological agent and the resulting symptoms of exposed persons could remain undetected for days, would be widely scattered, and depending on the agent, might not be identified immediately as a planned attack. Even after the outbreak of the symptoms, proper epidemiologic investigations are needed to confirm a bio weapon attack.
Despite of the unpredictable attack and use of a particular bio agent, surveillance of infectious diseases, detection and investigation of outbreak or the attack, identification of particular agent and the mode of transmission, and the development of prevention and control strategies are responsibilities of public health system. Acquiring and sustaining the capability for an adequate response to bioterrorism needs proper analysis and carefully integrated planning by public health care units, law enforcement officials, emergency response units and military.

Preliminary assessments of our nation's capabilities for responding to possible bioterrorist attacks have identified many deficiencies. From the public health perspective, these deficiencies include inadequate surveillance systems; lack of rapid diagnostic techniques, insufficient stockpiles and distribution systems of various medicines and vaccines, inefficient communication systems, and insufficient training of physicians, clinicians, and other health care workers. Then, some diseases that are considered as potential bio weapon agents, such as anthrax and plague, are no longer important public health problems in most of the developed countries, so the capabilities and capacities for responding to sudden outbreaks of these diseases could be insufficient. Then, there are new and genetically modified agents also for which a potential defence is required. (See Chapter One, Introduction)

A strategic plan for reducing the consequences of new and reemerging infectious diseases include different measures for improving the infrastructure facilities like establishing better surveillance systems, improving diagnostic techniques, developing new vaccines and drugs, and conducting research and providing training to physicians and health care workers. Improving capabilities and capacities for responding to bioterrorism would also improve normal public and community health system to respond against natural outbreak of diseases. For example, developing rapid diagnostic techniques that would make it possible to quickly detect bioterrorist attacks involving anthrax, plague, or Q fever would also have usefulness in the routine clinical diagnosis of natural outbreak because of these agents as well as other agents. Distribution systems set up to deliver antibiotics and vaccines to respond against bioterrorist attacks would also be very important in delivering antiviral compounds and
vaccines during an epidemic. Surveillance and communication systems are fundamental components of an adequate public health infrastructure, so an electronic, integrated surveillance system based on latest technology would be useful against a bio weapon attack. Actually, developing a separate infrastructure for responding to attack of bioterrorism would be poor use of already limited resources and various facilities. Therefore, developing value added public and community health systems especially in developing countries should be considered. (See Chapter Five, Implication of Non-State Actors)

Global health has undergone a political revolution in the last fifteen years. From a neglected area of international politics, public health has emerged prominently on the agendas of many policy areas in international relations, including national security, international trade, economic development, globalization, human rights, and global governance. This political revolution has occurred because of crises posed by infectious diseases, ferment in thinking about policy responses to these crises, and the need to engage material resources and capabilities to contain and mitigate the pathogenic threat. Today, the role of global health’s role is not only limited to protect humanity but it also plays an important role in international politics. (See Chapter Five, implications of Non-State Actors)

Building Civil-Defence

The possibility of biological warfare and especially bioterrorism attacks has been taken increasingly seriously by international community. Despite of all normative and technological efforts, because of the advantage of their covert and sudden use, problem in detection, logistic weaknesses and false assumptions in treatment and prevention strategies are some of the challenges to come up to create a potential defence against bio weapons. There is a strong need to improve cooperation between medical providers, public health, and veterinary agencies. Interagency, intersectoral, and international cooperation are also essential. Vaccines and antimicrobials are also needed to be stockpiled so that they can be mobilize rapidly and distributed to large numbers of people on a short notice. The major challenge is also to provide adequate
education, especially at grass roots level, about the symptoms and possible mode of
tack of bioweapons, different resources available to provide defence and their uses.
(See chapter five, Implication of Non-State Actors)

The recent verdict on the Bhopal gas tragedy has provoked the issue of the need
of a potential civil defence system against chemical or biological agents. The Bhopal
disaster or Bhopal Gas Tragedy is the world's worst industrial disaster. On December 2,
1984, the lethal methyl isocyanate (MIC) gas and other toxins leaked from the Union
Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India,
resulting in the exposure of over 500,000 people. The immediate death toll went up to
4,000 and it kept on increasing. The long term results proved to be more shocking and
horrible as the gas caused blindness, kidney failure and other deadly diseases among
people. For three years before the tragedy that killed 20,000 people, a local journalist
warned that the Carbide plant was unsafe and that its management was aware of this.
Since 1981, there were small leakages and in 1982, many workers were hospitalized
after another gas leak. However, neither the company or the state government took any
initiative in terms of enhancing the security system to check and detect if any leakage
occurs or on strengthening the civil defence including training of doctors and health
personals or increasing public awareness. This tragedy would have never happened if
the defence measures would have been taken after the first leakage itself and the effect
would have been lesser if we had a strong civil defence. (NDTV Website 2010)

Public awareness of the growing threat of bioterrorism is gathering momentum
today. Development of national preparedness and an emergency response to such an
attack is getting focus. Detection of the type and character of the bio agent used for the
attack, coordination of on-site treatment of the effected people, decontamination of the
affected environment, and its immediate isolation and neutralization are seen as
important measures to combat against the destructing effect of bio weapons.

The threat of bioterrorism has also accepted as the matter of international
concern and co-operation is now being reflected in the establishment of verification
procedures to create a defence against violations of the BTWC. Serious efforts can be
seen at international level to check bioterrorism at normative level. The funding for research and defensive measures against use of bio weapons have been increased specially in developing countries with an accountable role of various international organizations. The scientist community also seems to be responsible and focused on the peaceful use of biotechnology and to check the misuse of various technologies to be used for offensive bio weapon programs. There are several other measures are in force to check the development and use of bio weapons like new techniques of genetic engineering that help in the use of genomic information which could be further used:

(centers for Disease Control and Prevention)

- To develop novel antibiotics and vaccines,
- To enhance national and civil defence systems to contain and counteract against the use of bio agents in the manufacture of bioweapons,
- To minimize and eliminate vulnerability of different peoples, cultural and ethnic groups to get infected by various diseases or ethnic or peoples' specific weapons.

Scientists associated with research and development in the field of biotechnology and genetic engineering, public health officials and state governments are focusing on developing emergency preparedness against any sudden outbreak or bio weapon attack which includes preparation of new vaccines in guarding against the emergence of various diseases as a result of either accidental release or planned use in bioterrorism. The scientist community, state have an important role governments and international organizations have an important role to play in educating public to contain unexpected and sudden outbreaks of diseases through minimizing the easy acquirement of bio agents for use in bioterrorist threats.

To check the illegitimate use of various bio agents, obtained through either false or genuine means, the scientist community occupies a central role in answering the challenges posed in the production of bio weapons. Biological agents may be obtained from culture collections providing microbial species for academic and research purposes, supplies for bio agents for medicinal and other pharmaceutical purposes or
field samples and specimens. Therefore, it is a major challenge and responsibility for international scientist community to check easy access to dangerous bio agents to be used as weapons by terrorist organizations and also latest technologies against humanity. To establish and safeguard advancements of science for the welfare of humanity, scientist community can contribute to the building up of the defence against bioterrorism through the development of educational and public health training programs and surveillance protocols in counteracting bioterrorism.

Bioterrorist risks could be minimized through effective responses built around the development of preventive and control measures to control, minimize, and eradicate outbreaks of vaccine preventable diseases. Physicians, public health officials, biotechnologists, microbiologists, and genetic engineers have an important role to play in safeguarding against potential bioterrorism in the future through timely detection of various diseases which could be caused by using bio agents against target population.

Appropriate and timely analysis of bio weapon attack, strong public health infrastructure, the necessary networking of the clinical and specialized medical facilities involving public health workers, physicians, epidemiologists, and experts in communicable diseases are needed to ensure strong civil defence against bio weapons.

Bio weapons constitute a severe threat to national security, and to regional and international stability. Civilian and military vulnerability to bio weapons can be overcome by resorting to the development of biosensors, fast-reacting bio-detection agents, advanced medical diagnostics, and effective vaccination and immunization programs.

In neutralizing the effects of bio agents and making them inadequate for use as bio weapons, scientists are also concentrating on the development of a wide range of antibiotics and vaccines and development of biotechnology based defence science and technology programs. Current bio weapons defence research is also focusing on developing biosensors containing specific antibodies to detect various pathogens likely to be dispersed through sprays and air cooling systems. Environmental areas
contaminated with heavy metals, herbicides, pesticides, radioactive materials, and other toxic wastes are also taken as an important issue and scientists are also working on new technologies to solve this major problem.

Finally, we can develop a potential and comprehensive defence against the use of bio weapons by using latest technologies, increasing general awareness, strengthening public and community health systems, developing improved immunization and by strengthening norms and international cooperation. A comprehensive civil defence against bio weapons could be achieved by incorporation following points:

(i) Prepare public health agencies in general

- Because the initial detection of a covert biological attack will probably occur at the local level, disease surveillance systems at state and local health agencies must be capable of detecting unusual patterns of disease or injury, including those caused by unusual or unknown threat agents.
- Because the initial response to a covert biological attack will probably be made at the local level, epidemiologists at state and local health agencies must have expertise and resources for responding to reports of clusters of rare, unusual, or unexplained illnesses.

(ii) Steps that could be taken in preparing against biological attacks

- Enhance epidemiologic capacity to detect and respond to biological attacks.
- Supply diagnostic reagents to state and local public health agencies.
- Establish communication programs to ensure delivery of accurate information.
- Enhance bioterrorism-related education and training for health-care professionals.
- Prepare educational materials that will inform and reassure the public during and after a biological attack.
- Stockpile appropriate vaccines and drugs.
• Establish molecular surveillance for microbial strains, including unusual or drug-resistant strains.
• Support the development of diagnostic tests.
• Encourage research on antiviral drugs and vaccines.

(iii) Preparedness and Prevention

• Maintain a public health preparedness and response cooperative agreement that provides support to state health agencies who are working with local agencies in developing coordinated bioterrorism plans and protocols.
• Establish a national public health distance-learning system that provides bioterrorism preparedness training to health-care workers and to state and local public health workers.
• Disseminate public health guidelines and performance standards on bioterrorism preparedness planning for use by state and local health agencies.

(iv) Detection and Surveillance

• Strengthen state and local surveillance systems for illness and injury resulting from pathogens and toxins.
• Develop new algorithms and statistical methods for searching medical databases on a real-time basis for evidence of suspicious events.
• Establish criteria for investigating and evaluating suspicious clusters of human or animal disease or injury and triggers for notifying law enforcement of suspected acts of biological terrorism.

(v) Diagnosis and Characterization of Biological and Chemical Agents

• Establish a multilevel laboratory response network for bioterrorism that links public health agencies to advanced capacity facilities for the identification and reporting of critical biological agents.
• Establish regional biological laboratories that will provide diagnostic capacity during terrorist attacks involving various biological agents.
• Establish a rapid-response and advanced technology laboratory to provide around-the-clock diagnostic support to bioterrorism response teams and expedite molecular characterization of critical biological agents.

**(vi) Long-Term Response**

• Assist state and local health agencies in organizing response capacities to rapidly deploy in the event of an overt attack or a suspicious outbreak that might be the result of a covert attack.

• Ensure that procedures are in place for rapid mobilization of terrorism response teams that will provide on-site assistance to local health workers, security agents, and law enforcement officers.

• Establish a national pharmaceutical stockpile to provide medical supplies in the event of a terrorist attack that involves biological agents.

• Establish a national electronic infrastructure to improve exchange of emergency health information among local, state, and international health agencies.

• Implement an emergency communication plan that ensures rapid dissemination of health information to the public during actual, threatened, or suspected acts of bioterrorism.

• Create a website that disseminates bioterrorism preparedness and training information, as well as other bioterrorism-related emergency information, to public health and health-care workers and the public. (http://www.bt.cdc.gov/planning/)

To conclude, therefore, while the threat of bioweapons use by non-state actors remains a strong possibility, there are some deficiencies that remain in the medical care and logistics especially delivery infrastructure that would be necessary to build up a robust response to bioterrorism or other public health emergencies. These challenges that would face the health care delivery system include the basic problem of funding in developing countries, shortage of trained staff and the use of latest technologies. Therefore, expanding public awareness can be a way of overcoming some of these
limitations though it is also needed to overcome with these challenges to build up a strong public health system to respond against any emergency or attack.

Local, state and international level medical societies can help in developing a community disaster planning with on call systems for physicians, the coordination of care at normal and emergency health care sites, the preparedness of hospitals to receive patients of sudden outbreak of bio agent, and plans for integrating local and international medical assistance sent to the target population including health care workers as part of the public and community system and needed antibiotics or vaccines. States could consider contracting with their local medical societies to perform these medical-coordination functions, and also require providing proper medical education on preparedness for bio weapon attack.

For all this, sufficient expenditure of a portion of Medicaid funds is needed. Funds would also be needed for the implementation of training programs for physicians and public health care workers that focus on disaster preparedness at the health care facility. However, no one would propose funding for staffed but vacant hospital beds, but in effort to ensure national preparedness should include assisting emergency medical systems against any sudden outbreak and also to develop an electronic record of all the public and hospital facilities within a broad geographic area.

For a comprehensive defence against bio weapon attack to be truly effective, funds are needed especially in developing countries for creating general awareness against bio weapons and also to establish and develop strong public and community health system. Most of the funding for antiterrorist efforts is generally assigned for law enforcement and defence activities. We can easily recognize the important part that physicians, associated health care providers, and acute care hospitals would play during a bioterrorist attack and funds for public health should reach to the health care community.

Improving collaboration among public health officials and clinicians could be an important step in enhancing civil defence systems. Twenty four hour hot lines could
be established that provide a directory service to link clinicians to the appropriate public health officials for consultation on an unusual outbreak of illness, to assist with laboratory diagnosis, and to advise on current public health recommendations. Public health programs, on the other hand, should train clinicians ready to handle these calls.

New threats from weapons of mass destruction continue to emerge as a result of the availability of latest and advanced technologies and capacity to produce such weapons for use in terrorism. New and accessible technologies give rise to proliferation of such weapons that could be a major threat for regional and global security and stability. To combat against such threats and to secure international peace, international cooperation in devising preventive and protective responses is important. Training of civilians to respond against bio weapon attack is also needed. Defensive measures against the threat of bio weapon use involve proper consultation, monitoring and verification procedures and also through the constant availability and maintenance of international law and order force for proliferation controls and preparedness protocols.

Finally, to prepare defence against bio weapon use especially by non state actors, planning to ensure the safety of food resources and water supplies, controlling other infectious diseases by developing and establishing vaccination programs, and responding to the sudden attack with an improved and better health care system is needed. Physicians should be well prepared and trained to identify and contact a public health official in their area about suspected bioterrorism or another public health emergency and the health institutions should have a well-rehearsed plan if the particular case represents an outbreak or bioterrorism. If the emergency procedures are in place and rehearsed before the next sudden public health emergency occurs, civilian security would be well ensured.

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