

# MURRAY VALLEY ENCEPHALITIS VIRUS

## CDNA NATIONAL GUIDELINES FOR PUBLIC HEALTH UNITS

Revision history			
Version	Date	Revised by	Changes
1.0			

The Series of National Guidelines ('SoNGs') have been developed by the Communicable Disease Network Australia (CDNA) and noted by the Australian Health Protection Principal Committee (AHPPC). Their purpose is to provide nationally consistent guidance to public health units (PHUs) in responding to a notifiable disease event.

These guidelines capture the knowledge of experienced professionals, and provide guidance on best practice based upon the best available evidence at the time of completion.

Readers should not rely solely on the information contained within these guidelines. Guideline information is not intended to be a substitute for advice from other relevant sources including, but not limited to, the advice from a health professional. Clinical judgement and discretion may be required in the interpretation and application of these guidelines.

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# MURRAY VALLEY ENCEPHALITIS

## CDNA NATIONAL GUIDELINES FOR PUBLIC HEALTH UNITS

### 1. Summary

#### *Public health priority*

Urgent. Respond to confirmed and suspected cases within 24 hours.

#### *Case management*

Individual case management is the responsibility of the treating doctor. There is no specific treatment available for Murray Valley encephalitis virus (MVEV) infection. Patients who become unwell require supportive management by primary care or hospital services depending on the severity of illness.

#### *Contact management*

Contacts of an infected person cannot be infected by person-to-person transmission, or through a mosquito transferring virus from one person to another as humans are not reservoirs. Information about co-exposed persons is included under the contact management section. Except in unique circumstances, tracing of co-exposed persons is not indicated.

*Note:* These guidelines form the public health response to a human case of MVEV infection and are part of the framework for the detection and management of MVEV infection in Australia. This framework can be found at:  
(<http://www.health.gov.au/internet/main/publishing.nsf/Content/cdna-song-mvev#framework>)

### 2. The disease

#### **Infectious agents**

MVEV is a flavivirus closely related genetically and antigenically to Japanese encephalitis virus, West Nile virus (including the Kunjin strain found in Australia) and several other flaviviruses. Alfuy virus (ALFV) which is classified as a subtype of MVEV, also occurs in Australia but it has not been associated with human disease.

#### **Reservoir**

The primary hosts of MVEV are thought to be water birds such as herons and egrets, which act as reservoirs or amplifiers for infection. In particular, the Rufus (or Nankeen) Night Heron (*Nycticorax caledonicus*) is considered important. The principal virus cycle exists between these birds and the mosquito vectors. Native placental mammals, marsupials such as macropods (kangaroos and related species), and domesticated animals such as fowl, horses, pigs and cattle may be infected, but their role in natural transmission cycles is uncertain.

#### **Mode of transmission**

MVEV is a mosquito-borne virus and transmission is via a bite from an infected mosquito. The primary vector is the fresh water breeding mosquito *Culex annulirostris* (the common banded mosquito). Other mosquito species, including other *Culex* species and some *Aedes* species may be involved in MVEV ecology. There is no evidence of person-to person transmission, either directly or via mosquitoes. Rare cases of intra-uterine transmission of flaviviruses have occurred as well as transmission by blood transfusion and needle stick injuries.<sup>1</sup>

### **Incubation period**

The incubation period is usually 7 to 12 days, but occasionally can be as short as 5 days or as long as 28 days. Infection is believed to confer life-long immunity to MVEV.

### **Infectious period**

Not applicable. There is no evidence of person-to person transmission.

### **Clinical presentation and outcome**

MVEV commonly infects humans without producing apparent disease (subclinical infection). It may also cause a comparatively mild disease with features such as fever, headache, nausea and vomiting. In a small proportion of all people infected (estimated 1:200 – 1:1000) meningitis or encephalitis of variable severity develops.<sup>2,3</sup> In children, meningitis or encephalitis may occur in up to 1:20 cases of infection, depending on the geographical location.<sup>4-6</sup> Signs of brain dysfunction such as drowsiness, confusion, seizures, weakness, tremor, ataxia and/or cranial nerve palsies indicate the onset of encephalitis. Based on the 1974 outbreak (which occurred primarily in south-eastern Australia) and studies in Western Australia and Northern Territory, it is estimated that the case fatality rate of encephalitic cases is about 15%–30%<sup>4,6</sup> with long-term neurological sequelae occurring in 30%–50% of survivors and only 40% recovering completely.<sup>4-8</sup>

### **Persons at increased risk of disease**

The risk of infection with MVEV is dependent on the frequency and intensity of exposure to infected mosquitoes, and whether the person has been previously infected. People engaged in outdoor activities such as camping and fishing during periods of mosquito and virus activity may be at increased risk of infection. A four year longitudinal serologic study in an Indigenous community in Western Australia determined that the risk of infection among seronegative individuals was relatively constant regardless of age, although the numbers in the older groups were small.<sup>2</sup> The outcomes of encephalitis due to MVEV may be worse in the very young and those over 50 years-old, but severe disease and death may occur at any age. There is little information on MVEV infection in immunosuppressed persons but, based on overseas experience with similar flaviviruses, it is expected that they would be more susceptible to disease if infected.

### **Disease occurrence and public health significance**

MVEV was first isolated from patients who died from encephalitis during an outbreak of disease in the Murray Valley in Victoria and South Australia in 1951. The only Australia-wide outbreak of MVEV infection was in 1974, although most cases occurred in south-eastern Australia. Since then almost all cases have been infected in northern and central Australia, with regular MVEV activity and human cases in the Kimberley region of Western Australia and the northern two thirds of the Northern Territory. Infections have also occurred further south in the Pilbara, Gascoyne, Midwest, and Murchison areas of Western Australia (particularly in 2000 and 2011), in central Australia and in Queensland. There is also an occasional risk to south-eastern Australia, with cases reported in NSW in 2008 and 2011, and in South Australia in 2011. MVEV has also been detected in horses from time-to-time;

however, the implications for human health are unclear at this time. There was evidence of widespread MVEV activity in sentinel chickens and in horses in some areas of the southern states in 2011.<sup>9</sup>

MVEV activity in Australia may be broadly divided into two categories, as follows:

- **enzootic activity** (Kimberley region of Western Australia and northern Northern Territory)- annual MVEV activity as indicated by sentinel chicken programs, with one or two human cases on average each year, vectors and predisposing environmental conditions relatively well defined, and generally small human population centres.
- **epizootic activity** (including south-eastern Australia and southern Western Australia) - rare activity, with vectors, hosts and predisposing environmental conditions less well-defined and/or larger or more numerous centres of human population which are likely to have low levels of immunity, and where prevailing conditions may indicate potential for a large outbreak.

The risk of contracting MVEV infection is related to the presence of the principal vector, *C. annulirostris*, which is found throughout Australia (except for Tasmania). In northern Australia it is active year-round, with the number of mosquitoes greatest in the wet and post wet season. In southern regions, *C. annulirostris* tends to be a high-summer species associated with natural wetlands and irrigation waters, emerging during mid-to-late spring as the weather warms, peaking in abundance in mid-to late-summer, and disappearing before winter.

MVEV infection is a significant public health issue, with the potential for fatal cases and permanent disability. The potential severity elevates the level of public concern and media interest in MVEV infection. Economic impacts may also be significant, with direct costs of providing healthcare for persons with encephalitic disease and funding sentinel surveillance and mosquito control programs; and potentially indirect costs resulting from reduced tourism or labour shortages in mining or agricultural sectors in affected regions arising from public concern. National contingency plans are required for widespread outbreaks.

### 3. Routine prevention activities

Evidence of increased virus activity, including sentinel chicken seroconversions, occurrence of a human case, or other evidence of increased activity such as animal (eg horse) infections should prompt consideration of a public awareness strategy to promote personal protective behaviours and a targeted alert to medical practitioners and emergency departments to promote a higher level of suspicion for MVEV infection when assessing patients. Public awareness strategies may be targeted at particular groups such as fishermen, or campers in a particular region or location and information about the disease may be provided to people with similar high risk exposures as a case where practicable.

Prevention activities include:

- Maintenance of surveillance programs including mosquito monitoring and sentinel chicken flocks to detect activity of MVEV.
- Personal protective measures such as wearing loose fitting clothing with long sleeves and trousers and use of appropriate mosquito repellents.
- Avoidance of mosquito-prone areas and vector biting times, particularly around dawn and dusk and throughout the night.

- Implementing mosquito control measures in the environment including the use of insect screens and habitat modification and targeted mosquito management using larvicides and insecticides. However, it should be noted that the sheer size and inaccessibility of natural mosquito breeding habitat in large areas of Australia where MVEV is either enzootic or epizootic means that beyond the immediate vicinity of population centres it is generally not feasible to reduce mosquito populations to levels that don't pose some risk to public health.

#### 4. Surveillance objectives

The objectives of human surveillance are:

- to detect sporadic cases and outbreaks of MVEV infection
- to guide immediate action and control measures for both sporadic cases and outbreaks of MVEV infection
- to monitor the epidemiology of MVEV in Australia
- to identify geographic areas for targeted interventions or research
- to identify risk factors and high-risk populations

Monitoring of vectors and viral activity are essential elements of MVEV surveillance in Australia. For further information on vector and host surveillance, refer to the framework for the detection and management of MVEV infection in Australia. This framework can be found at: [insert url when available]

##### Sentinel animal surveillance

In some jurisdictions, MVEV (and Kunjin virus, KUNV) activity is monitored by detecting antibody seroconversion to the virus in samples from sentinel chickens. Dedicated sentinel chicken flocks are maintained all year round in Western Australia and the Northern Territory, and in the summer months in northern Victoria, along the Murray River in South Australia and in southern and western New South Wales. Sentinel chickens are generally bled monthly or fortnightly, and sometimes more frequently in higher risk periods. Currently, Queensland does not have dedicated sentinel chicken flocks. MVEV infection in horses may also provide a warning of MVEV activity, but the significance of MVEV detections in horses as it relates to human health risk is currently unknown.

##### Mosquito surveillance

Mosquito population surveillance is undertaken to monitor abundance of the principal vector species and to detect the presence of the virus in mosquitoes. Given adequate surveillance, virus activity can be expected to be seen in mosquito populations prior to any evidence of transmission to sentinel chickens (appearance of antibodies) or humans (clinical disease). The abundance of MVEV mosquito vectors is dictated principally by the abundance of water in the environment (rainfall patterns and irrigation) and temperature.

##### Climate surveillance

Monitoring of rainfall patterns, temperature, the Southern Oscillation Index via the [Bureau of Meteorology website](http://www.bom.gov.au/) (<http://www.bom.gov.au/>) and river flow data (e.g. [Murray Darling Basin Commission website](http://www.mdbc.gov.au/) (<http://www.mdbc.gov.au/>)) is also undertaken by some states.

#### 5. Data management

Enter confirmed cases onto the notifiable diseases database within one working day of notification. Document the potential exposure location(s) in the notifiable diseases database.

## **6. Communications**

On the day of notification, inform the communicable diseases control branch of the relevant state/territory Department of Health of the demographic and clinical aspects of the case and the likely place(s) of exposure. Where an exposure occurred outside the PHU area, also notify the relevant PHU as soon as possible. In the event of a cluster of cases, the state/territory communicable disease control branch should also notify the relevant details to the CDNA secretariat for dissemination to CDNA members, while individual cases should be included in the fortnightly jurisdictional reports.

## **7. Case definition**

Only confirmed cases of MVEV infection are notifiable. The current national case definition for surveillance of MVEV infection can be found at the [Health website](http://www.health.gov.au/casedefinitions): (www.health.gov.au/casedefinitions)

## **8. Laboratory testing**

A diagnosis of MVEV infection should be considered amongst the differential diagnoses in any patient who presents with encephalitis and who has been in an enzootic or epizootic area within the incubation period of the disease (5-28 days prior to the onset of symptoms), especially during the wet and post-wet seasons in northern areas or mid-spring to mid-autumn in southern areas.

### **Testing guidelines**

Samples should be sent to a PHLN laboratory, or an arbovirus reference laboratory that is National Association of Testing Authorities (NATA) accredited to perform relevant requested diagnostic testing on human samples (see Appendix 1). Where a case occurs in an area without known MVEV activity, positive results should be confirmed by a second arbovirus reference laboratory.

### **Samples**

- Blood (5 to 10ml) should be collected for testing for antibodies. In children it may be difficult to get this amount of blood, but it is important to try and maximise the sample volume as serological diagnosis of flavivirus infection usually requires multiple tests.
- CSF (1 to 3ml) from lumbar puncture, if performed, should also be sent for laboratory testing for flaviviruses. This volume should be in addition to the amount required for other tests such as glucose and protein measurements and bacterial examination. CSF can be used for virus detection and serological testing.
- Where pre-mortem or post-mortem tissues are available for testing, then this should be discussed with the laboratory.

### **Virus detection**

Virus can be detected by culture or by a nucleic acid test (NAT). The latter is more sensitive. Positive cultures are rare, and therefore culture is usually only performed where there is a positive NAT or where a suitable NAT is not available, and provided there is sufficient

specimen volume. Tissue cultures are available in most arbovirus reference laboratories, but the availability of animal inoculation is very restricted.

### **Serology**

Serological testing for flaviviruses is highly specialised due to the limited availability of the tests and difficulties in interpretation of results. Nearly all patients who have MVEV infection will have detectable IgM in the serum within a few days of onset of illness and it will persist for many months or years. Therefore detection of IgM in serum does not necessarily mean recent infection. Conversely, serum IgM may also be absent in some patients, especially those who have had previous flavivirus infections, such as MVEV infection in someone with past KUNV infection. IgM is present in the CSF in about 75% of encephalitis cases, and is indicative of intrathecal antibody production and central nervous system infection.

It is important that both acute and convalescent serum samples are collected in order to demonstrate a rise in IgG, as this confirms recent infection. However, both IgG and IgM are broadly cross-reactive among the flaviviruses. That is, a rise in IgG to MVEV with or without IgM, it could be due to infection with any flavivirus, depending on the patient's travel and exposure history. In Australia we have to primarily consider KUNV, and possibly Japanese encephalitis virus (JEV) and dengue virus (DENV), but rarer flaviviruses such as Kokobera and Edge Hill viruses also occur. Returned travellers may have been exposed to other viruses such as West Nile virus, JEV and DENV.

Therefore, the following criteria have been developed to assist in distinguishing the specific virus responsible for a flavivirus infection:

- Specific virus infection can be assigned if the IgG is shown to be specific to a single virus, by neutralisation or other specific tests.
- It is an unspecified flavivirus infection if the IgG cannot be shown to be specific to a single virus.
- Recent infection based on IgG detection requires a  $\geq$  four-fold (or equivalent) rise in IgG, or evidence of seroconversion or significant increase in antibody level, provided that there is a suitable clinical and exposure history.
- Recent meningoencephalitis can be assigned to a specific virus if the IgM to a single flavivirus is detected in the CSF in the absence of IgM to other likely flaviviruses. Where MVEV infection is suspected, as a minimum IgM tests for antibody to MVEV, KUNV, DENV and JEV should be carried out.
- If IgM to MVEV is detected in serum in the absence of IgM to other likely flaviviruses, this is only accepted as laboratory evidence for encephalitic illness, but not for non-encephalitic illness.

Detection of IgM to more than one flavivirus should be classified as an unspecified flavivirus infection unless specific IgG has been confirmed and notified as arbovirus (not elsewhere classified or NEC)

The Public Health Laboratory Network of Australia (PHLN) has formulated a laboratory case definition for flavivirus infection available from the [Health website](http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-phln-cd-flavivirus.htm) (<http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-phln-cd-flavivirus.htm>)

## **9. Case management**

### **Response times**

Investigation should commence within 24 hours of notification of a confirmed human case of MVEV infection. If any case is diagnosed outside the jurisdiction where the infection was likely to have been acquired, the communicable disease control branch in

the state/territory where it was thought to have been acquired should be notified on the same day, in order to ensure appropriate preventive measures can be implemented promptly.

The extent of a response to a case or cases of MVEV infection should take into account recent and current preventive activities in the implicated area, any available information from local mosquito and sentinel chicken surveillance programs, the epidemiological significance of the reported cases, prevailing environmental conditions and expected outcomes of the outbreak response.

In areas of enzootic activity (see “Disease occurrence and public health significance” in section 2) with established surveillance and response programs there may be little need for detailed investigations and interventions beyond continuation of existing programs. Hence, the response may rely on pre-prepared public warnings and advice about mosquito avoidance measures, reminders to medical practitioners and targeted mosquito control measures near an affected population centre, as appropriate.

In epizootic areas, investigations, interventions and warnings may substantially reduce further risks and provide important information about factors contributing to the outbreak that will inform predictions of future outbreaks and management approaches.

## **Response procedure**

### ***Case investigation***

All cases should be investigated to determine the likely place of acquisition of MVEV infection. An example MVEV investigation form is provided in Appendix 4.

PHU staff should ensure that action has been taken to:

- Consider signs and symptoms and their compatibility with MVEV infection
- Confirm the onset date and compatibility of the onset date with the incubation period of MVEV infection
- Liaise with clinicians and laboratory staff to check results and ensure that the relevant tests are conducted, including collection of convalescent specimens where appropriate and the need for confirmatory testing in a second laboratory if this is required in the context of local disease epidemiology.
- Where possible seek the doctor’s consent to interview the case or relevant care-giver.
- Interview case if possible (or otherwise family, friends and/or travelling companions) to determine local and overseas travel and exposure history in order to ascertain the most likely place and time the MVEV or other flavivirus infection was acquired (see “Exposure investigation” below). For cases acquired in another area, it may be necessary to consult with the relevant jurisdiction/PHU to determine who is best placed to interview the case or their proxy in detail about possible places of exposure (e.g. local water-holes, fishing spots, etc.).

### ***Exposure investigation***

Obtain a full travel history to determine whether they had visited an area with known (recent or previous) evidence of MVEV activity, during the exposure period (5-28 days prior to onset of symptoms) and whether the case had:

- Been bitten by mosquitoes, including the specific location(s) where this occurred and the intensity of exposure.



- Participated in recreational or other activities involving exposure to bushland, water-sources, coastal areas or other mosquito habitats (e.g., while fishing, gardening, bushwalking and picnicking). Clarify the type of accommodation used while in the risk area (e.g. camping, screened tents, air conditioned hotels).
- Used personal protection methods including repellents (and type thereof).
- Used protective clothing and/or mosquito nets routinely whilst in regions where arboviruses are present.

If a case has not traveled to an area of known MVEV activity in Australia (or the island of New Guinea, including Papua New Guinea, and the Indonesian Provinces of West Papua and Papua) within the incubation period of the disease, then the potential for infection to have occurred within a low-risk area of Australia exists. If this occurs, further investigation of potential reservoirs of infection and additional cases should be considered.

Interpretation of serological results may also require detailed questioning about past travel or residence within northern Australia or overseas where exposure to flaviviruses may have occurred.

### ***Case treatment***

No specific treatment is available for MVEV disease and care of symptomatic cases is largely supportive. Given the potential for neurological deterioration, patients with encephalitis should ideally be managed in hospitals with intensive care facilities and expertise in the management of complicated neurological disease. Management should be discussed with a physician with experience in the care of these patients.

### ***Education***

A factsheet on MVEV infection should be made available to the case and family and other co-exposed individuals to provide information about the nature of the infection and the mode of transmission. (See Appendix 3 - example factsheet).

### ***Isolation and restriction***

None.

### ***Active case finding***

Case finding should be undertaken in response to all cases, but should be limited to the geographical location in which the case was most likely to have acquired their infection. Case finding should focus on human cases of acute febrile illness in the affected area with headache and other signs of encephalitis including seizures, confusion or depressed consciousness, with no other obvious cause. Most usually, active case finding would be limited to alerts to a small number of community and/or hospital-based medical practitioners serving a regional area and a state/territory public health laboratory, but in some circumstances wider alerts might be appropriate, and include metropolitan tertiary referral hospital emergency departments and intensive care units, and even monitoring of data from existing emergency department syndromic surveillance systems.

Additional activities to identify milder, non-encephalitic cases should be considered if resources allow. Where human cases are identified in unexpected areas, opportunistic serological testing of domestic animals (e.g. chicken flocks) may be useful to help define the

range of MVEV activity. Similarly, opportunistic or systematic serosurveys of humans may be appropriate in defining infection rates and the area of risk.

## **10. Environmental evaluation**

MVEV is not transmitted between humans. Transmission of infection requires competent mosquito vectors and animal reservoirs of MVEV (see section 2.).

Control of the spread of MVEV and prevention of human cases rests on the management of competent mosquito vectors and personal and community (e.g. location of human settlements relative to habitat) strategies of mosquito avoidance.

Environmental evaluation and implementation of control measures is the responsibility of local environmental health authorities and jurisdictional medical entomology units. The aim of this assessment is to identify risk periods and areas due to expected rainfall or flooding or other indicators from models to direct mosquito control activities, including identifying common breeding sites and control of both larval and adult populations of *Culex* vector mosquitoes.

Evaluation of environmental risks should include information from mosquito monitoring and sentinel chicken surveillance programs, if available, in the context of historical knowledge of MVEV activity relative to seasonal rainfall and flooding events. Local animal health authorities should also be consulted regarding animal surveillance.

A recent development has been the evaluation of a new surveillance tool involving testing for MVEV presence by a PCR method using honey baits in special mosquito traps. The sensitivity, cost-effectiveness and technical feasibility of honey bait traps are still being established, but these have the potential to be a very useful tool in the future. Where possible, honey bait trap mosquito virus surveillance could be set up in the area to monitor for MVEV activity, as an adjunct to other methods, and for the purposes of comparison and refinement of the method.

## **11. Contact management**

Contacts of an infected person cannot be infected by person-to-person transmission, or through a mosquito transferring virus from one person to another as humans are not reservoirs. Therefore, this section provides details on the public health response for co-exposed persons.

### *Identification of co-exposed*

To date, MVEV disease has presented as sporadic cases, with no well documented instances of co-exposed persons developing disease. Similarly, time-place clusters of cases are rare, except over broad regions and extended time periods. Hence, except in unique circumstances, as described below, screening of co-exposed persons who do not have symptoms consistent with MVEV infection, is not indicated for public health purposes. Testing of these patients may be undertaken as part of their clinical management.

Special circumstances where tracing co-exposed persons might be appropriate include research projects aimed at determining infection rates in small groups of co-exposed persons or within communities in which a case has occurred, or unusual instances where a case of MVEV disease was part of a small group (such as a fishing party camping in an

isolated area) which experienced heavy mosquito-biting and information suggests that others in the group may have either non-encephalitic or encephalitic symptoms consistent with MVEV infection. In this instance the aim of identifying the co-exposed would be to facilitate laboratory testing and appropriate management for MVEV infection should any person from the co-exposed group have symptoms consistent with the disease.

### **Contact definition**

See above - ordinarily, identification of co-exposed persons is not indicated. In unique circumstances, as described above, co-exposed might be defined as persons who had the same exposure(s) as the case, such as members of a small group who shared outdoor activities and heavy exposure to mosquito vectors with the case.

### **Prophylaxis**

Nil. There is no vaccine available for MVEV.

The protective efficacy of JEV vaccines against NVEV infection have not been directly determined and may vary with the type of vaccine, with evidence to suggest that some may be protective while others may enhance infection.<sup>10</sup> This should be considered should widespread JE vaccination be required in an area with known MVE enzootic transmission (e.g. following a hypothetical JE importation into FNQ, given that we have competent JE vectors).

### **Education**

See above - ordinarily co-exposed do not need to be identified and no education is required. In unique circumstances, as described under "Identification of contacts", an MVEV infection fact-sheet (see example in Appendix 3) could be made available for co-exposed.

### **Isolation and restriction**

Nil.

## **12. Special situations**

Additional actions may be required where a cluster of cases in place or time is detected through analysis of case exposure history. The goal of the investigation is to identify the source of infection and potential risk factors for illness, thereby informing public health action. Stages and considerations may include:

- Defining the outbreak
- Assembling outbreak response and outbreak management teams which may include Public Health staff, medical entomologists, and state or local government EHOs. Staff experienced in arbovirus control should be consulted. Should the outbreak response team require expert advice it can contact NAMAC through the secretariat.
- Use of state/territory/other guidelines
- Outbreak investigation
- Outbreak management

The management and national co-ordination of an outbreak of MVEV infection in Australia is further detailed in the *CDNA Framework for the Surveillance, Prevention and Control of Murray Valley Encephalitis*.



### 13. References and additional sources of information

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10. Broom AK, Wallace MJ, Mackenzie JS, Smith DW, Hall RA. Immunisation with gamma globulin to murray valley encephalitis virus and with an inactivated Japanese encephalitis virus vaccine as prophylaxis against australian encephalitis: evaluation in a mouse model. *J Med Virol* 2000;61(2):259-265.

## 14. Appendices

Appendix 1. List of Arbovirus Reference Laboratories

Appendix 2. MVEV case investigation form

Appendix 3. MVEV Factsheet

Appendix 4. PHU checklist

## 15. Jurisdiction specific issues

Links to State and Territory Public Health Legislation, the *Quarantine Act* 1908 and the *National Health Security Act* 2007 are available at the [Health website](http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-state-legislation-links.htm):  
(<http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-state-legislation-links.htm>)

## **Appendix 1.** List of Arbovirus Reference Laboratories

### **Queensland**

Old Health Forensic and Scientific Services  
39 Kessells Rd  
Coopers Plains  
PO Box 594 Archerfield Qld 4108  
Phone: (07) 3274 9151

### **Victoria**

Victorian Infectious Diseases Reference Laboratory (Human)  
10 Wrecklyn St  
North Melbourne Victoria 3051  
Phone: (03) 9342 2600

Department of Primary Industries  
Attwood Centre  
475 Mickleham Road  
Attwood Victoria 3049  
Phone: (03) 9217 4200

CSIRO Livestock Industries  
Australian Animal Health Laboratory  
Private Bag 24 (5 Portarlington Road)  
Geelong Victoria 3220  
Switchboard: (03) 5227 5000

### **Western Australia**

The Western Australian Centre for Pathology and Medical Research  
Division of Microbiology and Infectious Diseases (Human)  
Hospital Avenue  
Nedlands WA 6009  
Switchboard: (08) 9346 3122

Arbovirus Surveillance and Research Laboratory  
Discipline of Microbiology and Immunology (Animal/Vector)  
School of Pathology and Laboratory Medicine  
The University of Western Australia  
35 Stirling Highway  
Crawley WA 6009  
Phone: (08) 9346 2212

### **New South Wales**

Pathology West - Institute of Clinical Pathology and Medical Research (ICPMR)  
Westmead Hospital  
Darcy Road  
Westmead NSW 2145  
Phone: (02) 9845 6255

FOR OFFICIAL USE ONLY

Appendix 2: Example MVEV Case Investigation Form

Notification ID: \_\_\_\_\_

Date and time notified: \_\_\_\_\_

Notified by: \_\_\_\_\_ Organisation/Hospital: \_\_\_\_\_ Phone: \_\_\_\_\_

Final classification:  Confirmed  Probable  Rejected

Date questionnaire completed: \_\_\_\_\_

Person(s) interviewed:

- Case
- Parent/guardian, (specify) \_\_\_\_\_
- Spouse/other family member (specify) \_\_\_\_\_
- General Practitioner (name) \_\_\_\_\_
- Treating Doctor (name) \_\_\_\_\_
- Other, specify \_\_\_\_\_

Please indicate who completed this form:

- Public health officer
- EHO (Name & Local Govt): \_\_\_\_\_
- Other: \_\_\_\_\_

Section 1: Case Details

First name: \_\_\_\_\_ Surname: \_\_\_\_\_

Gender:  M  F Date of Birth (day/month/year) : \_\_\_\_/\_\_\_\_/\_\_\_\_

Is the case of Aboriginal or Torres Strait Islander origin:

- Non Indigenous  Aboriginal  Torres Strait Islander (TSI)
- Aboriginal and TSI  Unknown

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Residential address (not PO Box): \_\_\_\_\_

Town/Suburb: \_\_\_\_\_

State: \_\_\_\_\_ Postcode: \_\_\_\_\_ Country \_\_\_\_\_

Phone: (Home) \_\_\_\_\_ Phone (mobile): \_\_\_\_\_ Phone (work): \_\_\_\_\_

Country of birth: \_\_\_\_\_ Year of arrival: \_\_\_\_\_

Occupation: \_\_\_\_\_

Occupation requires work mostly:  Indoors  Outdoors

Status

- Alive
- Died due to notifiable disease\_date \_\_\_/\_\_\_/\_\_\_\_\_
- Died due to other/unknown cause date \_\_\_/\_\_\_/\_\_\_\_\_
- Unknown

**Doctor details: General practitioner**

Doctor name: \_\_\_\_\_ Clinic name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone (work) \_\_\_\_\_ Fax (work) \_\_\_\_\_ Email: \_\_\_\_\_

**Section 2: Laboratory Criteria**

Name of Laboratory: \_\_\_\_\_

Date result available: \_\_\_\_\_

Specimen collection date: \_\_\_\_\_

Type(s) of specimen

- Blood
- Cerebrospinal fluid
- Other: \_\_\_\_\_

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Results

	Yes	No	Equiv.	Pending	Specimen type
MVE virus isolation					
Nucleic acid test: PCR +ve					
MVEV IgG +ve (initial bleed)					

	Yes	No	Equiv.	Pending	Bleed date 1	Bleed date 2	Titre (serology)
MVEV IgG +ve (initial bleed)							
MVEV IgG +ve (second bleed)							
MVEV IgM +ve (encephalitic illness Y/N)							
Virus neutralisation serology							

Confirmation at second laboratory:  Yes  No;  
 If yes, name of second laboratory \_\_\_\_\_

*Confirmation of laboratory result by a second arbovirus reference laboratory is required if the case occurs in areas of Australia not known to have established enzootic/endemic activity or regular epizootic/epidemic activity, see case definitions available from the [Health website](http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-casedefs-cd_mve.htm) ([http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-casedefs-cd\\_mve.htm](http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-casedefs-cd_mve.htm) ).*

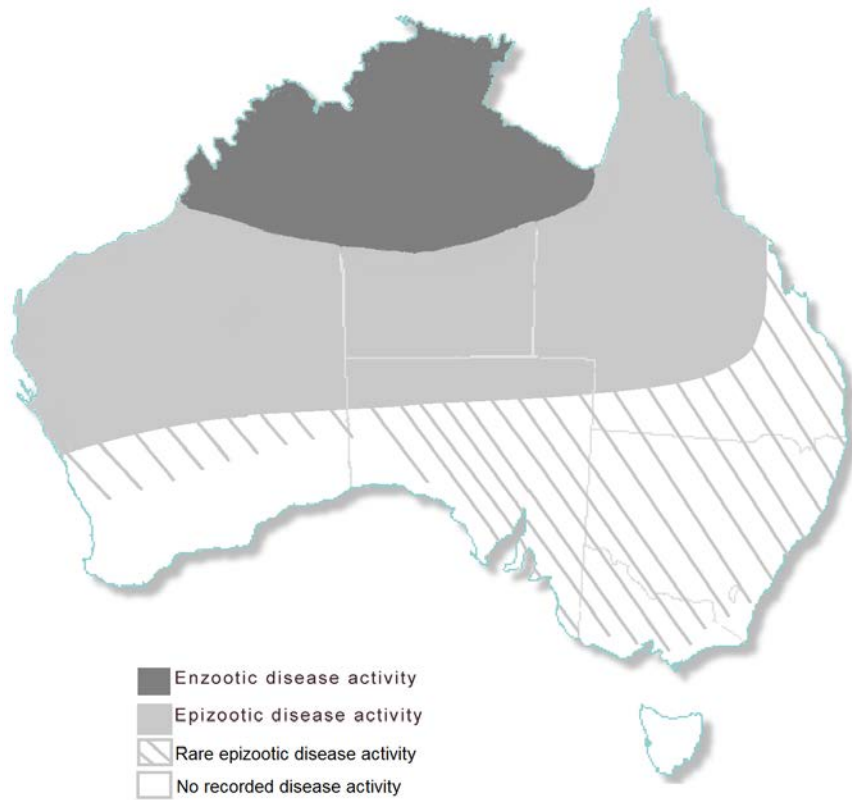


Figure 1. MVEV enzootic and epizootic regions in Australia

Has the case tested positive for MVEV before?  Yes  No

If yes, give details \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Has the case tested positive for any other arbovirus before?  Yes  No

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If yes, give details \_\_\_\_\_  
\_\_\_\_\_

**Section 3: Illness details**

Date of onset (D/M/Y): \_\_\_\_/\_\_\_\_/\_\_\_\_ Date of first consultation: \_\_\_\_/\_\_\_\_/\_\_\_\_

Total duration of illness:    days    hours

**Symptom profile**

No symptoms	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Nausea	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Dizziness	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Headache	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Tiredness	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Neck Stiffness	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Photophobia	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Fever	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Rash	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Muscle aches and pains	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Impaired consciousness	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Confusion	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Difficulty walking	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Young children: Drowsiness/floppy/irritability	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Other: Specify _____			

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History of illness from case or proxy:

History of illness from treating doctor:

**Section 4: Hospital presentation**

Did the case present to hospital?  No  Yes -> Date presented to hospital \_\_\_/\_\_\_/\_\_\_\_

Admitted to hospital:  No  Yes

If admitted, Hospital Name(s): \_\_\_\_\_ UR no: \_\_\_\_\_

Date admitted: (D/M/Y) \_\_\_/\_\_\_/\_\_\_\_

Date discharged: (D/M/Y) \_\_\_/\_\_\_/\_\_\_\_

Treating doctor / Unit: \_\_\_\_\_

Discharge summary requested:  No  Yes -> Date \_\_\_/\_\_\_/\_\_\_\_

**Section 5: Exposure period**

**Calculated exposure period** (Onset – 28 days) to (Onset – 5 days): \_\_\_/\_\_\_/\_\_\_\_ to \_\_\_/\_\_\_/\_\_\_\_

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Did the case travel in the 4 weeks before onset of symptoms?  No  Yes →  Within the State  Interstate  Overseas

During the exposure period, please indicate **all** suburbs/s or town/s (**Australian and overseas**) in which the person resided, worked or visited

Leave blank if information not available or unknown

	<b>Address/Suburb/Town/Country</b>	<b>Dates (arrival and departure)</b>	<b>Activity at this place</b>	<b>Building features</b>	<b>Noticed mosquitoes</b>	<b>Recall being bitten by mosquitoes here?</b>
1			Reside / Work / Visit	Screens / aircon	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
2			Reside / Work / Visit	Screens / aircon	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
3			Reside / Work / Visit	Screens / aircon	Yes No	Yes No
4			Reside / Work / Visit	Screens / aircon	Yes No	Yes No
5			Reside / Work / Visit	Screens / aircon	Yes No	Yes No
6			Reside / Work / Visit	Screens / aircon	Yes No	Yes No
7			Reside / Work / Visit	Screens / aircon	Yes No	Yes No
8			Reside / Work / Visit	Screens / aircon	Yes No	Yes No

*Notes to interviewer:* Where possible ask the person to identify the location down to a street or lot number or a particular part of a recreational area (e.g. wetland, nature reserve, golf course, etc).

**Section 6: Further details of location/activities/behaviour whilst in the place they were most likely to be have acquired their infection**

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What activities were they doing (camping/fishing/gardening)? \_\_\_\_\_

What type of accommodation? (tents / hotels / hostel) \_\_\_\_\_

Where did they notice mosquitoes - indoors/outdoors, near water bodies, in the bush, etc? \_\_\_\_\_

Did the case report use: (a) of personal mosquito repellent? Yes No; (b) protective clothing Yes No (c) mosquito nets? Yes No

Does the case know of other persons who have been to the same place who have become ill? Yes No (If Yes, seek further details)

**Section 7: Co-exposed**

Co-exposed can be defined as persons who have had the same exposure/s as the case including household members and persons who travelled with the case.

<u>Name , address and phone number</u>	<u>Age</u>	<u>Recent MVE-like illness</u>
		Yes No
		Yes No
		Yes No
		Yes No
		Yes No

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		Yes	No
		Yes	No

**Section 8: Public Health Action**

Mosquito precautions discussed:      Yes      No

Fact sheet sent:                              Yes      No

Other:

**Section 9: Interviewer**

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_/\_\_/\_\_



## Appendix 3: Fact sheet

# Murray Valley encephalitis (MVE)

### *What is MVE?*

Murray Valley encephalitis (MVE) is an uncommon but potentially fatal human disease that occurs after being bitten by a mosquito carrying the MVE virus.

### *How is MVE spread?*

The MVE virus is spread by the bite of an infected mosquito (usually *Culex annulirostris*, also known as the common-banded mosquito) and cannot be spread from person-to-person. Only about 1 person in 1,000 who is bitten by an infected mosquito will become unwell with MVE.

### *Where does MVE usually occur?*

Although MVE can occur throughout Australia, it is most common in northern Australia. The MVE virus is present during the wet and post-wet seasons in the top two thirds of the Northern Territory and the Kimberley region of Western Australia during most years. In some years it may extend into the Pilbara and occasionally the Midwest and Murchison regions of Western Australia, central Australia and Queensland. There is also an ongoing occasional risk to south-eastern Australia. The risk in southern areas increases between mid-spring and mid-autumn. Most cases are present between March and May.

### *What are the symptoms?*

Symptoms of MVE usually appear 5 to 28 days after being bitten by an infected mosquito. The early symptoms include headache, fever, nausea and vomiting, and muscle aches, which can progress to drowsiness, confusion, seizures or fits (especially in young children) and in severe cases delirium and coma.

### *Who is at risk?*

People most at risk are babies, young children and newcomers to a region where MVE occurs.

### *How is it diagnosed?*

A blood test is available to test for recent or past MVE infection. Consult a PHLN laboratory for a range of suitable diagnostic tests

### *What is the treatment?*

There is no specific treatment or vaccine available for MVE. The treatment of severe MVE is supportive and often requires admission to an intensive care unit.

### *How can MVE be prevented?*

The only protection from MVE is to avoid being bitten by mosquitoes. Everyone should take measures to avoid being bitten by mosquitoes, particularly those visiting and camping in or near swamp or river systems and in rural areas near sites of relatively high mosquito activity particularly after sunset and during the evening but also throughout the night. Mosquito protection for young children and babies is absolutely essential.

### *Personal protective measures*

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- Stay indoors when mosquitoes are most active, from just before sunset and all night.
- Wear loose, light-coloured clothing with long sleeves, long trousers and socks (mosquitoes can bite through tight-fitting clothes).
- Apply a protective repellent containing up to 20 percent diethyl toluamide (DEET) or picaridin to exposed areas of skin and reapply as directed by the manufacturer. Lotions and gels are more effective and long lasting than sprays.
- Use other mosquito protection devices such as mosquito lanterns
- Apply residual pyrethroids around the home or campsite, and/or to nearby shrubbery that provide a harbourage for mosquitoes..
- Ensure flyscreens in houses or caravans are in good condition.
- If camping out, sleep in a mosquito-proof tent or under a mosquito net. Repellents only protect against mosquito bites for up to four hours, not all night.

### ***What is the public health response?***

Hospitals and laboratories will notify cases of MVE to the local public health unit. Public health unit staff will investigate the likely source and determine whether others may be at risk of infection. Doctors should contact their public health unit for advice on the public health management of people presenting with MVE symptoms.

### ***Further information***

For further information on MVE disease, please contact your local doctor, community health centre or nearest public health unit.

For further information regarding mosquito control issues contact your nearest environmental health or medical entomology unit or council.

**Appendix 4.** PHU checklist

**PHU Murray Valley Encephalitis Checklist**

**Patient ID number:** \_\_\_\_\_

**Contact the patient's doctor to:**

- Obtain patient's history
- Confirm results of relevant pathology tests or recommend that the tests be done
- Inform the doctor you will have to contact patient or care-giver

**Contact the patient (or care giver) to:**

- Confirm onset date and symptoms of the illness
- Confirm inter- or intra-state or overseas travel history
- Identify location/s of patient during exposure period (5-28 days prior to onset of symptoms)
- Complete *MVEV infection Case Investigation Form*
- Provide with *MVE Factsheet*
- Identify known co-exposed who may have similar exposures and obtain contact details
- Contact patient's co-exposed to determine current symptoms and recommend testing if necessary
- Provide co-exposed with *MVE Factsheet*

**Contact laboratory to:**

- Obtain any outstanding results

**If exposed locally:**

**Contact local Environmental Health Authority (vector control team) to:**

- Inform them of case details and exposure information
- Work collaboratively to direct environmental management and vector control activities

**If exposed interstate:**

**Contact the communicable disease control branch in that jurisdiction:**

- Inform them of case details and exposure information to enable them to undertake follow-up, communications, environmental management and vector control

**Other issues:**

- Assess information against case definition to confirm case
- Enter case data onto notifiable diseases database
- Report details of case and action plan to state/territory CDB
- Initiate active case finding
- Consider alerting local doctors, EDs, laboratories
- Consider local media release