

Accidental and intentional animal disease outbreaks: assessing the risk and preparing an effective response

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Summary

Intentional animal disease outbreaks are infrequent, if not rare, yet they carry the potential for disastrous consequences. Normal but accidental outbreaks are not uncommon and they must be handled efficiently, effectively and economically. And whatever its origin a disease will then follow its usual epidemiology. Therefore, the effectiveness in dealing with the normal, and the practice, experience and confidence gained, will significantly aid a country in how it minimises the cost of an intentional disease outbreak. The response is what determines the financial and economic costs of a disease outbreak. This paper provides an overview of the various threats, targets, and possible government responses, all of which is then expanded upon in detail in the other papers in this issue of the *Review*.

Keywords

Bioterrorism – Bioweapon – Challenge – Emerging animal disease – Livestock – Post-harvest – Pre-harvest – Public health – Target – Threat.

Historical perspectives

While the future challenges facing veterinary medicine and public health will undoubtedly continue to revolve around natural introductions of animal and zoonotic diseases, the ever present, often overlooked, endemic diseases that relentlessly grind away at animal production, and emerging diseases that surface unexpectedly to threaten health (3), a growing concern is the intentional introduction of disease agents into animal populations. Such disruptive terrorist or criminal strikes might take the form of a deliberate introduction of a pathogenic agent into the food supply anywhere along the production line that runs from farm to fork (2, 7, 8, 9, 10, 19, 27, 28).

Recent terrorist attacks worldwide have focused on hitting soft targets with the intent of producing mass casualties and/or causing economic disruption, while simultaneously

producing high psychological impact and government instability. Information from various national and international government agencies worldwide, including the United Nations, Interpol and the World Health Organization (5, 16, 29), have indicated that undermining agriculture may well be a course of action that fits this extremist pattern. This is because large-scale foreign animal disease outbreaks have profound impacts on a country's infrastructure, economy, and export markets, and erode consumer confidence in the safety of the food supply. In addition, such outbreaks, whether due to accidental or intentional introduction, generate questions concerning government preparedness with regards to the protection of its critical infrastructures. The World Organisation for Animal Health (OIE) (www.oie.int), along with its 167 Member Countries, shares a common concern regarding the potential misuse of pathogenic biological agents that could affect animal health, public health and food production. The OIE is presently engaged in

providing guidelines, regulations, and standards to help prevent, diagnose, manage, and recover from such incidents.

Certain countries and organisations proclaim agroterrorism as an inevitable, unavoidable pending catastrophe, while other countries and organisations appear to pay scant attention to the subject; often dismissing this possibility as hysteria and hyperbole. The Director General of the OIE, Dr Bernard Vallat, has clearly and accurately articulated that there are, at present, substantial differences between countries in the perception of national threats from the deliberate use of pathogenic biological agents against animal populations (25). At the 28th World Veterinary Congress, Dr Vallat indicated his fears regarding the intentional introduction of biological agents, such as avian influenza, anthrax or rabies by bioterrorists intent on harming both animals and the public. Dr Vallat further voiced his concern regarding the intentional introduction of biological agents that strictly affect animals, since agents such as foot and mouth disease (FMD) could totally destroy the production of milk in a country (26).

There is a long but relatively thin history of using biological warfare, and its subset bioterrorism (BT), as a weapon of intentional aggression. While natural disease has its certain place in history, its use as a weapon is essentially a footnote, it has sometimes been used successfully, usually against naive susceptible populations, but at other times it has not had a significant impact even if disease cases have occurred (11). There has been a wealth of field trial experience, with its innate potentials for intentional disaster, but when one examines actual events – the German use of *Burkholderia mallei* against Allied horses in Argentina and New Jersey during World War I, other events in World War I in Europe, the Japanese use of *Yersinia pestis* in China during World War II, the Soviet use of tularaemia and glanders in Afghanistan – all these and others had arguable tactical impacts but were irrelevant strategically. The one event with strategic impact now in billions of dollars – the five anthrax spore-laden letters of 2001 in the United States of America (USA) – had a limited tactical impact and this may have been the act of a mere opportunist rather than an organised group. Possibly this is because biowarfare is perceived, as with chemical warfare, as a weapon of uncertain impact as well as being ethically unacceptable to the international community and thus likely to initiate an unconstrained overwhelming counter-attack from a strong opponent and international opprobrium.

On the other hand there are many groups with a history of targeting animals and agriculture, e.g. the animal rights groups and eco-terrorists with definite political agenda and experience in arson, animal 'liberation', threats, extortion, assaults, break-ins and theft. They have targeted, among others, medical and veterinary research facilities, fast food

facilities, butcher shops, intensive livestock operations, animal and poultry processing plants, and personnel involved with and employed in such establishments. The organisations involved have carried out hundreds of these acts at great cost to those targeted. For example, the US Federal Bureau of Investigation informed the US Congress in 2001 that two organisations, the Animal Liberation Front and the Earth Liberation Front, had committed over 600 criminal acts causing over US\$ 43 million of damage to US animal industries. However, although animal rights groups regularly target the food industries, there are presently no indications that they are interested in tampering with the food supply to cause human or animal disease outbreaks to date, probably because of their stated concerns for the health of animals and the environment. This is not to say that such organisations might not unknowingly provide training for those with less benign intentions.

Each period in history has its own brand of terrorist. During 1880-1910 it was the anarchists, a bunch of zealots whose ideology now counts for practically nothing. Most anarchists were non-violent but they had their firebrands and an ideology that could be twisted to appeal to a non-empathetic minority of wounded utopians. Next were the hyper-nationalists and several other extremist groups but they too came and went. This wave of terror will pass just as the others have. But others will take the stage (4).

However, the threat remains, even if thus far no terrorist group has used bioweapons (BW), not least in the minds of those health professions committed to fighting and preventing disease in humans, animals and plants. Since World War I there has been an increasing body of biowarfare research, both offensive and defensive. Collectively the latter has amply confirmed the possibility time and again that biological pathogens can be powerful and effective weapons. This results in a conviction that biological aggression will be used by terrorists. It is not a case of 'if' but 'when'. The difficulty in combating this threat is that the terrorist does not have a defined base that can be attacked. They are a diffuse group frequently embedded in a large population that prevents simple military action. There is a large body of successful counter-insurgency policy, strategy and tactics but, covering that is not the purpose of this publication. Our purpose is to show how the impacts of a potential biological disaster can be efficiently minimised by proactive decisions and actions taken before they occur, to cost effectively deal with them when they do, and how to facilitate rapid recovery.

Also it must be remembered that once past the opening scenario how we control both natural and intentional events is essentially identical. In preparing for the one we prepare for the other. How efficiently we do this determines the total cost and economic impact.

For the purposes of this analysis, agroterrorism is defined as the deliberate introduction of a disease agent, either against livestock or into the food chain, for the purposes of undermining socio-economic stability and/or generating fear (9). The threat of biological weapons directed against crops and processed foods has been reviewed elsewhere (15).

Natural versus unnatural, accidental versus intentional

Thanks to the advances of veterinary medicine and modern herd health protocols the frequency of major epidemics is much reduced. One can claim that in developed countries the health of modern flocks and herds is far better than that of the humans looking after them. The impact and frequency of major health problems are much reduced to the point of being absent as they must if farming is to make a profit. Natural events though not random – epidemiology would have any outbreak follow from a prior pattern of events to a predetermined outcome which would be determined by Kendall's threshold theory – rarely coordinate nicely to produce an epidemic. But occasionally it comes together, such as in the United Kingdom (UK) in 2001 with the FMD epidemic, when the widespread disease in one host species, sheep, coincided with the emergence of a large national cohort of veterinary officers without any meaningful experience or practice of dealing with a national emergency, which transformed a difficult situation into an expensive disaster. The fear is that an intentional bioterrorist event through the careful selection of agent, place and time may have a similar impact; that the terrorist can stack the odds. The terrorist's power in this situation is drawn from the gnawing unpredictability of if, how and when an attack might be launched and the absolute certainty that whatever happens will be extremely costly. While modern management practices have reduced the probability of a natural accidental epidemic to a very low value (though the economic and social consequences may then be high), the fears are that an intentional event will occur and that the consequences will be high (Fig. 1).

'Because terrorists can attack anything, anywhere, any time, and governments cannot protect everything, everywhere, all the time, terrorists always retain a certain advantage. Over the years the spectrum of targets attacked by terrorists has expanded. This asymmetry also means an inequality of effort between terrorist attackers and antiterrorist defenders. The amount of resources required for defence against terrorism is determined not by the very small number of terrorists, but rather by the virtually unlimited number of targets to be defended. This makes terrorism a cheap way to fight and a costly kind of threat to defend against' (13).

Complexity versus simplicity, reality?

'It ain't so much the things we don't know that get us into trouble. It's the things we know that just ain't so' [Artemus Ward]. How do we know that what we know is true?

One of the problems is that we know too much and we know too little. If you ask any applied microbiologist he or she can confidently describe a terrorist scenario for initiating a disease outbreak with this organism or that. But that is based on expert knowledge and experience with that pathogen, how to handle it safely without becoming infected oneself, and its delivery. On the other hand the old bioweaponers learnt by experiment and application that successfully weaponising a pathogen involved more than merely brewing it in large volumes. And they had accidents, sometimes fatal. Even experienced laboratories have exposure accidents with brucellae (30) and *Francisella tularensis* (18) (William Patrick, personal communication, 5 August, 2005). A terrorist group, unless it has good facilities and equal experience, will have accidents. The probability of that will determine which pathogens they are willing to work with, preferring those that are relatively apathogenic for humans or that can be protected against by vaccination and prophylactic antibiotics. This will allow the core terrorist team to build experience and 'live to bomb again'. Unless there is solid intelligence of specific terrorist group competence biodefence groups modelling terrorist capacity tend to errors of self-imaging under the excuse of 'worst-case scenario'. Predictions of what can be

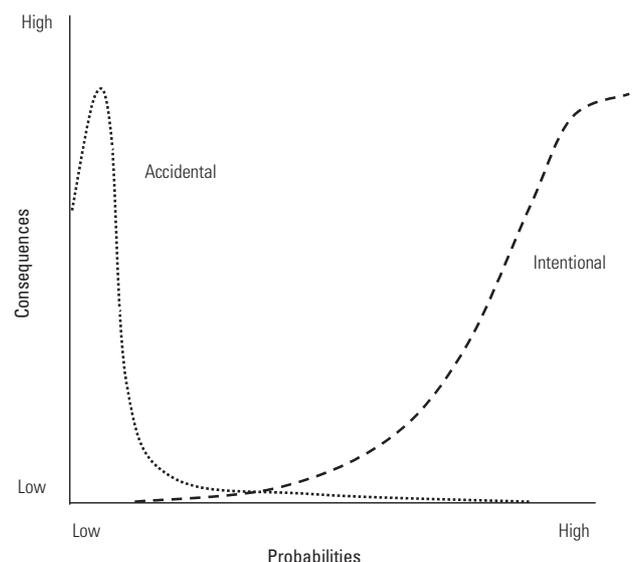


Fig. 1
Probabilities and consequences of accidental and intentional disease outbreaks

done are not the same as knowledge of true abilities. As stated by Representative Christopher Cox of California, latterly chairman of the US House of Representatives Committee on Homeland Security: 'Some experts believe that the hurdle for terrorist organisations to translate micro-organisms into biological weapons is relatively high. Others believe that this is a thin line of ignorance that can be easily crossed'.

The truth? Who knows. But once a group has a modest success, others may be encouraged to also attempt it. Which is why a fast, cost-efficient, effective response is important, nay, vital.

Responses

Unless there is a sudden change for the worst, disease outbreaks which are deliberately caused will remain rare and natural accidental outbreaks will continue to be the norm. These natural outbreaks must be prepared for; and when they occur, dealt with promptly, and the lessons learnt implemented to stop it happening again. By preparing for the norm, one is prepared for the abnormal. The methods for prevention, emergency management, mitigation and recovery are common to both circumstances. Spatially-targeted and industry surveillance systems must be in place and functional. Laboratory confirmation abilities need to be available and regularly tested. And tested plans should be in place to deal with surge demands in an emergency that flexibly reflect reality. Practice for the one is practice for the other.

One of the major problems in an emergency is inter-agency coordination and harmonisation, both national and international, of the necessary health, food and agricultural sectors. It is interesting how emergency post-mortems regularly point to shortcomings in coordination. And these failures increase the costs and delay effective responses. But the experience of a successful disease control programme builds confidence and generates collaborative ideas as to how it can be even better.

In the present day of interconnected global industries and economies, and the intercontinental transport of foodstuffs, both legal and illegal, pathogens are moved globally in spite of restrictions. Therefore policies have to be in place for the optimum control of novel diseases, whether by quarantine and slaughter, or by vaccination. And once past the opening days, the medical and veterinary responses are the same whatever the initiating cause. If vaccination is to be considered, there must be criteria for usage in place, tested and agreed, and sufficient stocks on hand of the perceived threat strains.

Emergency responses must be dual purpose.

Threats

There are three groups which can pose threats:

a) Nation states – those which have had or have offensive BW policies. Not only can they constitute a risk but employees and alumni from offensive programmes can take their skills and cultures elsewhere;

b) Non-state actors/terrorist groups – these groups have the potential to branch out from traditional weapons of improvised explosive devices and assassination to learn the details of constructing biological weapons. They take various forms, e.g. state-sponsored single-issue groups, nationalists, separatists, or apocalyptic cults. Their members include university graduates and it is only a matter of time until these groups will include or purposefully recruit individuals with advanced degrees in microbiology if they feel the need. Considerable discussion in recent bioterrorism literature has focused on the required educational expertise and technical skills needed to plan and execute a biological attack against humans, animals and plants. Several recent reports have clearly demonstrated that modern terrorist groups have many well-educated members, both senior and junior members (6, 20, 23) (Table 1). However, most procedures necessitate only a modest education and careful mentoring. An example of a group such as this is the well known Al-Qaeda (see Appendix);

c) Disgruntled individuals – probably the most likely as they are opportunists.

For terrorism to occur there must be:

a) a vulnerable target

b) the technical and organisational capability to carry out an attack

c) the intent to attack.

Terrorists seek to express their anger, and show and project power and control, in lieu of their real feelings of powerlessness. Common characteristics can be their diffuse objectives making it hard to understand their ideology and to infiltrate their groups; a sense of grandiosity; an apocalyptic or paranoid conspiratorial world view leading to defensive aggression. Motivations include primarily getting attention, also economic terrorism, millennialism, revenge and public chaos, mimicking God, crusade, and creating an aura of mastership of science and technology. They frequently copy others. Repeated terrorist successes may in time beget political force. This leads to big impact events that they collectively can watch via the media. The latter is a stage on which they can wage their war by performing terrorist acts.

Table I
Educational level achieved by known members of the Global Salafi Jihad movement (17)

Origin	Less than secondary school	Secondary school completed	Completed some university courses	B.A./ B.Sc.	M.A./ M.Sc.	Doctorate	Total
Core staff ^{a)}	1	1	1	16	1	5	25
South-East Asia	0	2	3	8	4	0	17
Maghreb Arab	13	8	9	6	1	0	37
Core Arab	8	5	25	14	1	0	53
Total	22	16	38	44	7	5	132

a) the core staff of the organisation are not based in one particular region

The mere demonstration of capability is enough but a ‘blast’ plays better to the media. The data presented in Table II (17) highlights this fact in that, from 1968 to 2005, a vast majority (82%) of documented terrorist attacks involved bombings, armed attacks, kidnapping, and assassinations. These types of attack are more likely to draw media attention and increase publicity and notoriety for terrorist groups seeking to gain attention and popular support for their ideological or political goals.

The use of biological agents has been carefully reviewed (6) and these studies indicate that the use of biological agents against livestock and poultry populations has been rare when compared to other targets. Carus found only three instances of the use of biological agents against agriculture targets (Table III). Overall, confirmed instances of the actual terrorist use of biological agents against agriculture are rare (2, 6, 27, 28). From the standpoint of most extremist groups, such actions would probably be viewed as too dry and mundane in comparison to traditional tactics (Table II) such as random shootings, assassinations and bombings – all of which focus on more spectacular, human-directed atrocities – because they do not produce immediate, visible effects. The impact of bioassaults on livestock and the food chain, although potentially economically significant, is delayed, lacking a single focal point of reference for the media to highlight. More specifically, there is less instantaneous drama such as occurs from a major truck explosion or suicide strike, which is essential to creating the immediate panic and loss of confidence in government officials that such acts are designed to elicit. However, the public as a whole do not understand biological agents and therefore their false perceptions magnify the impact and fears of any bioterrorist event, and lead to over-responses.

To the terrorist, animal diseases have the advantages that some are apathogenic for humans and vaccine protection exists for other diseases; since the terrorist team itself remains unharmed they can carry out this sort of attack repeatedly and build experience. That the impact will include the financial bankruptcy of many targeted industry

Table II
Tactics used in documented terrorist attacks carried out between 1968 and 2005 (17)

Tactic	The number of terrorist groups employing this tactic 1968-2005
Armed attack	198
Arson	88
Assassination	137
Barricade/hostage	56
Bombing	528
Hijacking	51
Kidnapping	170
Other	27
Unconventional attack	9

Table III
Criminal and terrorist objectives of all known bioterrorist attacks carried out between 1900 and 1998 (6)

Type of event	Terrorist	Criminal	Other/uncertain	Total cases
Murder	4	17	0	21
Terrorise	6	9	22	37
Extortion	0	13	3	16
Disruption	0	5	0	5
Anti-animal/crop	1	2	0	3
Mass murder	4	0	0	4
Revenge	0	3	0	3
Incapacitation	2	0	0	2
Political act	1	0	0	1

components – farmers, food processors, families of laid-off workers – is a ‘collateral damage’ similar to the many deaths of civilians caught in military cross-fire on ‘legitimate targets’. But if urban bombers have no care for them, the agroterrorist will be similarly unconcerned and regard it as a bonus social component of the economic cost.

Various selection criteria for the most dangerous anti-livestock and anti-poultry biological agents have been suggested (28). The most dangerous pathogens would be:

- pathogenic for livestock or poultry
- available and easy to acquire or produce
- highly infectious and contagious
- not harmful to the perpetrator
- robust and able to survive in the environment
- easily disseminated
- predictable, with an expected clinical disease pattern (including morbidity and mortality)
- attributable to a natural outbreak, ensuring plausible deniability if that is desired.

Unless a rogue nation state is willing to provide a pathogen product in a form suitable to survive transport, handling, and dispersal, this has to be prepared and assembled by the group or individual. This is easy in theory and some scenarios may be simple for the experienced. Fortunately, finding a group with instructional documents is not proof of actual ability though it may be an indicator of future intent; rather like a copy of *Playboy* hidden under a mattress can signal hopes but not necessarily sexual competence. Anthrax has long held a weapon position, not because of its lethality, in spite of its reputation, but because the spores are simple to produce and have an easy survivability. A parallel can be drawn for certain viruses that can be grown in eggs or are environmentally robust when harvested in high titre from lesions. There is a need to grow a minimum volume in order for it to be deliverable and the product must be in a form that does not challenge viability. And lastly it has to be dispersed effectively. Archival military research emphasised aerosols but engineering for this is specialised. It is far easier to deliver pathogens via sprays, food, feed, and water, especially as the food processing industries throughout the world have become increasingly vertically integrated. A recent industrial processing error in Spain involving roast chicken resulted in 921 salmonellosis cases across 13/18 provinces and communities in the country (22). There was the intentional salmonella attack in Oregon in 1984 that resulted in 751 cases (24), as well as malicious attacks on smaller groups (1, 14, 21). And lastly, if a group were preparing to use a biological pathogen they would quickly discover the problems of accessing targets. It is not the same as putting a bomb on a metropolitan train or bus. There would be a need to develop this expertise and therefore one can expect that groups may well practice in countries where they are comfortable to gain experience before taking on their true targets.

Analyses show that the scientific expertise among terror groups is very variable (Table I), but that some members have backgrounds in medicine, microbiology and pharmaceuticals, up to and including the PhD level. For example, Table I shows a high degree of education for the terror groups aligned with the Global Salafi Jihad movement led by Al-Qaeda [AQ] in that over 60% of membership had at least some university education. As a group, their education level exceeds the worldwide average. The educational level and technical expertise of such groups are clearly adequate to plan and execute a biological attack against animals. Although recent military, economic and political actions in many countries may have blunted AQ and related groups, these movements will continue to include well-educated extremist members. What criminals and terrorists cannot obtain through formal, traditional educational programmes can often be obtained through online educational services or through international and national biological conferences and seminars. Additionally, the Internet is identified as of great utility for the collection of information about diseases.

Any initial threat is most likely to be from known biological agents and current accessible modest technologies which involve expertise, knowledge and processes already in the public domain. However, future technical advances may make novel or non-conventional pathogens and their delivery more attractive to terrorists and others, especially as defences increase in thoroughness and complexity.

Targets

Targets stretch from individuals, to families (and their farms), communities, government infrastructure, public health, and finally economic sectors, including food and agriculture. The strategic objectives of the perpetrator(s) determine the target and the pathogen. The extent of a group's production and operational capabilities will affect its choice of targets, since few knowingly select targets that they lack the abilities to attack successfully. Moreover, most groups have limited access to pathogens and resources of time, finances, and personnel needed to meet the costs involved with developing and implementing new technologies. Unless given confidence by the success of another group new technologies are uncertain while soft targets vulnerable to traditional terrorist weapons are plentiful. On the other hand there is the perceived need to stand out from the terrorist herds and be relevant. And some groups are well funded and are attracting members with advanced technical capabilities.

While many BW scenarios invoke massive casualties, the reality is that many objectives can be met by minimal

numbers of cases, sufficient to ensure diagnosis. One confirmed case of FMD can be as economically crippling as a thousand. The American anthrax incidents in 2001 involved only five deaths and 22 cases; there is more health damage from ethyl alcohol on any weekend in many major cities in the USA, but the anthrax letters had an impact in billions of dollars. Therefore one should be as aware of the potential for ‘poisonous dwarf’ incidents as well as of the ‘monster’ mass-casualty attacks that are the focus of so much response planning. The myopic focus on mass-casualties virtually nullifies the need for countermeasures, replacing proaction, prophylactics and cost-effective responses with bulldozers, body bags and bigger budgets.

In today’s world agriculture is a global competitive industry. It is large. It is complex. In many countries it is highly concentrated, whether we consider beef feedlots, broiler hens, or soybeans. Many countries produce more of a product than they can consume domestically and therefore any stoppage on international trade will reverberate back onto the healthy stock in the national production pipeline and the farms producing feed for them. With industrialisation has come limited genetic diversity, which can add to the risk of disease spread. Some parts of the agriculture industry are easy to access; others are surprisingly complex even to those of us raised in the countryside. This latter point should be considered in tracing and tracking the activities of suspect groups. And lastly the risk from exotic pathogens, whether accidental or intentional, is compounded by poor initial recognition, the non-availability of vaccines, and absence of related control and eradication experience within the governmental Veterinary Services. More than anything else it is the efficiency and rapidity of their response that determines the economic impact of such an outbreak.

The threats to food and agriculture can be divided into two major groups: pre-harvest and post-harvest. Potential pre-harvest threats are to livestock – including aquaculture – and crops. For high response pathogens we should not exclude family farms or backyard breeders. ‘Pre-harvest’ outbreaks carry the risk of economic devastation compounded by international trade restrictions; financial disaster throughout the affected industry, associated industries (e.g. feed producers), and related communities (e.g. the UK FMD epidemic in 2001 severely impacted the rural tourist industry); and will be felt not just locally near affected farms but regionally and nationally. ‘Post-harvest’ events affect the food industries (processing, transportation, and delivery) and public health (possible human illness and death) impacting economic trade and can have social and political repercussions. Due to the vertical integration of many industries any direct interruption in just one part, much less a number, will have immediate and severe impacts on many others.

If one were to attempt to rank future potential bioterrorist attack scenarios, the following events may be considered as a guide:

- a) threats and hoaxes (e.g. hoax letter sent to a Wellington newspaper in 2005 claiming that FMD virus had been released on Waiheke island, New Zealand)
- b) murders and assassinations (e.g. the assassination of Bulgarian dissident Georgi Markov with a ricin-laden pellet fired from an umbrella)
- c) unannounced unclaimed non-lethal attacks (e.g. intentional salmonella attack in Oregon, 1984 [6])
- d) disruptions with few deaths (e.g. 2001 anthrax letters sent to a number of news organisations and two US Senators’ offices)
- e) localised lethal attacks (e.g. those which would have similar consequences to the accidental release of anthrax spores in Sverdlovsk in 1979)
- f) campaign of mass casualty attacks on different targets at different times (e.g. those initiated by the Japanese biological weapons facility unit 731, which used human ‘guinea pigs’ in their weapons research and development)
- g) lethal global outbreaks.

Only the last has yet to be witnessed.

Rules governing biological attacks

The following needs to be kept in mind when considering biological attacks:

- Rule 1: while theoretically easy to carry out, an effective agrobioterrorist attack is more difficult than the traditional bombing or murders;
- Rule 2: the true impact is determined not by the ‘bang’ but by the government(s) response(s);
- Rule 3: those involved in bioterrorism are not your average terrorists;
- Rule 4: in responding we have to be lucky all the time. They have to be lucky only once.

Similarly, there are certain characteristics shared by agrobioterrorist attacks:

- any human deaths may be coincidental;
- the full agricultural impact may be delayed;

– losses from the disease itself could be minimal but the indirect costs of controlling the disease, e.g. quarantine, surveillance, de-population, disposal, indemnity, etc., will be significant;

– an effective ‘attack’ does not necessitate massive death and destruction. It is the necessary responses to agricultural disease, to contain and clean up, to prevent further spread, and then to reclaim the previous level of disease control or freedom, lost exports and international recognition of freedom from disease and infection that eat up effort and funding with associated major economic and social costs. For example, FMD virus is a very robust virus which causes lesions on the feet and tongue, mammary glands and thyroid gland but in general it kills less than 1% of livestock affected – mainly calves from myocarditis – but the government response to FMD traditionally kills 100% of those affected.

Therefore, the desired results from an agricultural BT attack are much more complicated than the simple widespread terror induced in a human target population.

One cannot dismiss the possibility of agroterrorism emerging as a secondary tactic that is designed to complement and exacerbate the upheaval and social dislocation caused by more traditional tactics. Certainly the mechanics of executing an assault of this nature are relatively straightforward and far less complex than those associated with bioattacks against human populations. Factors contributing to this include:

– there is a large selection of animal biological agents from which to choose, with no less than 12 previous OIE ‘List A’ pathogens identified as having the potential to seriously impact animal health and/or trade;

– many exotic diseases are not zoonotic, so there is no risk of accidental human infection and therefore there are no requirements for elaborate personal protective equipment and containment procedures. However, advanced understanding of animal disease science would aid the perpetrator’s efforts to implement an attack on the agricultural industry;

– animal diseases can be quickly spread over wide geographic areas affecting large numbers of animals and farms, due to the intensive and concentrated nature of contemporary farming practices in many western countries, especially the USA, many European Union countries, and Asian Rim countries. Modern, rapid means of animal and human transportation worldwide immeasurably assists in disease spread. Animals provide the primary means of transmission; sophisticated weaponisation is not required. Due to the endemic nature of many of these diseases in large geographic regions worldwide, samples of agents are readily available from

clinical specimens collected from the field during natural outbreaks of disease;

– if the objective is human casualties, certain zoonotic diseases offer unique capabilities and the food chain offers a low-tech but highly conducive mechanism for disseminating a wide range of toxins and bacteria. This topic is discussed in full in other papers in this issue of the *Review*.

The ability to employ cheap and unsophisticated means to undermine a government’s economic base and possibly overwhelm its resources, gives livestock and food-related attacks an attractive cost-benefit payoff that would be of considerable interest to any group seeking to overcome extant power asymmetries between itself and the State it is targeting.

Recommendations for identifying and/or avoiding future incidents, minimising economic damage, and containing the disease

These recommendations are only covered briefly here as they are discussed in greater detail in the other papers in this issue of the *Review*. The following suggestions are to reduce overall costs and to reduce any public hysteria and political over-reaction that might be engendered by a successful agricultural BW attack (12):

– develop ‘early warning’ indicators;

– define hypothetical goals and possible objectives of those likely to use agricultural BT/BW techniques;

– remember that the more developed the industry, the more likely that the target component will be exports via singular cases (e.g. in reaction to the diagnosis of a bovine spongiform encephalopathy-like case in the USA); similarly, the less developed, the more likely that it will involve cruder processes and large numbers (e.g. ‘yellow rain’, rinderpest); and plan accordingly;

– remember that the bioterrorist’s preferred technique will involve a high impact–effort ratio, i.e. small effort with large impact, and therefore do not overlook possible unsophisticated preparations;

– be prepared without being paranoid; maintain an attitude of ‘Informed Suspicion’;

- have reliable rapid diagnostic tests released to the general agricultural community so as to reduce the frequency of false alarms;
- ensure that DNA testing kits are suitable for use in both natural and intentional situations;
- strengthen laboratory systems in the regions identified as being at risk;
- maintain field investigation team expertise and abilities. Try not to replace each ad hoc team with yet another. Rotate individuals in and out, not teams;
- the BT/BW team investigation should not interfere with the normal veterinary and agricultural responses to the emergency. Optimally it should be invisible to the public and silent, functioning in parallel and liaising closely with the emergency command. Unless the circumstances are blatant, any suspicions of BT/BW origin should not be voiced;
- do not give into the political temptation to suppress notification of disease outbreaks. It is far, far better to be proactive with the news thereby having some control of it and also insuring that it is accurate. Hiding information is a good way of ensuring that it is discovered and trumpeted without warning. Better to facilitate accurate news in a low-key manner than to suppress it. By providing prompt and accurate news releases to all the appropriate media one in fact controls the situation. Transparency nationally and internationally is vital. However, because of the implications – a true BW attack is an act of war – it is wise to not inform the news agencies of the BW nature of the suspected or confirmed source. That should be left to those responsible for national policy. Because of the risk of imitation by others, revealing a successful terrorist attack as ‘BW’ may be counter-indicated;
- do not be eager to publicise ‘near-misses’ firstly as any publicity would engender unnecessary excitement and speculation and secondly, a no-report indicates failure, something one might want the perpetrators to believe. Watch to see what happens, and note and act accordingly;
- preplan the agricultural, economic and policy response. If necessary, publicise one’s intentions. Minimise self-inflicted economic wounds. The recovery must be rapid. Transparency engenders trust and respect by other countries and while it may not prevent punitive protective actions by other countries it can reduce their severity in the longer term and will aid negotiations;
- preplan tactics and operations, including legislation, for carcass/crop disposal, site disinfection, and compensation. Compensation at market value paid promptly, either from government or insurance sources, will significantly reduce delays in reporting suspect animals/crops and reinforce community support;

- develop effective public information on improved disease prevention methods, especially in relation to prophylactics, livestock vaccination, and increased animal physical security by reducing their unsupervised contact with the public;
- run field war games so that government staff and representatives of the professional public are rehearsed; by professional public we mean private veterinarians, feed and dairy companies, feedlot owners, farmer representatives, and such. These exercises should not be overtly anti-BW but a routine ‘What do we do if there is an outbreak of FMD or Venezuelan equine encephalomyelitis or Newcastle disease or whatever’. They have drills for hurricanes and tornadoes, why not for agricultural emergencies? Reduce the potential for hysteria by widening the range of those involved in these exercises. With each year there is an increasing need to be prepared and rehearsed;
- if it is appropriate, maintain basic stocks of vaccines. While, for example, outbreaks of anthrax can be readily and efficiently stopped by vaccination, for other diseases it may be better to slaughter ones way out of them because of the knock-on effects of vaccination on international recognition of being disease free. It depends on circumstances. Thanks to the 2001 FMD epidemic the public acceptance of slaughter is now much reduced to the point that vaccination may be the preferred response for this and other diseases.

Conclusion

The 15th Century European explorers brought smallpox, measles and hepatitis to the American Indians with truly devastating results throughout the Hemisphere. They arguably returned with syphilis, which barely rates a footnote in subsequent European history. The disease that changed European history was plague from Central Asia. So it is not ‘if’, nor ‘when’ but ‘what’. The subsequent severity of the ‘what’ is not the agent but the efficiency of how we control it before, during, and after its emergence.

Appendix

Al-Qaeda, biological weapons, and agroterrorism

Al-Qaeda and AQ affiliated groups have long expressed interest in the offensive employment of chemical, biological, radiological, nuclear, and high explosive (CBRNE) materials. Indeed, in an interview with ‘Time Magazine’ four months after the August 1998 US East African embassy bombings, Osama Bin Laden specifically

asserted that acquiring weapons of mass destruction was a religious duty for all Muslims and one that was fully in accordance with Islamic precepts as defined by Allah. Islamic scholars refute that claim but, nevertheless, there is a substantial following who have chosen to interpret the Koran in this unrealistic manner.

No evidence currently exists that AQ has yet been able to translate its undoubted interest in weapons of mass destruction to actual possession. Moreover, the group's current disaggregated and resource-depleted character would seem to preclude the option of it being able to independently manufacture CBRNE weapons for large-scale, strategic attacks in the short-to-medium term. These considerations notwithstanding, one should not discount the possibility of more limited strikes being carried out to generate psychological and/or economic (rather than physical) damage. Such assaults would probably fit with the group's general operational patterns post-9/11; that is, emphasising modalities that are directed against unprotected 'soft' targets and which are cheap, easy to mount and capable of being executed with a minimum of outside support. It is in this context that attacks against agriculture take on a certain degree of relevance.

An act of agroterrorism would fit well both with AQ's currently reduced operational potential to execute large-

scale strategic strikes on the scale of 9/11, as well as with the network's general desire to deliver a crippling blow to the American economy. Introducing disease into livestock populations is very low tech. Because FMD is so contagious, and given the extremely concentrated and intensive nature of contemporary livestock farming practices in many western countries, a nationwide multi-focal outbreak may well ensue. Should such a catastrophe occur in the USA or many other countries, it would cost the affected country(ies) billions of dollars in lost livestock, livestock products, trade and tourism.

More importantly, various documents, manuals, letters and books (4) recovered in the wake of Operation Enduring Freedom in Afghanistan provide some empirical evidence that AQ was seeking to develop anti-animal agents as part of its general biological efforts. Figure 1A is a crude hand-drawn schema of their sophisticated interest in the acquisition, isolation, culture, identification and testing of various medically important bacteria. It is clear from the words 'Manpower' 'Vaccinated' and 'Antisera' in Boxes 1 and 1A that the author wanted to protect the scientists and laboratory technicians implementing this BW programme by vaccinating them or having antisera available in case of an exposure or infection.

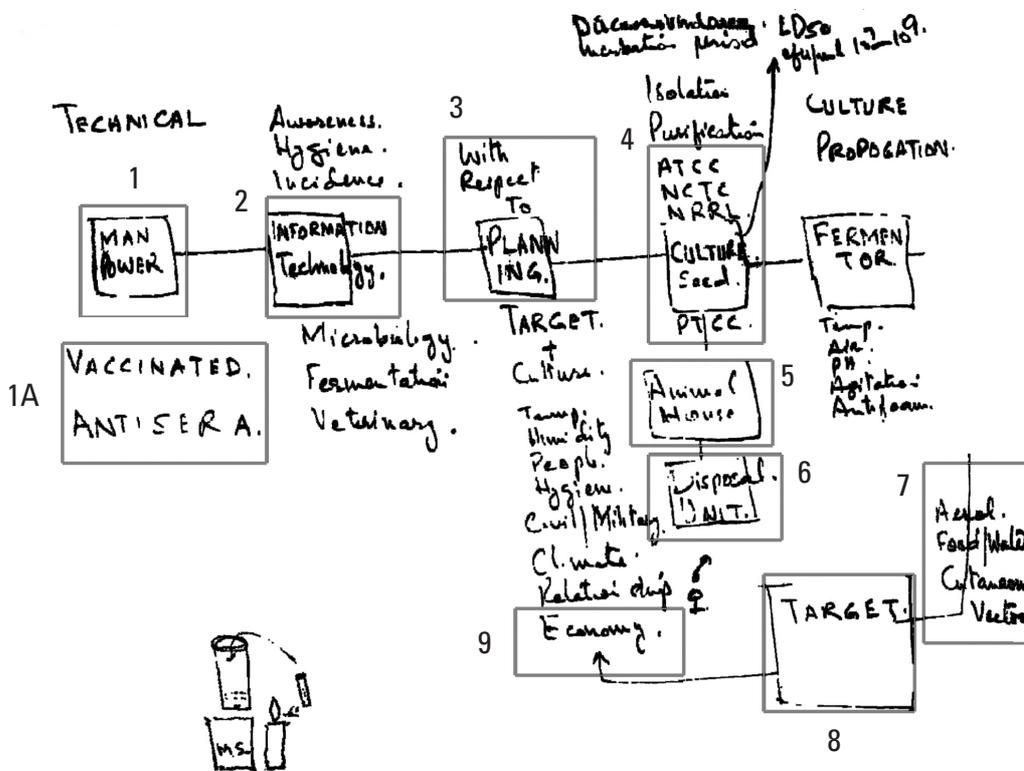


Fig. 1A
Crude hand-drawn schema recovered at a terrorist training camp in Afghanistan illustrating Al-Qaeda's sophisticated interest in the acquisition, isolation, culture, identification and testing of various medically important bacteria

Source: This document is available from government archives in the United States of America under the Freedom of Information Act

Foyers de maladies animales d'origine accidentelle et intentionnelle : évaluer le risque et préparer une riposte efficace

M. Hugh-Jones & C.C. Brown

Résumé

Les foyers de maladies animales d'origine intentionnelle sont peu fréquents, voire exceptionnels, mais leurs conséquences peuvent être désastreuses. Les foyers normaux mais accidentels ne sont pas rares, et doivent être pris en charge de façon efficace, efficiente et économique. Une fois déclarée, quelle que soit son origine, une maladie suivra son évolution épidémiologique habituelle. Par conséquent, l'efficacité de la prise en charge des foyers normaux et l'expérience et l'aisance acquises aideront considérablement un pays à trouver les moyens de réduire au minimum le coût d'un foyer de maladie d'origine intentionnelle. Ce sont les interventions destinées à faire face à un foyer de maladie qui en détermineront le coût économique et financier. Le présent article offre une description générale des menaces, des cibles et des réponses gouvernementales possibles ; chacun de ces points est ensuite repris et développé dans d'autres articles de ce numéro de la *Revue*.

Mots-clés

Arme biologique – Bétail – Bioterrorisme – Cible – Enjeu – Maladie animale émergente – Menace – Mesure après l'abattage – Mesure avant l'abattage – Santé publique.



Evaluación del riesgo de brotes zoonosarios de origen accidental o intencionado y preparación de una respuesta eficaz

M. Hugh-Jones & C.C. Brown

Resumen

Los brotes de enfermedades animales de origen intencionado son algo inhabitual, incluso raro, aunque pueden dar lugar a auténticos desastres. Los brotes normales pero de origen accidental no son infrecuentes, y exigen una respuesta efectiva, eficaz y económica. De todos modos, sea cual su origen, una enfermedad va a propagarse conforme a sus pautas epidemiológicas. Por ello, la eficacia a la hora de enfrentarse a episodios normales y la práctica, experiencia y confianza que con ello se adquieren ayudarán mucho a un país a la hora de reducir al mínimo las consecuencias de un brote provocado. El costo financiero y económico de un brote zoonosario depende de la respuesta que se le dé. Los autores describen sucintamente una serie de amenazas, objetivos y eventuales respuestas de los gobiernos, todo lo cual se aborda con más detenimiento en otros artículos de este número de la *Revista*.

Palabras clave

Amenaza – Arma biológica – Bioterrorismo – Desafío – Enfermedad animal emergente – Ganado – Medida posterior al sacrificio – Medida previa al sacrificio – Objetivo – Salud pública.



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