

# **Wildlife Exotic Disease Preparedness Program: Development of a surveillance system for detecting an incursion of West Nile virus in wild birds in Australia – Interim Report 2003 – 2004**

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## **Introduction**

The Australian Wildlife Health Network (AWHN) is a National initiative of the Commonwealth Government and is managed under the Wildlife Exotic Disease Preparedness Program (Australian Department of Agriculture, Fisheries and Forestry). Its mission is to promote and facilitate collaborative links in the investigation and management of wildlife health in support of human and animal health, biodiversity and trade.

In 2002-2003 the AWHN received seed funding of \$10K from the Wildlife Exotic Disease Preparedness Program to begin developing a surveillance system for detecting an incursion of West Nile Virus (WNV) in wild birds in Australia. This report presents progress to date in the first part of the work, which is to: examine the elements of an effective WNV surveillance system required in Australia in wild bird populations to detect an incursion of this exotic organism at an early stage before there are significant public health implications.

## **Background**

Flaviviruses are a group of viruses, some of which may cause significant disease in humans and animals. They are spread by insects, usually mosquitoes, but can cycle significantly through mammals or birds. Changing world climatic conditions are making conditions more favourable in Australia for the proliferation of arthropod vectors and/or natural hosts. Many of the natural vectors for exotic flaviviruses exist in Australia, though usually within limited distribution.

Flaviviruses include Murray Valley Encephalitis, Kunjin (both can cause Australian arboencephalitis), Dengue, WNV, Japanese encephalitis virus and yellow fever virus. A

number of flaviviruses can have serious disease sequelae in humans including permanent neurological dysfunction, chronic multisystemic disease and high mortality rates.

WNV is a Flavivirus commonly found in Africa, West Asia, and the Middle East. It also occurs sporadically in parts of Europe. WNV had not previously been documented in the Western Hemisphere until 1999 when it was recorded on the North American continent. CDC scientists believe the virus entered eastern United States in the summer of 1999, possibly earlier. It is not known from where the virus originated, but it is closely related to strains found in the Middle East.

Currently Flavivirus surveillance in Australia is conducted under the authority of state or territory of human health departments. The surveillance activities are mainly designed to act as an early warning system for Flaviviruses such as Murray Valley Encephalitis virus and other arboviruses such as Ross River virus. The systems are designed around three areas: sentinel surveillance; vector monitoring; and climate monitoring. The systems are reliant on sentinel animals, usually chickens that are strategically placed based on historical occurrence and vector data.

Animal health authorities, predominantly in the North of Australia and through the Northern Australian Quarantine Strategy (NAQS), also undertake monitoring for Flavivirus activity. These tend to be ad hoc surveys rather than a constant surveillance activity, though sentinel pigs are constantly monitored for Japanese encephalitis through NAQS. There is no "National Strategy" for Flavivirus surveillance in Australia, though there is national collection of data for reporting purposes. Any consideration of WNV surveillance in Australia should assess the capability of the current system to detect a WNV incursion.

In the US, WNV surveillance utilises sentinel chickens and horses, as well as dead bird surveillance. The approach of using dead bird surveillance, particularly with crows and other members of the Corvidae, has been very effective in the US as an early warning system for human cases. However, chickens have not been found to be effective sentinels in some situations. In Europe similar tactics are used but the European Commission has approved using equine as sentinels as part of a surveillance system for use in countries with WNV.

Kunjin virus is endemic in many species of wild life across much of Northern Australian. Kunjin encephalitis is much less common than MVE encephalitis, with only 3 definite cases recorded in the literature since 1974 in Australia. The virus can infect a wide range of mammals including humans, cattle, sheep, and horses. The sequelae of disease due to Kunjin virus appear less severe than MVE but the sample size of cases is small.

The epidemiology of Kunjin virus is less well documented but appears to be more widespread than MVE. The role of waterbirds in the transmission of Kunjin is unknown. Unlike the MVE virus, Kunjin virus has been detected in south-eastern Australia on several occasions since the outbreak of MVE in 1974. Further study is needed to define the distribution and morbidity rate of infections with Kunjin virus. WNV and Kunjin virus are antigenically indistinguishable.

## **Scope**

The Project examines key elements of an epidemiologically robust WNV surveillance system involving wild birds with a design that is applicable to the Australian context and focuses on:

- Effective elements of WNV surveillance in the Australian context;
- The behaviour of WNV and Kunjin virus in wild birds; and
- The efficient use of resources to target surveillance in the most appropriate areas relating to wild birds.

## **Progress to date**

The project to date has focussed on two areas: 1) developing the project team and project outline; 2) developing methodology and; 3) identifying key issues.

### *The project team and outline*

A project team has been assembled. The project is being lead by Dr Rob Williams and Dr Peter Black (Office of the Chief Veterinary Officer, Australian Department of Agriculture, Fisheries and Forestry) and has been formalised as part of the requirements as part of a Masters Degree in Veterinary Public Health Management through the University of Sydney.

The purpose of the study has been defined: to design a surveillance system for detecting an incursion of WNV in wild birds, taking into account existing systems for Flavivirus surveillance, and data collection from both sentinel and wild animal populations. This involves analysis of current Flavivirus surveillance activities both in Australia and overseas, as well as recommendations for WNV surveillance that is effective and efficient.

### *Methods*

Methodology has been finalised. The project is primarily a literature review of WNV surveillance in other countries, especially the US and Europe, and the potential lessons learnt for Australia, with a view to recommending some principles for WNV surveillance in wild birds. In reviewing current systems in place for both WNV and flaviviruses in general, the principles of surveillance emanating from the OIE and recognised experts.

The literature review involves the following sections:

- Introduction
  - Surveillance: what it is, types, why, elements of a program?
  - WNV and flaviviruses: what they are, why there are important?
- Material and Methods
  - How the review is conducted including literature, scoping with people.
  - Target three or four “key” references such as reviews of the North American and European WNV surveillance programs, and OIE.
- Results
  - What is needed in a surveillance program, what others do, what we do?
- Discussion
  - Identify gaps i.e. how does what we need and do align with the qualities of an “ideal” surveillance program?
  - Outline a model system e.g. active vs. passive surveillance, dead bird pick-up, sentinels including species of birds.

### *Key issues*

The first part of the work is currently being written up and is due for completion in early July 2003. Key issues identified include:

#### *i. Effective elements of WNV surveillance in the Australian context*

Whilst there are a number of lessons to be learnt from the overseas situation Australia has unique circumstances that require consideration when analysing the elements of any surveillance system. Dead bird surveillance may not be as significant in Australia as it is in the USA. Europe tends to differ in this respect from the USA, with variable reliability of dead bird surveillance in countries experiencing WNV incursions.

#### *ii. Current Flavivirus surveillance activities in Australia*

The primary question about current activities: are they adequate to detect an incursion of WNV before the virus becomes established? The initial response would appear to be no but a full assessment of the system currently in place is required before a qualified response can be given.

#### *iii. Lessons learnt from WNV surveillance activities overseas*

Overseas experience has shown that there are important elements to WNV surveillance. These include the use of sentinel animals (horses and chickens) and wild bird surveillance, including dead birds. The experience obviously differs with the strain of WNV and also

whether a country is experiencing outbreaks of WNV or not. Vector and climate monitoring also form critical elements of WNV activities. Most public health programs in developed countries involve the control of vectors using the appropriate insecticides.

*iv. Potential behaviour of WNV, especially virulent strains, and its interaction with Kunjin virus in wildlife*

This is potentially the most important issue that Australia faces with an incursion of WNV – how will it behave in the presence of Kunjin virus, especially in wildlife populations? Research in this area has been limited and requires more investigation. Speculation may lead to the conclusion that Kunjin virus will offer some cross protectivity against WNV in a population. However, this does not mean that significant disease cannot arise from a WNV incursion, even with Kunjin virus present. Kunjin has been reclassified as a subtype of WNV but its behaviour suggests it is not a virulent subtype, though it still may cause clinical disease.

*v. Limitations of the diagnostic tests available in Australia for WNV strains, including Kunjin virus*

Currently diagnostic capability in Australia is limited for WNV. Projects being conducted through the Biosecurity CRC are focussing on the ability to distinguish serologically between Kunjin and WNV, amongst other things. This is an important capability for Australia to establish, especially on live animal serology.

*vi. The efficient use of resources to target surveillance in the most appropriate areas relating to wildlife, especially wild migratory birds*

Widespread active surveillance in Australia is near impossible in wildlife. However, there are key areas in Australia where migratory birds land and these areas may form the basis of targeted surveillance for WNV. This may be hard to justify on the basis of cost before an incursion is detected but there is the potential for surveillance in wild birds to be conducted for a number of micro-organisms including avian influenza.

## **Future work**

The next three months will see: 1) completion of the first part of the work; 2) development and implementation of a targeted surveillance system for WNV based initially on dead corvid surveillance; 3) better definition and facilitation of investigation of key research questions relating to WNV susceptibility in Australian native birds and the role of Kunjin virus in WNV maintenance in Australian native birds. These last projects will be in collaboration with the Australian Biosecurity CRC.

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