

## **Nipah Virus in Swine and Humans in Malaysia, 1999–2000**

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The Nipah virus is an example of an emerging viral pathogen. This virus is a previously unknown member of the family Paramyxoviridae that has been identified primarily in humans and pigs in Malaysia. It was first recognized during an outbreak of respiratory and neurologic disease in pigs and encephalitis in humans. Between October 1998 and May 1999 there were 265 viral encephalitis cases with 105 deaths in humans who were active in the pig farming industry. Two elements that can be significant in the emergence of a viral epidemic or epizootic are the agent's pathogenicity to the host and its capacity to establish itself in new hosts. The Nipah virus, which appears to exist naturally in fruit bats, became established in pigs and was lethal to humans. Enormous numbers of pigs contracted the disease, which became so widespread that for public health protection, half of Malaysia's commercial pig population had to be destroyed.

From late 1998 through the first half of 1999, a new pig disease characterized by pronounced respiratory and neurologic signs, sometimes with sudden death in sows and boars, began to spread among pig farms in Malaysia. It was not initially identified as a new syndrome because the morbidity and mortality rates were not high and the symptoms were not markedly different from other known diseases including Japanese encephalitis, a mosquito-borne disease prevalent in most countries in Asia. But when measures to control Japanese encephalitis did not prevent an increased incidence of viral encephalitis in pig farm workers, attention was again focused on the mysterious pig disease. In March 1999, Malaysian researchers isolated an unknown virus, which was identified by the U.S. Centers for Disease Control and Prevention (CDC) as a previously unknown paramyxovirus. The virus was termed the Nipah virus and the syndrome in pigs became known as the Porcine Respiratory and Encephalitis Syndrome, Porcine Respiratory and Neurologic Syndrome, or simply Barking Pig Syndrome after the loud cough seen in infected pigs.

By the time the virus was identified, pigs on many farms in peninsular Malaysia were already showing signs of the disease. Transmission between farms was attributed to the movement of pigs, as well as the sharing of boar semen and possibly the movement of dogs and cats. The Nipah virus spread rapidly among pigs on the infected farms, probably by direct contact with infected pigs' excretions and secretions such as urine, saliva, or pharyngeal and bronchial secretions. Pigs in Malaysia are typically kept in close confinement, which can encourage the spread of pathogens between animals.

### ***What is the Nipah virus?***

The Nipah virus is a previously unrecognized paramyxovirus that appears to be related to another emerging virus, the Hendra virus in Australia. The Nipah virus can

infect pigs, humans, dogs, and goats. Antibodies to the virus have also been reported in cats and horses, and viral antigens were found in one case of meningitis in a horse. Sheep may also be affected. In pigs, the Nipah virus causes rapid and labored breathing, an explosive and non-productive cough, neurologic changes including lethargy or aggressive behavior, and sudden death. The Nipah virus spreads readily from infected swine to other species. In pigs, the virus is found in high concentrations in the epithelial cells of the airways, facilitating its airborne spread.

Most human cases are thought to occur after close direct contact with the excretions or secretions from an infected pig. In people, the Nipah virus causes fever, severe headache, myalgia, encephalitis, or meningitis. Approximately half of all cases seen to date have been fatal. In humans, after the virus circulates in the blood, it localizes in the brain. No cases of human-to-human transmission have been documented to date.

### ***Where did the virus come from?***

Fruit bats (flying foxes) are thought to be the natural hosts for the Nipah virus. Environmental circumstances could have led to the emergence of the virus from this species into pigs. There is greater contact between humans and their domestic animals and bats as intensive farming practices encroach into previously undisturbed natural habitats. The concentration of pigs and fruit trees on the same farms can lead to increased contact between fruit bats and pigs. Biologists have also noted that flying foxes are increasingly seen in urban areas. The discovery of the Nipah virus was facilitated by increased technical abilities, as well as by the discovery of a related virus, the Hendra virus, in Australia in 1994. Like the Nipah virus, the Hendra virus appears to be found in fruit bats in nature and was only discovered when it emerged into other species and caused disease.

### ***Control measures***

Nipah virus is a biosafety level 4 agent because it causes death in people and there is no treatment or vaccine. At the time of the outbreak, there were no biosafety level 4 laboratories in Malaysia. Researchers from both the U.S. CDC and the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) helped the Malaysian government to isolate the virus, develop diagnostic tests, conduct transmission studies, and implement an eradication program.

The primary measure used to control the Nipah virus outbreak was the culling of pigs. Between the end of February and the end of April 1999, over 900,000 pigs from almost 900 farms were destroyed. The depopulation of infected pigs successfully controlled the human epidemic. The culling program was stopped after all known and suspected infected herds were destroyed. An ELISA test was developed to identify infected farms and a national swine testing and surveillance program was begun at the end of April

1999. The program required that each farm be sampled twice, with a minimum interval of three weeks between sampling. In the following three months, 889 farms were tested and 50 farms were found to be positive. The positive farms were considered infected and a total of 172,750 pigs were destroyed. The government then developed a control program to provide continued monitoring of all pigs prior to slaughter. An educational program for farmers was also implemented.

Before the outbreak, pigs were second only to poultry in the Malaysian livestock industry. The Nipah outbreak resulted in the reduction of the pig population from 2.4 million to 1.32 million pigs in Malaysia. The total number of farms went from 1,885 to 829. The outbreak also caused dramatic changes in the pig farming industry. In one state, Negeri Sembilan, pig farming is completely prohibited. In other areas, pig farming is now only allowed in an identified Pig Farming Area. The restocking of farms that had been depopulated is subject to government approval. Farmers were encouraged to undertake other agriculture and livestock activities.

### ***Continued threats from the virus***

The presence of the Nipah virus in native wildlife populations poses a continuing threat to the pig and human population in Malaysia. The Nipah virus may have reemerged in June and July 2000 when neutralizing antibodies were found in pigs in some farms in Peninsular Malaysia. A total of 1,700 pigs were destroyed in two farms in the state of Perak. In July 2000, IgG antibodies to Nipah virus were also found in pigs in some farms in Sarawak. Four of the pig workers in Sarawak were also found to have antibodies to Nipah virus, resulting in the destruction of 6,000 pigs.

### ***Sources of Information***

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