Quarantined

An inspector has placed this area under quarantine for a disease of stock pursuant to sections 14(1) and 14(1A) of the Stock Act 1915. A person must not remove from or introduce to the quarantined area, stock, without the written authority of the chief executive (the Director-General, DPI&F).

Maximum penalty: 1,000 penalty units or 1 year's imprisonment.

Queensland Centre for Emerging Infectious Diseases
Biosecurity Queensland DEEDI
emerging infectious disease..

an infectious disease resulting from
• a previously unrecognized pathogen, or
• a known pathogen in a new location, or
• a known pathogen re-emerging as a result of host, pathogen or environmental change.
emerging diseases impacting humans..

- disease emergence has increased over time.
- 61.4% represent transmission from animals - 75.3% of these from wildlife.
- zoonotic EIDs from wildlife reach highest proportion in the last decade.

origins of emerging diseases..

Figure 1. Numbers of species of zoonotic pathogens associated with different types of nonhuman host.

Woolhouse et al, Emerg Infect Dis, 2005
factors promoting disease emergence..

- land-use change.
- human demographic change.
- global travel and commerce.
- microbial change.
- public health breakdown.
- cultural & social practices.
- economics.
in Australia..

a cluster of diseases emerging from bats..

- 1994 Hendra virus
- 1996 Australian bat lyssavirus (ABLV)
- 1997 Menangle virus
Hendra virus...

A Morbillivirus That Caused Fatal Disease in Horses and Humans

Keith Murray,* Paul Selleck, Peter Hooper, Alex Hyatt, Allan Gould, Laurie Gleeson, Harvey Westbury, Lester Hiley, Linda Selvey, Barry Rodwell, Peter Ketterer

Hendra and Hendra-like detections globally..

Fig. 1. World distribution of the Family Pteropodidae shown by a broken line (modified from Hill and Smith 1984). Genus Pteropus = vertical hatching (see text for sources). 1 = Pemba Island, 2 = Volcano Island, 3 = Northern Mariana Islands and Guam, 4 = Fiji, 5 = Samoa, 6 = Cook Islands.
in Australia..

Number of Hendra virus incidents

Number of Spillover Events

Year

1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
in Australia..

Number of Hendra virus cases

- **Cases**
- **Year**
- **Equine Cases**
- **Human Cases**
Hendra virus background..

- zoonotic BSL4 agent.
- 14 known spillover events.
- low infectivity, but high case fatality rate.
- human cases result from infected horses.

Photo: Kim Halpin
natural reservoir..

- flying foxes identified as a natural host in 1996.
- antibodies in all 4 species.
- antibodies across the geographic range.
- no attributed clinical disease in flying foxes.
- antibodies in archived samples.
HeV prevalence in bats...

associated with

- age
- pregnancy
- ecological stress

Andrew Breed 2007

Raina Plowright 2007
HeV prevalence in bats..

- evidence of infection in 33% of sampling events.
- evidence of infection in 3.6% of samples.
- virus isolated.
HeV prevalence in bats..

Proportion of PCR-positive pools by month

Hendra virus prevalence (%)

Month
spillovers to horses (within year)
risk of spillover..

probability of spillover from any given colony depends on

- the presence of infection,
- the proportion of susceptible flying foxes,
- the colony size..

plus

- the number and density of horses,
- the management of the horses,
- the virus strain/virus dose/route of infection?

potential viral load

effective contact
possible transmission pathways..

direct bat-horse transmission:

plausibly

• ingestion of partially eaten fruit.
• ingestion of ‘spats’.
• ingestion of contaminated pasture/feed.
• licking/sniffing foetal tissues.
possible transmission pathways...

indirect transmission via an intermediate host:

less plausible because:

- opportunity for direct contact with food debris/excreta around feeding sites.
- direct horse-to-horse and horse-to-human transmission via infected body fluids.
- clustering of bat and horse virus sequence.
- negative findings in non-bat species.
human cases..

by occupation and putative exposure event:

- 1994 horse owner
  - assisting vet necropsy infected horse.
- 1994 horse trainer and stable-hand
  - force-feeding infected horse.
- 2004 veterinarian
  - necropsy infected horse.
- 2008 veterinarian & nurse
  - nasal lavage on infected horse.
- 2009 veterinarian
  - respiratory endoscope on infected horse.
infection rates...

- **Redlands 2008**
  - 14 “high exposure”
  - 6 “low-moderate exposure”
  - infection rate : 10 %

- **Cawarral 2009**
  - 4 “high exposure”
  - 8 “low-moderate exposure”
  - infection rate : 8 %
emergence from wildlife..

- primarily an ecological process.
- landscape changes
  - populations under stress
  - changed population dynamics
  - changed infection dynamics

- a need to understand the ecology of the natural host, the pressures, and the underlying factors.

Photo: Raina Plowright 2008
A *One Health* approach...

- a complex systems approach for a complex situation.
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