

Commentary

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Bioterrorism

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Introduction

Bioterrorism has recently become an important political issue in the US. Spending on medical defense and research against bioterrorism is rising exponentially. US\$91m was spent in 1998, compared to a proposed budget of US\$336.6m for the year 2000.¹ Former President Clinton announced that he intended to ask Congress for a staggering US\$2.85bn to counter the bioterrorist threat with funds distributed between the FBI, military intelligence, the National Security Agency and the medical and emergency services.² In February 1999, the first ever national conference on defense against bioterrorism was organized by Johns Hopkins University. The conference was substantially oversubscribed and hundreds had to be turned away.² Frightening scenarios of invisible clouds of anthrax and smallpox drifting through cities and killing thousands of people were described. Is this simply American paranoia, or should Britain also be concerned about the threat of bioterrorism?

Although often perceived as a recent invention, biological weapons have been used for hundreds of years. During the siege of Kaffa (now Feodosia, Ukraine) in 1346, the Tatars catapulted the dead bodies of plague victims into the city, causing an epidemic among the inhabitants. The subsequent migration of refugees from the defeated city may have caused the second European plague pandemic.³ In the 18th century, Sir Jeffrey Amhurst deliberately caused a smallpox epidemic among hostile Native American tribes by giving them contaminated hospital blankets. The effect on the Indian population was devastating.⁴

Recent use of biological agents to cause deliberate harm has only rarely been described in the medical literature, with approximately one report per decade. During the 1960s, several outbreaks of typhoid and dysentery in Japanese hospitals were caused by intentional food poisoning by a bacteriologist.⁵ In 1970, four Canadian students developed asthma, eosinophilia and pulmonary infiltrates after consuming food deliberately infected with *Ascaris suum* ova.⁶ During a single month in 1985 in Dalles, Oregon, 751 people developed salmonella gastroenteritis after contamination of salad bars by the Rajneeshee religious cult.⁷ Most recently in 1996, 12 laboratory staff developed dysentery after intentional contamination of muffins by a colleague.⁸ Although these amateurish attempts seem relatively minor, many experts regard bioterrorism as capable of causing death and incapacitation to tens of thousands of people.

The former Congressional Office of Technology Assessment reported that a small aeroplane carrying 100 kg of anthrax spores could use a crop-sprayer to deliver a fatal dose to 3 million people.⁹ A report by the World Health Organization estimated that if an aeroplane released 50 kg of anthrax over a 2 km line, upwind of a population of 500 000 people, 95 000 people could be killed and 125 000 incapacitated.¹⁰ Other agents could also cause significant morbidity and mortality (Table 1). Even hoaxes alleging the use of biological agents can cause serious disruption. A series of hoaxes alleging the use of anthrax in several US states between October and December 1998 produced emergency

Table 1 Comparison of effects of biological agents

Agent	Downwind reach (km)	Dead	Incapacitated
<i>B. anthracis</i>	>20	95 000	125 000
<i>F. tularensis</i>	>20	30 000	125 000
<i>R. prowazekii</i>	5	19 000	85 000
TBE virus	1	9500	35 000
<i>Brucella</i> spp	10	500	125 000
<i>C. burnetii</i>	>20	150	125 000
RVF virus	1	400	35 000

Theoretical number of deaths and people incapacitated by release of 50 kg of biological agent along a 2 km line upwind of a population of 500 000 as calculated by a WHO expert group.¹⁰ TBE, tick-borne encephalitis; RVF, Rift Valley fever.

reactions from local and state health departments, CDC and the FBI. Businesses were temporarily closed, and many people were decontaminated and given antibiotic prophylaxis before the use of anthrax was excluded.¹¹

In the US, the threat of bioterrorism is taken extremely seriously, with the CDC, US Department of Health and Human Services, state and local health departments, federal agencies and non-governmental organizations working together to address bioterrorism and develop response plans. In Europe, bioterrorism has received much less attention. In this article we consider whether the threat from bioterrorism is real and how affected patients might present to the hospital physician.

Development of biological weapons

Following World War I, several countries began programmes to develop biological weapons including Belgium, Britain, Canada, France, Holland, Italy, Poland and the Soviet Union.⁴ However the most infamous biological weapons programme was probably that begun by Japan in 1932 in occupied Manchuria. Over a 13-year period, Chinese, Manchurian, American, British, Australian and Soviet prisoners were infected with *Bacillus anthracis*, *Neisseria meningitidis*, *Shigella* spp., *Vibrio cholerae* and *Yersinia pestis*. It is estimated that 3000 prisoners died at Ping Fan, the biological weapons development centre.⁴ Biological weapons were used in attacks on at least eleven Chinese cities, with widespread spraying from aircraft and release of millions of plague-infected fleas. The indiscriminate nature of these weapons is shown by an attack on Changteh, where the Japanese caused an estimated 10 000 casualties and 1700 deaths among their own troops.⁴

The US began an offensive biological weapons programme in 1942, based at Camp Detrick (later Fort Detrick). This programme continued until 1969, when President Nixon announced that all biological weapons production should stop and all existing stocks be destroyed. The US had developed a substantial biological arsenal of weaponized agents including *Bacillus anthracis*, botulinum toxin, *Francisella tularensis*, *Brucella suis*, *Coxiella burnetii*, staphylococcal enterotoxin B and Venezuelan equine encephalitis virus.^{4,12} Several anti-crop agents were stockpiled but not weaponized.⁴

During the Cold War, the US alleged that Soviet forces used T2 mycotoxins (Yellow Rain) in Laos, former Kampuchea, and Afghanistan.⁴ These accusations have proved difficult to confirm or refute. However, it is known that the former Soviet Union developed biological weapons for many years after signing the 1972 biological weapons convention prohibiting such activity.¹³ In 1979, an epidemic of anthrax occurred in Sverdlovsk, Russia, and US agencies attributed this to inhalation of spores released from a military microbiology facility. Although this was denied by the Soviet Government, an independent epidemiological study found that the most likely cause was accidental release of spores from the military facility, and this was eventually admitted by President Yeltsin in 1992.¹⁴ During the 1970s and 1980s, the Soviet Union allegedly operated at least six biological weapons research labs and five production facilities, and employed up to 55 000 scientists and technicians.⁴ One of these facilities located in Koltsovo, Novosibirsk employed 4000 people and stored smallpox, Ebola, Marburg and other haemorrhagic fever viruses.¹³ Ken Alibek, former deputy chief of the Russian bioweapons programme, has admitted that smallpox virus was weaponized into intercontinental ballistic missiles and bombs.¹⁵ A visit to the Novosibirsk site in 1997 found that the facility was half empty and poorly guarded, and the majority of scientists had left.¹³ It is possible that these scientists are now using their knowledge and skills to develop biological weapons programmes for other countries or for terrorist organisations, and they may have taken stocks of smallpox virus with them.

Between 1985 and 1991, Iraq developed a substantial biological weapons programme, including four aerial dispensers and 200 bombs and 25 ballistic missiles armed with biological agents.^{16,17} Although these weapons were not used during the Persian Gulf War, it has been alleged that they were used during the Iran-Iraq war, and traces of anthrax and mycotoxins were found in Iranian casualties.^{17,18} The United Nations Special Commission (UNSCOM) inspectors only discovered

the true extent of Iraq's biological weapons programme in 1995, following the defection of General Hussein al-Kamal, Saddam Hussein's brother-in-law. Iraq has declared to UNSCOM that it had stored 8400 l of anthrax (with a spore/cell count of 10^9 /ml), 19 000 l of botulinum toxin (strength unknown), 3400 l of *Clostridium perfringens* spores, 2200 l of aflatoxin and 10 l of ricin. Of this, 6000 l of anthrax (50 bombs and five missiles), 12 000 litres of botulinum toxin (100 bombs, 16 missiles) and an unknown quantity of aflatoxin (seven bombs, four missiles) were weaponized.¹⁶ Aflatoxin is carcinogenic and has no obvious use in biological warfare, suggesting the Iraqis may have produced it to use on civilian targets to create panic. More alarming is the suggestion that Iraq declared the aflatoxin to cover up some other, more dangerous, biological agent.¹⁷ Iraq claims to have destroyed these weapons unilaterally, but this has proved impossible for UNSCOM inspectors to verify.¹⁷

Aum Shinrikyo, the 40 000-member cult that caused the sarin gas attack on the Tokyo subway system in 1995, is also believed to have a substantial biological weapons programme. Between 1990 and 1995, the cult unsuccessfully tried to aerosolize anthrax and botulinum toxin throughout Tokyo on eight occasions.¹⁵ The cult sent an expedition to Zaire to acquire Ebola virus samples, and has also acquired a helicopter and two radio-controlled drones for disseminating biological and chemical agents.⁹ The cult is still legal despite the imprisonment of its leader.

Methods for producing biological weapons are now available on the internet, and the technology involved is not beyond the resources of highly determined terrorist groups. UNSCOM's work in Iraq has revealed how difficult it is to detect biological weapons production facilities, as most equipment is of dual-purpose design. The explosion of a conventional weapon is immediately apparent, but release of biological agents can be silent and pass undetected until victims begin presenting to medical services, perhaps several days after exposure. D.A. Henderson, former director of WHO's global smallpox eradication campaign, describes the scenario where a lightbulb filled with smallpox virus is released in a Washington subway, perhaps infecting as few as 100 people.¹³ The event would pass unnoticed, and it would be several days before patients became unwell and presented to physicians. By this time many other people would be secondarily infected, and a full-scale epidemic could occur.

The majority of physicians practising today have never seen a case of smallpox, pneumonic plague, typhoidal tularaemia, pulmonary anthrax nor many other diseases that could result from a bioterrorist

attack. Diagnostic microbiology laboratories may also have difficulties in correctly identifying the organism. Delays in diagnosis would be likely and for some biological agents this could result in hospital transmission of disease. When a patient with smallpox was admitted to a German hospital in 1970, 19 hospital in-patients developed the disease before the diagnosis was established, and hospital patients and staff had to be quarantined for 4 weeks to control further spread.¹⁹ Therefore medical practitioners need to be aware of the diseases which could be caused by bioterrorism, how to recognize them and how they might present in an atypical fashion.

Although CDC has a long list of restricted biological agents (Table 2),²⁰ relatively few could be

Table 2 CDC list of restricted agents

Type	Agent
Viruses	Crimean-Congo haemorrhagic fever
	Eastern equine encephalitis
	Ebola
	Equine morbillivirus
	Lassa fever
	Marburg
	Rift Valley fever
	South American haemorrhagic fever group
	Tick-borne encephalitis complex
	Variola major
	Venezuelan equine encephalitis
	Viruses causing hantavirus pulmonary syndrome
	Yellow fever
	Rickettsiae
<i>Rickettsia prowazekii</i>	
<i>Rickettsia rickettsii</i>	
Fungi	<i>Coccidioides immitis</i>
Bacteria	<i>Bacillus anthracis</i>
	<i>Brucella</i> spp.
	<i>Burkholderia mallei</i>
	<i>Burkholderia pseudomallei</i>
	<i>Clostridium botulinum</i>
	<i>Francisella tularensis</i>
	<i>Yersinia pestis</i>
Toxins	Abrin
	Aflatoxins
	Botulinum
	<i>Clostridium perfringens</i> epsilon toxin
	Conotoxins
	Diacetoxyscirpenol
	Ricin
	Saxitoxin
	Shigatoxin
	Staphylococcal enterotoxins
	Tetrodotoxin
T-2 mycotoxin	

prepared and distributed on a wide scale. The US Army Research Institute for Infectious Diseases identifies ten conditions which they feel are most suitable for bioterrorism: smallpox, anthrax, botulism, plague, tularaemia, Q fever, viral encephalitides, viral haemorrhagic fevers, brucellosis and staphylococcal enterotoxin B.²¹ The important features of these diseases, when acquired by inhalation, will be discussed.

Agents which could be used as biological weapons

Smallpox

Smallpox is potentially the most dangerous bioterrorist weapon because of its infectivity in aerosol form, case fatality of 30% and high patient-to-patient transmission rate. The world's population has become increasingly susceptible to smallpox because of the discontinuation of vaccination, and probably only 20% of the population are now protected.¹⁵ Clinical features include malaise, fever, rigors, vomiting, headache, backache, delirium and an erythematous rash. Over the following week, the patient develops mucous membrane lesions, which shed virus particles, and a rash which progresses from macules to papules to pustular vesicles. In contrast to varicella, the skin lesions are all present at the same stage of development. Patients are regarded as infectious until all of the scabs separate.²² Many exposed patients may shed virus from the oropharynx without developing the disease and cause further virus transmission.²³

A high degree of awareness is required to diagnose smallpox, because it can easily be confused with varicella, erythema multiforme or allergic dermatitis. Pharyngeal swabs and skin scrapings are required for virus isolation, ELISA and PCR. Samples from any suspected patient must be processed in a biosafety category 4 facility. Clinicians should not be complacent that this disease is extinct, because recognition of a single confirmed case would be an international emergency, and prompt diagnosis and appropriate precautions could save many lives. Strict quarantine, including respiratory isolation, is required for anyone in contact with the patient, as infection can occur even if the patient is 10 m away.¹⁹

There is no known treatment for smallpox, although cidofovir is effective *in vitro* and could be used.²¹ Smallpox vaccine would need to be given to all potentially exposed individuals. The US has only 5–7 million doses of smallpox vaccine stored and there is currently no facility to produce further vaccine. Therefore, if a terrorist group

began a concerted campaign of releasing smallpox virus, it would not be possible to protect the population.

Anthrax

During the Gulf War, the US stockpiled 30 million doses of ciprofloxacin in the zone of operations to protect troops in case of an anthrax attack.⁴ Iraq produced enormous quantities of anthrax, and it is possible that some of this is now in the possession of terrorist groups. Aerosolized anthrax spores would cause the inhalational form of disease (traditionally known as woolsorters' disease). After a 1–5 day incubation period, the patient develops a prodromal illness characterized by fever, malaise, nonproductive cough and chest discomfort. A 2–3 day asymptomatic period may then occur, or the patient may progress directly to fulminant disease with severe dyspnoea, stridor, cyanosis, septic shock, meningitis and death. Once symptoms occur, inhalational anthrax is usually fatal despite antibiotic treatment.

Diagnosis is made by blood culture and ELISA. The patient does not require isolation as person-to-person transmission does not occur. Treatment with intravenous ciprofloxacin and supportive therapy are required. Anyone exposed to an anthrax attack requires prophylaxis with a 4-week course of oral ciprofloxacin or doxycycline.²¹ The US military has stocks of an anthrax vaccine, although there are insufficient data in humans regarding the protective efficacy of the vaccine following inhalational exposure.²¹

Deliberate aerosolized release of anthrax would cause major problems for medical services. The exact location of release may be uncertain, due to the disease incubation period, and identifying those who have potentially been exposed may prove impossible. It is possible to develop sudden onset of illness up to 8 weeks after exposure. Therefore anyone developing non-specific influenza-like symptoms could be suffering from the prodromal illness. An appropriate public health warning would need to be issued and hospitals and general practitioners might then be swamped by an understandably panic-stricken public.

Botulism

Botulinum toxins are the most toxic compound known. They bind to the presynaptic nerve terminal, preventing the release of acetylcholine and blocking neuromuscular transmission. Between 24 h and several days after inhalational exposure to the toxin, symptoms develop including dysarthria, dysphagia, blurred vision, diplopia, ptosis and

photophobia. The disease then progresses to produce a symmetrical, descending, progressive skeletal muscle paralysis with eventual death from respiratory failure. The patient may be found to have postural hypotension, dry mucous membranes, dilated pupils, ocular muscle palsies and absent reflexes. As the disease may progress rapidly, many patients could die before seeking medical attention.

Individual cases may be confused with Guillain-Barre syndrome or myasthenia gravis. Diagnosis is difficult, as in aerosol-infected cases the toxin is not detectable in serum or stool and is only detectable in the nasopharynx for about 24 h after inhalation.²¹ The edrophonium test may be transiently positive in botulism, producing diagnostic confusion with myasthenia. With ventilatory support, mortality is low but the patient may require several weeks or months to recover. Administration of anti-toxin is the recommended treatment.²¹

Plague

Yersinia pestis is generally transmitted by flea vectors from rodents to humans, but can also be spread by respiratory droplets or aerosols, requiring an infectious dose of 100–500 organisms.²⁴ Following a bioterrorist attack, the most likely presentation would be of pneumonic plague. After a 2–3-day incubation period, there is severe malaise, myalgia, high fever, rigors, headache, septicaemia and bronchopneumonia. Disease progresses rapidly and mortality is high. Culture of blood, sputum and lymph node aspirates enables the diagnosis to be established. Serological tests are also available. Early recognition of disease is vital, because pneumonic plague is generally fatal if treatment is not commenced within 24 h of symptom onset. Options for treatment include streptomycin, doxycycline and chloramphenicol.²⁴ The patient should be barrier-nursed until he or she has received 3 days treatment. Following likely aerosol exposure to plague, tetracycline or doxycycline is advisable. Although a vaccine is available, it has limited efficacy following aerosol infection.²⁵

Tularaemia

Francisella tularensis is a zoonosis which can be spread to humans by insect bite, ingestion of contaminated food or water or by inhalation. As few as 10–50 organisms can produce infection via the respiratory route. The typhoidal (septicaemic) form of the disease develops after a 2–10 day incubation period with fever, prostration, chest discomfort, non-productive cough and weight

loss. Without treatment the mortality rate is approximately 35%.²⁶

Diagnosis is difficult because symptoms and signs are non-specific and as *F. tularensis* is not endemic in Britain, tularaemia may not be considered. Culture from blood or sputum can be technically difficult and potentially hazardous to staff. Serological testing is available, but is unlikely to be positive in the early stages of disease. Treatment is with streptomycin or gentamicin. Doxycycline or tetracycline can be used for prophylaxis. Human-to-human transmission is very rare and respiratory isolation is unnecessary.

Q fever

Coxiella burnetii is a zoonotic organism with high infectivity but relatively low virulence. If used as a biological weapon, it would be likely to have low mortality but high acute morbidity.¹⁰ The symptoms of Q fever are diverse, and up to 50% of infections are asymptomatic.²⁷ Patients may present with acute or chronic symptoms including fever, night sweats, headache, malaise, anorexia, weight loss, myalgia, cough, chest pain and skin rash. Neurological symptoms are common.²⁸ Chronic Q fever is an uncommon cause of endocarditis²⁹ but possibly may be more commonly associated with cardiovascular disease.³⁰ Q fever is diagnosed by serological testing and treated with tetracycline or doxycycline.

Viral encephalitides

These include Venezuelan (VEE), Eastern (EEE) and Western (WEE) equine encephalitis viruses. Natural infection is spread from horses to man by mosquito vectors, but these viruses are also infectious via aerosol.²¹ After an incubation period of 2–6 days, patients with VEE develop fever, myalgia, nausea, vomiting, headache and photophobia. Less than 4% of patients develop clinical encephalitis, and among the survivors, complete neurological recovery usually occurs.³¹ EEE and WEE have a 7–14 day incubation period followed by a prodromal illness with fever, malaise, headache, nausea and vomiting. Neurological symptoms then develop, with confusion, ataxia, seizures, paresis and cranial nerve palsies. EEE is the more severe disease: case fatality rates are high and many patients have permanent neurological sequelae.^{32,33} The morbidity and mortality of these infections when acquired by inhalation is uncertain and may be different to naturally acquired infection.

During the early stages of illness, virus can be isolated from the patient's serum. In the encephalitic stages, diagnosis is usually established by

serology. Therapy is supportive, as no specific anti-viral treatment is known to be effective. A vaccine is available for VEE but produces febrile reactions in many recipients. There is currently no vaccine available for WEE or EEE.

Viral haemorrhagic fevers

This diverse group includes the viruses causing Argentine, Bolivian, Brazilian and Venezuelan haemorrhagic fevers, Lassa fever, Rift Valley fever, Congo-Crimean haemorrhagic fever, and Marburg, Ebola and Yellow fevers. The symptoms vary according to viral species but generally include fever, myalgia and petechiae. Microvascular damage can lead to disseminated intravascular coagulation (DIC), shock, severe bruising and mucous membrane haemorrhage. Very low numbers of virions can establish disease following inhalation. Patients must be considered to be highly infectious and nursed in strict isolation. Diagnosis is established by virus isolation or serology. Many of these viruses require level 4 laboratory containment facilities for their isolation.

Ribavirin can be used to treat the South American haemorrhagic fevers, Lassa fever and Congo-Crimean haemorrhagic fever.^{34,35} Antibody therapy can also be used in Argentine and Bolivian haemorrhagic fevers, Lassa fever and Crimean-Congo haemorrhagic fever.²¹ Reducing damage to the fragile capillary bed by careful patient transfer, aggressive treatment of secondary bacterial infections, and treatment of shock and DIC, are essential. Mortality varies between agents.

Brucellosis

Four species are pathogenic to man: *Brucella melitensis* (acquired from goats), *B. suis* (pigs), *B. abortus* (cattle) and *B. canis* (dogs). These bacteria are highly infectious in aerosolized form, requiring only 10–100 organisms to establish infection. The incubation period is extremely variable, from a few days to several months. Symptoms are diverse and depend on the organs involved. Affected patients may have fever, night sweats, malaise, cough, chest pain, joint infections, osteomyelitis, hepatitis, genitourinary infections, anaemia, neutropenia, and thrombocytopenia. Most patients recover without treatment, although a minority will develop endocarditis, which can be fatal.³⁶

Diagnosis is established by serology or prolonged culture (6 weeks) of the organism from blood or bone marrow. Treatment is for 6 weeks with a combination of doxycycline and rifampicin to reduce the risk of relapse. For endocarditis, CNS, bone and joint infections, a more prolonged course

including an aminoglycoside is required. Prophylaxis can be given for three weeks to exposed subjects. There is no vaccine available.

Staphylococcal enterotoxin B

Staphylococcal enterotoxin B (SEB) is a common cause of food poisoning. SEB is extremely toxic by inhalation: 30 ng is sufficient to cause incapacitation and 1.7 µg can kill.²¹ The incubation period is very short, usually <6 h. Identifying the location at which SEB was released would therefore be easier than for other biological agents. SEB is a superantigen and causes the production of large quantities of cytokines. This results in the sudden onset of headache, fever, myalgia, cough, nausea, vomiting, dyspnoea, chest pain and occasionally circulatory collapse.

The diagnosis is difficult to establish. Several cases presenting with sudden-onset illness simultaneously should suggest SEB. Epidemiological and clinical features would distinguish aerosol exposure from food poisoning. Laboratory confirmation is difficult, though SEB toxin may be detected in urine or from nasal swabs.²¹ No specific anti-toxin is available, and treatment is limited to supportive measures.

Other agents

Typhus, tick-borne encephalitis and influenza have also been described as potential biological weapons^{10,15} and many other micro-organisms and their toxins could be used. Although we have focused on aerosol exposure, terrorists could contaminate food or water supplies or develop some other mechanism of dispersal. For many agents, the clinical presentation would depend upon the mechanism of exposure. Recognizing that bioterrorism is the cause of illness could be extremely difficult.

Epidemiological principles for recognizing bioterrorism

Several features of a disease outbreak may suggest that bioterrorism is the cause.¹² A disease occurring in an area where it is not endemic should immediately arouse suspicion. Exotic diseases such as pneumonic plague, smallpox, pulmonary anthrax, typhoidal tularaemia, haemorrhagic fever, typhus, etc. suggest the possibility of deliberate infection. The diagnosis of these diseases depends on an astute clinician considering them when faced with an undiagnosed unusual case. Physicians need to be aware of biological agents that could be used as

terrorist weapons, and the atypical manner in which these diseases might present.

Many diseases caused by bioterrorism present with relatively non-specific features. Rigorous epidemiological assessment is therefore required to discover the cause of the disease. An unusual temporal or geographic pattern may suggest that a disease outbreak is not a natural phenomenon. For example when anthrax occurred near Sverdlovsk, all cases were found to have lived or worked in a 4-km-wide band downwind of the military installation, suggesting that it was the source of the outbreak.¹⁴

Bioterrorism will often resemble a point-source outbreak with all cases clustering around a single time period. This may be untypical of the disease's usual pattern, but for diseases generally caused by a single exposure such as food contamination, it may not be unusual. If the clinical features of disease are untypical, this may suggest an unusual route of infection (e.g. inhalational anthrax). If those with exposure to a particular area have a high incidence of disease or those in a sheltered area (e.g. a building) have a lower exposure, this may suggest an airborne agent.

An unusually high incidence of disease may suggest deliberate infection, particularly if several point-source outbreaks occur simultaneously. With the benefit of hindsight, suspicion should have been aroused that deliberate contamination was the cause of the salmonella outbreak in Oregon, because of the extremely high number of cases, the failure to identify a single source of infection, the strong association with salad bars and the absence of illness occurring among those who ate from the same salad bars at large private functions.⁷

Rigorous epidemiological surveillance of background disease patterns is essential for the detection of most potential bioterrorist agents. For diseases such as smallpox, early recognition of disease and appropriate action could save many lives and avert a potential epidemic. Michael Moodie, president of the Chemical and Biological Arms Control Institute has said that 'The odds (of bioterrorism) are increasing ... we have to walk a fine line between hyping the risk ... and trying to convince people that it is a possibility for which we need to invest resources'.⁹ In Britain, awareness of the threat from bioterrorism is much lower than in the US. It is essential that awareness is raised among medical practitioners and public health departments to minimize the effects of any attack.

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