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BIOTERRORISM—THE THREAT IN THE WESTERN HEMISPHERE

The risk of biological, chemical, and radiological terrorism in the Americas is well recognized, and the potential impact of terrorism in the agricultural sector would be high.

There have been many instances where civilian food supplies have been sabotaged deliberately throughout recorded history, during military campaigns and, more recently, to terrorize or otherwise intimidate civilian populations. Deliberate contamination of food by chemical, biological or radio-nuclear agents can occur at any vulnerable point along the food chain, from farm to table. The most prominent immediate effects of biological or chemical weapons are illness and death, economic and trade effects, impact on public health services, as well as social and political implications.

Outbreaks of both unintentional and deliberate food borne disease can be managed by the same mechanisms. The most efficient and effective way of countering many types of emergencies, including food terrorism, include sensible precautions, coupled with strong surveillance and response capacity. The main requirement for rapid detection of an epidemic is a surveillance system that is sensitive for identifying small clusters of illness. Such systems permit identification of all disease outbreaks, whether intentional or unintentional. The primary responsibility for preventing and responding to acts of terrorism often lies with local and state authorities. Effective response is facilitated greatly by strong linkages between national Ministries of Agriculture and Health and their state and local counterparts, and through international networks.

To this end PAHO has been working with its Member States to strengthen their epidemiological and laboratory capabilities for the surveillance and control of communicable diseases through several of its technical cooperation programs. PAHO has been organizing networks of laboratories for identification of specific pathogens and for emerging and reemerging diseases.

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Background

1. Biological warfare is not a recent phenomenon. There are many examples throughout history of lethal or debilitating biological agents being used against enemies. Given biological warfare's relative ease of use, surprisingly few national or international incidents of agricultural bioterrorism have occurred. While thousands of toxic chemicals and pathogenic microorganisms have been investigated for their potential utility as weapons, few have been found satisfactory; and fewer still have found their way into weapons and actually been used. Some of these are summarized in Tables 1 and 2.

Table 1. Agents of Bioterror

Category A	Category B	Category C
Organisms that pose a risk to national security because they can be easily disseminated or transmitted from person to person; result in high mortality rates and have the potential for major public health impact; might cause public panic and social disruption; and require special action for public health preparedness.	Agents that are moderately easy to disseminate; result in moderate morbidity rates and low mortality rates; and require specific enhancements of diagnostic capacity and disease surveillance.	Emerging pathogens that could be engineered for mass dissemination because of availability; ease of production and dissemination; and potential for high morbidity and mortality rates and major health impact.
Anthrax (*Bacillus anthracis*) Botulism (*Clostridium botulinum* toxin) Plague (*Yersinia pestis*) Smallpox (variola major) Tularemia (*Francisella tularensis*) Viral hemorrhagic fevers (filoviruses [e.g., Ebola, Marburg] and arenaviruses [e.g., Lassa, Machupo])	Brucellosis *(Brucella* species*)* Epsilon toxin of *Clostridium perfringens* Food safety threats (eg., *Salmonella* species, *Escherichia coli* O157:H7, Shigella) Glanders *(Burkholderia mallei)* Melioidosis *(Burkholderia pseudomallei)* Psittacosis *(Chlamydia psittaci)* Q fever *(Coxiella burnetii)* Ricin toxin from Ricinus communis (castor beans) Staphylococcal enterotoxin B Typhus fever *(Rickettsia prowazekii)* Viral encephalitis (alphaviruses [e.g., Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis]) Water safety threats (e.g., *Vibrio cholerae*, *Cryptosporidium parvum*)	Examples include: emerging infectious disease threats such as Nipah virus and hantavirus

Source: http://www.bt.cdc.gov/Agent/agentlist.asp

Table 2. Animal Pathogens with Potential Bioweapons Application

Pathogens Weaponized or Pursued for Weaponization Potential	Additional Pathogens with Weaponization Potential
African swine fever Anthrax Foot-and-mouth disease Classical swine fever Psittacosis Rinderpest Trypanosomiasis Poxvirus	African horse sickness Avian influenza Bluetongue Bovine spongiform encephalopathy Contagious bovine pleuropneumonia Lumpy skin disease Newcastle disease Paratuberculosis Peste de petits ruminants Pseudorabies Rift valley fever Sheep and goat pox Swine vesicular disease Vesicular stomatitis

Source: Norm Steel. Econoterrorism: U.S. Agricultural Productivity, Concentration and Vulnerability to Biological Weapons. Unclassified Defense Intelligence Assessment for DOD [Department of Defense] Futures Intelligence Program, January 14, 2000.

2. There have been only 222 bioterrorism-related incidents in a 100-year period, and in only 24 cases have there been confirmed attacks—an average of 1 every four years worldwide. Fourteen of the 24 confirmed cases of bioterrorism or biocrimes are food- or agriculture-related; of those cases, 11 involved food poisoning, and only 3 targeted commercial animals or plants. Of the 222 documented incidents, only 6 appear to be clearly linked to attacks on commercial plants and animals. Furthermore, only one attack resulted in mass human casualties—the Salmonella contamination of food by the Rajneeshee cult in Oregon in 1984.

Consequences of Using Biological or Chemical Weapons

Short-term Consequences

3. The most prominent immediate effect of biological or chemical weapons is the large number of casualties that they may cause, and it is this characteristic that determines most preparedness strategies. The potential for overwhelming medical resources and infrastructure is magnified by the fact that the psychological reaction of a civilian population to biological or chemical attack is likely to be far more serious than that caused by attack with conventional weapons.

Long-term Consequences

4. The possible long-term consequences of the use of biological or chemical weapons, including delayed, prolonged, and environmentally mediated health effects, long after the time and place that the weapons were used, have generally received less attention in the literature than the more obvious short-term consequences discussed above. Some biological and chemical agents have the potential for causing physical or mental illnesses that either remain, or only become evident, months or years after the weapons have been used. The long-term health consequences of releases of biological or chemical agents may include chronic illness, delayed effects, new infectious diseases becoming endemic, and effects mediated by ecological changes. The unanticipated long-term effects of agents may prove more harmful than the immediate effects.

Psychological Warfare Aspects

5. Apart from their ability to cause physical injury and illness, biological and chemical agents can be used in psychological warfare because of the horror and dread that they can inspire. Even if the agents are not actually used, fear of them can cause disruption, even panic. Exacerbation of such effects can be expected from the exaggerated accounts of biological and chemical weapons that may arise in some circles.

Bioterrorism as an Emerging Threat to Food Security

6. Agriculture is a critical national infrastructure. Agriculture is the driving force of a country's food supply and food safety, which are the two principal components of food security. Agriculture's overall contribution to the national gross domestic product (GDP) in countries of the Western Hemisphere ranges from 2% to 32%. The food and agriculture sector is often a nation's largest employer. The economic multiplier of a farm commodity is a measure of total economic activity associated with a commodity. This measure is a reflection of the value of commodity leaving a farm for that commodity, plus the value accruing from transportation, marketing, and processing of the commodity. In the United States, for example, the Department of Commerce has concluded that the economic multiplier of exported United States farm commodities is 20 to 1; this compares with a multiplier of less than 2 to 1 for domestic crop sales (and the manufacture of major weapon systems) and less than 3 to 1 for domestic livestock sales.

Potential Targets

7. There are five potential targets of agricultural bioterrorism:

- field crops;
- farm animals;

- food items in the processing or distribution chain;
- market-ready foods at the wholesale or retail level; and
- agricultural facilities, including processing plants, storage facilities, wholesale and retail food outlets, elements of the transportation infrastructure, and research laboratories.

8. The food industry's widespread vertical integration facilitates the geographical spread of pathogens. This problem is exacerbated by the fact that many retail food industries presently do not have established procedures for preventing food contamination by terrorists.

9. It could be hard to distinguish a bioterrorist attack from a natural outbreak of animal or plant disease, thus providing cover for a terrorist. Compared with attacks against humans, attacks against agriculture are less risky to perpetrators. Anti-agriculture pathogens are generally safer to work with than human pathogens. It is also easier to develop and deploy biological agents against agriculture than against humans.

10. Financial losses from an attack on food systems would accrue from a number of interrelated consequences, including:

- direct losses of agriculture commodities to diseases,
- costs of diagnosis and surveillance,
- required destruction of contaminated crops and animals to contain disease,
- costs of disposal of carcasses,
- damage to consumer and public confidence,
- need for long-term quarantine of infected areas,
- losses due to export and trade restrictions, and
- disruption of commodity markets.

11. When one considers the economic and social consequences of the natural outbreak of bovine spongiform encephalopathy (BSE) in Great Britain in the 1990s, the potential impacts of a well-coordinated, targeted bioterrorist act come into perspective. BSE has already cost Great Britain between US$ 9 billion and $14 billion in compensation costs to farmers and laid-off employees, and at least another $2.4 billion in loss of export markets. These costs continue to escalate as confidence in British beef has been severely undermined; it will be exceedingly difficult to restore public confidence.

Terrorist Threats to Food Safety

12. There have been many instances where civilian food supplies have been sabotaged deliberately throughout recorded history, during military campaigns, and, more recently, to terrorize or otherwise intimidate civilian populations. Deliberate contamination of food by chemical, biological, or radio nuclear agents can occur at any vulnerable point along the food chain, from farm to table, depending on both the food and the agent. The malicious contamination of food for terrorist purposes is a real and current threat, and deliberate contamination of food at one location could have global public health implications. Outbreaks of both unintentional and deliberate foodborne disease can be managed by the same mechanisms.

13. Sensible precautions, coupled with strong surveillance and response capacity, constitute the most efficient and effective way of countering all such emergencies, including food terrorism. PAHO/WHO Member States should integrate consideration of acts of food sabotage into existing programs for controlling the production of safe food. Member countries should also strengthen existing communicable disease control systems to ensure that surveillance, preparedness, and response systems are sufficiently sensitive to meet the threat of any food safety emergency. Establishment and strengthening of such systems and programs will both increase Member States' capacity to reduce the increasing burden of foodborne illness and help them to address the threat of food terrorism.

14. The activities undertaken by Member States must be proportional to the size of the threat, and resources must be allocated on a priority basis. Prevention, although never completely effective, is the first line of defense. The key to preventing food terrorism is establishment and enhancement of existing food safety management programs and implementation of reasonable security measures. Prevention is best achieved through a cooperative effort between government and industry, given that the primary means for minimizing food risks lie with the food industry.

Potential Effects of Food Terrorism

Illness and Death

15. The potential impact of contaminated food on human health from deliberate acts of sabotage can be inferred from reports of unintended foodborne disease outbreaks. For example, the largest, best-documented incidents include an outbreak of *Salmonella typhimurium* infection in 1985, affecting 170,000 people, caused by contamination of pasteurized milk from a dairy plant in the United States. An outbreak of Hepatitis A associated with consumption of clams in Shanghai, China, in 1991 affected nearly 300,000 people and may be the largest foodborne disease incident in history. In 1994, an outbreak of *S. enteritidis* infection from contaminated pasteurized liquid ice cream that

was transported as a pre-mix in tanker trucks caused illness in 224,000 people in 41 states in the United States. In 1996, about 8,000 children in Japan became ill, including some deaths, with *Escherichia coli* O157:H7 infection from contaminated radish sprouts served in school lunches. If an unintentional outbreak from one food, such as clams, can affect 300,000 individuals, a concerted, deliberate attack could be devastating, especially if a more dangerous chemical, biological, or radio nuclear agent was used. Clearly, the potential health effects of a terrorist attack must be taken seriously by the health community and by those responsible for assessing and countering terrorist threats.

Economic and Trade Effects

16. Deliberate contamination of food may also have enormous economic implications, even if the episode is relatively minor. In fact, economic disruption may be a primary motive for a deliberate act, targeting a product, a manufacturer, an industry, or a country. Mass casualties are not required to achieve widespread economic loss and disruption of trade. Extortion threats directed at specific organizations, particularly those in the commercial sector, are more common than is generally believed.

Impact on Public Health Services

17. Foodborne illness, whether intentional or otherwise, can also paralyze public health services. The 1995 attack with nerve gas on commuters in the Tokyo subway system, while not foodborne, clearly illustrates the effects of a coordinated terrorist attack on an unsuspecting population. This highly publicized attack caused the deaths of 12 people and led 5,000 people to seek medical care. The response to the incident was prompt and massive, with 131 ambulances and 1,364 emergency technicians dispatched and 688 people transported to hospital by emergency medical and fire services. More than 4,000 people found their own way to hospitals and doctors. Many countries do not have the capacity to respond to such massive emergencies. The public health service facilities for coping with these types of emergencies and for providing continuing care may be strained to the limit. While many countries have some form of emergency response plan, they usually do not include consideration of food safety. This gap in preparedness could lead to misdiagnosis, incorrect laboratory investigations, and failure to identify and detain affected food. This would weaken or even preclude an effective response to a food sabotage incident.

Social and Political Implications

18. Terrorists may have a variety of motives, from revenge to political destabilization. They may target the civilian population to create panic and threaten civil order. As the response to mailing of envelopes containing *Bacillus anthracis* in the United States showed, limited dissemination of biological agents by simple means, causing few cases

of illness, can cause considerable disruption and public anxiety. Fear and anxiety may contribute to reduced confidence in the political system and government and may therefore result in political destabilization. When the effects are economic and lead to loss of income for some sectors of society, the political impact can be exacerbated. Finally, while contamination of the entire food supply is unlikely, preexisting food shortages could be worsened by deliberate contamination, again with an impact on political and social stability.

Reducing the Risk

Surveillance, Preparedness, and Response

19. It is highly unlikely that acts of food terrorism can be completely prevented, and it is even more unlikely, if not impossible, to prevent hoaxes. Much of the scientific knowledge required to produce chemical and biological agents that could be used to contaminate food deliberately is in the public domain. However, sensible precautions coupled with effective surveillance, preparedness, and response systems can do much to counter food terrorism. While most of the capacity to prevent food safety emergencies lies within the food industry, governments have a lead responsibility for detecting and responding to actual or threatened food terrorism incidents as well as other food safety emergencies. Covert or overt acts of food terrorism must first be detected by surveillance and other alert systems, before a response can be activated.

20. The main requirement for rapid detection of an epidemic is a surveillance system that is sensitive for identifying small clusters of illness. Such systems permit identification of all disease outbreaks, whether intentional or unintentional, but do not necessarily permit identification of the disease or its mode of transmission. Surveillance systems also provide information about the expected frequency and size of various disease outbreaks, thus providing a baseline for identifying unusual clusters that might herald a terrorist incident.

21. Early detection of disease resulting from covert food terrorism depends on sensitive surveillance systems for communicable disease at local and national levels, with close cooperation and communication among clinicians, laboratories, and public health professionals. Many Member States maintain surveillance systems for communicable diseases, which are collaborative efforts based on passive or active surveillance systems and often include a requirement for mandatory reporting of specific diseases and the pathogens that cause them.

22. Countries need to review their surveillance systems with respect to their capacity to recognize emergencies rapidly. Countries with highly accurate but slow systems should strengthen them to allow rapid detection of food terrorism incidents. The

deliberate contamination of food may be very difficult to recognize, especially if the agent is uncommon and the clinical symptoms are obscure.

Laboratories

23. Rapid diagnosis of causative agents during investigation of unexplained disease outbreaks often depends on requesting the appropriate diagnostic laboratory test. Clinicians who become aware of foodborne disease agents must be able to reach the public health sector for advice. The capacity to identify the cause of a disease cluster as a food terrorist act depends on both the circumstances of the case and the sensitivity of the investigative procedures. Rapid response depends on effective links to laboratories with the capacity to identify various foodborne agents, including unusual ones. Such laboratories must have appropriate expertise and analytical methods in place to detect chemical, biological, or radio nuclear agents in food and in human samples.

Epidemiological Investigations

24. The objectives of an epidemiological investigation of an outbreak are the same whether they are due to unintentional or covert contamination of food. Identification of the causative agent, the vehicle, and the manner of contamination is the most important aspect of the investigation, as it facilitates timely treatment of exposed people and removal of the contaminated food from circulation. Training of epidemiologists may need to be strengthened to include considerations of food and foodborne agents. Epidemiological investigations should include case definition, case finding, and pooling and evaluation of data about potential exposure in various locations. Case-control studies should be conducted to identify specific food vehicles. The investigations should also include collection of laboratory samples, transport and processing of samples, collation of information about sources of contamination, and coordination with law enforcement, food safety regulatory authorities, and emergency medical response agencies.

Investigative Tools

25. Computer-based networks for comparison of bacterial serotypes could enable fast recognition of strains with identical DNA fingerprints, suggesting exposure to a common source and allowing rapid recognition of any connection among geographically dispersed cases.

Key Issues to Address

26. Because the primary responsibility for preventing and responding to acts of terrorism often lies with local and state authorities, a strategic plan must address coordination and partnerships between national agencies and local authorities. This will

be facilitated greatly by the strong linkages between federal ministries of agriculture and health and their state and local counterparts, as well as with the intelligence, law enforcement, and criminal proceedings communities and through international relations and diplomacy.

27. In many ways, the most important partnerships will be with the private sector, particularly with the agribusiness sector—the most likely target of a terrorist act. Key components of the private sector that must be involved include producers of crops, livestock, poultry, and aquaculture products. While it will be important to engage key companies possessing strategic market shares, the most effective approach will be to work with national commodity organizations that represent the broad interests of their constituencies, that have staff in place, and that are often involved in government affairs and lobbying activities.

Conclusions

28. The strengthening of national public health capabilities to promptly detect and respond to cases or outbreaks of infectious diseases of potential massive spread and the improvement of mechanisms for exchange of information between countries are certainly the most important measures to reduce the possibility of international dissemination of biological weapons and bioterrorism.

29. To this end PAHO has been working with its Member States to strengthen their epidemiological and laboratory capabilities for the surveillance and control of communicable diseases through several of its technical cooperation programs, and has been organizing networks of laboratories for specific pathogens and for emerging and reemerging diseases. Additional preventive and response measures are summarized in Table 3.

Table 3. Elements to Consider for Preventive and Response Programs against Bioterror

Preventive Elements

- intelligence programs (identify potential threats and perpetrators; understand motivations; predict behavior; and consider preemptive action)
- monitoring programs (detect and track specific pathogens and diseases)
- targeted research
- moral suasion (discourage use of biological weapons)
- international treaties, protocols, and agreements (including effective verification programs)
- first-strike, deterrence strategies
- creation of agent-specific resistance in livestock, poultry, and crops
- vaccination against specific biological weapons agents
- modification, as appropriate, of vulnerable food and agriculture practices to minimize impacts of terrorist acts
- education and training of national, state, and local agencies in emergency drills
- public awareness via education programs.

Response Elements

- consequence management (also included in several of the following actions)
- early detection and prediction of patterns of dispersion
- early detection of specific biological weapons agents, delivery mechanisms, origins, and targets
- early management to check spread and minimize infection
- epidemiology
- treatment regimes
- casualty management (including carcass disposal and decontamination)
- diplomatic responses
- military responses
- legal responses
- economic responses
- compensation for losses
- management of economic consequences (including disruption of exports and commodity markets)
- education and training of national, state, and local agencies in emergency drills
- public awareness via education programs.

References

World Health Organization. Terrorist Threats to Food: Guidance for Establishing and Strengthening Prevention and Response Systems. Geneva: WHO; 2002. (http://www.who.int/fsf/Documents/Terrorism_&_food_En.pdf)

World Health Organization. *Public health response to biological and chemical weapons*. Geneva: WHO; 2001. (http://www.who.int/emc/book_2nd_edition.htm)

Parker HS. Agricultural bioterrorism: a federal strategy to meet the threat. McNair Paper 65. Washington, DC: Institute for National Strategic Studies, National Defense University; 2002. (http://www.ndu.edu/inss/macnair/mcnair65/McN65cont.html)

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