

Bio-terrorism: still interesting or concerning nowadays?

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Abstract: *Bio-terrorism involves using biological agents/toxins with the intent to intimidate or coerce a government or civilian population to further political or social objectives, usually leading to deaths or illnesses of humans but also of plants/animals.*

Their use would probably initially be considered as a natural or unintentional event, especially in case of live biological agents. Moreover, a natural occurring disease outbreak could have the same destructive outcome as an efficient biological weapon.

There is a need for proper differentiation between natural and intentional events although in the first stages the medical response should be similar; however, the course of incident management would take different paths later on.

Biological agents' investigation of dangerous pathogens, from natural unusual outbreaks or bio-terrorist attacks/other intentional use, imply the collaboration of different institutions with responsibilities in public health but also in national security and defense. The National Security and the Defense System institutions think mainly in security terms while national health care system institutions think principally in medical care/prevention terms. These two ways of acting have to be combined in order to deal properly with hazardous biological agents.

Keywords: *bio-terrorism; disease outbreak; biological agents.*

INTRODUCTION

“Bio-terrorism refers to the intentional release of biological agents or toxins for the purpose of harming or killing humans, animals or plants with the intent to intimidate or coerce a government or civilian population to further political or social objectives” as suggested by Interpol. (1)

Deliberate or accidental release of a biological agent, chemical agent, or radio-nuclear materials (CBRN agents), could potentially cause severe harm and pose a huge burden on public health systems (1).

Such a release would probably initially be considered as a natural or unintentional event (2).

From all the CBRN agents, biological agents can cause the widest range of effects, being as dangerous as nuclear weapons and as easily available as industrial/domestic chemical agents (1). Moreover, a natural event such as an emerging disease outbreak could have the same destructive outcome as an efficient biological weapon. But there are some important differences between intentional and unintentional events involving biological agents and these differences raise the main topic discussed

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GENERAL SITUATION

The threat of natural epidemics is always present, no matter the level of awareness of the public health systems, authorities, or populations. A convenient example is of course the 2014 Ebola epidemic: so far it is the largest of its kind in history, affecting multiple countries in West Africa and even producing few secondary cases in USA and EU (Spain).

On February 15, 2015, according with USA Centers for Disease Control and Prevention website, (CDC Atlanta), the overall situation was the following (<http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html>) (accessed on February 19, 2015): Countries with widespread transmission (Guinea, Liberia, Sierra Leone): total cases* – 23218; Laboratory-confirmed cases – 14088; total deaths – 9365. Countries with an initial case or cases and/or localized transmission (United Kingdom): 1 case, Laboratory-confirmed cases – 1; no death. Previously affected countries** (Nigeria, Senegal, Spain, United States, Mali): total cases* – 34; Laboratory confirmed cases – 32; Total deaths – 15. (*Total case counts include probable, suspected, and confirmed cases. **The outbreaks of Ebola virus disease (EVD) in Senegal, Nigeria, Spain, the United States, and Mali have ended. A national EVD outbreak is considered to be over when 42 days, double the 21-day incubation period of the Ebola virus, has elapsed since the last patient in isolation became laboratory negative for EVD.)

In December 2014 and January 2015, some reports suggested that the “Islamic State in Iraq and Syria” (ISIS) terrorist organization, operating in Iraq, would try to use Ebola infected militants as perpetrators, spreading the disease (i.e. by sending volunteers to the afflicted African areas to get infected on purpose, then sending them to Europe or USA to spread the disease). The World Health Organization (WHO) investigation did not confirm this information (<http://www.emro.who.int/irq/iraq-news/no-ebola-cases-detected-in-iraq.html>). (Accessed on February 19, 2015)

Moreover, let’s not forget that the 1918 flu pandemic – the “Spanish flu” – caused between 50 and 100 million deaths, making it one of the deadliest natural disasters in human history. By comparison, the estimated death toll of First World War ranges “only” between 15 and 35 million deaths and even the deadliest conflict, Second World War ranges between 40 and 72 million deaths.

The more robust a nation’s preparedness, however, the more reduced will be the consequences of any outbreak whether natural or man-made and the likelihood of being attacked. Every state should improve his bio-defense capabilities in order to avoid the development of an incident involving biological agents into a catastrophe. Yet, there is no perfect national bio-defense system, regardless the wealth and power of the country. Cooperation among relevant institutions is crucial in this critical area; especially cooperation between the public health system and the institutions involved in homeland security is needed in order to achieve a better level of preparedness.

However, there is no such thing as a standard, “universal” response algorithm, given the fact that the actual response process depends on a multitude of factors, such as: national institutional specificity (number of institutions involved in response, their responsibilities and competencies, equipment and resources employed etc.), specific national policies in place, specific social-economic issues and so on.

In Romania the relevant legislative framework has been updated according to European and international laws and regulations (under BTWC – Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction and IHR – International Health Regulations).

Also, the responsible institutions have specific procedures in place for different parts of the hazardous agent investigation.

However, up to date, in Romania there is no overall coherent algorithm of response to incidents involving biological agents (detailed and adapted both for

known and for potentially unknown or emergent agents) with the subsequent SOPs (Standard Operational Procedures) well synchronized, efficient and agreed by all responsible institutions.

Moreover, for some key components of the response chain of actions there are no updated SOPs, especially in the detection/identification/typing of the hazardous agent component. Therefore, in case of a real incident, the overall response speed will be slowed and important errors might impair the efficacy of the procedures and strategies selected for mitigation/containment of the biological threat. And this, of course, could lead to severe consequences.

Since the beginning of the current Ebola epidemic efforts have been made in Romania for planning, preparedness and developing structures and procedures to be followed for defending, minimizing the consequences and recovering after this outbreak and any other similar (<http://goo.gl/nsyOg2>).

And for sure, this will result in a higher capacity to deal with an unusual outbreak, being an important and necessary part of the “bio-defense” system.

But is this covering for deliberate induced incidents, outbreaks or epidemics, or for accidental release from research laboratories? We shall investigate if there are some characteristics of the “artificial” outbreaks that result in the need for a different approach of the investigation and reaction compared with natural ones. Although by no means exhaustive, a list of patterns that may give some indication of a deliberate release would include (1;2;3,4):

- » sudden increase in patient with similar symptoms/ multiple cases of unexplained disease, syndrome or death, especially if having common work location or activities/“point source outbreak”/multiple cases with similar disease or syndrome presenting around the same time; »» simultaneous outbreaks of similar illness in noncontiguous areas;
- » similar typing of agents isolated from temporally or spatially distinct sources;
- » disease with an unusual geographic or seasonal distribution;
- » recognized illness occurring in an unusual setting within a community;

- » single case of disease caused by uncommon agent;
- » multiple unusual or unexplained disease entities coexisting in the same patient without other explanation;
- » unusual form of infection e.g. inhalational anthrax, pneumonic plague, mediastinitis/recognition of atypical transmission routes e.g. by aerosol, food or water;
- » unexpected degree or speed of onset;
- » failure of a common disease to respond to usual therapy;
- » intelligence of a credible threat;
- » heightened terrorist alert level (severe, critical);
- » suspected or known deliberate or accidental release in another country;
- » illness affecting a key sector of the community/ attenuated morbidity in protected professionals groups;
- » illness only among people in proximity to common ventilation systems;
- » “downwind plume pattern”: cases concentration found downwind from a source point;
- » death or illness among animals preceding, accompanying or especially succeeding illness in humans;
- » unusual, atypical, genetically engineered, or antiquated (or “extinct”) strain of agent, authors’ “signature” (known past researches either civil or military);
- » diagnosis of a disease generated by an agent from the lists of potential useable in a terrorist attack.

These “indicators” are especially useful when we are dealing with a covert (hidden) attack and the actual disease cases or intelligence gained represents the first “piece of information” of the intended release of a harmful biological agent. In order to be recognized and to trigger a specific chain of action all the actors involved have to be aware of the potential meaning of these indicators: medical staff, public health authorities, law enforcement agencies, and so on.. (1, 2, 3)

When dealing with an overt attack (at least law enforcement and/or other responders are informed about it), the awareness of it occurs earlier than in covert ones but this doesn’t mean that it is an easier

situation to deal with. A well prepared system can gain most advantage from the time given by knowing from the onset that a bio-terrorist incident is developing. Otherwise, only the early psycho-social effect is different, knowing that the main levels of intended epidemics effects are (2):

- » physical – actual diseases;
- » psychological – fear, mass panic;
- » economic – travel restrictions, business affected;
- » environmental – affecting humans, animals, plants.

These effects can be recognized in natural outbreaks as well, but at least the second and the third kind will be far more intense in an intentional (or accidental release) event, if not all. The aim of such an incident management is to partially minimize its' consequences if not to avoid them altogether.

This requires some mechanisms “in place” to defend from the threat and others to detect, investigate and react to it. And the intentional biological agent release needs some specific investigation and solving components. Both the health and the criminal sides of the situation have to be tackled simultaneously (1,3).

The investigation proceeds within the frame of the national legislation on: working/securing/developing/acquiring/possessing/transferring/transporting biological agents (2). In overt attacks, usually an incident response team has to be deployed, with multidisciplinary approach: first responders,

CBRN experts, medical personnel, risk assessment specialists, decision makers, etc. Good decisions made at this point can lower the consequences significantly (2,3).

In both overt and covert attacks, a chain of actions has to be accomplished by a partnership of institutions mainly from law enforcement and public health systems, with some either common or specific goals: protect health and safety of public/determine cause of bio-terrorism attack/outbreak, stop further crimes/stop further cases of disease and outbreaks, apprehend and convict criminals/build science base for future prevention (1,3).

Sharing information between law enforcement and

medical or public health components is crucial both for better timing and for more efficient decisions and actions (1). Some joint investigations and operations are essential for a good coordination between agencies. (3) Main priorities in biological incidents are: preservation of life, safety of personnel involved, investigation (microbiological, epidemiological, criminal etc.), intelligence to prevent further attacks, public reassurance and return to normality (1).

Another special concern in intentional (or accidental) biological agents release incidents is related to genetically modified organisms. These pathogens can pose any imaginable problem from the investigation stage up to the afterward recovery.

From biological agents expressing other species characters and virulence factors up to special “powers” like multi-drug resistance and high resilience in the environment or resistance to different decontamination methods, an GMO (genetically modified organism) can be anything (4,5).

Intentionally released biological agents are most likely to be delivered by aerosols (1). Therefore the most probable syndrome resulted will be a respiratory one, despite the pattern of the usual naturally occurring disease caused by the biological agent. The optimum particle size is 0.3-5.0 μ in diameter, which is small enough to reach the alveoli when it is inhaled (1, 4,5). This can be achieved by aerosol generators mounted in fixed locations or on trucks, cars, or boats as well as from cruise missiles and planes equipped with tanks and spray nozzles (1,2). Numerous climatic factors affect the efficiency of such methods including wind velocity and direction, humidity, degree of cloud protection from direct sunlight, and rainfall (1,4,5,6).

Aerosols could be disseminated by direct delivery into ventilation or air conditioning systems or via letters or parcels (1,2). Suicide attacks would be extremely effective for disseminating diseases (1,2).

Food and water are also suitable vehicles for local delivery of pathogens, especially when the goal of the attacker is more social disturbance and panic than actual killings (1,2,3).

DISCUSSION

The main question is: presuming that facing the threat of 2014 Ebola epidemics the medical community and the public health system will improve their capacity to prevent/investigate/react and recover in natural epidemics, is this enough to reduce to an acceptable level the risk posed by a potential bioterrorist attack?

Hazardous biological agents investigation for rapid detection and identification of novel, emerging and dangerous pathogens, from natural unusual outbreaks or bio-terrorist attacks/other intentional use, imply the collaboration of different institutions with responsibilities in public health but also institutions with responsibilities in national security and defense, especially in the case of “unnatural” events.

Each of these institutions has specific responsibilities and a specific set of procedures for their own part of the action. But until now, in Romania there is no agreed, detailed and acknowledged chain of action.

In every step of the investigation/reaction: on site detection, sampling, transport, laboratory investigation (screening, investigation, in depth analysis), case management, public communication, criminal investigation, epidemiological investigation, public health decision, political and economic decisions, there are several institutions involved, depending on the actual situation and the legal frame (e.g. General Inspectorate for Emergency Situations, Romanian Intelligence Service, the NBC department of Romanian Police, other departments from the Ministry of Internal Affairs, Ministry of Defense – in some special cases).

These response units would be involved in site response, including sampling and transport and in other law enforcement actions and in recovery and return to normality; Ministry of Health, National Institute for Public Health, Local Public Health Authorities, Infectious Disease Hospitals, National Institute for Research and Development for Microbiology and Immunology “Cantacuzino” etc. will be involved in microbiological, epidemiological and clinical investigation, in case management/recovery.

Even if the legal frame defines the role and responsibilities of each of these organizations, their action procedures are not properly linked nor their collaboration entirely formalized. Some of the specific SOPs are adapted from international guidelines, some designed to relate to Romanian conditions. Some aspects remain uncovered because not all institutional procedures relate to the others.

On European and international level there are several action plans, recommendations and guidelines in place. The major international organisms (e.g. EU, NATO, etc.) have their algorithms and SOPs. Also this is true for the most important institutions from developed countries which are involved in hazardous biological agents’ investigation and response (e.g. Health Protection Agency, UK; “Robert Koch” Institute, Germany; Centers for Disease Control and Prevention, USA, and so on).

These procedures cannot be applied in Romania exactly as they are. Therefore, a thorough assessment of the entire biological agents investigation and response to biological threats process has to be done taking into consideration Romanian specificity and the SOPs have to be optimized accordingly, up to an efficient algorithm usable by relevant national institutions, followed by improving the logistics where needed and within the financial possibilities of Romania.

One of the problems is the difference between the mind settings of the major actors. The National Security and Defense System institutions think mainly in security terms and the National Health Care System institutions (including public health authorities) think mainly in medical care/prevention or usual outbreaks terms. These two ways of understanding/acting have to be combined in order to deal properly with hazardous agents either from unusual natural outbreaks and especially bio-terrorist attacks.

CONCLUSION

Our opinion is that bio-terrorism is (or should be) still a matter of concern in Romania (and elsewhere in EU or worldwide). This should trigger a process of

increasing the awareness about intentional outbreaks and epidemics and as a consequence begin to enhance the capacity of medical community and public health system to properly manage the risk of a bio-terrorist attack or an accidental release of an

unusual biological agent. And last but not least, the cooperation between institutions involved in health care and those responsible for security and defense should be improved up to the proper level of efficiency.

References:

1. Bioterrorism Incident Pre-Planning & Response Guide, 2nd Edition – 2010, INTERPOL General Secretariat, Bioterrorism Prevention Programme, 200 Quay Charles de Gaulle, 69006 Lyon, France
2. Dr. Dilys Morgan (HPA CfI), Dr. Bengü Said (HPA CfI), Ms. Amanda Walsh (HPA CfI), Prof. Virginia Murray (HPA CRCE), Dr. Simon Clarke (HPA CRCE & Frimley Park NHS Foundation Trust), Dr. David Lloyd (HPA CRCE), Dr Kai Rothkamm (HPA CRCE), Dr. Nick Gent (HPA LaRS & CEPR) (Authors of 2010 version). Initial investigation and management of outbreaks and incidents of unusual illnesses, a guide for health professionals with particular reference to events that may be due to chemical, biological or radiological causes, including deliberate and accidental releases, version 5.0 July 2010, Health Protection Agency; Wellington House, 133-155 Waterloo Road, London, SE1 8UG
3. Criminal and Epidemiological Investigation Handbook, 2006 Edition, Federal Bureau of Investigation, Centers of Disease Control and Prevention, the US Department of Justice, the US Army Soldier Biological Chemical Command
4. Zygmunt F. Dembek (Senior Editor), Medical aspects of Biological Warfare, 2007, Published by the Office of The Surgeon General, US Army Medical Department Center and School, Borden Institute, Washington DC.
5. Dumitru Buiuc și Marian Neaguț, *Tratat de microbiologie clinică*. Ed. II. Editura Medicală, București, 2008,. ISBN (10) 973-39-0593-3.
6. P. Bossi a, D. Garin et al. Bioterrorism: management of major biological agents, *Cell. Mol. Life Sci.* 63 (2006) 2196–2212.