

Bioterrorism: A Global Threat

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ABSTRACT

Terror is a Latin word which means to frighten. Terrorism usually refers to killing of innocent people by antisocial groups with the vested interest of their own. Terrorism is practiced by collecting people from different regions, religions, of different age groups, by keeping objectives like social, economic or political. Sometimes terrorists stop or discriminate their activities once they achieve their goal. Bioterrorism is the intentional use of biological agents or their products to cause harm. Sometimes such attacks might be done to create a publicity or media spectacle. It is the unlawful use of force and violence against people. Biological weapon can strike suddenly without any warning and cause hazardous effects for longer duration. The effectiveness of the attack not lies in the act itself but also in the reaction of public and Government. Delivery of the biological agents can be through letters, parcels, toys, food items, books or anything. It is easy for bioterrorist to transfer the agents through these media or environment.

Key words: Biological agents, Bioterrorism, Dentist, Oral health, Terrorism.

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INTRODUCTION

According to International Emergency Disasters Data Base, disaster has been defined as an event that “overwhelms local capacity, necessitating a request to a national or international level for external assistance”. Events that can lead to disasters are classified as natural events (e.g., earthquakes, floods, tornadoes) and manmade events (e.g., military emergencies and terrorist attacks using chemical, biological, radiological, nuclear or explosive devices)(1). Terrorism or Bioterrorism term is not new to the world. The term “terrorism” comes from the French word *terrorisme*, which is based on the Latin verb *terrere* (to cause to tremble). Terrorism can be defined as a strategy of using violence, social threats, or coordinated attacks, in order to generate fear, cause disruption, and ultimately, brings about compliance with specified political, religious, or ideological demands(2). Bioterrorism can be defined as the use, or threatened use, of biological agents which promote or spread fear to or in-

timidate an individual, a specific group, or the general population for religious, political, ideological, financial or personal purposes(3).

Prediction of bioterrorist attack is very difficult, and consequences of a successful attack may be devastating and cannot be ignored easily(4). Bioterrorist act may have political, religious, ideological, or criminal motivating factors and can be planned by a single individual or group of individuals or be part of state-sponsored terrorist activities(5). In simplest manner, bioweapon directed against the military is called as biowarfare whereas its direction against civilians is called as bioterrorism(6).

India has been traditionally vulnerable to natural disasters due to its unique geo-climatic conditions and ranks as the second country among the countries prone to disaster in terms of affecting population. According to India's Hazard profile, 60% of land mass is prone for earth quakes, 40 million hectares that is 8% of landmass prone

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for floods and 68% of the total area is vulnerable to drought(1).

OBJECTIVES

To assess the knowledge, attitude, practices or behavior of all the health care professionals including students of same fraternity regarding Bioterrorism through thorough literature search.

MATERIALS & METHOD(7,8)

A thorough literature search was performed to understand and identify the updates in the field of Bioterrorism.

Inclusion criteria

Original research articles, In-vitro and In-vivo studies, comparative studies, Systematic and narrative reviews especially emphasizing on Bioterrorism and their agents.

Articles reported only in English were considered for the present review.

Exclusion criteria

Articles whose only abstracts are readable, original research articles with weak methodology.

Source of literature: Contact with

Experts, Electronic database PubMed, Google, and Manual Search were done till 2016 for the relevant literature using key phrase “Bioterrorism”.

Information obtained: Literatures, Reports, Questionnaire, and Guidelines

Agents: Biological weapons can be defined as “microorganisms that infect and grow in the target host producing a clinical disease that kills or incapacitates.” Such microbes may be natural, wild- type strains or may be

Table 1: Difference between “Terrorism” and “Bioterrorism” (9)

	Terrorism	Bioterrorism
Speed at which attack results in effect.	Immediate	Prolonged
Site of attack	Specific	Unknown
Knowledge of attack boundaries/scope	Well understood	Unknown
Familiarity with means of attack	High	Low
Distribution of affected patients	Concentrated area	Geographically dispersed
Decontamination of environment or victims	Confined environment	Geographically dispersed
Isolation/Quarantine	Not usually necessary	Required for transmissible diseases.
Medical interventions	Trauma, first aid	Antibiotics, vaccines

Table 2: Bioterrorism agents

These agents can be classified as Category A, B and C agents(4,11,12,13).		
Category A agents These agents are considered the highest risk and highest priority because they can easily spread from person-to-person.	Category B agents These agents are the second highest priority.	Category C agents These agents are the third highest priority and are considered emerging threats for disease
Result in high mortality rates	Result in moderate morbidity rates and low mortality rates	Third highest priority agents & have the potential for high mortality and morbidity rates
Easily disseminated	Moderately easy to disseminate	That could be engineered for mass dissemination in the future
Category A agents include anthrax (<i>Bacillus anthracis</i>), botulism (<i>Clostridium botulinum</i> toxin), plague (<i>Yersinia pestis</i>), smallpox (<i>variola major</i>), tularemia (<i>Francisella tularensis</i>), and viral hemorrhagic fevers (filoviruses).	Category B agents include brucellosis (<i>Brucella</i> species), <i>Salmonella</i> species, <i>Escherichia coli</i> , <i>Shigella</i> , glanders, melioidosis (<i>Burkholderia pseudomallei</i>), psittacosis (<i>Chlamydia psittaci</i>), Q fever, Ricin toxin from <i>Ricinus communis</i> (castor beans), Staphylococcal enterotoxin B, typhus fever (<i>Rickettsia prowazekii</i>), viral encephalitis (alphaviruses, such as Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis), and water safety threats (i.e., <i>Vibrio cholerae</i> , <i>Cryptosporidium parvum</i>).	Category C agents include Nipah virus, Hantavirus, severe acute respiratory syndrome (SARS), and HIV.

Table 3: Clinical syndrome caused by bioterrorism agents(4,11,14)

ANTHRAX	SMALL POX	BOTULISM
Abrupt fever, respiratory distress, chest pain	Fever with papular rash that begins on the face and extremities and uniformly progresses to vesicles and pustules	Acute bilateral descending flaccid paralysis beginning with cranial nerve palsies

the result of genetically engineered organisms(10).

According to the Centers for Disease Control and Prevention (CDC), high-priority agents include organisms that pose a risk to national security because they-(3)

- Can be easily disseminated or transmitted from person to person
- Result in high mortality rates and could potentially have a major impact on public health
- Might cause public panic and social disruption
- Require special action for public health preparedness

CHRONOLOGY OF ANTI-BIOTERRORISM (BIOSAFETY) ACTIONS(15)

1910-1920’s-The first use of chemical and biological weapons in combat leads to efforts ban their use.

1925- The Geneva Protocol prohibits the use of biological and chemical weapons in war.

November 25, 1969- President Richard M. Nixon unilaterally renounces the use of biological weapons in war by the United States restricts research to immunization and safety efforts. Three months later, he extends the ban to include toxins.

1972- Convention on the prohibition of the development production, and stockpiling of bacteriological (biological) and toxin weapons and their destruction.

1980’s- Arms control initiatives fail to curb biological and chemical weapons proliferation.

1984 -The Reagan administration presented a draft treaty to ban the production and storage of chemical weapons to the Conference on Disarmament in Geneva.

1990’s-Concerns over exposure to chemical and biological weapons during the Persian Gulf

War increased support for international treaties.

April 15, 1997- New regulations aimed at limiting a access to chemicals and pathogens that could be made into weapons go into effect under the 1996 Antiterrorism and Effective Death Penalty Act.

April 29, 1997 -The Chemical Weapons Convention into effect.

November 19, 2001- Fifth BWC Review Conference.

ORAL HEALTHAND DENTAL PRACTITIONERS

As of January 1, 2009, the Dental Practice Act was modified, which said that in a declared emergency, the dentists who were part of the local emergency response team or Dental Emergency Responder (DER), and / or had received proper training could assist during an emergency, provide services for which they had been trained(16).

Mass disaster situations may arise from natural or manmade circumstances like bioterrorism. Dental professionals are an integral part of the health care community who can provide care to the public by playing various health care roles in response to bioterrorist attacks(17). The various roles of dentists in mass disaster management,

that include bio surveillance and notification, diagnosis and monitoring, triage, referrals of patients, immunizations, decontamination and infection control would be considered(16).They are trained and skilled in administering drugs by injection, can place sutures and control bleeding. Also, they are able to participate in interdisciplinary professional groups(1),Providing Cardiopulmonary Resuscitation, Obtaining medical histories of the patient providing or administering anesthesia

Starting IV lines(16). The varying extents of use of forensic dental techniques and the resulting positive impacts made on human identification will also be included. The importance of preparation by way of special training for the dental personnel, mass disaster rehearsal, and use of modern day technology will be stressed on.

SUMM ARY

Bioterrorism is a threat to an India and International peace as well, to avoid its long term ill effects medical fraternity must educate both the public and policy makers about it. The need of the hour is develop biodefense mechanism by full international support and to educate the likely target populations about precautions and protective measures to be taken in such attacks. Medical and dental practitioners, other health care personnel and their auxiliaries can play a vital role by providing valuable service to their patients and communities gaining information or updating their knowledge regarding the same.

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Table 4: Previous literatures available on Bioterrorism(4,11,14)

Author & Year	Title	Target population	Sample size	Conclusion
Chen et al(18)2002 The Journal of Family Practice	On the front lines: Family physicians' preparedness for bioterrorism	Family physicians	976	Only one quarter of family physicians felt prepared to respond to a bioterrorist event. However, training in bioterrorism preparedness was significantly associated with physicians' perceived ability to respond effectively to an attack. Primary care physicians need more training in bioterrorism preparedness and easy access to public health and medical information in the event of a bioterrorist attack.
Rico et al(19) 2002 Florida Dept.ofHealth	Knowledge and Attitudes About Bioterrorism and Smallpox: A Survey of Physicians and Nurses	Licensed physicians and nurses in Miami-Dade County	350/5990 Physicians 350/13,381 Nurses	There was a minority of physicians and nurses who are willing to volunteer and participate in a community response.
Robyn et al(20) 2004 JOEM	Clinicians' Knowledge, Attitudes, and Concerns Regarding Bioterrorism after a Brief Educational Program	New York city Clinicians	310	Educational programs are useful in enhancing the public health response to bioterrorism and its consequences.
Robyn et al(21) 2004 JOEM	Terrorism preparedness training for occupational Health Professionals	Occupational health professionals	84/106	Relatively brief training in terrorism preparedness can increase the confidence of occupational health professionals in their ability to respond to terrorism. Adequate preparedness for the broad range of potential terrorist events may require much more intensive training than is currently being provided to occupational health professionals.
Katz et al (22) 2006 JADA	Dentists' preparedness for responding to bioterrorism A survey of Hawaii dentists	All licensed dentists residing in the state of Hawaii	1016	A low prevalence of prior training coupled with a high degree of willingness to provide assistance indicates the need for additional BT preparedness training. This should be provided as continuing education offerings to practicing dentists and incorporated into the dental school curriculum.
Katz et al(23)2006 Prehospital and Disaster Medicine	Hawaii Physician and Nurse Bioterrorism Preparedness Survey	Licensed physicians and nurses residing in Hawaii	115/255	Additional bioterrorism preparedness training should be made available through continuing education and also should become a component of both medical and nursing school curricula. It is important to provide the knowledge necessary for physicians and nurses to improve their ability to perform in the event of a bioterrorist attack.

Author & Year	Title	Target population	Sample size	Conclusion
Vinodhet al(17)2010 Journal of Dental Education	Dental professionals' knowledge and perceived need for education in bioterrorism preparedness	Dental professionals (Dentists & Dental hygienists)	453 (297+156)	No significant differences between New England& Oregon dental professionals were observed in terms of actual knowledge or perceived need for bioterrorism education. Integrating training and education into the predoctoral dental and dental hygiene curricula and developing continuing education courses would improve knowledge and better prepare dental professionals to effectively perform American Dental Association-recommended roles during any future bioterrorism events.
Craneet al(24)2010 Journal of Emergencies, Trauma, and Shock	Assessment of community healthcare providers ability and willingness to respond to emergencies resulting from bioterrorist attacks	Community health care providers	Internet based survey. Invitations were sent to 22,800 healthcare providers in Florida, which resulted in 2,279 respondents.	The findings suggest that only one-third of Florida community healthcare providers were prepared for a bioterrorism attack, which is an insufficient response rate to effectively respond to a bioterrorism incident.
Chaudhari et al (2)2011 IAPHD	Knowledge, Attitude and ractice regarding Bioterrorism amongst the Medical and Dental Interns in Dr. D.Y.Patil Deemed University – A Questionnaire study	Medical &Dental interns	Medical interns (64) & Dental interns(71)	Medical interns had better knowledge, attitude and practice as compared to dental interns. But syllabi for both faculties are insufficient to provide basic information regarding bioterrorism. Hence there is need for curriculum reform as well as need for new training courses on preparedness againstbioterrorism.
Mérenset al(25) 2012 Euro Surveill	Assessment of the bio-preparedness and of the training of the French hospital laboratories in the event of biological threat	Laboratory personnel (microbiologists and technicians)	18/25 participants	Key to successful detection of biological agents in case of a biological threat is the training of the laboratory personnel dealing with class III organisms as well as the standardization and validation of methodsimplemented by all laboratories of the network. It is important to provide specific guidelines to alllaboratories involved in the network.
Aghaeiet al(26)2013 J Emerg Trauma Shock	Bioterrorism education effect on knowledge and attitudes of nurses	Nurses	65	The education has a positive effect on nurses' knowledge and attitudes and it can be a guideline for administratorsof the Ministry of Health and medicine for planning to achieve the goals of preventive and defense against bioterrorism.

Author & Year	Title	Target population	Sample size	Conclusion
Chhabra et al(27)2014 Disaster Medicine and Public Health Preparedness	Disaster management among dental graduates in a private dental Institution in India: A pilot study	Dental graduates in a private dental Institution	103	Respondents had favorable attitudes toward disaster management, but their knowledge and behavior required considerable improvement. Knowledge of the respondents was significantly associated with their attitude. This pilot study highlights the need for curriculum changes in dental education in India and further nationwide study.
Żurek et al(28)2015 MicroMedicine	Assessment of bioterrorism awareness in a group of nurses	Professionally active nurses	100	1. In the current political situation of Poland, the nurses consider a bioterrorist attack a real threat. 2. The respondents are aware of bioterrorism, can name risk factors, targets of the attack and epidemiological clues suggesting biological weapon was used. 3. Majority of respondents find the knowledge of bioterrorism not satisfactory and indicate the need to educate medical staff and the public.
Pour et al(29)2015 Iranian Journal of Emergency Medicine	Effect of education on knowledge and Attitude Regarding Bioterrorism	Students of different branches of biological sciences	120 Students (60 females)	Educational intervention led to an improvement in female participants' knowledge regarding bioterrorism nature, causative factors, diagnosing bioterrorism agents, and management at the time of terrorist attacks. Yet, the low level of knowledge and tendency of the students indicates the need for more education in this field.

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