Dealing with unexpected or unknown emergencies: examples of Australian approaches

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Summary
Emergencies may derive from unknown agents or an unusual incident from a known exotic or endemic disease agent. Veterinary administrations must be able to deal rapidly with these occurrences, to allay public fears, media interpretations, and environmental or political concerns.

The emergency approach to deal with such incidents should be based on well-established disease control principles. In dealing with the unknown, veterinary authorities must take a comprehensive approach to managing the problem. Events such as the bovine spongiform encephalopathy in the United Kingdom and Europe have shown that management becomes much more complex when animal health events also involve human disease. The absence of scientific knowledge creates an environment of speculation, fear and mistrust, which may seriously erode the ability of animal health authorities to respond as they would wish.

An established structure which identifies the roles and responsibilities of key players and clearly states where accountability for handling the situation ultimately rests is essential. In addition, emergency plans which have been tested by training exercises, for example, are critical. Other operators who could be involved in the management of emergencies must also be fully aware of their roles in the event of a problem.

Over recent years, Australia has experienced a number of new diseases which have had to be handled in an environment of uncertainty and in conditions where knowledge was lacking. The authors briefly outline a number of these incidents as case studies and list the key factors involved in dealing with each emergency.

Keywords

Introduction
Veterinary administrations and governments are having to deal increasingly with new and emerging diseases where, at least in the initial stages, the situation is uncertain and the implications for animal and public health, and environmental and trade perspectives are unclear. The uncertainty which arises from these situations is of great concern. Notwithstanding these ‘unknowns’, action must be taken rapidly to manage the problem and allay consumer, producer and community fears.

A generic approach to emergency management is an appropriate way of handling such situations. Such an approach is covered by Murray and McCutcheon in this volume \((21)\). This paper expands on a number of factors that can be taken into account when dealing with emergencies where the aetiology of the disease is unknown or unclear.
In recent years, Australia has experienced a number of new diseases which have had to be handled in an environment in which uncertainty prevails and knowledge is lacking. These diseases include equine morbillivirus, virus-associated mass mortality of pilchards, ostrich fading syndrome, choroid blindness of kangaroos, bat lyssavirus, pig paramyxovirus and Japanese encephalitis (36). A brief summary of these conditions is provided below.

Factors that may influence the management of unusual or unknown disease emergencies

There are a number of factors which should be considered when managing unusual situations. Questions that need to be asked are given below:

- What could the public health implications be?
- From an animal health (including wildlife) perspective, can a search be made of the literature or is there access to literature so that the best possible contemporary advice can be obtained without delay?
- What are the potential risks to other species?
- What environmental issues are relevant: weather patterns, land clearing/levelling, wildlife distribution and migration patterns, urbanisation of farmlands, product and people movements, etc.?
- What livestock and product movements have occurred from the area where the emergency has occurred, to which geographical locations, within Australia and abroad so that recall/notification procedures can be implemented if necessary?
- How best can the media and the authorities of other countries be informed to ensure confidence that a comprehensive and professional approach is being taken to manage the emergency?
- How best can political considerations be handled while giving priority to the management of the problem?

In dealing with the unknown, veterinary authorities must take a comprehensive approach to managing the problem. Figure 1 illustrates some of the factors and inter-relationships which need to be considered and managed. Events such as the occurrence of bovine spongiform encephalopathy in Australia and Europe have shown that if animal health events also involve human disease, management becomes much more complex. The absence of scientific knowledge creates an environment of speculation, fear and mistrust, which may seriously erode the ability of animal health authorities to respond as they would wish.

There will invariably be some delay in reaching a confirmed diagnosis while the diagnostic laboratories urgently screen samples against a variety of comprehensive test technologies. It is during this period that speculative comment and journalism may create significant political and trade pressures. This therefore requires harvesting the knowledge and the co-operation of veterinary experts, farmers, industry leaders and scientific experts through an integrated management team.

While an epidemiological investigation is being conducted, the media, politicians, national and international community must be kept informed to provide the necessary level of public and consumer confidence. These activities will need to be conducted at the local, regional and national levels in a co-ordinated manner.

![Fig. 1](image_url)

Factors influencing the management of unknown emergencies
From an animal health perspective, the approach should focus on rapid response, using the generic principles outlined by Murray and McCutcheon (21).

Principles of handling unknown diseases

A key to the management of any emergency is having an established plan which identifies the roles and responsibilities of the principal players and where accountability for handling the situation ultimately rests. It is critical that such a plan be tested by, for example, training exercises and that other operators who could be involved in the management of emergencies be fully aware of the role they are required to play in the event of a problem.

Working from first principles, the following tasks need to be undertaken urgently during an unknown disease incident:

- containment, control, isolation (quarantine and movement restrictions)
- establishment of exclusion zones around infected premise(s)
- determination of principles of spread by contact
- trace-forward, trace-back in-contact animals (and humans in this case)
- decontamination procedures
- identification of possible carriers.

In addition, it is particularly important that there is an infrastructure in place that enables those with key responsibilities to meet, for example, by teleconference, within a few hours of an unusual situation, so that agreement can be reached between the key stakeholders on the way ahead (Figs 2 and 3). In this regard, the importance of laboratory diagnosis and expertise cannot be underestimated, as well as the need for the support of experienced epidemiologists.

The Consultative Committee on Emergency Animal Diseases (CCEAD) in Australia, is a useful model comprising Chief Veterinary Officers of all sub-national States/Territories and the head of the exotic disease laboratory. For public health emergencies, Chief Medical Officers and other specialists are also involved as required. This 'war cabinet' model provides the vehicle for reaching agreement on the national approach to responding to the emergency and for the management of information to the sectors identified in Figure 1.

However, handling emergencies involves more than just scientific expertise. The involvement of non-scientific participants (e.g. industry, leaders, environmental experts) in communication networks and managing teams is also a critical component which enables the leader of the emergency to cover all issues and be empowered to make decisions.

Photo: courtesy of P.M. Thorner, Office of the Australian Chief Veterinary Officer

Fig. 2
Briefing staff on the application of infected and surveillance zones during the outbreak of Newcastle disease in Western Sydney (Australia) in September 1998
In situations of uncertainty, potential public health considerations are of paramount importance. Accordingly, it is sensible to include on any emergency management response team one or more medical expert(s) to participate as a joint partner(s) in the deliberations. As events unfold, the balance of activities may vary. The Australian experience is that in the case of 'unknowns', it is most useful to involve wildlife experts to assist in surveillance activities and to advise on the habits of a range of wildlife species. Depending on the circumstances, it is usually necessary to introduce other scientific support, such as entomologists and production experts.

Research activities invariably provide support to the response to unknown emergency situations. Indeed, many research workers are keen to investigate unusual disease occurrences given the scientific interest generated by unexpected or unknown diseases. However, as part of the emergency management process, Australia is moving progressively towards building a research and development component into the emergency response process. In effect, this means that a nominated person will work with research agencies to develop research priorities of an immediate- and medium-term nature so that funds can be targeted to the key issue at hand in an orderly fashion.

A critical success factor in the management of unknown emergency situations is access to resources both financial and in kind. It is therefore important that a pre-agreement be reached on the availability of funds, so that this does not impede the early response to an emergency situation. In this regard, resource needs in the early stages to scope the problem and to conduct basic control measures are usually not excessive. However, resources to support longer term research and control measures can be significant and need to be considered carefully after the initial response phase of the emergency has been completed.

Another critical element is effective media management. It is not uncommon for the media to sensationalise issues and there is little that can be done if this is the way the media wish to present an event. What can be done, however, is to provide, in a timely fashion, media statements and to work with the media. Such press statements and interviews should be made in an open and honest manner and, if facts are unclear or unknown, this should not be hidden. What is more important is that the media be informed of actions that are being taken to try to ascertain the cause of the problem and which will become the basis for any emergency management decision. Being effective in responding to the media requires certain qualities and it is strongly suggested that media management training be an integral part of emergency management training. Those with particular skills and competence in this area should receive additional coaching and be allocated the public relations side of the exercise.

Key stakeholders in emergency situations are often directly involved in industry. Their interest and concerns derive from the fact that they can have much to lose in personal and financial terms from problems, particularly of the unknown
variety. However, industry can be a major adjunct to the management of problems because of their deep understanding and knowledge of production systems, movements of stock and other local and national information. Their contributions to support the management of emergencies are therefore of critical importance.

The success of the management of an emergency depends upon the collective activities of a small multidisciplinary team. However, Ministerial and Departmental Chief Executive Officer support is essential if the response is to succeed. This is because any response team must have delegated authority to take actions without having to seek the usual Government approval. It is therefore important that Ministers and/or Heads of Department understand the role they have to play in an emergency response situation, are aware of the plans in place, and have absolute confidence in the team that is handling any emergency.

In summary, there are a number of critical success factors involved in handling emergencies, including those caused by unknown agents. These are effective planning, training, awareness, nomination of management teams, a multidisciplinary approach, effective infrastructure, including laboratory and epidemiological support, adequate resource allocation, effective communication, including media management, and Ministerial and/or Head of Department support with delegation authority to handle problems.

International notifications and responses

The Office International des Epizooties (OIE) does not have a published policy on how countries should notify the Central Bureau of unusual situations. It is not uncommon that the first notifications of potential problems are seen in the international media or on the Internet, e.g. Promed.

Australia tends to provide notification to the OIE and/or Promed on issues of interest. However, it is quite clear that such a process, although transparent, can lead to adverse reactions from importing authorities. Accordingly, Australia does send cables to posts so that ambassadors/counsellors, Veterinary Services can be briefed on the issue and deal with the situation bilaterally on a local basis.

The OIE has a key role to play in this regard by developing reporting arrangements for this kind of situation. However, the simple notification of a situation and distribution of such reports globally is not adequate. This can often have trade implications and have an adverse impact on the reputation of a country unless it is explicitly recognised that the country in question has an excellent, reliable veterinary infrastructure in place, is perfectly competent to handle any problem, and can certify products as being healthy and free from disease.

Australian case studies

Some case studies are summarised below which outline approaches taken in Australia in recent years to the agreement of some new and/or emerging situations. These approaches were based on the model framework used for emergency management in Australia and either implicitly or explicitly took into account the range of factors illustrated in Figure 1.

Responses were developed from first principles in some cases, based around the Australian Veterinary Emergency Plan (AUSVETPLAN) approach (website address: http://www.brs.gov.au/aphb/aha/ausvet.htm).

A summary of the key mitigating factors highlighted previously in Figure 1 is presented for each incident.

Case study 1: equine morbillivirus now known as Hendra virus

The key factors involved in managing the emergency were as follows:
- previously undiscovered virus/emerging viral pathogen
- thoroughbred racing horses/companion animals
- human death and illness
- location in suburban capital city
- intense local, national and international media interest
- direct political involvement and support
- international and domestic trade.

In September 1994 a new virus appeared in a single thoroughbred racing stable in suburban Brisbane, Australia (1, 25, 27, 28). A total of thirteen horses died and a further seven were infected with equine morbillivirus (EMV) but recovered. A fourteenth death occurred in the Cannon Hill spelling paddock on or about 11 September and was included as a case on epidemiological grounds but this animal was not examined either clinically or pathologically. A stablehand and the trainer also became infected and the trainer died (6) (Table I). Clinical signs seen were indicative of hyperacute respiratory disease, similar to African horse sickness. Symptoms included breathing difficulties, high fever and a bloody foam discharge from nose and mouth, as the virus was shown to attack blood vessels, causing pulmonary oedema (15, 38). The trainer and a stablehand suffered from respiratory disease at the same time (5, 22). The stablehand recovered slowly but the trainer died, after intensive hospital treatment.

The previously undiscovered virus was identified rapidly, but the national and international impact was significant (4, 17, 24). Investigation of the incident required an intensive response, due to the human health aspects and public concern (8). A multidisciplinary team, chaired by the Commonwealth Chief Veterinary Officer, worked with Chief Veterinary Officers of all sub-national States/Territories and the Commonwealth Scientific and Industrial Research
Table I
A chronology of the development of cases of equine morbillivirus and associated illness in humans, September 1994

<table>
<thead>
<tr>
<th>Cases</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horses</td>
<td></td>
</tr>
<tr>
<td>Canon Hill (paddock)</td>
<td></td>
</tr>
<tr>
<td>Hendra (stables)</td>
<td></td>
</tr>
<tr>
<td>Hendra (neighbouring property)</td>
<td></td>
</tr>
<tr>
<td>Kenilworth (150 km distant)</td>
<td></td>
</tr>
<tr>
<td>Samford (paddock)</td>
<td></td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
</tr>
<tr>
<td><strong>9</strong></td>
<td>13</td>
</tr>
<tr>
<td><strong>10 horses dead</strong></td>
<td>14</td>
</tr>
<tr>
<td><strong>2 horses moved</strong></td>
<td>15</td>
</tr>
<tr>
<td><strong>2 horses moved</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>1 horse dead</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>1 horse dead</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse recovered</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse recovered</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse dead</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse recovered</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse dead</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse dead</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse recovered</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1 horse recovered</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humans</th>
<th>=</th>
<th>=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stablehand</td>
<td><strong>Becomes ill</strong></td>
<td><strong>Hospitalised</strong></td>
</tr>
<tr>
<td>Trainer</td>
<td><strong>Becomes ill</strong></td>
<td><strong>Slow recovery</strong></td>
</tr>
</tbody>
</table>

Source: Queensland Department of Primary Industries, Australia

Organisation (CSIRO) Australian Animal Health Laboratory (AAHL) and other specialists to discover the cause of the illness.

The Queensland Department of Primary Industries (QDPI) sent samples to the CSIRO AAHL, where tests quickly eliminated the possibility of the major exotic viral diseases of horses, such as African horse sickness and equine influenza. Samples were also sent to the Fairfield Infectious Disease Hospital in Victoria, Australia, and to the Centers for Disease Control (CDC) in Atlanta, Georgia, United States of America (USA).

While exotic disease tests were being conducted, the Queensland State Laboratory investigations effectively ruled out potential bacterial diseases such as anthrax and possible poisons such as paraquat and plant toxins. Within days, scientists at the AAHL isolated a virus from the lungs of two diseased horses (8). Confirmation of this finding came when the QDPI detected a virus in two additional horses which was then shown by the AAHL to be the same virus. Transmission trials confirmed that this virus was the cause of the deaths of the horses.

Work at the AAHL showed that the horse trainer and a stablehand had both been exposed to the virus at a high level. The same virus has also been isolated from lung samples from the horse trainer. Based on these and other associations, the Queensland Health Department now believes that this virus also caused the death of the horse trainer (26).

The virus was characterised as a member of the Paramyxoviridae family using electron microscopy (Fig. 4). Sequencing of virus segments and comparing them with known viruses has shown that the virus is a morbillivirus only distantly related to the other morbilliviruses which include measles, rinderpest and canine distemper viruses (23).

With the cause known, tests were developed at the AAHL for screening and surveillance. Over 2,500 horse samples and 150 human samples were tested (Fig. 5).

Media management and the provision of information were very important aspects, due to both humans and horses being infected. The management of the emergency in a residential area of a capital city compounded public interest and fears. The QDPI produced comprehensive information sheets using a question/answer format. These were placed in mail boxes in all houses in the area and mailed to every registered veterinarian in the State.

Given the possibility of an exotic disease, the Queensland State Government announced, on 23 September 1994, the cancellation of horse racing and imposed a general stand-still on horse, donkey and mule transport in a wide area of south-east Queensland. Quarantine was imposed on stables at Hendra in Brisbane, the old Cannon Hill saleyards and a property at Kenilworth. In the absence of evidence of continuing transmission, the quarantine area was later reduced to a 5-km radius around the infected premises. The speed of scientific investigation and diagnosis prevented major national disruption to the 1994 Melbourne Spring Carnival and the Melbourne Cup. The rapidity of response also prevented major disruption to other industries and export markets.
Complete virus
Nucleocapsid

Photo: courtesy of the Australian Animal Health Laboratory of the Commonwealth Scientific and Industrial Research Organisation

Fig. 4
Electron microscopic photo of the Hendra virus

Sampling a stallion for serological testing: equine morbillivirus response in Hendra, Queensland, Australia, 1994

Photo: courtesy of the Queensland Department of Primary Industries
The immediate aspects of the disease which required resolution included the following:
- transmission of the morbillivirus
- the characteristics of the virus, means of spread and multiplication within live animals, and
- the origin of the virus.

In October 1995, EMV was associated with a second death when a farmer from Mackay in north Queensland died in Brisbane (33). The man, who gave positive results for EMV, is believed to have contracted the virus while helping his wife, a veterinarian, with autopsies on two horses at their thoroughbred stud in August 1994. Subsequent tests at the AAHL in Geelong on tissue from the dead horses revealed the presence of EMV.

No link was found between the 1994 Hendra (Brisbane) outbreak and the death of the Mackay farmer (14, 30). Since 23 October 1995, the Queensland veterinary authorities have sampled over 3,300 animals from 300 populations on horse premises, race meetings, horse events and mixed enterprise farms. This total includes 2,792 horses and the remainder consists of other domestic species and wildlife which have been sampled (37).

The results shown in Table II were recorded using the AAHL serum neutralisation test.

### Table II

**Hendra virus testing, using the Australian Animal Health Laboratory serum neutralisation test**

<table>
<thead>
<tr>
<th>Reason for sampling</th>
<th>Number of samples collected</th>
<th>Number of negative samples</th>
<th>Number of positive samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mackay property investigation/other</td>
<td>980</td>
<td>912</td>
<td>0</td>
</tr>
<tr>
<td>Survey*</td>
<td>2,168</td>
<td>2,066</td>
<td>0</td>
</tr>
<tr>
<td>Trace-back (horses)</td>
<td>136</td>
<td>136</td>
<td>0</td>
</tr>
<tr>
<td>Trace-forward (horses)</td>
<td>124</td>
<td>124</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,388</strong></td>
<td><strong>3,238</strong></td>
<td><strong>0</strong></td>
</tr>
</tbody>
</table>

* Targeted survey of properties in the local Mackay area and random survey of 100 farms throughout Queensland.

Sampling of more than 300 species of domestic animals and wildlife was undertaken in an attempt to trace the source of the virus. All test results were negative, except for some cases of positive serology for EMV in Megachirottera fruit bats known in Australia as 'flying foxes' (13, 14, 32, 40).

The virus appears to require close contact, such as touching infected horse saliva or nasal secretions, for transmission. In 1996, following a review of the security procedures of the AAHL, the EMV was reclassified as requiring level-4 security, that is, the highest level of security procedures. All people working with the virus, whether in the laboratory or with live animals, are required to wear a 'space suit' with an individual air supply, or to work with the virus contained in an enclosed cabinet known as a flexible film isolator.

The speed of diagnosis also assisted in the protection of other industries. The quality of the scientific investigation has been recognised internationally. The Cannon Hill area includes an export meat works. An unidentified 'killer disease of horses and people' could have damaged export meat markets. Fast and effective communication through official, high-level sources also reduced the potential for misinformation within Australia.

**Case study 2: pilchard herpesvirus**

The key factors involved in managing the emergency were as follows:
- unknown single aetiology, virus implicated but not isolated
- very visible mass mortality
- public health issue
- environmental issue
- intense local, national and international media interest
- political pressure and support
- commercial aquaculture production and quarantine import policy.

The first reports of observed pilchard *Sardinops sagax* (*neopilchardus*) deaths occurred 1,000 km and 24 hours apart (first reported on 22 and 23 March 1995). The trawler Comet reported observing dead pilchards on 22 March throughout the area of the eastern and central Great Australian Bight on the inside of the continental shelf in the area 33°30S, 133°E to 33°15S, 127°38E. Lobster fishermen reported dead pilchards south of Kangaroo Island on 23 March.

The overall rate of movement varied but was estimated at 28 nautical miles per day east of the original sightings and 17 nautical miles per day to the west. In total, mortalities spread over approximately 6,000 km in about 70 days. This front then spread northwards up the east and west coastlines of Australia, with reports off Geraldton (Western Australia), Noosa (Queensland) by early June and the east coast of Tasmania. Mortalities were also reported off the east coast of the North Island of New Zealand.

Only adult pilchards were affected by the episodes. Preliminary estimates made in Western Australia were that only 8% to 30% of the population died. Schools of apparently healthy adult pilchards were then reported in previously affected areas. As far as is known, no other aquatic species or predators have suffered related mortalities. The pilchard mortality was a single event in each area. Western Australian Fisheries personnel observed the front and were able to accurately predict its time of arrival at a given point in south-west Australia.
The proportion of the population affected by the episode was unknown. Off the central southern coast in South Australia extensive searching by pilchard fishermen found no adult pilchards in the ten days following the deaths in that region. Some adult pilchards were found in the area by about 20 May (forty days after the episode). Fishing subsequently returned to almost normal, although catches were reduced.

Even though pilchards of all year classes intermix freely, only adults of about 12 cm or larger were affected. Eggs and larvae of pilchards are largely confined to the continental shelf region, with the majority usually found within the inner half of the shelf. In some locations, the juveniles were found at inshore locations, particularly embayments and sometimes estuaries. However, in other locations (e.g. Western Australia), extensive studies in these inshore locations failed to locate any juvenile pilchards, with the only sightings having been in offshore areas, often from stomach contents of birds (e.g. penguins) or tuna.

Pilchards caught by fisheries are usually at least two years old (approximately 12 cm in length) with a maximum age of nine years. Adult and juvenile pilchards are planktiverous, both eat zooplankton but only the adults are capable of retaining phytoplankton due to the growth and change in morphology of their gill rakers with age.

Samples of affected fish were consistently adult pilchards between 12 and 18 cm in length (judged to be two and three year classes). The fish were reported to be in good condition and at various stages of the reproductive cycle. Clinical signs of 'propellering' (i.e. spinning near the surface) were reported with live, clinically affected fish showing brown gills (16, 39).

There is little scientific information available on the pathogens of pilchards in other countries. Herpesviruses have not been reported previously in pilchards. However, herpesviruses are commonly found in other marine species, including finfish and crustaceans. Herpesviruses are generally host-specific, usually remaining within a single genus, and sometimes are even more specific, staying within a single species. The Pilchard Mortality Task Force was assembled on 10 May 1995 under the aegis of the CCEAD in response to reports that mortalities had occurred over an increasingly wide geographic area. Membership included representatives from Commonwealth and State bodies, the National Fishing Industry Council and CSIRO, involving Chief Veterinary Officers, fish biologists, oceanography researchers, epidemiologists and laboratory specialists.

Public health
The major health concern arose from any biotoxins related to phytoplankton blooms. Extensive testing showed no evidence that a toxin was responsible for the mortalities or that there were any health impacts for animals eating pilchards. Tests on pilchards, mussels and scallops for amnesiac shellfish poisoning, neurotoxic shellfish poisoning and paralytic shellfish poisoning using high-performance liquid chromatography and mouse bioassay proved negative. There were no lesions in organs of seagulls which ate large quantities of dead pilchards and no reports of significant losses among predators or scavengers. Tests performed on pilchards, mussels and scallops were all negative.

There was no report of illness amongst the public. Rats fed with 'kill' pilchards over a three-week period remained unaffected. There was no evidence of any link between pilchard mortalities and health risks to humans or to other animals.

A voluntary closure on pilchard fisheries was implemented in both Western Australia and Victoria for a short period as a quarantine measure. The Queensland regulatory authorities seriously considered imposing quarantine on pilchards from the southern States but concluded that such quarantine was unenforceable and had no basis for either human or animal health reasons.

Case study 3: ostrich fading syndrome
The key factors involved in managing the emergency were as follows:
- unknown aetiology
- political pressure and support regarding quarantine import policy and a valuable consignment still under import quarantine control
- environmental issues
- local, national and media interest as several jurisdictions were involved
- trade.

During 1995, deaths occurred in young ostrich chicks farmed in several Australian States. The term 'ostrich fading syndrome' (OFS) was adopted for a condition that affected some young ostrich chicks in New South Wales, Victoria, Queensland and Western Australia during the hatching season. The syndrome was characterised by a progressive weakness and failure to thrive among the affected chicks, usually leading to death several days or weeks later. The problem ceased after a short time.

A national investigation was conducted to determine if there was a link with recently imported ostriches and the possibility of an exotic disease being involved (18). The situation was confounded by a consignment of some AUS$18 million worth of ostriches which was present at the time on the Australia off-shore quarantine station on Cocos Island. These ostriches were due for release at the same time as this problem was detected in Australian chicks.

The most common lesion seen was enteritis of the upper small intestine causing separation of the enterocyte layer with
subsequent villous abnormalities. An infiltrate of plasma cells was common in observed cases and some chicks had amyloid-like material deposited under the basement membrane. Haemosiderin-laden macrophages were present in the lamina propria in subacute lesions. Bone marrow was usually hypoplastic to some degree although the lesion varied from mild to severe.

Other lesions were characteristic of secondary infections. Bacterial enteritis causing tissue necrosis was often seen in the lower bowel. Focal hepatic necrosis, pneumonia and peritonitis were present in some cases.

The investigation team also found that it was highly unlikely that contact with ostrich chicks imported in January 1995 from the Cocos Island Quarantine Station was responsible for introducing the syndrome to Australia. The syndrome had been seen among young Australian ostrich chicks well before the release of the consignment in late January.

Representatives from the Australian Ostrich Association (AOA) participated in the investigation team. The AOA conducted a survey of its members and received nearly 400 replies supplying valuable information on the industry. The survey revealed that owners of purely Australian-hatched chicks had seen signs that could be linked to the fading syndrome. The study shows that mortalities tend to peak late in the hatching season (February and March).

Reports from abroad show that similar syndromes are present in most other countries where ostriches are raised (35). Ostrich chicks appear to be particularly susceptible to a range of physical and behavioural stresses and one of their reactions is to stop eating and lose condition. They then succumb to a range of secondary infections.

Despite intensive investigations at the AAHL and at several State veterinary laboratories, scientists could find no infectious cause for the syndrome. Although specialists have not totally discounted the possibility of an infectious agent, they have confirmed that none of the major exotic diseases of poultry, including virulent Newcastle disease, was involved. The team believes that there are other factors contributing to OFS. These include stress, such as extreme or changing weather, being transported at a young age, or being mixed with other chicks. Nutritional and other husbandry factors may have also been involved in some of the cases.

The syndrome was present in at least seven flocks before the consignment of chicks was imported from Cocos Island in January and was also seen in at least six flocks where there was no contact with imported chicks. Therefore, the imported chicks were not responsible for introducing a new disease syndrome to Australia.

Case study 4: kangaroo blindness

The key factors involved in managing the emergency were as follows:

- unknown aetiology
- public sympathy and local, national and international media interest
- political interest
- environmental issues
- multiple jurisdictions
- public health issues regarding the consumption of kangaroo meat
- international and domestic trade.

In 1994, an outbreak of blindness in kangaroos occurred in western New South Wales, South Australia (9) and north-western Victoria. The disease continued during 1995 but abated in 1996. Animals affected were mostly western grey kangaroos (Macropus giganteus) but small numbers of eastern grey kangaroos (M. giganteus), red kangaroo (M. rufus) and a few wallaroos (M. robustus) were also affected (19).

There is documented evidence that kangaroo blindness has been recognised for many years and severe clinical cases, such as those reported recently, may be precipitated by stress, such as droughts. There is no evidence that other animals or humans are affected.

Field investigations were conducted and appropriate specimens forwarded to various state veterinary pathology laboratories and to the AAHL at Geelong. The lesions seen in kangaroos are characteristic of a localised virus infection of the retina, optic tracts and the central nervous system. Laboratories have consistently isolated two viruses in the eye tissues of affected kangaroos.

Further isolation of viruses showed they were orbiviruses of the Wallal and Warrego serotypes. Transmission tests were performed on susceptible kangaroos and the disease was reproduced in animals infected with the Wallal serotype while the Warrego serotype was shown to be a fortuitous invader.

All known orbiviruses are insect-borne. The Wallal serotype was detected in two species of Culicoides (C. dycii and C. austropalpalis) gathered in New South Wales during the peak of this epidemic. No transmission tests using insects have been performed but healthy in-contact animals housed with infected animals were not affected.

Due to public concern at seeing television pictures of distressed, blind kangaroos bumping into objects in their environment, media management was an important aspect in the response to this event. Wildlife authorities and research scientists took the lead for media comment, as environmental and wildlife agencies, not agriculture administrations, have legislative responsibility for kangaroos.
Besides the use of veterinary laboratories and pathologists in diagnosing the causative agent, Chief Veterinary Officers and the Australian Quarantine and Inspection Service (AQIS) were involved from a public health perspective in respect to kangaroo meat. There are a number of factors which suggest that chorioid-retinitis of kangaroos is not a condition of concern in relation to kangaroo game meat. All lesions in the blindness syndrome are confined to the head which is discarded and not used for human consumption. Furthermore, diseases associated with the orbivirus group require insect transmission and there is no evidence in the literature to implicate ingestion as a means of establishing infection by members of this virus group.

Despite substantial arboviral surveys in Australia to further understand the epidemiology of conditions such as Murray Valley encephalitis, there is no medical evidence to date to suggest that the Wallal serotype has zoonotic potential.

A Council comprised of the Australian Federal, State and Territory and New Zealand Ministers of Agriculture has produced a standard code entitled Game Meat for Human Consumption (3). This code deals with the production, handling, processing and transportation of game meat for human consumption and for products derived from game meat.

Kangaroo meat exported to Germany and other Member States of the European Union continued to be certified by AQIS as conforming with Directive 92/45/EEC which sets strict meat import requirements, including that each carcass processed is inspected by a Government-employed meat inspector who is under the direct supervision of a veterinary officer, to ensure that the meat is fit for human consumption (10). In addition, all Australian kangaroo meat processing plants are examined and certified by European veterinary experts. This ensures that Australian meat exported to Europe is processed to the very high standards demanded by European consumers.

A previously undiscovered lyssavirus was isolated from bats in Australia in May 1996 (12, 34). The virus was detected following an investigation of a sick black Megachiroptera fruit bat, Pteropus alecto (known in Australia as a ‘flying fox’), at Ballina in New South Wales. The New South Wales Wollongbar Regional Veterinary Laboratory and the AAHL in Geelong collaborated to investigate the case. The AAHL isolated and classified the new lyssavirus and sent samples to the CDC in Atlanta (USA) for further serological typing of the virus and vaccination studies.

In November a woman wildlife carer in Queensland developed encephalitis and died after being bitten and scratched by a bat. By the end of December 1996, the Australian bat lyssavirus (ABL), as the virus came to be known, had been isolated from three of the four species of flying foxes (fruit-eating bats) in Australia and one species of insectivorous bat (7, 20).

Response

The AAHL determined that the lyssavirus isolated from bats in Australia is closely related to classical rabies virus (serogroup 1, genotype 1). However, the gene sequence of the N gene Australian bat lyssavirus varies from that of genotype 1 by approximately 8% (11). The CDC advised that human, veterinary and sub-unit rabies vaccines provide cross-protection against Australian bat lyssavirus and that the serum of rabies-vaccinated people neutralises the virus, as does hyperimmune reference sera.

A multi-disciplinary Lyssavirus Expert Group was established to co-ordinate the response to ABL issues. The Group developed protocols for prophylactic vaccination of high-risk categories of people, such as bat carers, veterinary laboratory staff and wildlife officers, and for post-exposure treatment of people bitten or scratched by an infected or suspect infected bat (2). The Group also co-ordinated diagnostic, surveillance and research programmes.

A National Bat Lyssavirus Task Force developed a research plan. The agencies involved include the AAHL, State and Territory veterinary and medical scientists, and others. The Commonwealth Department of Health and Family Services has provided approximately AU$600,000 to the AAHL over two years to fund necessary investigations. The Queensland Government provided additional funds for research in Queensland. Key components of the research plan were epidemiological and surveillance studies to determine the extent of species affected and the geographical range of the virus.

Surveillance for Australian bat lyssavirus

Surveillance of bats for the virus is being undertaken in all States/Territories of Australia. Surveillance is being focused on bats showing illness, although healthy bats are also being sampled. Retrospective investigation of stored bat tissues are being undertaken in an attempt to determine the time the...
virus has been present. Opportunities to undertake studies on bats in neighbouring countries are being explored. Under the Northern Australian Quarantine Strategy some samples have been collected in Papua New Guinea.

Following a meeting of the Consultative Committee on Emergency Animal Diseases held in January 1997, the need for national consolidation of surveillance data on bat lyssavirus was recognised and the Australian National Animal Health Information System was asked to establish a system for collating, storing and reporting this data.

Results of surveillance
Figure 6 shows sampling by region, and Figure 7, the location of lyssavirus-positive bats. The known distribution of the virus in fruit bats extends from Darwin and Townsville in the north and along the east coast as far as Melbourne. Inland, the virus has been found at Narramine, north-west of Sydney, and near Mount Isa in western Queensland (Fig. 7). All reports of the yellow-bellied sheath-tailed bat (Saccolaimus flaviventris) have been from south-east of Queensland. The earliest positive case found has been in archival material from a black flying fox (P. alecto) collected in Townsville in January 1995.

Continued surveillance for Australian bat lyssavirus is important because health authorities need to have some idea of the prevalence of the agent in the bat population in order to develop and maintain recommendations for treatment and vaccination of people exposed to bats. Further information is also required on the probability of isolating virus from both 'sick' and 'healthy' bats.

Case study 6: pig paramyxovirus
The key factors involved in managing the emergency were as follows:

- unknown aetiology, previously undescribed virus isolated
- public health issue
- animal welfare issue
- environmental issue
- local, national and media interest
- trade.

A single piggery in New South Wales experienced significant piglet mortality over a four-month period from mid-April in 1997 (Fig. 8).

The episode was characterised by a significant reduction in farrowing rate, associated with the birth of stillborn and mummified piglets, some with abnormalities of the brain, spinal cord and skeleton. The disease spread sequentially from one unit to others, eventually affecting up to one third of litters. Sows and gilts of all parities were affected, with individual litters containing a combination of live, stillborn and mummified foetuses. There was no other clinical disease detected in other pigs on the piggery.

Confirmatory testing excluded all known exotic diseases of pigs, such as classical swine fever, porcine reproductive syndrome and Aujeszky's disease. Diseases of public health concern, such as equine morbillivirus and Japanese encephalitis, were also excluded. An isolated virus from clinically affected animals was found to belong to the Paramyxoviridae family (29, 31). Viruses from this family typically survive for only a short time outside the host and are spread by respiratory contact.
The affected piggery and a number of associated remote growing units were placed under quarantine to protect the industry and prevent the spread of the agent. Investigations included determination of whether the virus was widespread in the industry, and what action was considered as being necessary to manage the disease for the future safety of the industry.

Human health authorities worked with animal health administrations to investigate any potential risks to piggery or abattoir workers and to consumers of cooked pork. For reasons of professional prudence, the human health authorities tested blood samples from workers at the piggery and abattoir. There had not been any indication of illness associated with the virus in people. This precautionary approach was to investigate whether there was a remote possibility that an occupational health and safety hazard existed for workers.

The application of quarantine to intensively housed livestock, such as pigs and poultry, raises an important management issue, namely: animal welfare. When holding animals under such husbandry systems with a defined product 'finishing' cycle (e.g. bacon weight, pork weight), available accommodation rapidly becomes a limiting factor. Animals continue to be born into the system, but finished animals are not despatched for slaughter. The affected piggery had been sending approximately 800 finisher pigs and 30 sows to slaughter per week.

The issue of cash flow for operational costs, such as stockfeed, is another consideration which affects the viability of such commercial enterprises. Even if the sale of pigs held back is subsequently allowed, overweight pigs at slaughter are worth substantially less, increasing financial losses. These aspects had to be considered as part of the decision-making of the emergency response. Removal of movement restrictions becomes imperative, while allowing sufficient time for scientific research to be able to provide answers on how to contain, control and eradicate the disease.

Decision-making was facilitated by directly involving the President of the pig industry council in a national management group. This incident management group also included the Chief Executive Officer of the Commonwealth Department of Agriculture, Fisheries and Forestry and the Chief Executive Officer of the affected State of New South Wales. The decision options agreed are listed below and are illustrated in Figure 9.

Fig. 9
Agreed decision options for dealing with the Australian emergency of pig paramyxovirus in 1997
1. Continue full quarantine, with no pig movements off the property

This option was unacceptable after 29 August, due to the rapid escalation that would have occurred in pig stocking rates and associated welfare problems. Even a temporary delay would have resulted in approximately 850 bacon pigs per week, worth about AUS$150 each (i.e. approx. AUS$130,000 in total) being withheld, placing unsustainable pressure on the cash flows of the piggery. Even if the sale of these pigs had been allowed subsequently, overweight pigs are worth substantially less, increasing financial losses.

2. Release all pigs for unconditional slaughter

Implementation of this option would have been a return to the situation prior to 21 August. This decision would have been dependent on the provision of sufficient evidence to satisfy public health officials that the ongoing risk to human health was negligible.

Under this option, further management of quarantine and disease control activities would have been dependent on the nature of the virus, whether it was widespread in the industry, and what action was determined to be necessary to manage the disease for the future safety of the industry.

3. Release all pigs for processing only

Implementation of this option would have been dependent on provision of sufficient evidence to satisfy public health officials that the ongoing health risk to abattoir workers and processed products was negligible.

This option was likely to be associated with significant financial loss to the piggery owner because of the trade restrictions imposed, however the scale of these losses could not be determined at the time of compiling these decision options.

Future management of the disease on the affected piggeries would be as for option 2.

4. Relax quarantine to allow slaughter only of grower pigs over 16 weeks of age, and/or sows

This option would have allowed continued slaughter of grower pigs for about another five to six weeks, while additional information was collected to support the removal of slaughter restrictions on other pigs.

For this option to be acceptable, the public health risk associated with the continuing slaughter of these pigs would have needed to be assessed as negligible, and there would have to have been a realistic chance of obtaining sufficient data to enable relaxation of slaughter restrictions within four to five weeks.

5. Slaughter and disposal of pigs

If the conditions required to satisfy public health concerns and allow the resumption of slaughtering from affected piggeries could not be met, the only alternative would have been to slaughter all pigs at the piggery and dispose of the carcasses by burial. This option would have incurred a substantial financial loss to the piggery owner (estimated at AUS$3 million), in addition to losses already incurred, as well as major financial, logistic and operational difficulties in performing the slaughter of more than 20,000 pigs.

6. Release quarantine immediately

If there was evidence that the virus was already widespread, ongoing quarantine could not have been justified.

In progress or planned investigations

Studies relevant to the public health risks associated with this virus were in progress at the time of consideration of options, or were due to commence shortly (Table III). All studies were conducted at the New South Wales Central Laboratory, except where otherwise indicated.

Decision strategies

Table IV presents those strategies which were based on the studies currently being conducted or planned at the time, and the possible outcomes of these studies within the time constraints outlined above. Consultation with public health officials was necessary to determine what results, if any, would provide sufficient assurance for them to support any of the suggested actions.

By 29 August, results were expected to be available from repeat testing of piggery workers, testing for cross-reactions with human paramyxoviruses, serology on abattoir workers, serology on additional unexposed human sera and possibly some data on viral characterisation.

Based on these results, Table IV was used to list possible outcomes, the criteria for determining each outcome and the recommended action to follow.

If options 3 or 4 had been adopted, further decisions would have been required as a high priority to determine what additional studies were needed to allow further relaxation of the continuing restrictions within an acceptable time-frame (less than 4 weeks for option 4), and to determine whether this was achievable.

If option 5 had been adopted, a detailed operational strategy for slaughter and disposal of the pigs would have been developed as a matter of urgency.
Table III
Summary of studies of the public health risks of pig paramyxovirus in Australia in 1997

<table>
<thead>
<tr>
<th>Study</th>
<th>Likely time to completion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Human serology</strong></td>
<td></td>
</tr>
<tr>
<td>Repeat test of current sera from piggery staff*</td>
<td>Monday 25 August</td>
</tr>
<tr>
<td>Testing pig sera for cross-reaction with human paramyxovirus (Health Department)*</td>
<td>Friday 22 August</td>
</tr>
<tr>
<td>Testing human (piggery workers) sera for cross-reaction with human paramyxovirus (Health Department)*</td>
<td>Friday 22 August</td>
</tr>
<tr>
<td>Re-test of piggery workers in 4 weeks*</td>
<td>5 weeks</td>
</tr>
<tr>
<td>Test abattoir and grower farm workers*</td>
<td>1 week from sample delivery</td>
</tr>
<tr>
<td>Test panel of unexposed human sera (a limited number have already been done)*</td>
<td>1 week from sample delivery</td>
</tr>
<tr>
<td><strong>2. Pig studies</strong></td>
<td></td>
</tr>
<tr>
<td>Virology on unsuckled pigs from affected litters*</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Longitudinal studies on pigs from affected litters (serology and virology)*</td>
<td>4 weeks (preliminary) to 4-6 months</td>
</tr>
<tr>
<td>Virology on sows that have had affected litters</td>
<td>4 weeks from sample collection</td>
</tr>
<tr>
<td>Virology on grower pigs</td>
<td>4 weeks from sample collection</td>
</tr>
<tr>
<td>Repeat breeding of affected sows*</td>
<td>1-2 weeks</td>
</tr>
<tr>
<td><strong>3. Virological studies</strong></td>
<td></td>
</tr>
<tr>
<td>Viral characterisation (AAHL)*</td>
<td>1-2 weeks</td>
</tr>
<tr>
<td>Infectivity for human tissue cultures*</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Transmission trials (AAHL)</td>
<td>6-8 weeks</td>
</tr>
<tr>
<td><strong>4. Epidemiological studies</strong></td>
<td></td>
</tr>
<tr>
<td>Probable source of infection (including the possibility of genetic material, based on trace-back)</td>
<td></td>
</tr>
<tr>
<td>Extent of spread to other species on one infected site</td>
<td></td>
</tr>
<tr>
<td>Extent of spread to other piggeries</td>
<td></td>
</tr>
<tr>
<td>Whether the virus is widespread in the national pig population</td>
<td></td>
</tr>
</tbody>
</table>

* Studies had already commenced

AAHL: Australian Animal Health Laboratory

Investigations continue into the condition, but there appears to be an epidemiological link between the affected piggery and a nearby large colony of fruit bats (flying foxes). In a preliminary study, 42 of 125 serum samples collected from fruit bats in New South Wales and Queensland gave positive results in the virus neutralisation test, with titres of 16 to 256.

Table IV
Outcomes and actions based on studies conducted on the public health risks of pig paramyxovirus

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Criteria</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No evidence of human infection</td>
<td>All human sera negative</td>
<td>Option 2</td>
</tr>
<tr>
<td>Evidence of limited human infection</td>
<td>Evidence of cross-reactions with known human paramyxoviruses or in unexposed sera</td>
<td>Option 2, 3 or 4</td>
</tr>
<tr>
<td>Evidence of more widespread human infection but no further pig infection</td>
<td>Single piggery worker remains sero-positive following substantial challenge</td>
<td>Option 2, 3, 4 or 5</td>
</tr>
<tr>
<td>Evidence of more widespread human infection but no further pig infection</td>
<td>No other sero-positives, and No evidence of cross-reactions</td>
<td></td>
</tr>
<tr>
<td>Known virus identified</td>
<td>Additional piggery or abattoir workers sero-positive in absence of known heavy challenge</td>
<td>Option 2, 3, 4 or 5</td>
</tr>
<tr>
<td>Known virus identified</td>
<td>No evidence of cross-reactions</td>
<td></td>
</tr>
<tr>
<td>Virus unknown</td>
<td>PCR and other tests at AAHL identify specific virus</td>
<td></td>
</tr>
<tr>
<td>Virus is endemic in the national pig herd</td>
<td>AAHL unable to identify or characterise the isolate as any previously known virus</td>
<td></td>
</tr>
<tr>
<td>Virus has not been contained</td>
<td>Serological evidence of widespread infection in piggeries not connected with one infected site</td>
<td></td>
</tr>
<tr>
<td>Virus has not been contained</td>
<td>Serological evidence of spread to other piggeries through movement of pigs, people and/or fomites</td>
<td></td>
</tr>
</tbody>
</table>

PCR: polymerase chain reaction
AAHL: Australian Animal Health Laboratory
Positive samples were recorded, as follows:
- 26 of 79 grey-headed fruit bats (P. poliocephalus)
- 11 of 20 black fruit bats (P. alecto)
- 4 of 10 spectacled fruit bats (P. conspicillatus)
- 0 of 15 little red fruit bats (P. scapulatus)
- one unidentified species.

This panel included positive samples collected in 1996 before the pigs were infected, as well as positive samples collected in November 1997 from a colony of grey-headed fruit bats 33 km from the piggery, supporting the hypothesis that fruit bats were the primary source of the virus.

Other sampled species in the vicinity of the affected piggery included rodents, birds, cattle, sheep, cats, and a dog, all of which gave negative results to serological tests.

**Case study 7: Japanese encephalitis**

The key factors involved in managing the emergency were as follows:
- public health being a major issue due to human deaths
- disease never reported within Australian territories before
- local and national media interest
- jurisdictional issue involving human health, animal health and environmental agencies
- trade.

In 1995 Japanese encephalitis (JE) was confirmed in a fatal outbreak of encephalitis in humans on Badu Island. Figure 10 shows the location of Badu Island which is an Australian-controlled territory in the Torres Strait between Papua New Guinea and the northernmost peninsula of mainland Australia.

Subsequently, sero-epidemiological surveys of domestic pigs were conducted by the Northern Australian Quarantine Strategy (NAQS), with support from the QDPI and the Queensland Department of Health (QHealth). These surveys included all the islands of the Torres Strait and the northern peninsula area of Cape York Peninsula. Seropositive pigs were detected on nine of the most northerly Torres Strait islands. Some horses and dogs were also found to have seroconverted.

As a result, NAQS, QDPI and QHealth set up a network of sentinel herds in the Torres Strait and the northern peninsula area (NPA), the aim being to detect any incursion from the Western Province of Papua New Guinea where the disease was believed to have recently established. Sentinel pigs were established on Badu, Saibai and Damley Islands in 1996. The sentinel program was supplemented by survey visits by NAQS staff to the other islands where pigs, horses and poultry were also tested. In March 1996, 12/13 sentinel pigs on Saibai Island had seroconverted. No other sentinel pigs or animals bled during surveys in 1996 seroconverted. As the majority of the inhabitants of the northern Torres Strait had been vaccinated by QHealth in 1995 in response to the outbreak, only the seroconversion of sentinel animals could provide indications of JE activity in the area.

Following a review of the animal programme in late 1996, a sentinel cattle herd was established at Bamaga, although the sensitivity of cattle as sentinels for JE has not yet been established. The sentinel animal herd operations were complemented by a series of surveys covering the Torres Strait, NPA and Cape York Peninsula. Samples of sera from wild migratory waterbirds, collected by cannon netting, were also tested for JE and other avian diseases.

Samples obtained from the sentinel herds and surveys were serologically tested by QHealth. Duplicate samples were tested for other exotic animal pathogens by the AAHL. Results were distributed to all participating and interested agencies, and feedback was provided to the local inhabitants.

Results from the 1996-1997 NAQS programme demonstrated seroconversion of sentinel pigs on Saibai Island alone. These pigs seroconverted in March 1997, showing that infection of the north-western islands was a repetitive event probably linked to the seasonal changes at that time of year.

A NAQS general animal survey of the Papua New Guinea/Irian Jaya border region was conducted in mid-1997. Serological results indicated widespread exposure of domestic and feral pigs to JE, particularly in the Western Province of Papua New Guinea. QHealth and the University of Queensland conducted human serosurveys, mosquito trapping and virus isolation studies in the area. Their results also indicated that an epizootic of JE was occurring in southern Papua New Guinea.

Following consultation with all participating agencies, and in view of the potential reservoir of JE present in Papua New Guinea, the NAQS surveillance effort was increased in 1997-1998 with the aim of providing early warning of JE incursion into Torres Strait and northern Australia. It is generally acknowledged that the virus tends to cycle in naive pigs before reaching the human population. However, due to the delay in development of protective antibodies in pigs and processing times for the samples, diagnostic results may not give much advanced warning prior to development of clinical disease in unprotected humans. Nevertheless, results from sentinel pigs are invaluable to confirm an incursion and delinate distribution. This information is essential for the planning of response actions by human and animal health authorities.

For 1997-1998, NAQS expanded sentinel pig herds to include Saibai, Boigu, Badu, Moa (S Pauls community), Mabuiag and Yam Islands. Other islands would be covered by six-monthly surveys. However, since the 1995 outbreak on Badu Island, island communities have been steadily reducing
numbers of domestic pigs. This caused some problems, with low numbers of pigs of a suitable age being available for sentinel herds or for bleeding as part of surveys. Yam Island had to be removed from the sentinel herd programme as there were no suitable pigs present, while islands such as Boigu had a total of only four pigs, two of which would soon be too old to sample. In spite of these difficulties, sufficient numbers of pigs were tested in December 1997 and January 1998 and showed no indication of JE activity at that time.

Incursion of Japanese encephalitis
The first indication of an incursion of JE into the Torres Strait was the nearly simultaneous seroconversion of sentinel pigs on Badu and Moa Islands and the diagnosis of a clinical case in an eleven-year-old unvaccinated boy resident on Badu. This was followed by seroconversions of sentinel pigs on Saibai, Mabuiag Islands and at Seisia on the Australian mainland.

The consensus of opinion in the participating agencies is that this incursion was probably due to windblown infected mosquitoes from Papua New Guinea. Contributing factors include the drought in Papua New Guinea, which allowed very large numbers of mosquitoes to breed in the resulting stagnant water, and strong north-westerly winds capable of transporting these mosquitoes to the Torres Strait and Cape York. The evidence from the NAQS sentinel herds suggested that a major incursion was occurring. NAQS personnel immediately initiated a response aimed at determining the extent and rate of spread. Surveys were conducted and all pigs in island and regional mainland communities which did not contain sentinel animals were sampled. Pigs seroconverted on all Torres Strait islands where they were present, except for Warraber and Kodall Islands. Pigs on Hammond Island had also seroconverted, in addition to those on nearby Thursday Island.

As only residents on the northern islands had previously been vaccinated, the results from the NAQS surveillance resulted in prompt action from QHealth to extend human sero-surveillance and response actions beyond Badu Island to other communities.

Fig. 10
The location of Badu Island, showing quarantine and protected zones during the episode of Japanese encephalitis in 1995
Japanese encephalitis on the Australian mainland
Within weeks of the initial human clinical case and seroconversion of pigs in the Torres Strait, a second human case was diagnosed on 23 March 1998 (a fisherman in the Mitchell River region of western Cape York). This was the first recorded incursion of JE onto the Australian mainland.

Following discussions with QHealth and QDPI, NAQS undertook surveillance of areas along the west coast of Cape York and the Gulf of Carpentaria. This response centred on the rapid collection of sera from domestic and feral pigs in the Pormpuraaw and Kowanyama area to confirm the presence of JE and to discover the extent of spread. Concurrently, QHealth conducted a serosurvey of human residents in this area. Other NAQS staff conducted cannon netting operations in the Karumba region to sample waterbirds.

In a joint NAQS/QDPI helicopter and ground-based survey of the Mitchell River area, sera were obtained from 114 feral pigs and 20 domesticated pigs. This was sent to the QHealth laboratory in Brisbane and to the AAHL. Results from the adult feral pigs were complicated by concurrent exposure to endemic flaviviruses, but 6 of 20 domestic pigs showed serological evidence of exposure to JE only. This result, coupled with the isolation of JE virus and polymerase chain reaction (PCR) product from sentinel pigs on Mabuiag Island and at Seisia, confirmed the extent of the incursion.

Human serological testing failed to detect any further unequivocal human cases. However, the potential seriousness of the situation prompted QHealth and Commonwealth Health to hold a conference at Cairns on 8 and 9 July 1995 with all major stakeholders to discuss courses of action.

Future directions
The conference recognised the pivotal role played by the NAQS sentinel animal herds and recommended that these be extended to provide coverage of the entire Cape York Peninsula, Gulf of Carpentaria and the northern areas of the Northern Territory and Western Australia. These recommendations were accepted by AQIS and planning has commenced to extend sentinel activities. Survey activities have also been expanded in the 1998-1999 NAQS operational plans.

Conclusion
The Australian experience illustrates that the events described above have a number of characteristics which need to be taken into account when handling unusual situations. Some of the more important of these characteristics have included:
- a public health impact
- the fact that some conditions have not previously been recorded
- none of the conditions were listed by the OIE
- wildlife could well play a major role in the epidemiology of disease
- there were adverse impacts on trade and/or a significant effort had to be devoted to working with overseas governments to allay concerns.

A major characteristic was the level of consumer concern because of the publicity generated by these unusual situations.

Given the nature and characteristics of the conditions described, a number of lessons can be learned to enhance the ability of veterinary administrations to respond to these unknown situations. In outlining some of the approaches adopted, readers should pay particular reference to the first part of this publication entitled ‘Generic principles’, which deals with a universal approach to emergency management.

Critical success factors include the following:
- the core people who manage emergencies must have a detailed knowledge and understanding of their roles and functions
- ready access to cash, non-cash and expert resources
- the freedom for teams to manage emergency situations without undue external interference.

A multidisciplinary approach is essential as is effective communication with consumers, industry and, as appropriate, overseas governments.

Importing countries should, in their consideration of trade actions, try to make decisions on official information, rather than solely on media statements which are often inaccurate or which grossly exaggerate the situation. In so doing, importing countries should take into account the quality, effectiveness and reputation of the Veterinary Services of the exporting nation. The OIE should consider the development of codes for the guidance of governments on these types of issues.

Acknowledgements
The authors wish to thank the members of the Australian Consultative Committee on Emergency Animal Diseases, the Commonwealth Department of Agriculture, Fisheries and Forestry, the State and Territory Departments of Agriculture/Primary Industries, the Division of Animal Health of the Commonwealth Scientific and Industrial Research Organisation and their dedicated staff for so generously providing the information used in the production of this paper.
Comment faire face à des urgences imprévues ou inconnues : l’expérience de l’Australie

G. Murray & P.M. Thornber

Résumé
Les urgences zoosanitaires peuvent être dues à des agents pathogènes inconnus ou bien à des incidents inhabituels liés à des agents connus, exotiques ou endémiques. Les Services vétérinaires doivent être en mesure de faire face rapidement à ces situations, avant qu’elles n’alarment l’opinion publique et les médias, qu’elles ne deviennent un problème politique ou n’inquiètent les écologistes.
Le traitement de ce type d’urgences doit se fonder sur des principes de lutte bien établis. Face à une situation inconnue, les autorités vétérinaires doivent privilégier une approche globale. Des événements tels que l’encéphalopathie spongiforme bovine au Royaume-Uni et dans le reste de l’Europe ont montré que la gestion devient beaucoup plus complexe lorsqu’un problème zoosanitaire s’accompagne de cas de maladie chez l’homme. L’absence de connaissances scientifiques ne fait que favoriser la spéculaton, la crainte et la défiance, ce qui peut sensiblement gêner les autorités chargées de la santé animale et les empêcher de réagir comme elles le souhaiteraient.
Il est indispensable d’avoir une structure bien établie, qui définisse les rôles et les responsabilités de chacun et indique clairement qui doit rendre compte en dernier ressort. Il est également souhaitable de disposer de programmes d’urgence, testés lors d’exercices de simulation. Si des intervenants extérieurs aux Services sont associés à la gestion des urgences, ils doivent être, eux aussi, parfaitement informés de leur rôle en cas de problème.
Ces dernières années, l’Australie a connu un certain nombre de maladies nouvelles, qui ont dû être traitées dans un climat d’incertitude et de relative ignorance. Les auteurs retracent quelques-uns de ces incidents et décrivent les facteurs qui ont été déterminants dans chacune de ces situations.

Mots-clés

Cómo hacer frente a emergencias imprevistas o desconocidas: la experiencia australiana

G. Murray & P.M. Thomber

Resumen
Una emergencia puede deberse a agentes desconocidos o resultar de un episodio infrecuente causado por un patógeno exótico o endémico. Las autoridades veterinarias deben ser capaces de hacer frente con rapidez a tales incidentes con el fin de disipar cualquier temor de la opinión pública, interpretación de los medios de comunicación o posible preocupación de orden ambiental o político.
Cualquier plan de emergencia orientado a luchar contra tales incidentes debe basarse en principios comprobados de control de enfermedades. Cuando se enfrentan a lo desconocido, las autoridades veterinarias deben adoptar
planteamientos de alcance general para abordar el problema. Fenómenos como el de la encefalopatía espongiforme bovina en el Reino Unido y Europa han puesto de relieve que la gestión se complica sobrenaturalmente cuando a los problemas zootécnicos se añaden efectos sobre la salud humana. La falta de conocimientos científicos da rienda suelta a las especulaciones, el temor y la desconfianza, lo que puede reducir considerablemente el margen de maniobra de las autoridades zootécnicas.

En tales contextos, resulta fundamental la existencia de una estructura sólida capaz de asignar funciones y responsabilidades a los principales ejecutantes implicados y de designar sin ambigüedades al responsable último de hacer frente a la situación. Por otra parte, también es básico disponer de planes de emergencia previamente ensayados y comprobados, por ejemplo mediante simulacros. Es importante asimismo que toda persona susceptible de verse implicada en la gestión de emergencias tenga pleno conocimiento de su cometido por sí la evolución del problema hiciera necesaria su intervención.

En los últimos años, Australia se ha visto expuesta a varias enfermedades nuevas, a las que ha debido hacer frente en una atmósfera de incertidumbre y falta de suficientes conocimientos. A modo de ejemplo, los autores relatan brevemente varios de tales episodios y enumeran los factores que han resultado clave para la gestión de cada una de las emergencias.

**Palabras clave**


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**References**


