

# Murray Valley encephalitis

## Fact sheet

---

### Introductory statement

Murray Valley encephalitis (MVE) is a disease of humans and horses caused by an arbovirus, which is endemic to northern Australia, Papua New Guinea and Irian Jaya (Knox et al. 2012). Murray Valley encephalitis virus (MVEV) principally cycles between wild birds and mosquitoes. Wild birds (herons and cormorants) are considered important in the ecology of MVE, primarily playing the role of reservoir host, however they are not clinically affected.

### Aetiology

**Virus:** Murray Valley encephalitis virus (MVEV), **genus:** *Flavivirus*; **family:** *Flaviviridae*.

NB: Other notable viruses in this genus include Japanese encephalitis, Kunjin, Dengue, West Nile and St Louis encephalitis viruses.

**Grouping (non-taxonomic):** Arbovirus (**Arthropod borne virus**, see separate fact sheet on Arboviruses for more details).

Murray Valley encephalitis was previously called Australian Encephalitis and Australian “X” Disease, which also included Kunjin virus as a cause. Kunjin virus is a closely related zoonotic Australian arbovirus, which shares vector and wild bird host species with MVEV but tends to produce a milder disease in humans (see WHA fact sheet “West Nile and Kunjin virus in Australia”).

### Natural hosts

**Primary reservoir host:** Birds, especially herons and cormorants (Marshall et al. 1982a).

**Clinically affected hosts:** Humans and horses. These are considered to be dead-end hosts since the resultant viraemia is not sufficient to allow transmission (Roche et al. 2013).

### World distribution

Australia, Papua New Guinea and Irian Jaya.

## Occurrences in Australia

MVEV has been isolated from a white-faced heron (*Egretta novaehollandiae*) (Marshall et al. 1982b). Numerous species of native Australian wildlife, feral animals and domestic animals have tested positive to serological tests (haemagglutination inhibition) for MVEV antibodies (Appendix 1). In particular cormorants, night herons, brolgas, eastern grey kangaroos, agile wallabies, cattle, horses and feral pigs have high antibody prevalence for MVEV.

The virus was first isolated in Australia in 1918 but wasn't identified as the cause of disease in humans in the Murray Valley in Victoria and South Australia until the 1950s.

Seven major outbreaks of MVE have occurred in Australia since 1917; the most recent in 1974 with cases from all mainland states. Since then, nearly all cases of MVE have been limited to northern WA and the NT. Only occasional cases have been reported in Qld, central Australia and central regions of WA (Mackenzie et al. 1998). However, there may be evidence of southerly spread, perhaps with changing climatic conditions (Cordova et al. 2000).

During the 1974 outbreak, 52 horses showing neurological signs were sampled around NSW and found to be serologically positive for MVEV (Gard et al. 1977). A survey in 2007-08 found 2.9% of 716 horses in NSW and 5.3% of 201 horses in Victoria tested positive for MVEV (Roche et al. 2013).

In 2011 there was significant viral activity, as indicated by widespread seroconversion among sentinel chicken flocks, after heavy rainfall and regional flooding. This was followed by an increase in the number of human cases, including nine from WA, four from NT, two from SA, one from NSW and one unconfirmed case from Victoria. MVEV was also detected in horses exhibiting neurological signs across south-eastern Australia (Knox et al. 2012).

## Epidemiology

### Transmission

Mosquito-bird transmission cycle: mosquitoes (principally *Culex annulirostris*) are the primary vectors and birds are the amplifying hosts. Wading birds, in particular the rufous (Nankeen) night heron, (*Nycticorax caledonicus*) are considered the major amplifying hosts. MVEV has also been isolated from *Culex australicus* (which feeds mainly on rabbits and birds), *Ochlerotatus tremulus* (formerly *Aedes tremulus*), and other mosquito species. There is evidence that virus may persist in desiccation-resistant mosquito eggs, allowing it to re-emerge when conditions become favourable (Mackenzie et al. 1998; Cordova et al. 2000). Dead-end hosts such as horses and humans become infected when bitten by infected mosquitoes. Eggs and recently hatched chicks of little pied cormorants (*Microcarbo melanoleucos*) possessed antibody to MVEV, implying passage of antibodies from the mother to the egg (Anderson 1953).

Experimental studies showed viraemias in birds of one to nine days (Boyle et al. 1983). Viraemia has been experimentally induced in galahs (*Eolophus roseicapilla*), sulphur-crested cockatoos (*Cacatua galerita*), black ducks (*Anas superciliosa*), little corellas (*Cacatua sanguinea*), eastern grey kangaroos (*Macropus giganteus*), mice (*Mus musculus*), pigs, dogs, rabbits, chickens and horses (Kay et al. 1985a; Kay et al. 1985b; Kay et al. 1987). Experimentally infected agile wallabies (*Macropus agilis*), cattle and sheep did not develop detectable viraemias but some mosquitoes feeding on them became infected (Kay et al. 1985b). Of those animals that developed viraemias, grey kangaroos and rabbits had sufficiently high titres to infect mosquitoes for several days and may therefore be considered capable amplifying hosts (Kay et al. 1985b).

## Sources of agent

Wild birds, mainly herons (particularly the rufous night heron), cormorants and darters (Marshall et al. 1982a). Further research is required to determine whether eastern grey kangaroos and rabbits act as amplifying hosts in the wild (Kay et al. 1985b).

## Incubation period

Herons and other birds: 1-2 days (experimental) (Boyle et al. 1983).

Humans: Usually 7-12 days but can range from 5-28 days (Knox et al. 2012).

## Morbidity and mortality rates

Humans: 1:1000 to 1:2000 infections result in clinical disease (Mackenzie et al. 1998). Up to 25% of clinical cases are fatal and a further 25% have permanent sequelae (Mackenzie et al. 1998).

## Clinical signs

Wildlife are not known to be clinically affected by infection with MVEV.

Clinical signs in humans include fever, headache, nausea and vomiting, progressing to neurological signs associated with meningitis and encephalitis (Knox et al. 2012).

Affected horses display neurological symptoms including depression, weakness (particularly in hind limbs), ataxia, wide-based stance, drooping head, sweating, facial paralysis, proprioceptive deficits and recumbency (Gordon et al. 2012; Holmes et al. 2012). One Australian stockhorse showed clinical signs for a duration of 3 months and was euthanized (Barton et al. 2015).

## Diagnosis

Serological tests for antibodies (haemagglutination inhibition or serum neutralisation tests), indicating exposure to MVE, are the primary methods used to investigate MVE in avian and wildlife species. Virus isolation of blood, serum or other tissues may also be used (Marshall et al. 1982b).

A diagnosis of MVE in humans is made based on history of possible exposure, clinical signs and serology. MRI may be useful initially as it can provide presumptive positive information, such as bilateral hyperintensity of the deep grey matter in the thalami, temporal lobes, red nucleus and cervical spinal cord, before serological results are available. However, confirmation of a suspected MVEV infection requires either the isolation of the virus itself, detection of MVEV RNA, a fourfold rise in the IgG titre between acute and convalescent serum samples, or detection of IgM in serum or CSF (Knox et al. 2012).

## Clinical pathology

Wildlife are not known to be clinically affected by infection with MVEV. In clinically affected species such as humans, the CSF usually shows a raised protein concentration, normal glucose concentration and a leucocytosis with a predominance of mononuclear cells (Knox et al. 2012).

## Pathology

Pathological changes associated with infection of wildlife with MVEV have not been reported in wildlife.

In humans, there are no characteristic gross lesions and the pathologic picture is one of focal necrosis of neurons, inflammatory glial nodules, and perivascular lymphoid cuffing (Anderson 1954). Horses show similar signs of a sub-acute, non-suppurative encephalomyelitis, most severe in the hippocampus, mid-brain, meninges, medulla and cervical spinal cord, characterised by mononuclear cell perivascular cuffing, neuronal necrosis and gliosis (Gordon et al. 2012).

## Differential diagnoses

In humans, other causes of febrile illness and encephalitis or meningitis should be considered. In horses, other differential diagnoses include infections with equine herpesvirus-1, Hendra virus and Kunjin virus.

## Laboratory diagnostic specimens and procedures

Collect plasma for MVEV PCR and serum for serology. A second serum sample collected 7-10 days after the first may be required to confirm a rise in titre. Collect CSF for culture, PCR and serology (Knox et al. 2012).

Laboratory procedures include isolation of MVEV, MVEV RNA detection tests (e.g. PCR), and serological tests such as haemagglutination inhibition, immunofluorescence assays and enzyme immunoassays (Knox et al. 2012). State health laboratories, several universities and Commonwealth laboratories perform testing for MVE.

Virus isolation, PCR and serology can also be used to diagnose infection in horses and birds (Marshall et al. 1982b; Studdert et al. 2003; Gordon et al. 2012).

## Treatment

There is no specific treatment for MVE other than supportive treatment.

## Prevention and control

MVEV has been shown to be endemic in many Australian wild bird populations. Prevention and control techniques in wildlife could be based on those recommended for humans.

There is no available vaccine for humans, however infection with MVEV confers lifelong immunity. General mosquito bite prevention and specific or ongoing vector control should be exercised (see the Arbovirus factsheet for more details). Sentinel chicken flocks are used to provide a warning of viral activity.

## Surveillance and management

In Australia, MVE is a notifiable disease in humans. Monitoring programs for MVEV include the use of sentinel chickens and *ad hoc* monitoring of vector species in endemic areas. As for other arboviruses, serum banking of potential wild animal hosts for later testing may be helpful. Evaluations of surveillance in sentinel species from 2001 to 2012 are available at <http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-arboanrep.htm>. Several predictive models based on climatic conditions, vector dynamics and sentinel chicken seroconversions exist, but remain largely untested due to the sporadic nature of epidemics (Spencer et al. 2001).

## Statistics

Wildlife disease surveillance in Australia is coordinated by the Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public. Coordinators in each of Australia's States and Territories report monthly on significant wildlife cases identified in their jurisdictions. There are no records of MVE in the National Wildlife Health Surveillance Database.

NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. Please contact [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au).

We encourage those with laboratory confirmed cases of this condition in native Australian or feral animals to submit this information to the national system for consideration for inclusion in the national database. Please contact us at [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au).

## Research

The relative importance of the roles of wildlife hosts, vector dynamics, or other human, virus or environmental factors has yet to be elucidated for MVEV.

The factors leading to MVE epidemics or clinical infections, and the role of wildlife, are not fully known although they likely involve:

- Vector dynamics e.g. changes in available breeding areas, abundance patterns and distribution.
- Interactions between vectors, bird reservoirs and humans e.g. migration of birds, migration of immune-naïve humans and horses to endemic areas.
- Other factors such as interactions with other Australian or exotic arboviruses, the involvement of unidentified wildlife hosts or other reservoir host factors.
- MVEV has close relations and cross-reactions with exotic flaviviruses such as Japanese encephalitis, Dengue and West Nile viruses, which have caused higher levels of morbidity and mortality in humans and animals. Better understanding of MVEV ecology, immunity and interactions may be important for addressing the risks of other exotic flaviviruses.

## Human health implications

MVEV causes serious disease in humans and outbreaks in humans have occurred in southern Australia (Spencer et al. 2001). The Australian Department of Health has a detailed information on MVE in humans (see [www.health.gov.au/internet/main/publishing.nsf/Content/cdna-song-mvev.htm](http://www.health.gov.au/internet/main/publishing.nsf/Content/cdna-song-mvev.htm)). Individual state and territory departments of human health also provide electronic fact sheets.

## Conclusions

Wildlife are considered important in the disease ecology of MVE. The role of wildlife is primarily that of reservoir host and wildlife are not known to be clinically affected by infection with MVEV. The relative importance of the roles of wildlife hosts, vector dynamics, or other human, virus or environmental factors has yet to be elucidated. MVEV has close relations and cross-reactions with exotic flaviviruses such as Japanese Encephalitis, Dengue and West Nile viruses, which have caused higher levels of morbidity and mortality in

humans and animals. Hence MVEV ecology, immunity and interactions may be important considerations for addressing the risks of other exotic flaviviruses.

## Appendix 1: Antibody prevalence for Murray Valley encephalitis virus in Australian fauna

	Sampling year	State	% positive (number sampled)	Reference
<b>BIRDS</b>				
<i>Pelecaniformes</i> (cormorants and darters)	1951-1952	SA	9 (11) <sup>N</sup>	Miles and Howes (1953)
Great cormorant ( <i>Phalacrocorax carbo</i> )	1951	Vic	100 (4) <sup>N</sup>	Anderson (1953)
Great cormorant	1954	NT	100 (1) <sup>N</sup>	Miles and Dane (1956)
Great cormorant	1974	NSW/Vic	33 (3) <sup>HI</sup>	Marshall et al. (1982a)
Little black cormorant ( <i>P. sulcirostris</i> )	1951	Vic	50 (4) <sup>N</sup>	Anderson (1953)
Little black cormorant	1974	NSW/Vic	42 (26) <sup>HI</sup>	Marshall et al. (1982a)
Little black cormorant	1954	NT	0 (2) <sup>N</sup>	Miles and Dane (1956)
Little pied cormorant ( <i>Microcarbo melanoleucos</i> )	1951	Vic	68 (22) <sup>N</sup>	Anderson (1953)
Little pied cormorant ( <i>M. melanoleucos</i> )	1954	NT	50 (2) <sup>N</sup>	Miles and Dane (1956)
Little pied cormorant ( <i>M. melanoleucos</i> )	1974	NSW/Vic	39 (46) <sup>HI</sup>	Marshall et al. (1982a)
Australasian darter ( <i>Anhinga novaehollandiae</i> )*	1951	Vic	60 (5) <sup>N</sup>	Anderson (1953)
Australasian darter*	1954	NT	75 (4) <sup>N</sup>	(Miles and Dane 1956)
Australasian darter	1974	NSW/Vic	50 (4) <sup>HI</sup>	Marshall et al. (1982a)
Great crested grebe ( <i>Podiceps cristatus</i> )	1974	NSW/Vic	0 (17) <sup>HI</sup>	Marshall et al. (1982a)
Little grebe ( <i>Tachybaptus ruficollis</i> )	1954	NT	0 (1) <sup>N</sup>	Miles and Dane (1956)
Australasian grebe ( <i>T. novaehollandiae</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Australasian grebe	1974	NSW/Vic	20 (5) <sup>HI</sup>	Marshall et al. (1982a)
Hoary-headed grebe ( <i>Poliiocephalus poliocephalus</i> )	1951	Vic	0 (11) <sup>N</sup>	Anderson (1953)
White-necked heron ( <i>Ardea pacifica</i> )	1954	NT	0 (1) <sup>N</sup>	Miles and Dane (1956)
White-necked heron	1974	NSW/Vic	33 (9) <sup>HI</sup>	Marshall et al. (1982a)
White-faced heron ( <i>Egretta novaehollandiae</i> )	1951	Vic	83 (6) <sup>N</sup>	Anderson (1953)
White-faced heron	1951-1952	SA	100 (1) <sup>N</sup>	Miles and Howes (1953)
White-faced heron	1954	NT	40 (5) <sup>N</sup>	Miles and Dane (1956)
White-faced heron	1974	NSW/Vic	33 (18) <sup>HI</sup>	Marshall et al. (1982a)
Rufous/Nankeen night heron ( <i>Nycticorax caledonicus</i> )	1951	Vic	60 (5) <sup>N</sup>	Anderson (1953)
Rufous/Nankeen night heron	1964-1967	Qld	70 (10) <sup>HI</sup>	Whitehead et al. (1968)
Rufous/Nankeen night heron	1974	NSW/Vic	88 (25) <sup>HI</sup>	Marshall et al. (1982a)
Australian pelican ( <i>Pelecanus conspicillatus</i> )	1954	NT	100 (2) <sup>N</sup>	Miles and Dane (1956)
Australian white ibis ( <i>Threskiornis molucca</i> )	1951	Vic	27 (11) <sup>N</sup>	Anderson (1953)
Australian white ibis	1974	NSW/Vic	40 (10) <sup>HI</sup>	Marshall et al. (1982a)
Straw-necked ibis ( <i>T. spinicollis</i> )	1951	Vic	50 (4) <sup>N</sup>	Anderson (1953)
Straw-necked ibis	1954	NT	100 (1) <sup>N</sup>	Miles and Dane (1956)
Royal spoonbill ( <i>Platalea regia</i> )	1954	NT	0 (1) <sup>N</sup>	Miles and Dane (1956)
Royal spoonbill	1974	NSW/Vic	0 (1) <sup>HI</sup>	Marshall et al. (1982a)
Yellow-billed spoonbill ( <i>P. flavipes</i> )	1974	NSW/Vic	0 (1) <sup>HI</sup>	Marshall et al. (1982a)
"Anseriformes (ducks, swans and geese)"	1951-1952	SA	20 (25) <sup>N</sup>	Miles and Howes (1953)

Black swan ( <i>Cygnus atratus</i> )	1951	Vic	38 (13) <sup>N</sup>	Anderson (1953)
Black swan	1974	NSW/Vic	22 (9) <sup>HI</sup>	Marshall et al. (1982a)
Australian shelduck ( <i>Tadorna tadornoides</i> )	1974	NSW/Vic	0 (1) <sup>HI</sup>	Marshall et al. (1982a)
Pacific black duck ( <i>Anas superciliosa</i> )	1954	NT	0 (1) <sup>N</sup>	Miles and Dane (1956)
Pacific black duck	1974	NSW/Vic	5 (20) <sup>HI</sup>	Marshall et al. (1982a)
Grey teal ( <i>Anas gracilis</i> )	1954	NT	71 (7) <sup>N</sup>	Miles and Dane (1956)
Grey teal	1974	NSW/Vic	6 (158) <sup>HI</sup>	Marshall et al. (1982a)
Chestnut teal ( <i>A. castanea</i> )	1974	NSW/Vic	0 (6) <sup>HI</sup>	Marshall et al. (1982a)
Australasian shoveler ( <i>A. rhynchosotis</i> )	1974	NSW/Vic	0 (4) <sup>HI</sup>	Marshall et al. (1982a)
Pink-eared duck ( <i>M. membranaceus</i> )	1974	NSW/Vic	0 (13) <sup>HI</sup>	Marshall et al. (1982a)
Hardhead ( <i>Aythya australis</i> )	1974	NSW/Vic	0 (6) <sup>HI</sup>	Marshall et al. (1982a)
Australian wood duck ( <i>Chenonetta jubata</i> )	1951	Vic	50 (2) <sup>N</sup>	Anderson (1953)
Australian wood duck	1974	NSW/Vic	0 (5) <sup>HI</sup>	Marshall et al. (1982a)
Musk duck ( <i>Biziura lobata</i> )	1951	Vic	57 (7) <sup>N</sup>	Anderson (1953)
Musk duck	1974	NSW/Vic	0 (2) <sup>HI</sup>	Marshall et al. (1982a)
Plumed whistling duck ( <i>Dendrocygna eytoni</i> )	1974	NSW/Vic	0 (7) <sup>HI</sup>	Marshall et al. (1982a)
“Rallidae (water-hens)”	1951-1952	SA	21 (25) <sup>N</sup>	Miles and Howes (1953)
Dusky moorhen ( <i>Gallinula tenebrosa</i> )	1951	Vic	50 (4) <sup>N</sup>	Anderson (1953)
Dusky moorhen	1974	NSW/Vic	0 (5) <sup>HI</sup>	Marshall et al. (1982a)
Purple swamphen ( <i>Porphyrio porphyrio</i> )	1974	NSW/Vic	0 (2) <sup>HI</sup>	Marshall et al. (1982a)
Black-tailed native-hen ( <i>Tribonyx ventralis</i> )	1951	Vic	50 (4) <sup>N</sup>	Anderson (1953)
Black-tailed native-hen	1954	NT	50 (6) <sup>N</sup>	Miles and Dane (1956)
Eurasian coot ( <i>Fulica atra</i> )	1951	Vic	13 (16) <sup>N</sup>	Anderson (1953)
Eurasian coot	1954	NT	100 (1) <sup>N</sup>	Miles and Dane (1956)
Eurasian coot	1974	NSW/Vic	13 (15) <sup>HI</sup>	Marshall et al. (1982a)
Black-winged stilt ( <i>Himantopus himantopus</i> )	1951	Vic	0 (2) <sup>N</sup>	Anderson (1953)
Black-winged stilt	1974	NSW/Vic	0 (5) <sup>HI</sup>	Marshall et al. (1982a)
Red-necked avocet ( <i>Recurvirostra novaehollandiae</i> )	1974	NSW/Vic	0 (4) <sup>HI</sup>	Marshall et al. (1982a)
Red-kneed dotterel ( <i>Erythrogonys cinctus</i> )	1951	Vic	0 (4) <sup>N</sup>	Anderson (1953)
Black-fronted dotterel ( <i>Euseiornis melanops</i> )	1951	Vic	0 (2) <sup>N</sup>	Anderson (1953)
Sharp-tailed sandpiper ( <i>Calidris acuminata</i> )	1951	Vic	33 (6) <sup>N</sup>	Anderson (1953)
Silver gull ( <i>Chroicocephalus novaehollandiae</i> )	1951	Vic	0 (3) <sup>N</sup>	Anderson (1953)
Silver gull	1951-1952	SA	0 (1) <sup>N</sup>	Miles and Howes (1953)
Silver gull	1974	NSW/Vic	0 (2) <sup>HI</sup>	Marshall et al. (1982a)
“Land birds”	1951-1952	SA	0 (20) <sup>N</sup>	Miles and Howes (1953)
Brolga ( <i>Grus rubicunda</i> )	1964-1967	Qld	89 (28) <sup>HI</sup>	Whitehead et al. (1968)
Collared sparrowhawk ( <i>Accipiter cirrhocephalus</i> )	1974	NSW/Vic	0 (1) <sup>HI</sup>	Marshall et al. (1982a)
Little eagle ( <i>Hieraaetus morphnoides</i> )	1954	NT	100 (1) <sup>N</sup>	Miles and Dane (1956)
Whistling kite ( <i>Haliastur sphenurus</i> )	1951	Vic	50 (2) <sup>N</sup>	Anderson (1953)

Wedge-tailed eagle ( <i>Aquila audax</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Southern boobook ( <i>Ninox novaeseelandiae</i> )	1974	NSW/Vic	0 (1) <sup>HI</sup>	Marshall et al. (1982a)
Dusky woodswallow ( <i>Artamus cyanopterus</i> )	1974	NSW/Vic	0 (1) <sup>HI</sup>	Marshall et al. (1982a)
Black-faced woodswallow ( <i>A. cinereus</i> )	1951	Vic	100 (1) <sup>N</sup>	Anderson (1953)
Willy wagtail ( <i>Rhipidura leucophrys</i> )	1951	Vic	50 (2) <sup>N</sup>	Anderson (1953)
Welcome swallow ( <i>Hirundo neoxena</i> )	1951	Vic	0 (6) <sup>N</sup>	Anderson (1953)
Black-faced cuckoo-shrike ( <i>Coracina novaehollandiae</i> )	1954	NT	0 (2) <sup>N</sup>	Miles and Dane (1956)
White-bellied cuckoo-shrike ( <i>C. papuensis hypoleuca</i> )	1954	NT	0 (1) <sup>N</sup>	(Miles and Dane 1956)
Silver-crowned friarbird ( <i>Philemon argenticeps</i> )	1954	NT	100 (1) <sup>N</sup>	Miles and Dane (1956)
White-winged chough ( <i>Corcorax melanorhamphus</i> )	1951	Vic	30 (10) <sup>N</sup>	Anderson (1953)
Little crow ( <i>Corvus bennetti</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Australian raven ( <i>C. coronoides</i> )	1951	Vic	0 (3) <sup>N</sup>	Anderson (1953)
Australian raven	1974	NSW/Vic	0 (2) <sup>HI</sup>	Marshall et al. (1982a)
Torresian crow ( <i>Corvus orru ceciliae</i> )	1954	NT	50 (2) <sup>N</sup>	Miles and Dane (1956)
Magpie-lark ( <i>Grallina cyanoleuca</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Magpie-lark	1954	NT	50 (6) <sup>N</sup>	Miles and Dane (1956)
Noisy miner ( <i>Manorina melanocephala</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Grey shrike-thrush ( <i>Colluricincla harmonica</i> )	1951	Vic	100 (1) <sup>N</sup>	Anderson (1953)
White-plumed honeyeater ( <i>Lichenostomus penicillatus</i> )	1951	Vic	100 (1) <sup>N</sup>	Anderson (1953)
Australian magpie ( <i>Cracticus tibicen</i> )	1951	Vic	0 (2) <sup>N</sup>	Anderson (1953)
Masked lapwing ( <i>Vanellus miles novaehollandiae</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Banded lapwing ( <i>V. tricolor</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Crested pigeon ( <i>Ocyphaps lophotes</i> )	1951	Vic	0 (2) <sup>N</sup>	Anderson (1953)
Crested pigeon	1954	NT	37 (27) <sup>N</sup>	Miles and Dane (1956)
Peaceful dove ( <i>Geopelia striata</i> )	1951	Vic	0 (2) <sup>N</sup>	Anderson (1953)
Peaceful dove	1954	NT	100 (3) <sup>N</sup>	Miles and Dane (1956)
Bar-shouldered dove ( <i>G. humeralis</i> )	1954	NT	100 (4) <sup>N</sup>	Miles and Dane (1956)
Pallid cuckoo ( <i>Cacomantis pallidus</i> )	1954	NT	0 (1) <sup>N</sup>	Miles and Dane (1956)
Eastern koel ( <i>Eudynamys orientalis</i> )	1954	NT	0 (1) <sup>N</sup>	Miles and Dane (1956)
Dollarbird ( <i>Eurystomus orientalis</i> )	1954	NT	25 (4) <sup>N</sup>	Miles and Dane (1956)
Galah ( <i>Eolophus roseicapilla</i> )	1951	Vic	0 (2) <sup>N</sup>	Anderson (1953)
Galah	1954	NT	25 (8) <sup>N</sup>	Miles and Dane (1956)
Galah	1974	NSW/Vic	0 (8) <sup>HI</sup>	Marshall et al. (1982a)
Red-collared lorikeet ( <i>Trichoglossus haematodus rubritorquis</i> )	1954	NT	75 (4) <sup>N</sup>	Miles and Dane (1956)
Mallee ringneck ( <i>Barnardius zonarius barnardi</i> )	1951	Vic	0 (2) <sup>N</sup>	Anderson (1953)
Red-winged parrot ( <i>Aprosmictus erythropterus</i> )	1954	NT	75 (4) <sup>N</sup>	Miles and Dane (1956)
Red-rumped parrot ( <i>Psephotus haematonotus</i> )	1951	Vic	30 (10) <sup>N</sup>	Anderson (1953)

Yellow rosella ( <i>Platycercus elegans flaveolus</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Sulphur crested cockatoo ( <i>Cacatua galerita</i> )	1951	Vic	0 (1) <sup>N</sup>	Anderson (1953)
Red-tailed black cockatoo ( <i>Calyptorhynchus banksii</i> )	1954	NT	33 (3) <sup>N</sup>	Miles and Dane (1956)
Domestic fowl ( <i>Gallus gallus domesticus</i> )	1954	NT	9 (70) <sup>N</sup>	Miles and Dane (1956)
Domestic fowl	1974	Qld	10 (458) <sup>HI</sup>	Doherty et al. (1976)
Domestic fowl	1963-1966	Qld	24 (186) <sup>HI</sup>	Doherty et al. (1968)
Muscovy duck ( <i>Cairina moschata</i> )	1954	NT	0 (12) <sup>N</sup>	Miles and Dane (1956)
"Birds"	1967-1969	Qld	60 (48) <sup>HI</sup>	Doherty et al. (1971)
REPTILES				
Reptiles: Gould's monitor ( <i>Varanus gouldii</i> ), Blue-tongued skink ( <i>Tiliqua scincoides</i> ), Black-headed python ( <i>Aspidites melanocephalus</i> ), Keelback snake ( <i>Tropidonophis mairii</i> )†	1969	Qld	33 (15) <sup>HI</sup>	Doherty et al. (1971)
MAMMALS				
Common brushtail possum ( <i>Trichosurus vulpecula</i> )	1967-1969	Qld	50(2) <sup>HI</sup>	Doherty et al. (1971)
Agile wallaby ( <i>Macropus agilis</i> )	1967-1968	Qld	93(169) <sup>HI</sup>	Doherty et al. (1971)
Eastern grey kangaroo ( <i>M. giganteus</i> )	1967-1968	Qld	86 (28) <sup>HI</sup>	Doherty et al. (1971)
Northern nail-tail wallaby ( <i>Onychogalea unguifera</i> )	1968	Qld	100 (1) <sup>HI</sup>	Doherty et al. (1971)
Black flying fox ( <i>Pteropus alecto</i> )	1967-1968	Qld	67 (6) <sup>HI</sup>	Doherty et al. (1971)
Little red flying fox ( <i>P. scapulatus</i> )	1967-1968	Qld	50(20) <sup>HI</sup>	Doherty et al. (1971)
Water-rat ( <i>Hydromys chrysogaster</i> )	1967-1969	Qld	4 (27) <sup>HI</sup>	Doherty et al. (1971)
Canefield rat ( <i>Rattus sordidus</i> )	1967-1969	Qld	14(14) <sup>HI</sup>	Doherty et al. (1971)
Horse ( <i>Equus caballus</i> )	1951-1952	SA	27 (102) <sup>N</sup>	Miles and Howes (1953)
Horse	1974	NSW	11 (13) <sup>HI</sup>	Marshall et al. (1982a)
Horse	1974	Qld	91 (23) <sup>HI</sup>	Doherty et al. (1976)
Cow ( <i>Bos taurus</i> )	1969	Qld	83 (66) <sup>HI</sup>	Doherty et al. (1971)
Goat ( <i>Capra aegagrus hircus</i> )	1954	NT	84 (19) <sup>N</sup>	Miles and Dane (1956)
Feral pig ( <i>Sus scrofa</i> )	1967-1968	Qld	74 (4) <sup>HI</sup>	Doherty et al. (1971)
Feral pig ( <i>S. scrofa</i> )	1971-1976	NSW	58 (358) <sup>HI</sup>	Gard et al. (1976)
Dog ( <i>Canis lupus familiaris</i> )	1968	Qld	93 (30) <sup>HI</sup>	Doherty et al. (1971)

\* Anderson (1953) refers to *Anhinga rufa*, an African species, most likely the species was *A. novaehollandiae*.

† Doherty et al. (1971) did not specify what species or how many of each were positive, but mentioned that multiple *T. scincoides* (at least) were positive.

HI = haemagglutination inhibition test, N = serum neutralization test.

## Acknowledgements

We are extremely grateful to the many people who had input into this fact sheet and would specifically like to thank Crystal Kelehear, Peter Holz and Shan Siah.

Updated: 12 April 2016

## References and other information

- Anderson, SG (1953) Murray Valley encephalitis: a survey of avian sera, 1951-1952. *Medical Journal of Australia* **1**, 573-576.
- Anderson, SG (1954) Murray Valley encephalitis and Australian X disease. *Journal of Hygiene* **52**, 447-468.
- Barton, AJ, Prow, NA, Hall, RA, Kidd, L, Bielefeldt-Ohmann, H (2015) A case of Murray Valley encephalitis in a 2-year old Australian Stock Horse in south-east Queensland. *Australian Veterinary Journal* **93**, 53-57.
- Boyle, DD, Dickerman, RW, Marshall, ID (1983) Primary viraemia responses of herons to experimental infection with Murray Valley encephalitis, Kunjin and Japanese encephalitis viruses. *Australian Journal of Experimental Biology and Medical Science* **61**, 655-664.
- Cordova, SP, Smith, DW, Broom, AK, Lindsay, MD, Dowse, GK, Beers, MY (2000) Murray Valley encephalitis in Western Australia in 2000, with evidence of southerly spread. *Communicable Disease Intelligence* **24**,
- Doherty, RL, Carley, JG, Kay, BH, Filippich, C, Marks, EN (1976) Murray Valley encephalitis virus infection in mosquitoes and domestic fowls in Queensland, 1974. *Ajebak* **54**, 237-243.
- Doherty, RL, Standfast, HA, Domrow, R, Wetters, EJ, Whitehead, RH, Carley, JG (1971) Studies of the epidemiology of arthropod-borne virus infections at Mitchell River Mission, Cape York Peninsula, North Queensland. IV. Arbovirus infections of mosquitoes and mammals, 1967-1969. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **65**, 504-513.
- Doherty, RL, Whitehead, RH, Wetters, EJ, Gorman, BM (1968) Studies of the epidemiology of arthropod-borne virus infections at Mitchell River mission, Cape York Peninsula, North Queensland. II. Arbovirus infections of mosquitoes, man and domestic fowls, 1963-1966. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **62**, 430-438.
- Gard, GP, Giles, JR, Dwyer-Gray, RJ, Woodrooffe, GM (1976) Serological evidence of inter-epidemic infection of feral pigs in New South Wales with Murray Valley encephalitis in virus. *Ajebak* **54**, 297-302.
- Gard, GP, Marshall, ID, Walker, KH, Acland, HM, De Sarem, WG (1977) Association of Australian arboviruses with nervous disease in horses. *Australian Veterinary Journal* **53**, 61-66.
- Gordon, AN, Marbach, CR, Oakey, J, Edmunds, G, Condon, K, Diviney, SM, Williams, DT, Bingham, J (2012) Confirmed case of encephalitis caused by Murray Valley encephalitis virus infection in a horse. *Journal of Veterinary Diagnostic Investigation* **24**, 431-436.
- Holmes, JM, Gilkerson, JR, El Hage, CM, Slocombe, RF, Muurlink, MA (2012) Murray Valley encephalomyelitis in a horse. *Australian Veterinary Journal* **90**, 252-254.
- Kay, BH, Hall, RA, Fanning, ID, Young, PL (1985a) Experimental infection with Murray Valley encephalitis virus: galahs, sulphur-crested cockatoos, corellas, black ducks and wild mice. *Australian Journal of Experimental Biology and Medical Science* **63**, 599-606.
- Kay, BH, Pollitt, CC, Fanning, ID, Hall, RA (1987) The experimental infection of horses with Murray Valley encephalitis and Ross River viruses. *Australian Veterinary Journal* **64**, 52-55.
- Kay, BH, Young, PL, Hall, RA, Fanning, ID (1985b) Experimental infection with Murray Valley encephalitis virus. Pigs, cattle, sheep, dogs, rabbits, macropods and chickens. *Australian Journal of Experimental Biology and Medical Science* **63**, 109-126.

Knox, J, Cowan, RU, Doyle, JS, Ligtermoet, MK, Archer, JS, Burrow, JN, Tong, SY, Currie, BJ, Mackenzie, JS, Smith, DW, Catton, M, Moran, RJ, Aboltins, CA, Richards, JS (2012) Murray Valley encephalitis: a review of clinical features, diagnosis and treatment. *Medical Journal of Australia* **196**, 322-326.

Mackenzie, JS, Broom, AK, Hall, RA, Johansen, CA, Lindsay, MD, Phillips, DA, Ritchie, SA, Russell, RC, Smith, DW (1998) Arboviruses in the Australian region, 1990 to 1998. *Communicable Diseases Intelligence* **22**, 93-100.

Marshall, ID, Brown, BK, Keith, K, Gard, GP, Thibos, E (1982a) Variation in arbovirus infection rates in species of birds sampled in a serological survey during an encephalitis epidemic in the Murray Valley of south-eastern Australia, February 1974. *Australian Journal of Experimental Biology and Medical Science* **60**, 471-478.

Marshall, ID, Woodroffe, GM, Hirsch, S (1982b) Viruses recovered from mosquitoes and wildlife serum collected in the Murray Valley of south-eastern Australia, February 1974, during an epidemic of encephalitis. *Australian Journal of Experimental Biology and Medical Science* **60**, 457-470.

Miles, JAR, Dane, DMS (1956) Further observations relating to Murray Valley encephalitis in the Northern Territory of Australia. *Medical Journal of Australia* **1**, 389-393.

Miles, JAR, Howes, DW (1953) Observations on virus encephalitis in South Australia. *Medical Journal of Australia* **1**, 7-12.

Roche, SE, Wicks, R, Garner, MG, East, IJ, Paskin, R, Moloney, BJ, Carr, M, Kirkland, P (2013) Descriptive overview of the 2011 epidemic of arboviral disease in horses in Australia. *Australian Veterinary Journal* **91**, 5-13.

Spencer, RG, Azoulas, J, Broom, AK, Buick, TD, Daniels, PW, Doggett, SL, Hapgood, GD, Jarrett, PJ, Lindsay, MD, Lloyd, G, Mackenzie, JS, Merianos, A, Moran, RJ, Ritchie, SA, Russell, RC, Smith, DW, Stenhouse, FO, Whelan, PI (2001) Murray Valley encephalitis virus surveillance and control initiatives in Australia - Part One. *Communicable Disease Intelligence* **25**,

Studdert, MJ, Azuolas, JK, Vasey, JR, Hall, RA, Ficorilli, N, Huang, JA (2003) Polymerase chain reaction tests for the identification of Ross River, Kunjin and Murray Valley encephalitis virus infections in horses. *Australian Veterinary Journal* **81**, 76-80.

Whitehead, RH, Doherty, RL, Domrow, R, Standfast, HA, Wetters, EJ (1968) Studies of the epidemiology of arthropod borne virus infections at Mitchell River Mission, Cape York Peninsula, North Queensland. III Virus studies of wild birds 1964-1967. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **62**, 439-445.

The Australian Department of Health has state-specific fact sheets on Australian Arboviruses

<http://www.health.gov.au/internet/main/publishing.nsf/Content/health-arbovirus-resources-factsheets.htm>

The Australian Department of Health Communicable Diseases Network Australia has national guidelines for public health specific to MVE available at:

<http://www.health.gov.au/internet/main/publishing.nsf/Content/cdna-song-mvev.htm>

## To provide feedback on this fact sheet

We encourage those with laboratory confirmed cases of this condition in native Australian or feral animals to submit this information to the national system for consideration for inclusion in the national database. Please contact us at [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au).

## Disclaimer

This fact sheet is managed by Wildlife Health Australia for information purposes only. Information contained in it is drawn from a variety of sources external to Wildlife Health Australia. Although reasonable care was taken in its preparation, Wildlife Health Australia does not guarantee or warrant the accuracy, reliability, completeness or currency of the information or its usefulness in achieving any purpose. It should not be relied on in place of professional veterinary consultation. To the fullest extent permitted by law, Wildlife Health Australia will not be liable for any loss, damage, cost or expense incurred in or arising by reason of any person relying on information in this fact sheet. Persons should accordingly make and rely on their own assessments and enquiries to verify the accuracy of the information provided.



Find out more at [www.wildlifehealthaustralia.com.au](http://www.wildlifehealthaustralia.com.au)  
email [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au)  
or call +61 2 9960 6333