

## Hendra virus infection risks

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### Abstract

Bats of the genus *Pteropus* are natural hosts of henipaviruses, an emergent group of viruses that includes two recognised members of the genus: Hendra virus and Nipah virus. Hendra virus was first described in 1994 in Australia. To date, there have been 11 recognised spillover events of Hendra virus to horses, four of these involving subsequent horse-to-human transmission. Animal health authorities in Australia foster increased awareness, alertness and preparedness in the horse-owning and veterinary communities, and encourage husbandry practices to minimize risk of exposure of horses to flying fox excreta. However, the proximate triggers for spillover events remain unclear.

Bats of the genus *Pteropus* (flying foxes) are natural hosts of henipaviruses, a emergent group of viruses responsible for fatal disease in livestock and humans.<sup>1</sup> There are two recognised members of the genus: Hendra virus, first described in 1994 in Australia, and continuing to cause sporadic cases; and Nipah virus, first described in Malaysia in 1999, and now causing clusters of encephalitic disease in humans in Bangladesh. The latter, where bat-to-human and human-to-human transmission are disturbing features, and the reports of recent outbreaks of Hendra virus in horses in eastern Australia, have re-focused public and scientific attention on these threatening viruses.

To date, there have been 11 recognised spillover events of Hendra virus to horses, four of these involving subsequent horse-to-human transmission (Table 1). Low infectivity and a high case fatality rate continue to be features of Hendra virus infection in both horses and humans. Infection appears not to transmit readily from bats to horses, or from horse to horse, or from horses to humans. However, once infected, horses have a 75% probability, and humans a 50% probability, of a fatal outcome. All human cases are attributed to exposure to infected horses; there is no evidence of bat to human transmission.

Spillover of Hendra virus from bats to horses is a rare event, notwithstanding a horse population in Australia estimated in excess of 200,000, and substantial geographic overlap of the occurrence of flying foxes and horses. Nonetheless, it is evident that spillover to horses will continue to occur, and that future outbreaks can be expected where conducive circumstances exist. The lack of

an effective treatment modality either for horses or humans, plus the absence of a protective vaccine for either, limits risk management to exposure minimisation, early detection and effective case biosecurity. Animal health authorities in Australia foster increased awareness, alertness and preparedness in the horse-owning and veterinary communities, and encourage husbandry practices to minimize risk of exposure of horses to flying fox excreta. Examples of the latter include ensuring horse feed and water containers are placed under cover, and excluding horses from grazing under favoured flying fox food trees. The effectiveness of management strategies targeting the natural host (for example, risk forecasting, risk mapping) are currently limited by an incomplete knowledge of the ecology of the virus in flying foxes. This area remains a research priority.

Infection in flying foxes causes no evident disease. Infection appears widespread, both taxonomically and geographically, and archived serum samples from the 1980s indicate an antibody prevalence consistent with that currently prevalent. Daszak *et al* contend that disease emergence from wildlife is primarily an ecological process, and that factors such as deforestation, habitat fragmentation, and urbanization facilitate emergence.<sup>2</sup> It is clear that flying fox populations across their global range have been impacted by such processes, and it is entirely plausible that this ecological disruption has driven the emergence of Hendra virus (and a number of novel agents) from flying foxes. However, what is less clear are the proximate triggers for spillover; those factors or circumstances that determine why spillover

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**Table 1: Outbreaks of Hendra virus infection in Australia**

Location	Involvement	Time
Mackay	2 horses & one human	August 1994
Brisbane (Hendra)	20 horses & two humans	September 1994
Cairns (Trinity Beach)	1 horse	January 1999
Cairns (Gordonvale)	1 horse & one human	October 2004
Townsville	1 horse	December 2004
Peachester	1 horse	June 2006
Murwillimbah	1 horse	October 2006
Peachester	1 horse	June 2007
Cairns (Clifton Beach)	1 horse	July 2007
Brisbane (Redlands)	5 horses & two humans	June 2008
Proserpine	3 horses	July 2008

events occur in some years and not others, or at some times of year and not others. The temporal pattern of Hendra virus spillover events suggests the possibility of seasonal factors being these proximate triggers. Such factors could plausibly be environmental, biological or ecological. This contention is supported by Plowright *et al*, who reported reproductive and nutritional stress in flying foxes to be associated with an increased risk of infection.<sup>3</sup> The two near-concurrent, but spatially disparate, Hendra virus spillover events in 2008 have sharpened focus on these proximate factors, and they remain a research priority.

Minimisation of the future occurrence and impact of Hendra virus requires an understanding of the ecology of flying foxes, of virus infection dynamics in flying foxes, and of the factors that promote spillover - the factors that create the 'epidemiologic bridge' from flying foxes to horses.

## REFERENCES

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