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UNDERSTANDING THE THREAT POSED BY BIOWARFARE AND THE NEED FOR ENHANCING PREPAREDNESS OF THE PUBLIC HEALTH MANAGEMENT SYSTEM

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Abstract—*Bioterrorism is a form of biological warfare or biowarfare involving a planned and deliberate use of contagious disease causing and highly pathogenic strains of microorganisms as weapons of mass destruction. Highly virulent, resistant an even emergent strains of pathogens are released as agents through the medium of air, water or food causing life threatening illnesses and panic in the human population. The present study makes an attempt to understand the harsh risk posed by such toxic pathogenic agents and the need to prepare the Public Health Management Systems towards effective management of highly infectious diseases. The major threats identified through content analysis for the present study are: a) usage of highly virulent and pathogenic strains, b) modification of the strains to highly resistant forms, c) capacity to remain undetected for several hours/days, d) easy transmission, e) potential for serious adverse impact on public health, panic and social disruption.*

Some recommendations of the study are: 1) biowarfare should be viewed as a major public health emergency across the globe, 2) understanding the demands placed on the Public Health Management Systems and the need for preparedness to deal with such crisis, 3) need for creating public awareness and sensitization towards the risk posed by bioterrorism, 4) setting up mechanisms for i. disease surveillance, ii. rapid and early detection and iii. Efficient epidemiological management of the attack of bioweapons.

Keywords: *Biowarfare, Bioterrorism, Bioweapons, Pathogens, Public Health Management System.*

INTRODUCTION

Bioterrorism is a form of biological warfare which involves a deliberate, planned and intentional release of biological agents which have the potential to cause widespread diseases and illnesses among human beings. Such biological weapons are in the form of microorganisms which are typically found in nature and are virulent i.e. have disease causing ability but are often found to be mutated to increase their virulence effect or in order to make them resistant against commonly available drugs, antibiotics and medications. Such microbes can rapidly spread through any medium - air, water, soil, food (Center for Disease control, 2006).

MICROBES – AS BIOLOGICAL WARFARE AGENTS

Reviewed literature shows that microbes which are used as agents for bioterrorism are shown to display the following characteristics:

- Pathogenic strains of microorganisms-viruses, bacteria, toxins.
- These microbes have the potential to cause widespread diseases and illnesses.
- Such agents are typically found in nature.
- These microbes are highly virulent in nature and cause infectious diseases.
- Aare often genetically engineered, mutated and modified to increase their virulence or to make them drug resistant.
- Such microbes can rapidly spread through any medium-air, water, soil, food.
- Such microbes are often found to be easily spread infections from person to person.
- In ancient time's crude methods such as fecal matter, animal carcasses were used for contamination of soil, water bodies while in modern times dried spores, Genetically Modified Organisms (GMOs) are used.
- Such agents pose a threat to national security and causes public concern.

Commonly identified bioterrorism agents:

- Anthrax,
- Plague,
- Brucellosis,
- Smallpox,
- Viral Encephalitis
- Viral Hemorrhages
- Toxins

Bioterrorism agents can be classified into three categories as shown in the table below:

Table - Classification of Bioterrorism Agents

Factors	Category A	Category B	Category C
Risk Factor	Easily transmitted	Moderate ease of transmission	Easily available, spread
Mortality Rate	High death rate	Moderate death rate	Low death rate
Public Health impact	major	moderate	moderate

HISTORICAL PERSPECTIVE OF BIO-WEAPON BASED ATTACKS

Pathogen	Place	Time period	Bio-warfare method
Claviceps purpurea (rye ergot-fungus)	Syria	6th century BC	Pathogen spread through contamination of water supply
Bubonic plague	City of Kaffa	1346	The hurling of the dead bodies of plague victims
Small Pox	Native Americans in France	1767	Spreading of smallpox via contaminated blankets
mycotoxins (fungal toxins)	Afghanistan		Incidents of 'yellow rain'.
Salmonella	United States, Oregon	1984	intentional contamination of restaurant salad
Anthrax spores	US	2001	Bio-weapon delivered through the postal system.

(Source: Adapted from Das & Kataria (2010), Bioterrorism: A Public Health Perspective, MJAFI, 66(3), 2010, 255-260)

Das & Kataria (2010) opined in one of their study that spread of epidemics due to avian (H5N1) influenza in Hong Kong, Ebola hemorrhagic fever in central Africa and Nipah virus (NiV) infection in Malaysia, Singapore and India, often raise concerns regarding possibility of bioterrorism but investigations revealed lack of evidence.

RESEARCH METHODOLOGY

The present study utilized content analysis based on the reviewed literature. Several studies were reviewed including reports, historical accounts illustrated in research articles and reports, national and international studies were reviewed. Full texts, abstracts, white paper repo.

FINDINGS

PREVENTION AND MANAGEMENT MEASURES - BIOTERRORISM AGENTS

Reviewed literature clearly indicates the need for having strong countermeasures and policies for dealing with the crisis of bioterrorism attacks such as:

- Need for increased preparedness of public healthcare centers especially in detected cases of outbreak.
- Need for strengthening and enhanced public and clinical management of highly infectious diseases.
- One of the major issues lies in timely identification and discrimination between a natural pathogenic outbreak and a bioterrorist attack. This is supported in the study by Das & Kataria, 2010 who state that prompt distinction between these two types are needed for effective and efficient medical intervention and management.

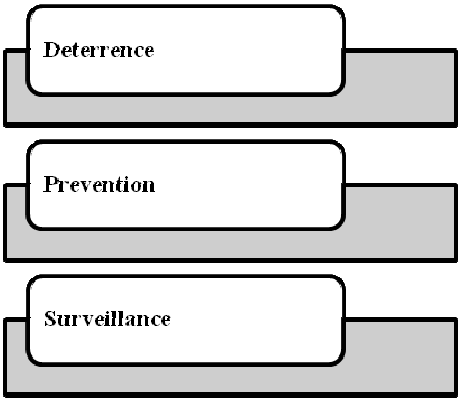
Table - Common routes of microbial entry and methods of detection of bioterrorist attacks

Route of entry of pathogen	Common bioterrorism agents	Commonly used Methods of detection
Inhalation	Aerosols, spores	pathogen detectors collocated with air quality monitors
Gastrointestinal Tract	bomblets delivered by aircrafts	Syndrome surveillance by doctors in hospital out-patient departments (OPDs), private practitioners and family physicians
Mucous Membranes/Skin	delivery by post	
	deliberate infiltration of infected animals vectors and pests	

(Source: Adapted from Das & Kataria (2010), Bioterrorism: A Public Health Perspective, MJAFI, 66(3), 2010, 255-260)

STEPS IN MANAGEMENT AND CONTROL OF BIOTERRORISM

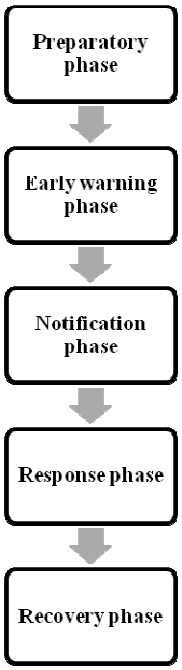
Pinto (2013) stresses on the need for counterterrorism of biological terrorism to deter such attacks in the future. The study highlights the following procedures:



Deterrence through legislations such as "**Bioterrorism Act, 2002 (USA)**" which focus on prevention of bioterrorist attacks, maintenance of safety of food, water and drugs from biological agents. Prevention is the need of the hour for controlling biological, chemical, biological and radiological threats. Surveillance is needed to monitor, control and diagnose unexpected causes of diseases, variants of organisms, similar genetic makeup or genetically modified organisms. Medical management of such outbreaks is the need for the hour. There is immense need for having strong public laws and setting up of warning networks for creating general public sensitization.

Das & Kataria (2010) state that the response and management of Bioterrorism attacks can be divided into five main phases:

Figure- Steps in Management of Bioterrorism Attacks



(Source: Adapted *from Das & Kataria (2010), Bioterrorism: A Public Health Perspective, MJAFI, 66 (3), 2010, 255-260)*

1. Preparatory phase

This phase deals with preparedness in order to maximize effective and efficient dealing with the medical and national safety crisis as a result of a biological warfare attack. The laboratory facilities should be monitored and regularly upgraded to ensure that they are equipped with state of the art and all medical facilities to deal with medical emergencies. Doctors, rapid response teams and quick response medical team should be trained to handle such emergencies, mobile clinics and ambulances must be kept ready to deal with such possibilities. Such attacks are aimed at creating panic and disturbances among public, hence they must be kept informed at regular intervals about the status of the outbreaks and they should be made aware of precautionary measure and sensitized to the need for self reporting of cases of infection.

2. Early warning phase

In this phase the collected data must be analyzed through real time systems. Artificial Intelligence and computer assisted data analytics can play an integral role in notification, compilation and interpretation of epidemiological data. This step is critical towards containment and control of the outbreak.

3. Notification phase

The activities in this phase deal with quick epidemiological investigations through laboratory testing support towards confirmation of diagnosis in affected persons, quarantine of those infected, providing necessary medical support and care and keeping the public health management systems in gear.

4. Response phase

This phase is highly critical as it deals with contacting key health personnel, and domain experts for identification, treatment and follow up, developing a workable and appropriate action plan after assessment of the situation in terms of available resources and management system in place, implementation of the action plan by quick response medical teams, notification to identified state and national level laboratories.

5. Recovery phase

This phase is the last phase and it stresses on restoring conditions of normalcy after the setback. The situation is assessed in terms of damage to resources and economy and measures are identified to replenish the damaged medical, financial and other resources. Data compiled by the quick response teams are compiled and contingency plans are drawn for future and public advisory about normalcy are issued.

RECOMMENDATIONS

- Warning networks to be set up for general public awareness.

- Quick diagnosis through efficient and effective diagnostic procedures.
- Preparing the public health management systems to deal with such crisis
- Regular monitoring of novel and virulent forms of pathogens that have the capacity to spread diseases.
- Immediate need for having a bioterrorism regulatory law and policy for counter-terrorism measures and control.

CONCLUSION

The studies reviewed reveal that bioterrorism remains a major threat in today's global community despite peace treaties at national and international levels. Hence it should be viewed with concern and preparatory steps should be taken in advance to meet any major outbreak. The study clearly indicates the major types and nature of various biological pathogens, their ability to be used as biological warfare agents and the possible steps for control and remediation. As revealed through the findings of this study, there is need for public and administrative measures through sensitization and awareness creation programs, equipping laboratories and testing centers with cost effective and efficient diagnostic procedures and emergency medical equipments. Doctors and medical practitioners should be trained to handle all medical emergencies at any hour and the quick response teams should be alert and vigilant at all times. Mock drills are needed at public places to inform citizens about the threat posed by biological warfare to the national security systems and to avoid panic among public and to aim towards minimizing damage and mortality.

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