FEATURE

EVALUATING THE THREAT OF BIOLOGICAL WEAPONS IN EASTERN AFRICA

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Biological, chemical and nuclear weapons, often referred to as weapons of mass destruction (WMD), have captured global public attention in recent years. The war in Iraq in 2003 and 2004 was waged because some countries, led by the United States, believed Iraq had chemical and biological weapons and wished to prevent the transfer of these weapons to terrorists or terrorist organisations. While no such weapons were found in Iraq, this does not preclude the possibility that elsewhere governments or terrorist groups may develop or use biological weapons in the future.

This article, through an analysis of the literature, evaluates the situation in eastern Africa, covering the countries belonging to one or both of two regional organisations, the East African Community (EAC), and the Intergovernmental Authority on Development (IGAD) to see how potential threats from biological weapons may be viewed and how governments in this region could respond to this threat using tools for public health and disease control.

Deliberate disease is caused through the intentional use of an infectious biological agent or toxin as an act of biological warfare or biological terrorism. The term 'biological agent' applies to a diverse group of micro-organisms as well as toxins of micro-organisms, plants and animals. Biological warfare or biological terrorism is specifically defined as the use of biological agents to deliberately inflict disease and/or death on humans, animals or plants. When a biological agent is used in the manner described, it is regarded as a biological weapon (BW). Thus crops and livestock as well as human populations are considered possible biological terrorist or biological warfare targets.[1] While some biological agents harm only the exposed population (for example botulism toxin), infectious agents producing contagious disease (for example smallpox) could disseminate through susceptible populations unaffected directly by the initial biological terrorist event, as would happen in natural infections.

Biological weapons are not new, but the technologies of production and delivery were developed and perfected in the 20th century. For thousands of years biological agents have been available as instruments of warfare and terror, producing fear and harm in vulnerable populations.[2]

Eastern Africa has seen many conflicts since World War II. Freedom wars, inter-state wars,

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civil wars and ethnic violence are either ongoing or are part of recent history.[3] Economic hardship and inequalities, distrust of government and religious extremism are among the factors that have created a climate in which individuals or groups feel that any action they may take, however heinous, is justified in furthering their cause. This contributes to insecurity in the region and the world at large.

Terror attacks in recent years, such as the bombing of the Oklahoma government building in the US (1995), the US embassy bombings in Kenya and Tanzania (1998),[4] the attacks on the World Trade Center on 11 September 2001, and attacks in Morocco, Indonesia, Russia, Egypt and Spain, have led observers to realise the apparent danger of terrorist threats all over the world. Future terrorist attacks will continue to involve bombs and firearms, but may also involve the use of biological weapons to cause disease.[5]

Major infectious diseases known to have potential in biological warfare are endemic in eastern Africa and often cases of emerging disease are reported from the region. This means that the disease-causing micro-organisms occur naturally in the region and are therefore accessible to those with sufficient knowledge to use to deliberately cause disease. This is an adequate reason to presume that eastern Africa, like other regions with similar conditions, faces a potential threat from BW. Outbreaks of Ebola fever (in Uganda and Sudan),[6] Rift Valley fever (in Kenya and Somalia)[7] and yellow fever (in Kenya)[8] have been reported in recent years. The outbreaks of Ebola fever and Rift Valley fever in Uganda and Kenya respectively showed that the region has insufficient resources to deal with such epidemics. A successful deliberate disease attack would probably cripple the public health system. Both lethal and incapacitating agents could have an adverse impact on the civilian health care delivery system in a BW attack scenario. Potential manifestations include terror in the affected population and medical care personnel; an overwhelming number of casualties, placing demands on special medications; a need for personal protection in medical care settings and clinical laboratories; and problems with general handling.[9]

Biological agents with potential use as biological weapons

The biological agents thought most likely to be used as biological weapons include B anthracis (anthrax), Francisella tularensis (tularemia), Yersinia pestis (plague), Variola virus (smallpox), agents of viral haemorrhagic fevers, and botulism toxin. Other likely agents include Brucella spp (brucellosis), Vibrio cholerae (cholera), Burkholderia pseudomallei (glanders), Coxiella burnetti (Q fever), agents of viral encephalitis, staphylococcal enterotoxin, ricin and mycotoxins (table 1).[10] More than half of the organisms recognised as having a potential in biological warfare are endemic to the eastern Africa region.

Elsewhere, the severe acute respiratory syndrome (SARS) epidemic is the most recent reminder to the world of the challenges that emerging infectious diseases pose to health care systems, economies and overall security. While infectious diseases have traditionally been regarded as a medical issue, the threats posed by them in a rapidly changing global environment are no longer confined to the sphere of health risks. The disruption of business activities, travel and tourism (and hence economic growth and development) following the outbreak of SARS is among the serious potential repercussions that necessitated defining it and similar epidemics in broader, more strategic terms.[11]

Today the scale, speed and extent of the movement of people and goods are unprecedented. These movements, in turn, have shaped the appearance, spread and distribution of infectious diseases, not just in humans, but also in animals.[12] The SARS case is instructive. With the movement of people in and out of China and the ease of international air travel, it was not surprising that SARS spread to more than 31 countries in every region of the world in less than six months.[13] Indeed, in a globalised world, no community can be entirely immune from emerging infectious diseases.[14] While SARS appeared to have been contained, at least temporarily, by the end of 2003 and thus far has not become a global epidemic in the way that HIV/AIDS has,[15] the economic losses associated with it may be felt for a long time in many countries.

Table 1

Viruses	
Eastern equine encephalitis virus	Ebola haemorrhagic fever virus
Sin Nombre virus (hantavirus)	Junin virus
Lassa fever virus	Machupo virus
Marburg virus	Rift Valley haemorrhagic fever virus
Crimean-congo haemorrhagic fever virus	Tick-borne encephalitis virus
Variola major virus (smallpox virus)	Venezuelan equine encephalitis virus
Western equine encephalitis virus	Yellow fever virus
Monkeypox virus	West Nile haemorrhagic fever virus
Rickettsiae	Coxiella burnetii (Q fever)
Rickettsia prowazeki (typhus)	Rickettsia rickettsii (spotted fever)
Bacteria	
Brucella sp (brucellosis)	Francisella tularensis tularemia
Burkholderia sp (glanders)	Yersenia pestis (plague)
Bacillus anthracis (anthrax)	
Toxins	
Abrins	Anatoxins
Botulinum toxins	Bungarotoxins
Clostridium toxin	Ciguatoxin
Ricins	Saxitoxin
Shigatoxin	Staphylococcal enterotoxins
Trichothecene toxins	

Similar cases of major economic damage and of the way the costs can be aggravated by initial lack of transparency are well documented for other infectious diseases, human and animal, originating in both wealthier and poorer countries.[16] The HIV/AIDS pandemic continues and no clearly successful concerted international action exists to deal with it. A wide gap still exists between the threat posed by HIV/AIDS and coordinated, effective international action. Within a few years of its identification, HIV/AIDS had spread to every continent and every country. So far, 25 million people have died of AIDS, and about 3 million people a year continue to die from the disease. This massive loss of human resources involves the most economically productive group of the population, altering the economic and social structures of the countries that are most affected.[17]

It is widely acknowledged that openness has contributed directly to the relative success of Uganda in tackling AIDS.[18] On the one hand, widespread coverage in the media has raised public awareness about the nature of the disease and avoiding infection. On the other hand, the willingness of those working in the health professions to share their knowledge and experience with journalists has encouraged informed reporting that, in turn, has strengthened the ability of individuals to take effective precautionary measures.[19] This is in contrast to the approach taken by some governments on the same subject where information on the transmission of the disease (HIV/AIDS) to the public is confused or unclear.[20] Unfortunately it follows that information on the control and prevention of the disease becomes unclear in the process.

In 2000 the United Nations Security Council declared AIDS an international security threat, followed by similar political endorsements at the meetings in Okinawa and Genoa of the Group of Eight industrialised countries (G8).[21] Despite these initiatives, however, AIDS, tuberculosis, malaria and other endemic diseases are perceived by many countries (if not most) as health or social problems, not as human security threats.

The lesson learned from the AIDS outbreak in Africa is that the media can be an important instrument of health policy. Countries whose governments provide the media with contradictory or incorrect information, as has happened with AIDS in some countries in Africa, or that

conceal information, as occurred at the beginning of the SARS epidemic, risk losing the war against such diseases. Yet it remains common practice for many governments to consider that access to information by journalists, even in these areas, should be strictly controlled or managed.[22] Openness to the media and the public is not simply a question of issuing timely and informative press releases.[23]

Management and containment of epidemics

Ministries of health (MoHs) across Africa are mandated to deal with all health issues including budgetary allocations to deal with infectious disease outbreaks. They are responsible for containing disease outbreaks wherever they occur in a country. Hospitals and care-giving institutions have a core function owing to their being in a special position to recognise an emerging outbreak of a given disease.[24] Early detection of a biological agent attack or a natural outbreak depends on epidemiological warning networks and the individual clinical/laboratory expertise of medical personnel, because diagnostic procedures are the same for disease that is caused deliberately and for infections that occur naturally.[25]

During a crisis or outbreak an MoH may involve the services of its internal agencies or refer the matter to international organisations such as World Health Organisation (WHO) or non-governmental organisations (NGOs) for relevant action and to obtain support.

Outbreaks of rare diseases are unpredictable and local health personnel may fail to recognise the early signs at the onset of a major epidemic, mostly because of lack of relevant skills. When this happens, people with contagious infections are allowed to move freely, putting others at risk. Corpses may be released for burial without a public health caution.

When field workers in remote locations suspect a rare infectious disease, the referral/reference centres in the cities may not always have the facilities and reagents for some required tests. Samples then have to be sent abroad for testing to positively identify the infecting agents. This takes time and makes the management of the disease outbreak even more challenging as medical personnel have to deal blindly with unknown agents until identification details come from abroad. Consultation between operators is complicated by distance.

Epidemic situations are always of concern to the members of public as well as the health professionals. The ministry of health is usually under pressure to do its best, a task made more difficult by the lack of resources in many developing countries.

Payment for health services by the users in some countries[26] is a further impediment, as many cannot afford these costs. It is therefore in the interest of society that certain services should not be charged for, as this provides an incentive for people to seek treatment.[27] The other impediment to effective public health management is the complete lack of infrastructure in some areas in developing countries. Sick people often die before they reach hospitals. Poor communication means that outreach by public health educators is difficult and requires additional resources. Radio broadcasts could be of great help, but this service is not developed either.

Use of early warning systems such as weather forecasts and satellite imaging to predict and contain outbreaks should be part of the health management strategy. Heavy rains have been noted to be of key importance in disease outbreaks.[28] Many epidemics are associated with extended heavy rains and include both vector-borne and water-borne diseases. The relationship between heavy rains and disease outbreaks could help to identify incidents of deliberately caused disease. The outbreak of major diseases under ordinary climatic conditions should be regarded with suspicion and infecting organisms studied further.

Biotechnology trends in eastern Africa

The extent of development of biotechnology and scientific research centres differs among the countries in eastern Africa. Most government and private research institutes are free from regulation at operational level and set and control their own research agendas. Institutes are trusted to ensure that only ethical research is conducted. In some countries there is a great deal of collaboration between national and

international organisations, which facilitates transparency. In a vibrant biotechnology community, it is possible that unauthorised research can be conducted without the knowledge of the responsible authorities, for example the controversial HIV/AIDS research in humans done without the authority of the Kenya Medical and Licensing Board.[29]

Biomedical research should be managed to ensure that its applications are for peaceful purposes only.[30] The core of future biological warfare threat will probably not consist of a large weapon stockpile, but will probably be the capacity to produce weapons (and their antidotes or phylaxis) on a large scale in a short time or in a crisis. Biotechnology may improve biological warfare capabilities through process and product improvement. This product improvement may involve modifications of pathogens through genetic engineering or through the creation of novel agents and vectors as well as through the development of new equipment for analysis and production. The process of improvement relates to the way agents are manufactured. Optimisation of procedure could lead to production of larger batches within very limited time or the use of small, less conspicuous equipment that is easier to hide in legitimate installations and activities. Genetically modifying existing pathogens may make them more virulent and resistant to drugs and render these agents resistant to environmental stress such as ultra-violet radiation and meteorological conditions after their release to the environment. It is therefore important to have controls in place that will make it less likely for biotechnology to be used to develop or improve biological weapons.[31]

The level of deliberate disease threat in eastern Africa

A deliberate disease threat assessment is needed to reduce the uncertainty that currently permeates debate over biological terrorism. Undertaking such a threat assessment is important in the current environment where the public feels insecure and limited resources are available to improve the situation.

An analysis of the threat of use of biological weapons would include identifying which groups or individuals might pose a threat, which agents might be used, how an attack might be carried out, what motivates groups or individuals to use such weapons and which areas would be targeted. Answers to these questions will lead to the development of a number of possible scenarios.

The level of threat is a reflection of the will to use these agents, and not just a technical issue of how to use them. All countries in eastern Africa face some level of threat because of the conflicts and insecurity in the region as well as the easy access to infectious materials.

The impact of the use of biological weapons would be most direct on clinical microbiologists. If a terrorist attack with a biological agent were to occur, medical microbiology laboratories would be instrumental in helping to detect and identify the agent and in alerting authorities. Referral centres should have all necessary resources to support the field laboratories. Although Bacillus anthracis has received a great deal of publicity as a potential biological weapon, other organisms should not be ignored.

Terrorist activities

Terrorist groups exist to promote religious, ethnic, political (ideological) or economic causes. Acts of biological terrorism could therefore have political, religious, ideological or criminal motives and could conceivably be planned by groups or a single individual or be part of state-sponsored terrorist activities

The activities leading to the 1998 American embassy bombings in Kenya and Tanzania were well coordinated and planned. This trend has continued with most recent attacks across the world. Various attacks are timed to take place simultaneously and on multiple targets. This indicates that terrorist groups make extensive plans for these activities. It is now known that the suspected perpetrators can be citizens of one or different countries, which demonstrates the capacity of these groups to successfully recruit members and execute plans undetected by law enforcement agencies. This was true of the events of 11 September 2001 in the United States.

When compared to other weapons, the acquisition, storage and transportation of

biological weapons could be considerably easier. Competent undergraduate students could readily master viral, bacterial culture methods and simple genetic engineering. It is possible that a group or individuals with appropriate training could produce lethal weapons in adequate amounts and then disseminate them in a manner that would result in thousands of casualties and widespread panic.

Outbreaks of infectious diseases are a common occurrence in eastern Africa and the region suffers from insecurity owing to countless conflicts. This makes the threat of the use of biological weapons in this region something that has to be considered by the relevant government departments. In addition, the distinction between national and global threats is artificial, as infectious agents do not observe the divide. Adequate public health surveillance and response are solutions to preparing for biological warfare events. Only long-term planning and funding can sustain such a global undertaking, which has to be internationally financed and managed. Infectious diseases with no known prophylactic remedies will continue to infect travellers and local people and remain a possible biological weapon.[32]

Disease surveillance and control

Infectious diseases can undermine the security of a country whether these diseases are deliberately inflicted by biological warfare or occur naturally. While the Biological and Toxins Weapons Convention (BTWC) prohibits the development and use of biological weapons, the defence against a natural or intentional epidemic is the same: a robust global public health surveillance system and the ability to respond efficiently and effectively to disease outbreaks. The state has an important role in combating the threat of deliberate disease because it has the moral duty to protect its citizenry.

An effective way of countering the threat of deliberate disease is to establish and maintain disease surveillance and control programmes. Most of the publications on epidemics in eastern Africa indicate that very little disease surveillance is done at present.[33] Where gains were made in control and eradication, they were later lost through neglect of control protocols such as vaccinations and control of livestock movements between endemic and non-endemic areas. There seems be unanimous agreement among observers that the main reason for the failure of surveillance and control systems is lack of funding. This is blamed on reduced funding for the responsible government organs and agencies owing to shrinking economies. National governments and other interested stakeholders will have to find the required funds, for if infectious diseases are not eradicated or at least maintained at minimum levels, an added threat will be their use as biological weapons, endangering people away from the endemic areas.[34] Observers have expressed the view that disease surveillance should be intensified and coordinated beyond the divide of national boundaries. Surveillance programmes should be part of the public health management systems. The ideal situation requires setting up local and international surveillance/response teams. Teams endowed with the necessary techniques and resources should be put in place so that they can deal with epidemics when they occur. This will ensure that expertise in dealing with these diseases is available uniformly throughout the region.[35] It is also important to register the groups/individuals engaged in these emergencies to minimise chances of hazardous materials being acquired by groups whose intent would be to cause disease outbreaks. Vaccination programmes have to be maintained because failure to do so may lead to a loss of the gains previously achieved in terms of disease control. Besides, for every case of sickness encountered, prevention is cheaper than cure. Some authors encourage joint veterinary and human disease surveillance as a way of cost cutting for zoonotic disease control and such a team can be schooled to monitor biological weapons as well (see the commentary by Dorothy Preslar in this issue of *African Security Review*).

Civil society role in disease control

Developing countries in general cannot afford to increase spending on health. Any added major spending on health is unlikely to come from national government treasuries. Increased funding for public health systems would have

to be sought from wealthier nations and donor agencies. But there is a role for civil society organisations in preventing the use of biological weapons and in ensuring that the damage inflicted by such use is minimised.

NGOs and professional organisations could monitor the activities of research institutes, industrial concerns and government installations to ensure that research is for peaceful purposes only; monitor the health system to ensure that it has adequate resources to deal with a disease outbreak; and coordinate between countries when crises are encountered, especially during epidemics of diseases that have potential use in BW programmes. The continuous education of emergency department personnel, laboratory technicians, doctors, nurses and public health workers would play a key role in ensuring that there is a high level of preparedness to detect and manage epidemics. Workshops/seminars and refresher courses on case management, drug use and diagnosis should be regularly undertaken or be made part of continuing education.

Information gaps exist for some of the important infectious diseases endemic in the region and these can be bridged by information generated through new research. New research could lead to new products that would aid in the management of these infectious diseases. These information gaps exist on diseases such as brucellosis, plague, anthrax, rickettsial diseases and haemorrhagic fevers, endemic to the eastern African region. Studies centred on epidemiology and biology aspects of these infectious agents would bridge the information gap and hence increase knowledge of these diseases in the region.

Researchers could generate specific materials and information that can be used as tools for training health practitioners and as reference materials for the diseases. The use, for example, of molecular probes would shed some new light on the epidemiology of these diseases and validate their use (probes) for general diagnosis, hence creating new tools for disease surveillance. Research should also be directed towards the development of vaccines against the agents of haemorrhagic fevers as the existing vaccine is only for yellow fever.

Strengthening the international norm

It is vital that the international community should ensure that there is compliance with the BTWC, which prohibits the hostile use of disease against humans, animals or plants.[36] A number of researchers and governments have favoured linking the BTWC to specific measures for fighting infectious diseases and the transfer of relevant technology and expertise to achieve this end. For example, a measure that became known as the Vaccines for Peace Programme was proposed to counteract the threat of both deliberate and natural disease.[37] A second proposal was made to establish a global disease surveillance programme.[38] If institutionalised, these measures may have had the capacity to limit the threat posed by deliberate disease. Some international institutions, such as the Office International des Epizooties (OIE), the UN Food and Agriculture Organisation (FAO) and WHO, are seen as appropriate bodies for implementing such programmes.

While the BTWC is, in general, designed to prevent the transfer of BW materials and technology, article X does encourage 'the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes'.[39] The spirit of this article underlines the need for state parties to cooperate in defeating disease, by developing cures, vaccines, and surveillance tools. Not only is this of benefit to developing states, but it is the best guarantee of diminishing the threat posed by deliberate disease.

In 2004 the states parties to the BTWC held expert and political meetings to consider 'enhancing international capabilities for responding to, investigating and mitigating the effects of cases of alleged use of biological or toxin weapons or suspicious outbreaks of disease; and strengthening and broadening national and international institutional efforts and existing mechanisms for the surveillance, detection, diagnosis and combating of infectious diseases affecting humans, animals and plants. A global response to the containment of infectious diseases through the provision of vaccine and surveillance tools is necessary to ensure that a country which reports a rare disease occurrence will not just be

reporting out of fear of retribution for failing to make such a report, but because they would receive support to contain the outbreak.

The recent outbreaks of SARS and the continuing AIDS epidemic have demonstrated critical weaknesses in global public health infrastructure in the face of a threat from a novel pathogen.[40] The international community must continue to learn from the experience of natural outbreaks to improve early detection and effective response to emerging disease on a global basis. Minimising the impact of disease, of natural or deliberate origin, will save countless lives as well as deter future bio-terrorist acts.[41] States parties to the BTWC are due to meet in 2006 for the Sixth Review Conference to review the convention. It is important that the ideals of 1972 BTWC should be retained, that the convention be reinterpreted in the light of recent scientific developments, and that states parties find a way to strengthen the BTWC through the adoption of measures to monitor and verify treaty compliance.

Notes

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