



Of bats, bugs and men (feature)

Lessons for Australia: A biosecurity year in review

31 January 2008

Equine 'flu brought biosecurity into focus in 2007. But it wasn't the only issue. Around the world there were a host of issues, new and old.

Avian flu continued its slow march across the globe killing birds and people. England's foot-and-mouth disease outbreak reminded us of the \$10 billion threat foot-and-mouth poses to our livestock and food exports. And at home we dealt with the facial tumour disease of Tasmanian devils, abalone herpes virus, citrus canker and others.

In fact, when you add all these together, 2007 was a big year for biosecurity. And, through the cancellation of race meetings and the impact of equine influenza on the horse industries—from strappers and pony club members, to horse breeders and captains of industry—2007 was a year where biosecurity issues affected the whole community.

Equine 'flu under control

So how did we fare? "It's been a mixed bag really, but probably every major disease response is," says Dr Nigel Perkins, a veterinary epidemiologist who directs the disease surveillance program for the Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease. "We were definitely behind the eight-ball at the time horse 'flu was detected because of the extreme infectiousness of the virus and the level of spread of infection in the days prior to detection." The important thing is that we review everything, so we do better next time."

But, Perkins says, there were some major successes in the war against horse 'flu. "Once the outbreak was discovered, controls on the movement of horses were put in place in a matter of hours. Without a doubt, the rapid response of the departments of primary industry in New South Wales and Queensland ensured the virus did not get into the other states and confined infection to selected regions of affected states, largely those areas where infected horses had been moved to, prior to detection of the outbreak." Subsequent spread of the disease has been successfully confined through a combination of biosecurity measures and vaccination against the virus. Eradication of the outbreak now appears very likely to be successful. "We are now very much at the tail end of the epidemic."

Behind the scenes a new test made things easier. The molecular test for rapid detection of equine influenza was actually developed by CSIRO and the Biosecurity Centre for bird 'flu, but it can also pick up other strains of influenza virus, such as horse 'flu, all within a few hours.

Avian 'flu spreading slowly

As far as avian influenza itself goes, the big story is no story. The situation has not changed much in the past year and that's a worry, according to the Biosecurity Centre's chief executive officer Dr Stephen Prowse. A lowering of the profile of bird 'flu provides breathing space for the virus to mutate making human to human transmission easier. "The longer the problem exists, the higher the risk."

"Avian influenza appears to be endemic in poultry in Asia," says Prowse. "There are still fairly regular reports of human infection and fatalities every two to four weeks, and continued sporadic outbreaks in birds in developed countries. While there hasn't been extensive human to human transmission, almost certainly it has happened in a small number of cases."

The only practical way of controlling the disease, he says, is to vaccinate poultry to reduce the virus load, and to minimise risk factors associated with the virus transmission from poultry to people—particularly in handling, slaughtering and disposing of infected birds. In addition, a vaccine and vaccination strategy for humans is under development.

Such a program needs to involve Indonesia, which at present is withholding crucial samples of the avian influenza virus from the World Health Organisation, and through it, international vaccine developers.

Indonesia argues that the virus samples constitute intellectual property, which it won't disclose without guaranteed access to any vaccines developed from it. "The public health risk of avian influenza is a major concern to Western countries," says Prowse, "but it is not such a short-term problem for developing countries where it is a much lesser public health problem than malaria, TB, HIV or dengue fever, for instance."

Aside from the problem of human deaths, avian influenza remains a hugely important threat to the poultry industry. For the past year, the Centre has sponsored programs to monitor wild bird populations in northern Australia to track the presence and behaviour of the disease. It has also joined with the Australian Centre for International Agricultural Research (ACIAR) in supporting projects on the spread of the virus in South-East Asia, particularly on the part played by wild birds and poultry markets. The CRC has also been building skills and capability through training PhD students from the region.

Nipah virus spreads from person to person

But there is another emerging pathogen, equally virulent, that is beginning to cause concern. While it has not been recorded in Australia, it has a curious connection with this country. It's called Nipah virus. It's harboured and spread by fruit bats and flying foxes, and kills up to 75 per cent of its human victims.

Nipah virus is one of only two members of a recently discovered group closely related to those which cause measles and mumps, the henipaviruses. The first henipavirus, Hendra virus, was discovered in 1994 after the death of a horse trainer and several horses in Queensland. Following the Australian experience and a renewed interest in fruit bats as potential carriers, Nipah virus came to light in Malaysia five years later killing several hundred people associated with commercial pig farming.

Since 2001, outbreaks of Nipah virus have been occurring annually after the monsoon in Bangladesh, but the past couple of years have shown a disturbing change. Previously, to become a threat to humans, the virus had to pass from bats through an intermediate host, usually pigs, in which it multiplied, then to humans. The Bangladesh form can now be transmitted directly to humans, and from human to human.

Because flying foxes have the capability of spreading Nipah virus over a large area, including Australia, the Australian Biosecurity Centre considers it a significant threat as an emerging disease. As yet there is no therapy available to treat the encephalitis it causes. So, last July the Centre organised a forum in Canberra with animal health, public health and wildlife health organisations to review current henipavirus knowledge.

So far, they've developed novel tests for the presence of henipaviruses in host animals, and have been involved in several collaborative projects with international research groups to assess the risk of Nipah virus spreading to Australia. The forum identified significant knowledge gaps and recommended priorities for research into the ecology of henipaviruses.

A deadly new threat

A third emerging virus causing much discussion is chikungunya. This mosquito-borne virus was originally identified in Tanzania in the early 50s. It causes fever and severe joint pain but, until recently, had only been associated with sporadic outbreaks and rarely with death.

Since 2005, however, chikungunya virus seems to have changed its behaviour with significant outbreaks in southern India and Sri Lanka. In 2006 a third of the population on the French island of Réunion in the Indian Ocean was infected— over 250,000 people. Over 200 people died.

Last August and September, 160 cases of chikungunya virus were reported from northern Italy, around Ravenna. Eight cases have been reported in travellers to Australia.

The virus appears to have mutated to become more virulent. And it is now known to be carried by more species of mosquito that previously thought — particularly the Asian tiger mosquito, which is also spreading worldwide.

"We are investigating if Australian mosquitoes can also transmit the chikungunya virus and whether we can distinguish it from Ross River virus," says Prof John MacKenzie, deputy CEO of the Centre. MacKenzie is organising a national meeting on the threat of chikungunya in mid-February.

A problem for Australia, he says, is that chikungunya is so closely related to the endemic Ross River virus that the present diagnostic tests may have difficulty distinguishing between the two. A further complication of diagnosis is that dengue fever, also found in north Queensland but from a completely different group of viruses, produces similar symptoms.

Pushing back the foot-and-mouth threat

As seen with horse 'flu, exotic diseases do not have to kill or debilitate people to cause a lot of damage, particularly economic damage. An important part of the history of Australian agriculture has been the battle against diseases that lower the quality or yield of crops or livestock. A classic example has been foot-and-mouth disease (FMD).

Australia's FMD-free status is a major trading advantage for our meat and livestock products. But it's hardly a reason for complacency. In 2007, the UK suffered its second outbreak of FMD in six years. The 2001 outbreak originated from swill feeding at a pig farm in northern England. But the 2007 outbreak was an "own goal", traced to a sewage leak at England's major FMD research facility.

While FMD problems in the UK pose less risk to Australia, according to Prof John Edwards, dean of the vet school at Murdoch University in Perth, we need to keep an eye on FMD in South-East Asia.

"Australia has in place very good quarantine arrangements, and that's the reason why we've been able to remain foot-and-mouth free for the past 140 years," he says. "But the dramatic growth in international travel and trade between Asia and Australia increases the risk. Our biosecurity would be very much enhanced if we eradicated FMD to our north."

Edwards is a former director of the South-East Asia FMD program. He says the disease has been eradicated in the Philippines and Indonesia in the past two years, but has been spreading in Malaysia and Vietnam. The Australian Biosecurity Centre, of which Murdoch University is a supporting partner, has been jointly funding PhD scholarships to allow students from South-East Asia to develop skills by undertaking projects that track the disease and its economic consequences, and so assist with organising eradication programs.

Another bad year for devils

Another biosecurity problem with very different economic consequences is the Tasmanian devil facial tumour disease. In the past two years, studies at the University of Tasmania and the University of Sydney have confirmed the condition to be an infective cancer transmitted through biting, says Dr Steven Smith, manager of the Tasmanian Government's Save the Tasmanian Devil program.

"The researchers have also found that the immune system of the devils does not recognise tumour cells from other devils as alien and is not triggered by them. There is a lack of genetic diversity in the devil population. They are all susceptible to the disease. We can't stop devils moving through the bush and biting each other, so there is little we can do to stop the disease spreading in Tasmania, and it is moving steadily westward."

While further research on the genetic makeup of the devils may lead to clues for vaccination or treatment, Smith says, there's no guarantee. The only way of ensuring the survival of the Tasmanian devil is to establish disease-free populations from which the animals can be re-introduced.

"The program must be larger than any captive breeding program in the world — about 1500 animals. We only have the capacity to hold 400 to 500 in captivity at the moment. They are solitary animals and very expensive to keep in captivity."

The Commonwealth Government has already pledged \$10 million over five years and the Tasmanian Government is also working on a five-year budget. It is hoped to attract corporate sponsors to support the program. After all, the Tasmanian devil is one of the best known cartoon characters in the world.

Abalone and lemon

There have been plenty of other biosecurity battles over the past year. Two areas where measures appear to be working are in aquaculture and the citrus industry. In late 2005, a herpes virus was first detected in four abalone farms in Victoria's Western District. It was a blow to an emerging abalone aquaculture business, which is beginning to generate millions of dollars in exports.

The farms voluntarily went into quarantine. Their stock was removed. They have been completely populated from clean sources, and the abalone aquaculture industry is moving on. That's the good news. Unfortunately the story does not end there.

The virus is now being picked up in wild populations around the reefs of south-western Victoria and appears to be expanding its range, says Dr Andrew Cameron, Victoria's deputy chief veterinary officer. "We are developing a DNA test and protocols to gain a better understanding of what is going on in the wild." Attempts have been made to limit accidental human spread in the wild population by banning the taking of abalone in areas where the disease is known to exist, and by harvesting abalone along the apparent edge of distribution, in an attempt to develop the marine equivalent of a fire break.

Citrus trees are now being replanted around Emerald in central Queensland, after a nasty brush with the bacterial disease citrus canker, which causes unsightly lesions and reduces fruit quantity and quality. Australia's citrus industry is worth more than \$400 million annually, about half in exports.

After initial detection in mid-2004, an eradication program involving the destruction of about 500,000 citrus trees swung into action. The Emerald area has been disease-free since the beginning of 2006, and replanting began last July.

Declare it for Australia

While biosecurity may sound like something out of James Bond, it rarely if ever involves secret agents or terrorists. Biosecurity, and the research that underpins it, is an essential part of protecting the lives and livelihoods of Australians.

But it's worth remembering that we, the travelling public still pose the greatest threat to our nation's biosecurity. In 2007 4,100 people were fined for serious breaches of quarantine. Ten times that number were cautioned. And twelve tonnes of poultry meat, eggs and feathers were confiscated. Any of this material could have brought avian influenza to Australia.

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Science in Public for the Australian Biosecurity Cooperative Research Centre

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Links

Further information

<http://www1.abcrc.org.au>

http://www.mja.com.au/public/issues/188_01_070108/joh10777_fm.html

<http://www.cdc.gov/ncidod/EID/vol12no12/06-0710.htm>