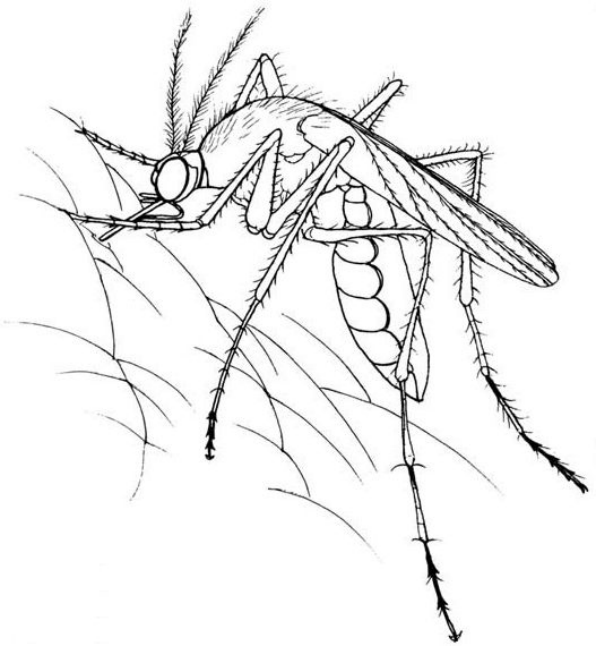
DIVISION OF
Environmental Public Health

# Surveillance and Control of Selected Arthropod-borne Diseases in Florida

## 2011 Guidebook



## Part One – Mosquito-borne Diseases

FLORIDA DEPARTMENT OF
HEALTH

## Purpose

This publication establishes guidelines for detecting and monitoring arthropod-borne diseases and minimizing the risk of human infection. This manual identifies functions and prescribes responsibilities which will assure that appropriate prevention and control methods are initiated promptly and effectively. Please address comments to Dr. Leena Anil, Florida Department of Health's Division of Environmental Health, 4052 Bald Cypress Way, Bin A-08, Tallahassee, Florida 32399-1720, (850) 245-4444 x2437, FAX (850) 922-8473.

## Contents

## Acknowledgements

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The Interagency Arbovirus Task Force.

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# Interagency Arbovirus Task Force 2011

**Department of Ag and Consumer Services**
**Steve Dwinell** [steven.dwinell@freshfromflorida.com]
Asst. Director, Div. of Agric. and Envir. Services
**Michael Page** [michael.page@freshfromflorida.com]
Chief, Bur. of Entomology and Pest Control
**Peter Jiang** [yongxing.jiang@freshfromflorida.com]
State Medical Entomologist
3125 Connor Blvd
Tallahassee, FL 32399-1650
(850) 617-7913 (Dwinell); (850) 617-7988 (Page)
(850)-617-7929 (Jiang)
**William Jeter** [william.jeter@freshfromflorida.com]
**Michael A. Short** [michael.short@freshfromflorida.com]
Veterinarian Manager, Division of Animal Industry
407 S. Calhoun St. Mayo Bldg
Tallahassee, FL 32399-0800
(850) 410-0901[Jeter]; (850) 410-0901[Short]
**Alice Agasan** [alice.agasan@freshfromflorida.com]
Chief, Bur.of Diagnostic Laboratories, Division of Animal Industry
(321)-6971405
***James Maxwell** [James.Maxwell@freshfromflorida.com]
Laboratories Director,Bur of Diagnostic Laboratories, Division of Animal Industry
Bronson Desk: 321-697-1423; Live Oak Desk: 386-330-5730
P.O. Box 458006, 2700 N. John Young Parkway
Kissimmee, FL 34745-8006

**Department of Health**
**Carina Blackmore** [carina_blackmore@doh.state.fl.us]
(850) 245-4732
***Lisa Conti** [lisa_conti@doh.state.fl.us] (850) 245-4251
**Leena Anil** [leena_anil@doh.state.fl.us](850) 245-4444 ext. 2437
***Danielle Stanek** [danielle_stanek@doh.state.fl.us]
(850) 245-4117
***Richard Hopkins** [richard_hopkins@doh.state.fl.us ]
(850) 245-4412
***Tom Belcuore** [tom_belcuore@doh.state.fl.us]
(352) 258-4295
4052 Bald Cypress Way, Bin A-08
Tallahassee, FL 32399
**Lillian Stark** [lillian_stark@doh.state.fl.us]
Bureau of Laboratories, 3602 Spectrum Boulevard
Tampa, FL 33612
(813) 974-5990

**Florida Association of County Health Officers**
**Kevin Sherin** [kevin_sherin@doh.state.fl.us]
Orange County Health Department
6101 Lake Ellenor Drive, Orlando, FL 32809
(407) 858-1400

**Fish and Wildlife Conservation Commission**
***Dwayne Carbonneau** [dwayne.carbonneau@MyFWC.com]
**Mark Cunningham** [mark.cunningham@MyFWC.com]
***Dan Wolf** [Dan.Wolf@MyFWC.com]
FWC-Wildlife Research Lab
1105 SW Williston Rd, Gainesville, FL 32601
(352) 955-2231 ext 105 [Cunningham]
(352) 955-2231 ext 118 [Wolf]

**Florida Medical Entomology Laboratory**
***Walter Tabachnick** [WJT@ufl.edu]
**Jonathan Day** [jfday@ufl.edu]
IFAS - University of Florida
200 Ninth Street, Southeast, Vero Beach, FL 32962
(772) 778-7200 ext 124(Tabachnick);
(772) 778-7200 ext 132(Day)

**Public Health Entomology Research and Education Center (PHEREC)**
**John Smith** [docmx8@gmail.com]
PHEREC - Florida A & M University
4000 Frankford Avenue
Panama City, FL 32405-1933
(850) 872-4184 ext 23

**Florida Mosquito Control Association**
**James Burgess** [burgess@lcmcd.org]
Lee County Mosquito Control
P.O. Box 60005, Ft Myers, FL 33906
(239) 694-2174 ext 163

**University of Florida College of Veterinary Medicine**
**Maureen Long** [longm@ufl.edu]
***Paul Gibbs** [pgibbs@ufl.edu]
PO Box 110880, Gainesville, FL 32608
(352) 392-2239 ext 4026 [Long]; (352) 294-4182 [Gibbs]

**University of Florida Emerging Pathogens Institute**
***Dana A. Focks,** [dafocks@epi.ufl.edu]
***Dana N Zimmel** [zimmeld@ufl.edu]
**Glenn Morris** [jgmorris@epi.ufl.edu]
2055 Mowry Road, Gainesville, FL 32611
352-294-5148[Focks] ; 352-273-7526[Morris]

**University of Florida College of Public Health and Health Professions**
**Gregory C Gray**[[gcgray@phhp.ufl.edu]
101 S. Newell Dr (HPNP bldg),
Gainesville Florida 32610
(352)-273-9449 ext 9188

**Florida Environmental Health Association**
**Paul Minshew** [paul_minshew@doh.state.fl.us]
Volusia County Health Department,1845 Holsonback Drive,
Daytona Beach, FL 32117
(386) 274-0691

**Department of Environmental Protection**
**Dana C. Bryan** [dana.bryan@dep.state.fl.us]
Florida Park Service
3900 Commonwealth Blvd MS 500
Tallahassee, FL 32399-3000
(850) 245-3029 ext 3511

**University of South Florida**
**Thomas Unnasch** [tunnasch@health.usf.edu]
Department of Global Health, (813)974-0507

**United States Department of Agriculture, Center for Medical, Agricultural & Veterinary Entomology**
***Kenneth Linthicum** [kenneth.linthicum@ars.usda.gov]
***Gary G. Clark** [gary.clark@ars.usda.gov]
1600/1700 S.W. 23rd Drive
Gainesville, FL 32608
(352) 374-5700[Linthicum]; (352) 374-5910[Clark]

*Liaison

# Chapter 1
# Arthropod-borne Disease Control Coordination

**The Surveillance and Control of Selected Mosquito-borne Disease Florida Guidebook** provides information on diseases of concern and is updated annually. This publication establishes guidelines for detecting and monitoring mosquito-borne diseases and minimizing the risk of human infection. It describes agency coordination and responsibilities in the control of mosquito-borne diseases and explains the components of the state surveillance system and responses to identified disease activity.

Control of arthropod-borne diseases in Florida is coordinated through interagency cooperation at the state and local levels. Intensification of surveillance and initiation of control measures occur in response to evidence of increased transmission in nature. Different agencies become involved at various times during routine surveillance. Therefore, a crucial part of a good surveillance program is to disseminate information to the proper agencies and persons.

## Roles and Responsibilities:

### I. Department of Health (DOH) County Health Department (CHD)

*Contact: local county health departments*

- Conduct epidemiologic investigation to search for new, previously undetected cases and classify cases as to time (chronological distribution), place (geographic distribution of residence and place of likely exposure), risk factors, and person (demographics).
- Collect reports of suspected, probable, and confirmed human cases of West Nile fever and neuroinvasive disease, Eastern equine encephalitis, and St. Louis encephalitis, dengue fever, dengue hemorrhagic fever, malaria, yellow fever, Lyme disease, Rocky Mountain spotted fever, ehrlichiosis and anaplasmosis and other reportable arthropod-borne diseases and enter into Merlin or other appropriate epidemiologic reporting database. Case definitions are available at: http://www.doh.state.fl.us/disease_ctrl/epi/surv/CaseDefinitions.html. Confirmed and probable cases are reportable under Chapter 381, Florida Statutes.
- Facilitate submission of diagnostic specimens from physicians and hospitals as required.
- Participate in appropriate sentinel avian and horse surveillance activities.
- Communicate current arbovirus surveillance activity with the appropriate mosquito control personnel, school boards, media and public, etc. and coordinate plans for prevention and control activities.
- Provide community information and education as required.
- Coordinate with the DOH Division of Environmental Health (DEH) and with local mosquito control to issue health alerts to the media or to the public.

### II. DOH Bureau of Laboratories

*Contact: Department of Health Bureau of Laboratories, Tampa, (813) 974-8000; Jacksonville, (904) 791-1500.*

- Conduct appropriate tests to confirm or support the diagnosis of arthropod-borne diseases in humans and animals.

- Conduct appropriate tests as part of surveillance for arthropod-borne disease agents in animals and mosquitoes. Animal test results should be faxed to Florida Department of Agriculture and Consumer Services (FDACS) Animal Industries and positive results should also be faxed to the Division of Environmental Health. Mosquito test results should be provided to the submitter; positive results should also be reported to the CHD and DEH.
- Report by telephone the results of all probable and confirmed human serologic or virologic tests to the CHD, the DEH, and to the attending physician. Follow-up written reports are submitted as soon as possible.
- Prepare weekly summary reports with results for sentinel flock testing, including the number of sentinel sera submitted, number tested, and number positive by county. Summary reports should be sent electronically to the submitter, the DEH, and the CHD.

**III. DOH Division of Environmental Health (DEH), Bureau of Environmental Public Health Medicine**

*Contact: Division of Environmental Health, (850) 245-4299.*

- Direct statewide surveillance, prevention and control programs for human arthropod-borne diseases.
- Provide guidelines for sentinel arbovirus surveillance.
- Conduct epidemiologic analyses of data from CHDs and laboratories.
- Conduct or participate in epidemiologic investigations.
- Distribute weekly electronic arbovirus epidemiology summary reports to CHDs, mosquito control agencies, FDACS, physicians and veterinarians, CDC and other interested parties and post to the Mosquito Disease public web page.
- Maintain information connectivity among agencies via weekly summary reports, appropriate media including monthly electronic *EpiUpdate*, website development, and as-needed arbovirus conference calls.
- Recommend declarations of health alerts to the County Health Officer.
- Recommend health threat declarations to the State Surgeon General.
- Coordinate prevention and control activities with CHD's, DACS, Department of Environmental Protection (DEP), Florida Tourism Board, mosquito control agencies and other key organizations.
- Report human and veterinary arbovirus cases into the national arbovirus surveillance database, ArboNet, and coordinate and consult with CDC on national and international arbovirus surveillance and studies, and enhancement of prevention and control efforts.

**IV. DOH State Health Office (Press/Communications)**

*Contact: Communications Director, (850) 245-4111*

Review arbovirus related press releases as appropriate.

- Distribute mosquito-borne illness threats.
- Coordinate with CHD PIO's and DEH regarding media response to medical alerts.

**V. DOH Division of Disease Control, Bureau of Epidemiology**

*Contact: Bureau of Epidemiology, (850) 245-4401*

- Maintains human surveillance database (Merlin), disease outbreak communication system (EpiCom), and the electronic surveillance system for the early notification of community-based epidemics (ESSENCE).

**VI. Department of Agriculture and Consumer Services (DACS) Bureau of Entomology and Pest Control (BoEPC)**

*Contact: Bureau of Entomology and Pest Control, (850) 617-7997 or (850) 617-7929.*

Collect and distribute mosquito species and count data from local mosquito control agencies.

- Provide technical advice and support, mosquito control, and other services as needed to local mosquito control programs, DEH, and CHDs.
- Facilitate the sharing of mosquito control personnel and equipment between districts, as allowed for in Florida Statutes 388.231 and 388.351.
- Coordinate with the Bureau of Environmental Public Health Medicine and with local CHDs before releasing vector data to the media or to the public.
- Notify local mosquito control of unusual arbovirus activity or events.

**VII. DACS Division of Animal Industry and Bureau of Diagnostic Laboratories**
*Contact: State Agriculture Veterinarian, (850) 410-0900; State Diagnostic Laboratory (veterinary), (321) 697-1400 (Kissimmee) or 386-330-5700 (Live Oak).*

- Direct statewide surveillance for animal arthropod-borne diseases with Florida veterinarians and other partners and determine likely exposure site.
- Conduct appropriate tests for detection of arthropod-borne diseases in animals.
- Report veterinary arbovirus cases to DOH DEH as soon as exposure site is determined.
- Provide animal health alerts and animal arbovirus prevention information to animal industry organizations such as USDA and Florida Veterinary Medical Association, and private veterinarians.

**VIII. Mosquito Control Agencies**
*Contact: local mosquito control agencies or the Florida Coordinating Council on Mosquito Control at (850) 922-7011*.

- Conduct appropriate mosquito and arbovirus surveillance as feasible.
- Share arbovirus surveillance data with partners as appropriate.
- Provide larvicide and adulticide applications as appropriate and feasible.
- Provide adequate avian serosurveillance of most likely sites of St. Louis encephalitis virus (SLEV) and WNV activity (maintain and monitor flocks and collect blood samples) as feasible.
- Disseminate public information on mosquito control activities.

**IX. Florida Universities**
*Contact: FMEL, (772) 778-7200; PHEREC, (850) 872-4184.*

- Provide arthropod-borne disease research at: the Florida Medical Entomological Laboratory (FMEL), University of Florida; the John A. Mulrennan, Sr. Public Health Entomology Research and Education Center (PHEREC), Florida A&M University and University of South Florida.
- Distribute research findings.
- Provide consultation and technical assistance to disease and arthropod control agencies.

**X. Department of Environmental Protection (DEP)**
*Contact: Office of the Director, Florida Park Service, (850) 245-3029.*

- Coordinate efforts for intensified mosquito control on protected public lands as needed during health threats.
- Provide consultation and technical assistance as required.
- Provide arbovirus surveillance information as appropriate to the DEP Safety Coordinator and Safety Advisory Board, Florida Park Service district offices and safety coordinators, DEP Boating Safety Officers, DEP Division of Law Enforcement, DEP Office of Greenways and Trails and DEP Office of Coastal and Aquatic Managed Areas

**XI. Florida Fish and Wildlife Conservation Commission (FWC)**
*Contact: Florida Fish and Wildlife Conservation Commission, (850) 488-3831.*

- Maintain a database for bird mortality reporting and surveillance.
- Provide consultation and technical assistance as needed.
- Provide arbovirus surveillance information as appropriate to regional biologists and wildlife rehabilitators.

**XII. Florida Tourism Marketing Corporation**
*Contact: Visit Florida, (850) 488-5607.*

- Provide timely and accurate arboviral prevention information to attractions, hotels/motels and travel agencies.
- Maintain a toll-free number, (888)-735-2872, with appropriate health information for people wishing to visit the state.

**XIII. Physicians and Hospitals**
*Contact: local physicians and hospitals or the Florida Medical Association at (850) 224-6496.*

- Report suspected cases of arthropod-borne diseases to their local CHD as required by law.
- Submit appropriately timed specimens for confirmation of clinical diagnosis (e.g., CSF and sera, or paired sera drawn at least 1 week apart).

**XIV. Veterinarians**
*Contact: local veterinarians or the Florida Veterinary Medical Association at (407) 851-3862*.

- Report suspected veterinary cases of eastern equine encephalitis virus (EEEV) and west Nile virus (WNV) infection to the State Veterinarian (FDACS) or suspect human cases to the local CHD as required by law.

## XV. Centers for Disease Control and Prevention (CDC), Division of Vector-Borne Infectious Diseases

*Contact: Division of Vector-Borne Diseases, (970) 221-6400.*

- Provide technical assistance and laboratory support as requested.
- Coordinate with the World Health Organization and its regional offices (e.g., Pan American Health Organization) on international surveillance, research, prevention, and control.

## XVI. Notification and Public Information of Arboviral Surveillance Results

- On a weekly basis, DOH will summarize the surveillance data and email the information to the Interagency Arbovirus Taskforce representatives. DOH will also provide this information to:
    - CHDs
    - CDC

The DOH will be responsible for release of public information regarding recommended public precautions. Local organized mosquito control districts, with the assistance of BoEPC, will be responsible for release of public information regarding mosquito control activities. BoEPC will be responsible for release of public information regarding mosquito control activities in those regions of the state where there are no local organized mosquito control units. DAI will be responsible for release of public information regarding animal health issues.

For the purposes of coordinated local responses and possible intensification of integrated vector control, CHD epidemiologists should share non-identifying case locality and onset information of human arbovirus cases under investigation with local mosquito control districts. DOH will notify the workgroup members by email of the county of residence of such suspect cases.

The interagency partners will strive to immediately share significant new information with each other and the other individuals and organizations listed in this section in order to assure the most rapid response possible to new developments.

# Chapter 2
# Select Endemic Arboviruses in Florida

## Overview

Arthropod-borne viruses, i.e. “arboviruses”, are viruses that are maintained in nature through transmission between susceptible animal hosts by blood-feeding arthropods (e.g., mosquitoes and ticks). Most arboviruses that cause human encephalitis are members of three of the major virus families: the Togaviridae (genus *Alphavirus*), Flaviviridae, and Bunyaviridae.

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are dead-end hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission in the vector (e.g., the virus is transmitted from the female to the offspring).

Arboviral diseases have a global distribution. Arboviral agents of encephalitis in the United States include: St. Louis encephalitis virus (SLEV), West Nile virus (WNV), Eastern equine encephalitis virus (EEEV), Western equine encephalitis virus (WEEV), Venezuelan equine encephalitis virus (VEEV), Everglades virus (EVEV), and the California serogroup viruses including La Crosse encephalitis virus, all of which are transmitted by mosquitoes. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In Florida, where arthropods are active late into the year, cases can occur into the winter months. Most human infections are asymptomatic or may result in a nonspecific flu-like syndrome. Onset may be insidious or sudden with fever, headache, myalgias, malaise and occasionally prostration. Infection may, however, lead to encephalitis, with a fatal outcome or permanent neurologic sequelae. Fortunately, only a small proportion of infected people progress to having encephalitis.

Laboratory criteria for arboviral disease diagnosis include: a four-fold or greater change in serum antibody titer between acute and convalescent samples; virus isolation or viral antigen or nucleic acid identified in tissue, blood or cerebrospinal fluid (CSF), or other body fluid; virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred; or virus-specific immunoglobulin M (IgM) antibodies [e.g. enzyme-linked immunosorbent assay (EIA or ELISA), microsphere immunoassay (MIA), or immunofluorescence assay (IFA)] in serum with confirmatory virus-specific neutralizing antibodies [e.g., serum neutralization (SN) or plaque reduction neutralization (PRNT) test] in the same or later specimen .

Because the arboviral encephalitides are viral diseases, antibiotics are not helpful for treatment and the effectiveness of antiviral agents has not been shown. Treatment is supportive, attempting to deal with problems such as swelling of the brain, respiratory paralysis and other treatable complications like bacterial pneumonia. There are currently no commercially available human vaccines for these diseases, though several types of WNV vaccine are in development. A vaccine is available for horses and ratites (ostriches and emus) against EEEV, WEEV and VEEV. Equine vaccines protecting against WNV have been on the market since 2001.

Arboviral disease can be prevented through personal and community protective measures. Personal protective measures include reducing time outdoors, wearing long pants and long-sleeved shirts, applying Environmental Protection Agency (EPA) approved mosquito repellent to exposed skin areas as recommended by CDC and maintaining screens/doors. Residual insecticide applications, on and around screen doors, give added protection. Community preventive measures include reducing mosquito-breeding sites around residences (e.g., drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers and removing/destroying discarded tires, bottles, cans, pots and pans, broken appliances) and may include the use of insecticides (larvicides and adulticides) to kill mosquitoes. Repellents containing DEET (N,N-diethyl-m-toluamide), permethrin, or picaridin are excellent tools for personal protection. Additional options on the market, specifically IR3535 and oil of lemon eucalyptus, are registered with the EPA and have performed well in evidence published in the peer reviewed literature. Some references indicate that picaridin is reportedly less irritating to the skin. For CDC's latest guidelines, see www.cdc.gov.

Several local, state and federal agencies are involved with the surveillance and control of arboviral diseases. Mosquito-borne encephalitis surveillance activities include screening mosquito populations, sentinel chickens, wild birds, and other animal cases to detect increased arbovirus activity before it occurs in people, and to intervene to significantly reduce risk of transmission to humans An important component of any surveillance system is the establishment of baseline data against which current disease activity can be measured. All stakeholders involved in arbovirus surveillance should collect and maintain baseline data for each surveillance activity, and utilize this information to assess the level of risk to the human population. In addition, the rapid diagnostic techniques used in threat recognition can shorten public health response time and reduce the geographic spread of infected vectors, and thereby, the cost of containing them.

The surveillance required to determine risk is being increasingly refined by the utilization of technologies which allow for rapid identification of zoonotic viruses in bird and mosquito populations. Virus isolation and detection are useful to identify viral agents in mosquito vectors. While virus isolation still depends upon growth of virus in cell culture or neonatal mice, virus detection has been greatly facilitated by the availability of virus-specific genomic sequence information for use in polymerase chain reaction (PCR) assays, and monoclonal antibodies (MAbs) for use in IFA and ELISA tests. MAbs with avidities sufficiently high to allow for specific binding to virus antigens in a complex protein mixture (e.g., mosquito pool suspensions) have also enhanced the ability to rapidly identify virus agents *in situ*.

## St. Louis Encephalitis

St. Louis encephalitis virus (SLEV), a flavivirus, was the most common mosquito-transmitted human pathogen in the U.S. prior to the introduction of WNV. During the summer season, SLEV is maintained in a mosquito-bird cycle, with periodic amplification by birds and *Culex* mosquitoes. In Florida, the principal vector is *Cx. nigripalpus*, a ubiquitous species found throughout Florida.

Infection with SLEV results in inapparent infection in a variety of birds and mammals with a resultant period of viremia that lasts a matter of days. Humans represent an incidental, dead-end host. The estimated incubation range is four to 21 days. The clinical spectrum of human SLEV infection includes inapparent infection, mild illness (fever with headache), aseptic meningitis, and encephalitis that can progress to coma and death. Less than 1% of SLEV infections in people are clinically apparent and the vast majority of infections remain undiagnosed. Encephalitis, especially that progressing to coma and death, is more common with

older age. The case fatality rate in Florida SLEV epidemics has ranged from 4 to 30 percent. Deaths were almost exclusively among people aged 50 and older.

The first recognized SLE outbreak occurred in St. Louis, Missouri in 1933. Since then, many SLE epidemics have been documented in North America with the vector species varying by region. In Florida, SLE outbreaks were documented in 1959 (N=68), 1961 (N=25), 1962 (N=222), 1977 (N=110), 1980 (N=10), 1990 (N=223), 1993 (N=8) and 1997 (N=9). The epicenter of the outbreaks was the Tampa Bay area for all years but 1977 and 1990. In 1980, six sporadic cases of SLE were reported from counties around Tampa Bay (Pinellas, Hillsborough, Pasco, Manatee and Sarasota). In addition, four cases were reported from residents of Fort Walton Beach in Okaloosa County. This incident was particularly interesting in that human cases of SLE had never before been documented in the panhandle of Florida. These cases also occurred between July 10 and August 2, much earlier than the normal transmission peak seen in September and October.

These outbreaks stimulated the establishment of research into mosquito-borne diseases and mosquito control activities including two arbovirus research facilities in Tampa and Vero Beach. The most widely used surveillance technique in Florida has been the use of chicken sentinel flocks, and these are maintained in about half of Florida's 67 counties. Interestingly, SLEV activity in Florida has decreased dramatically since WNV was first detected in the state in 2001. Research suggests that antibodies for WNV may protect against SLEV [Fang, Y, and WK Reisen. Previous infection with West Nile or St. Louis encephalitis viruses provides cross protection during reinfection in house finches[1,2]]. No human SLE cases have been reported in Florida since 2003.

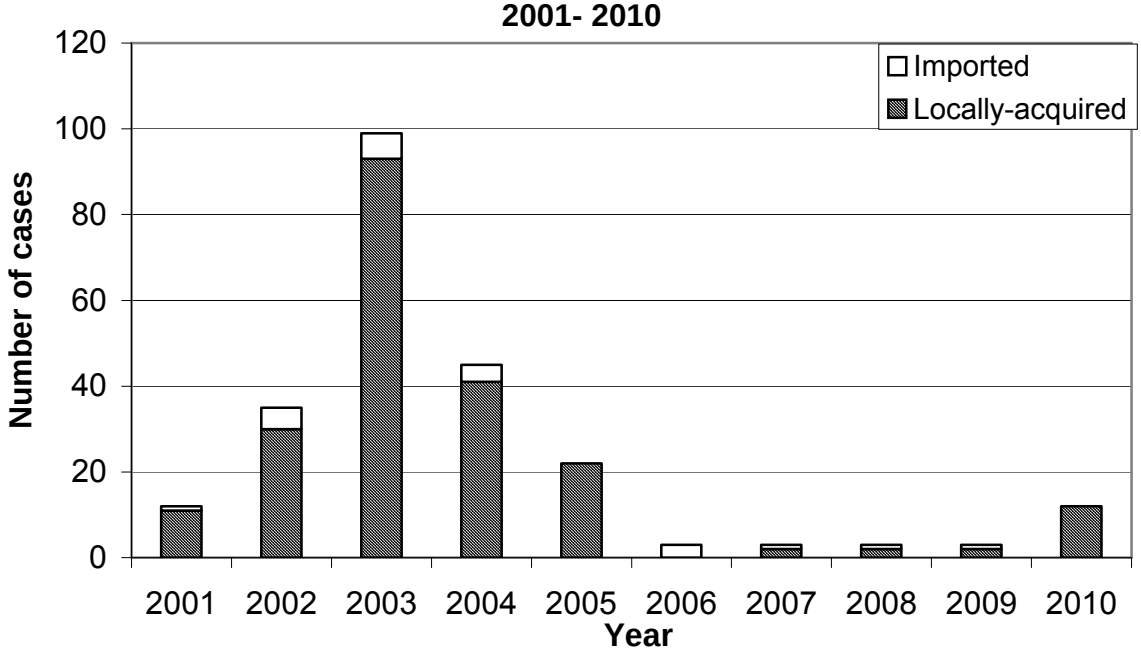
## West Nile Fever and Neuroinvasive Disease

West Nile virus (WNV) was first identified in Uganda in 1937 and remained in the eastern hemisphere until the outbreak in the northeastern U.S. in the summer and fall of 1999. Since then the virus has spread and by the end of 2004, it had been detected in 48 states and close to 30,482 human cases had been confirmed through 2010 nationwide. The virus is closely related to SLEV and cross reacts with SLEV in serological testing. WNV was first detected in Florida in July 2001 in a crow in Jefferson County. Twelve human cases were reported in the state that year. In 2002, 35 human cases of WNV illness were detected in Florida. Included among these cases were two individuals who acquired their infections via organ transplants and one person who became infected from a blood transfusion. The peak occurred in 2003 with 99 cases confirmed. In recent years, an average of three cases were reported annually. Twelve human cases and one positive asymptomatic blood donor were reported in 2010. Less dry environmental conditions, and waning of population immunity may explain the increase in cases in 2010.

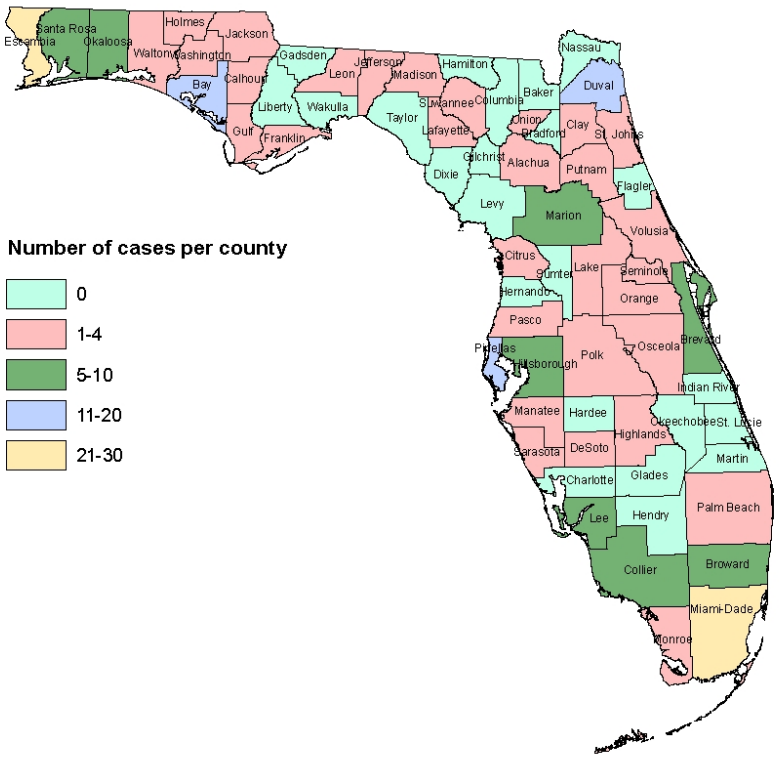
WNV activity in Florida is focal in nature. In 2001, the epicenter of the WNV outbreak was in the north-central part of the state. The following year, activity was most intense in northwestern and central counties. The focus in 2003 was the panhandle, while south Florida saw the most activity in 2004. In 2005, 86% of the cases were reported in Pinellas County. Most cases in 2010 occurred in counties located in the central and south part of the state. Since its initial detection, WNV activity has been reported in all 67 Florida counties. The peak period of transmission in Florida is July through September.

[1] Fang Y, Reisen WK. Previous Infection with West Nile or St. Louis encephalitis viruses provides cross protection during reinfection in house finches. Am JTrop Med Hyg. 2006, 75(3): 480-5.
[2] Ottendorfer C, Ambrose J, et al. Isolation of Genotype V St. Louis Encephalitis virus in Florida, Emerg Infect Dis. 2009, 15(4): 604-606.

## Human Cases of West Nile Virus Disease in Florida, 2001- 2010




## Human Cases of WNV Illness Acquired in Florida 2001-2010



Like SLEV, the natural cycle of WNV appears to involve *Culex* mosquitoes and wild birds. However, unlike SLEV, WNV causes high rates of mortality in certain families of birds, especially corvids (crows and jays) and ratites. It is also pathogenic for horses. More than 1,000 cases of equine WNV infection were confirmed in Florida from 2001-2010. Twenty-six equine infections with WNV were confirmed in 2010, which was the highest number since 2005. An WNV outbreak also occurred in an alligator farm in Glades County; infected alligators amplify virus and may transmit virus to other alligators and people through fecal shedding and contact with tissues while viremic.[3]

The clinical spectrum for human WNV infection includes asymptomatic infection, mild illness (fever and headache), aseptic meningitis, and encephalitis that can progress to coma and death. Approximately 80% of those infected show no clinical symptoms. Twenty percent have mild symptoms, and less than 1% experience the neuroinvasive form of illness. Typically, symptoms appear between 2 and 15 days after the bite of an infected mosquito. In Florida, case fatality rates range from 4% for all cases to 7% among those who develop the neuroinvasive form of the disease. Individuals over 60 years of age seem to be at increased risk of severe disease. Immunosuppressed transplant recipients are also at increased risk of developing severe disease.[4] A growing body of scientific literature also indicate that in some instances, animal and human WNV infections may be chronic.[5-9] . A longitudinal study [9] of WNV cases in Houston recently identified WN viral RNA in the urine of 20% of the cohort years after their initial disease. Research in this cohort also found associations between persistence of symptoms, sustained detectable IgM response, and altered cytokine expressions, strengthening the hypothesis that some patients might have persistent infection. These experimental data increase concern regarding the long term impacts of WNV infection, including in those who were initially mildly or subclinically affected. Economical impacts of WNV neuroinvasive disease have been calculated to be $225,000 for each fatal infection and $136,839 for non-fatal cases.[10] The impacts and cost of chronic infection have yet to be determined.

Because SLEV, WNV and dengue virus are antigenically related, cross-reactions are observed with some serologic tests. Plaque reduction neutralization testing (PRNT) performed at DOH BOL-Tampa can distinguish SLEV and WNV. The CDC Dengue Branch in Puerto Rico can also perform PRNT to distinguish dengue virus infection, however the test is complex and molecular testing on acute serum samples is preferred.

West Nile virus (WNV) infections in **asymptomatic blood donors** do not meet reportable disease criteria, however, do provide useful surveillance information for CHDs as blood bank testing targets detection of the active viremic stage using nucleic acid-amplification testing (NAT).[11] Suspect samples from the blood banks should be forwarded to DOH BOL for confirmatory testing. Some patients in early stages of viremia go on to develop clinical disease

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[3] Klenk K, et. al. 2004. Alligators as West Nile virus amplifiers. Emerg Infect Dis. 10:2150-2155.
[4] CDC. 2005. West Nile Virus Infections in Organ Transplant Recipients --- New York and Pennsylvania, August--September, 2005 MMWR. 54(40);1021-1023
[5] Pogodina VV, et al. Study on West Nile virus persistence in monkeys. Archives of Virology 1983; 75: 71–86.
[6] Tesh RB, Xiao SY. Persistence of West Nile Virus infection in vertebrates. In: Diamond MS, ed. West Nile Encephalitis Virus Infection. New York: Springer, 2009,pp. 361–377.
[7] Siddharthan V, et al. Persistent West Nile virus associated with a neurological sequela in hamsters identified by motor unit number estimation. J Viro. Published online: 18 February 2009. doi:10.1128/JVI.00017-09
[8] Tonry JH, et al. Persistent shedding of West Nile virus in the urine of experimentally infected hamsters. Am J Trop Med Hyg. 2005; 73: 320–324
[9] Murray K, et al. Persistent infection with West Nile virus years after initial infection. J Infect Dis. 2010; 201: 2–4
[10] Zohrabian A, Meltzer MI, Ratard R, Billah K, Molinari NA, Roy K, et al. West Nile virus economic impact, Louisiana, 2002. Emer Infect Dis. 2004;1736-44. http://www.cdc.gov/ncidod/EID/vol10no10/03-0925.htm
[11] CDC. Detection of West Nile Virus in Blood Donations --- United States, 2003. MMWR. 52(32);769-772

and should then be reported as a case. Donors that remain asymptomatic but whose sample test positive at BOL suggest that virus exposure occurred in the 2 weeks prior to donation, and can be used to meet the mosquito-borne illness advisory or alert criteria for the county that exposure most likely occurred in.

## Eastern Equine Encephalitis

Eastern equine encephalitis virus (EEEV) is an alphavirus that was first identified in the 1930s and currently occurs in focal locations of the eastern United States. EEEV occurs in natural cycles involving birds and *Culiseta melanura* in freshwater swampy areas with a peak of activity between May and August. In this usual cycle of transmission, virus does not escape from the swampy areas because the mosquito involved prefers to feed upon birds and does not usually bite humans or other mammals.

For reasons not fully understood, the virus may escape from endemic foci in swamp areas in birds or bridge vectors such as *Coquillettidia perturbans, Aedes atlanticus, Cx. nigripalpus, Cx. quinquefasciatus, Aedes sollicitans* and *Aedes vexans.* These species feed on both birds and mammals and can transmit the virus and cause disease in people, horses, dogs and some birds such as pheasants, quail, ostriches and emus. Native bird species are rarely clinically affected by the virus. While small focal outbreaks of human disease have occurred in the United States, equine epizootics can be a common occurrence in unvaccinated populations since horses typically live outdoors and can attract hordes of biting mosquitoes. Human cases may be preceded by those in horses; therefore, horse cases may be used as a potential surveillance tool. Migratory birds may introduce the EEEV to northern states in the spring each year.

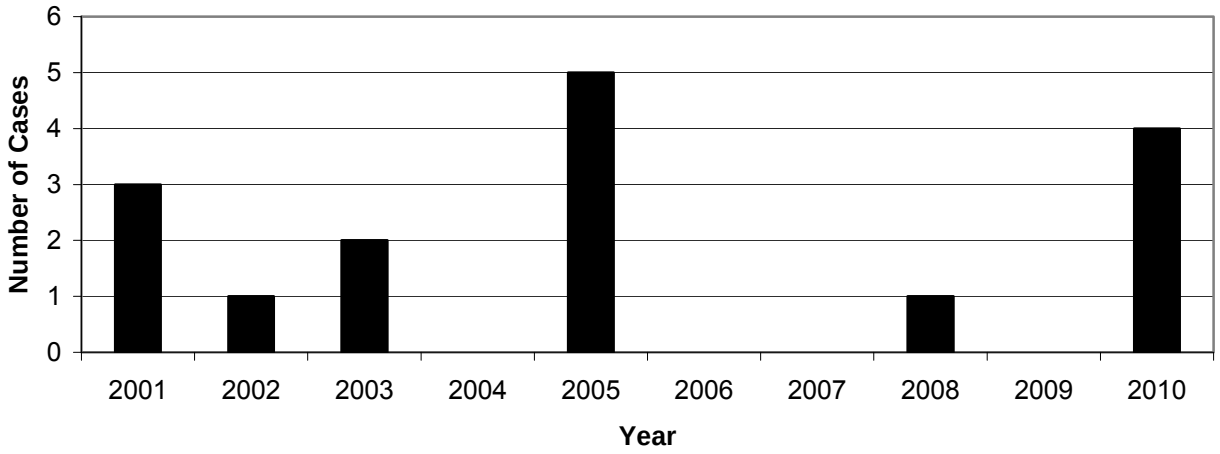
Compared with some other arboviral diseases, fewer EEEV infections are likely to be asymptomatic. In New Jersey it is estimated that for every 23 people bitten by an infected mosquito, one will develop clinical disease. It takes from 3-10 days after the bite of an infected mosquito for an individual to develop symptoms of EEE. These symptoms begin with a sudden onset of fever, general muscle pains, and a headache of increasing severity. Many individuals will progress to more severe symptoms such as seizures and coma. Approximately one-third of all people with clinical encephalitis caused by EEEV will die from the disease. Of those who recover, many will suffer permanent brain damage requiring long-term medical care. Individuals under 20 years of age seem to be at increased risk of severe disease and accounted for 75% of reported case in Florida between 1998 and 2010.

Human and equine cases occur within five miles of *Cs. melanura*-producing swamps. All evidence indicates that human EEE does **not** have epidemic potential in Florida. Four human cases of EEE were reported in 2010 with onset dates in June and July. Continuous surveillance for the past fifty-three years (1957-2010) has documented only 85 sporadic cases in people (average 1.6 cases per year; range 0-5). Although sentinel chicken serosurveillance may not be as predictive of human infections for EEEV as for West Nile or SLEV, if the level of activity is high, mosquito control and personal protection should be recommended to reduce human risk.

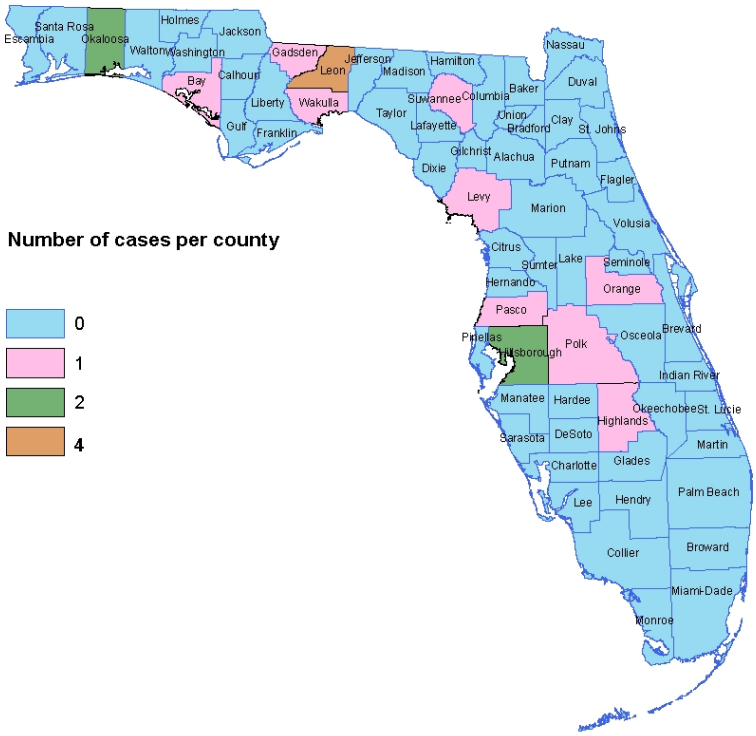
Whereas *Cs. melanura* is distributed statewide, human (and equine) cases of disease have predominantly been in areas north of Lake Okeechobee. Historically, there have been clusters of cases in seven areas: Escambia County; Walton-Holmes-Jackson counties; Duval County; Alachua-Marion counties; Leon-Jefferson-Madison counties; the lower St. Johns area of Volusia, Flagler, Putnam and Clay counties; and the Green Swamp region of Lake, Orange, Pasco, Polk, Osceola, Pinellas, Hillsborough and Manatee counties. There were a high number of equine cases and EEEV antibody positive sentinel chickens in 2008, 2009 and 2010, indicating the continuing presence of EEE in Florida and highlighting the importance of equine

immunization. In 2010, equine cases abruptly jumped from below the 5 year average in May, to well above the 5 year average June through August, and multiple equine cases were reported in counties south of Lake Okeechobee. A sustained and unusually cold weather front that extended into south Florida may have impacted vectors and avian reservoir migratory patterns, resulting in a fluctuation in EEE epidemiology. The depressed state economy may also have resulted in decreased equine vaccinations statewide.

**Human Cases of EEE Disease in Florida**
**2001 - 2010**




**Human Cases of EEE Acquired in Florida 2001 - 2010**



## Other Arboviral Encephalitis

Other arboviral encephalitides of minor public health significance that occur in Florida are caused by Everglades Virus (EVEV), an alphavirus, (family *Togaviridae*) and Keystone and Jamestown Canyon virus (family *Bunyaviridae*; California group). To date, no reported human cases of WEE have been acquired in Florida. While serologic evidence of EVEV infection has been documented in south Florida, only three clinical cases have ever been identified, two near Homestead and Florida City in Miami-Dade County (1968 and 1971) and one near Vero Beach (1968). The only recorded human case of Keystone virus illness occurred in a young child from Sarasota in 1964. One human case of Jamestown Canyon virus illness was confirmed in Lee County in 1993. La Crosse encephalitis virus is another arbovirus occurring in the Appalachian and Midwestern regions of the United States with similar symptoms as WNV disease and SLE. It is not believed to be present in Florida. Highlands J virus (HJV) is a mosquito-transmitted alphavirus that is similar to EEEV in its natural cycle. Highlands J virus is transmitted from *Culiseta melanura* mosquitoes to songbirds in freshwater swamps. It has a low pathogenicity in mammals and rarely cause disease in humans or horses. During the 1990-91 SLE outbreak in Florida, four patients were reported to be infected with SLE and HJ; however, exposure to HJV has not been associated with human illness. There have been outbreaks reported in caged birds but the symptoms are mild.

**Occupational Precautions:**

Although arboviruses are most often transmitted by the bite of infected mosquitoes, many of these viruses can also be transmitted through needle sticks, cuts, or mucous membrane contact with infected animal's, blood, or tissues. Workers involved in necropsies or other procedures involving potentially infectious materials should use every precaution to minimize their risk for exposure to fluids or tissues during handling, including standard droplet and contact precautions; using and disposing of needles, scalpels, and other sharp instruments safely; and minimizing the generation of aerosols.[12]

[12] CDC. 2002. Laboratory-Acquired West Nile Virus Infections --- United States, 2002. MMWR. 51(50);1133-1135

Case Definition

# Acute Arboviral Diseases (neuroinvasive and non-neuroinvasive)

reporting code = 06210 Western Equine Encephalitis virus (neuroinvasive)
= 06211 Western Equine Encephalitis virus (non-neuroinvasive)
= 06220 Eastern Equine Encephalitis virus (neuroinvasive)
= 06221 Eastern Equine Encephalitis virus (non-neuroinvasive)
= 06230 St. Louis Encephalitis virus (neuroinvasive)
= 06231 St. Louis Encephalitis virus (non-neuroinvasive)
= 06250 California serogroup virus (neuroinvasive)
= 06251 California serogroup virus (non-neuroinvasive)
= 06620 Venezuelan Equine Encephalitis virus (neuroinvasive)
= 06621 Venezuelan Equine Encephalitis virus (non-neuroinvasive)
= 06630 West Nile virus (neuroinvasive)
= 06631 West Nile virus (non-neuroinvasive)

Case report form: (08/08)
*Florida Confidential Vector-borne Disease Infection*
**MERLIN ELECTRONIC SUBMISSION**

## Background

Arthropod-borne viruses (arboviruses) are transmitted to humans primarily through the bites of infected mosquitoes, ticks, sand flies, or midges. Other modes of transmission for some arboviruses include blood transfusion, organ transplantation, perinatal transmission, consumption of unpasteurized dairy products, breast feeding, and laboratory exposures.

More than 130 arboviruses are known to cause human disease. Most arboviruses of public health importance belong to one of three virus genera: *Flavivirus*, *Alphavirus*, and *Bunyavirus*.

### Clinical description

Most arboviral infections are asymptomatic. Clinical disease ranges from mild febrile illness to severe encephalitis. For the purposes of surveillance and reporting, based on their clinical presentation, arboviral disease cases are often categorized into two primary groups: neuroinvasive disease and non-neuroinvasive disease.

Neuroinvasive disease Many arboviruses cause neuroinvasive disease such as aseptic meningitis, encephalitis, or acute flaccid paralysis (AFP). These illnesses are usually characterized by the acute onset of fever with stiff neck, altered mental status, seizures, limb weakness, cerebrospinal fluid (CSF) pleocytosis, or abnormal neuroimaging. AFP may result from anterior (polio) myelitis, peripheral neuritis, or post-infectious peripheral demyelinating neuropathy (i.e., Guillain-Barré syndrome). Less common neurological manifestations, such as cranial nerve palsies, also occur.
Non-neuroinvasive disease Most arboviruses are capable of causing an acute systemic febrile illness (e.g., West Nile fever) that may include headache, myalgias, arthralgias, rash, or gastrointestinal symptoms. Rarely, myocarditis, pancreatitis, hepatitis, or ocular manifestations such as chorioretinitis and iridocyclitis can occur.

**Clinical criteria for diagnosis**

A clinically compatible case of arboviral disease is defined as follows:

Neuroinvasive disease

Fever (≥100.4°F or 38°C) as reported by the patient or a health-care provider, **AND**

Meningitis, encephalitis, acute flaccid paralysis, or other acute signs of central or peripheral neurologic dysfunction, as documented by a physician, **AND**

Absence of a more likely clinical explanation.

Non-neuroinvasive disease

Fever (≥100.4°F or 38°C) as reported by the patient or a health-care provider, **AND**

Absence of neuroinvasive disease, **AND**

Absence of a more likely clinical explanation.

**Laboratory criteria for diagnosis**

Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, **OR**

Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, **OR**

Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, **OR**

Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred, **OR**

Virus-specific IgM antibodies in CSF or serum.

**Case classification**

*Confirmed: Neuroinvasive disease* A case that meets the above clinical criteria for neuroinvasive disease and one or more the following laboratory criteria for a confirmed case:

Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, **OR**

Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, **OR**

Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, **OR**

Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred.

*Non-neuroinvasive disease* A case that meets the above clinical criteria for non-neuroinvasive disease and one or more of the following laboratory criteria for a confirmed case:

Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, **OR**

Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, **OR**

Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, **OR**

Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred.

*Probable: Neuroinvasive disease* A case that meets the above clinical criteria for neuroinvasive disease and the following laboratory criteria:

Virus-specific IgM antibodies in CSF or serum but with no other testing.

*Non-neuroinvasive disease* A case that meets the above clinical criteria for non-neuroinvasive disease and the laboratory criteria for a probable case:

Virus-specific IgM antibodies in CSF or serum but with no other testing.

**Comment**

Interpreting arboviral laboratory results

**Serologic cross-reactivity.** In some instances, arboviruses from the same genus produce cross-reactive antibodies. In geographic areas where two or more closely-related arboviruses occur, serologic testing for more than one virus may be needed and results compared to determine the specific causative virus. For example, such testing might be needed to distinguish antibodies resulting from infections within genera, e.g., flaviviruses such as West Nile, St. Louis encephalitis, Powassan, Dengue, or Japanese encephalitis viruses.

**Rise and fall of IgM antibodies.** For most arboviral infections, IgM antibodies are generally first detectable at 3 to 8 days after onset of illness and persist for 30 to 90 days, but longer persistence has been documented (e.g, up to 500 days for West Nile virus). Serum collected within 8 days of illness onset may not have detectable IgM and testing should be repeated on a convalescent-phase sample to rule out arboviral infection in those with a compatible clinical syndrome.

**Persistence of IgM antibodies.** Arboviral IgM antibodies may be detected in some patients months or years after their acute infection. Therefore, the presence of these virus-specific IgM antibodies may signify a past infection and be unrelated to the current acute illness. Finding virus-specific IgM antibodies in CSF or a fourfold or greater change in virus-specific antibody titers between acute- and convalescent-phase serum specimens provides additional laboratory evidence that the arbovirus was the likely cause of the patient's recent illness. Clinical and epidemiologic history also should be carefully considered.

**Persistence of IgG and neutralizing antibodies.** Arboviral IgG and neutralizing antibodies can persist for many years following a symptomatic or asymptomatic infection. Therefore, the

presence of these antibodies alone is only evidence of previous infection and clinically compatible cases with the presence of IgG, but not IgM, should be evaluated for other etiologic agents.

**Arboviral serologic assays.** Assays for the detection of IgM and IgG antibodies commonly include enzyme-linked immunosorbent assay (ELISA), microsphere immunoassay (MIA), or immunofluorescence assay (IFA). These assays provide a presumptive diagnosis and should have confirmatory testing performed. Confirmatory testing involves the detection of arboviral-specific neutralizing antibodies utilizing assays such as plaque reduction neutralization test (PRNT).

**Other information to consider.** Vaccination history, detailed travel history, date of onset of symptoms, and knowledge of potentially cross-reactive arboviruses known to circulate in the geographic area should be considered when interpreting results.

Imported arboviral diseases Human disease cases due to Dengue or Yellow fever viruses are nationally notifiable to CDC using specific case definitions. However, many other exotic arboviruses (e.g., Chikungunya, Japanese encephalitis, Tick-borne encephalitis, Venezuelan equine encephalitis, and Rift Valley fever viruses) are important public health risks for the United States as competent vectors exist that could allow for sustained transmission upon establishment of imported arboviral pathogens. Health-care providers and public health officials should maintain a high index of clinical suspicion for cases of potentially exotic or unusual arboviral etiology, particularly in international travelers. If a suspected case occurs, it should be reported to the appropriate local/state health agencies and CDC. Arboviral encephalitis cannot be distinguished clinically from other central nervous system (CNS) infections.

**Acute and convalescent sera from reported and suspect cases should be acquired and sent to the Bureau of Laboratories.**

**Eastern Equine Encephalitis Virus Serology**

| | | | |
|---|---|---|---|
| 1a | EEE IgM + ***and*** | | |
| | 2a | IgG + (HI, IgG ELISA, IFA)…… | Confirmed case |
| | 2b | IgG – ……... | Go to 3 |
| | | 3a CSF IgM+……. | Confirmed case |
| | | 3b Serum collected < 7 days post onset…….. *Submit convalescent serum for confirmatory testing* | Probable case |
| | | 3c Serum collected > 7 days post onset……..……. | Not a case |
| 1b | EEE IgM – ***and*** | | |
| | 4a | IgG - ……. | Not a case |
| | 4b | IgG + ……. | Go to 5 |
| | | 5a IgG+ in a single serum…….. | Go to 6 |
| | | 6a IgG titer low……. (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA) | Not a case |
| | | 6b IgG titer high…… (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA) | Probable case |
| | | 5b IgG+ in paired sera……. | Go to 7 |
| | | 7a Antibody titers in both sera are the same or < four-fold difference …… | Go to 8 |
| | | 8a IgG titer low …….. (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA) | Not a case |
| | | 8b IgG titer high…….. (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA) *Submit convalescent serum for confirmatory testing* | Probable case |
| | | 7b Antibody titers in the two sera ≥ four-fold difference | Confirmed case |

**West Nile Virus Serology**

Note: All specimens tested for flaviviruses at the DOH laboratories are tested for antibodies to multiple viruses (i.e. WNV, SLEV and DENV) before considered confirmed. Antibodies cross reactive to all three viruses are often present in flavivirus positive sera. Specific antibodies to the virus causing the infection generally have the highest titers.

| | | |
|---|---|---|
| **1a** | **WNV IgM +** | **Go to 2** |
| | 2a IgG + by HI, IgG ELISA, or IFA assays | Confirmed case<br>*PRNT assay may be needed to definitively distinguish WNV, SLEV, and DENV ab. |
| | 2b IgG- by HI, IgG ELISA, or IFA assays | Go to 3 |
| | 3a CSF WNV IgM + | Confirmed case |
| | 3b Serum collected < 7 days post onset | Probable case<br>*Submit convalescent serum for confirmatory testing |
| | 3c Serum collected > 7 days post onset | Not a case |
| **1b** | **WNV IgM –** | **Go to 4** |
| | 4a IgG - | Not a case |
| | 4b IgG + | Go to 5 |
| | 5a IgG + single serum | Go to 6 |
| | 6a IgG titer low* (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA) | Not a case |
| | 6b IgG titer high (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA) | Probable Case<br>*Submit convalescent serum for confirmatory testing |
| | 5b IgG + in paired sera | Go to 7 |
| | 7a Antibody titers in both sera are the same or < four-fold difference | Go to 8 |
| | 8a IgG titer low* (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA) | Not a case |
| | 8b IgG titer high | Probable case<br>*PRNT assay needed to distinguish SLEV, WNV, and DENV ab |
| | 7b Antibody titers in the two sera ≥ four-fold difference | Confirmed case |

* Indicative of infection or immunization with a group B Flavivirus at an undetermined time

**St Louis Encephalitis Virus Serology**

| | | |
|---|---|---|
| **1a** | **SLEV IgM +** | **Go to 2** |
| | 2a IgG + by HI, IgG ELISA, or IFA assays | Confirmed case<br>*PRNT assay may be needed to definitively distinguish WNV, SLEV, and DENV ab |
| | 2b IgG- by HI, IgG ELISA, or IFA assays | Go to 3 |
| | 3a CSF SLEV IgM + | Confirmed case |
| | 3b Serum collected < 7 days post onset | Probable case<br>*Submit convalescent serum for confirmatory testing |
| | 3c Serum collected > 7 days post onset | Not a case |
| **1b** | **SLEV IgM –** | **Go to 4** |
| | 4a IgG - | Not a case |
| | 4b IgG + | Go to 5 |
| | 5a IgG + single serum | Go to 6 |
| | 6a IgG titer low* (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA) | Not a case |
| | 6b IgG titer high (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA) | Probable Case<br>*Submit convalescent serum for confirmatory tetsing |
| | 5b IgG + in paired sera | Go to 7 |
| | 7a Antibody titers in both sera are the same or < four-fold difference | Go to 8 |
| | 8a IgG titer low* (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA) | Not a case |
| | 8b IgG titer high (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA) | Probable case<br>*PRNT needed to distinguish SLEV, WNV, and DENV ab |
| | 7b Antibody titers in the two sera ≥ four-fold difference | Confirmed case |

* Indicative of infection or immunization with a group B Flavivirus at an undetermined time

# Chapter 3
# Dengue

Dengue fever is caused by any of four closely related dengue virus (DENV) serotypes (DENV 1-4). It is a painful, debilitating febrile disease (so-called "break-bone fever") that is rarely fatal. This illness is characterized by fever, myalgia, arthralgia, retro-orbital pain, abnormal vascular permeability, hypovolemia and abnormal blood clotting mechanisms. Dengue hemorrhagic fever-dengue shock syndrome (DHF-DSS) is a group of severe hemorrhagic symptoms that occur in a small percent of those infected. In those with severe disease, shock is the predominant sign. Case fatality rate with DHF can be 10% or higher if untreated, but can be drastically lowered (<1%) with timely and appropriate fluid therapy. Encephalitis is a rare consequence of dengue infection. Infection with one dengue serotype does not protect against the others and a second infection may put people at greater risk for DHF and DSS.

Dengue is transmitted between people by the mosquitoes *Aedes aegypti,* most commonly found in south Florida, and *Aedes albopictus,* found throughout the state. Incubation period is 3-14 days, in most cases symptoms begin 4-7 days after the mosquito bite and last 3-10 days. People can transmit the virus to other mosquitoes if bitten while viremic, usually beginning the day before symptom onset and continuing for five days. It then takes 8-12 days for the mosquito to become infectious to previously uninfected people. A large proportion (up to 50%) of people infected with dengue do not display symptoms but can still transmit the virus to mosquitoes. Unlike other flaviviruses such as West Nile virus, human are the only important vertebrate hosts of DENV.

Dengue has become increasingly common in the Caribbean, Central America, the Pacific, and South America during the past two decades. Today, about 40% of the world's population lives in areas where there is a risk of dengue transmission. The World Health Organization estimates that 50 to 100 million infections occur annually, including 500,000 DHF cases and 22,000 deaths. In 2010, CDC issued two dengue warnings through their Health Alert Network (HAN); one related to an increased risk of dengue in Haiti earthquake responders and a second related to increased dengue activity worldwide.

Until 2009, the last dengue virus epidemic in Florida occurred in 1934-1935 in the Tampa and Miami areas. Since then, a small number of cases have been reported each year in individuals with recent travel history to a dengue-endemic country. In past Florida epidemics, the sole vector of the dengue viruses (DENV) was undoubtedly *Ae. aegypti.* However, since that time, *Ae. albopictus* have become established in Florida, and this species is an important vector of DENV in Asia. Both species prefer to feed during the day, unlike most vectors associated with Florida endemic arboviruses. *Ae. aegypti* feeds exclusively on humans, is highly domesticated, and primarily utilizes artificial containers as larval habitats. In contrast, *Ae. albopictus* is an opportunistic feeder and fundamentally a treehole- and leaf axil-dwelling species that is secondarily an artificial container dweller. Traditional CDC Light Traps, which are the standard mosquito traps used for WNV, SLEV, and EEEV mosquito vector surveillance, are not optimal for these species.

During the summer of 2009, local dengue transmission was identified in Key West, FL. The Monroe County Health Department and Florida Department of Health were notified of a traveler to Key West, FL who had been diagnosed with dengue fever immediately after her return. DOH and CDC collaborated to perform a serosurvey in order to determine the extent of the outbreak. Cases were also identified by physician submission and a medical record review at the local hospital. Ultimately, 27 cases were confirmed, with onset dates ranging from July to October

2009. This suggests an infection rate of approximately five percent of the Old Town, Key West population during the outbreak. Infected *Ae. aegypti* mosquitoes were collected in mid-October. All serotyped human and mosquito samples were categorized as DENV-1.[13] In 2010, 66 cases of locally acquired dengue associated with Key West were reported in Florida with onset dates ranging from March 17 to November 30, 2010. Several samples collected from 2009 and 2010 cases typed as DENV-1, the same virus strain, suggesting that virus transmission had continued at a low level throughout the winter, probably masked by the H1N1 influenza pandemic. Monroe County Health Department and Monroe Mosquito Control District continued innovative and aggressive public and health care provider outreach and mosquito control efforts into the winter of 2010, with a goal of dengue eradication. This effort has received strong support from community partners including the local naval base. The personnel from CDC Dengue Branch also continue to share their expertise and guidance.

In 2010, single cases of local dengue transmission were identified in Broward (August) and Miami (October). Molecular diagnostic testing performed at DOH BOL identified DENV-3 in the Broward serum sample and DENV-2 in the Miami-Dade submission, indicating two unrelated dengue introductions. The county health departments and local mosquito control agencies worked closely together to respond. Local Broward Code Enforcement officials also supported efforts to remove *Ae aegypti* breeding sites.

With increasing dengue incidence worldwide and frequent international travel, it is likely that dengue outbreaks will continue to be an issue in Florida. In 2010, 133 cases of imported dengue were reported in individuals with travel history to a dengue endemic country in the two weeks prior to onset: Puerto Rico 27 %, other Caribbean countries 27 %, Central America 21%, South America 20% and Asian and African countries 5%. Because dengue can be a non-specific illness and is not diagnosis commonly considered by most United States physicians, an outbreak may not be detected quickly. Appropriate, good communication and recurring education of medical, public health and mosquito control personnel is an important means of minimizing the impact of an introduction of one of these viruses. Any case of dengue that is not readily explained by recent foreign travel is strongly suggestive of local transmission and should be investigated aggressively. The Arbovirus Surveillance Coordinator in DEH should be immediately notified and mosquito control personnel should be contacted to ensure timely *Ae. aegypti* and *Ae. albopictus* surveillance and control. In such a situation, the threat of additional cases in the near-term is substantial. Identification of a focus of local dengue transmission anywhere in Florida elicits immediate notification of physicians and public health workers and a mosquito-borne disease advisory should be issued for the public.

Recognition of DENV transmission in Florida also requires an immediate assessment and appropriate response by local mosquito control personnel to reduce exposure of residents to *Ae. aegypti and Ae. albopictus* vectors. Potential response involves treatment or removal of all container habitats found in the area. Ground level adulticiding may be appropriate, but aerial adulticiding is generally thought to be ineffective in the control of dengue outbreaks. Vigorous public education through the news media encouraging residents to assist in the effort to eliminate artificial container habitats.

[13] CDC. 2010. Locally acquired dengue — Key West, Florida, 2009–2010. MMWR. 59:577-581.

# Case Definition
# **Dengue Fever**

reporting code = 06100
case report form: (HSDE, 8/08)
*Dengue Case Investigation*

## Clinical description

Dengue fever (DF) is most commonly an acute febrile illness defined by the presence of fever and two or more of the following, retro-orbital or ocular pain, headache, rash, myalgia, arthralgia, leukopenia, or hemorrhagic manifestations (e.g., positive tourniquet test, petechiae; purpura/ecchymosis; epistaxis; gum bleeding; blood in vomitus, urine, or stool; or vaginal bleeding) but not meeting the case definition of dengue hemorrhagic fever. Anorexia, nausea, abdominal pain, and persistent vomiting may also occur but are not case-defining criteria for DF. Dengue hemorrhagic fever (DHF) is characterized by all of the following:

- Fever lasting from 2-7 days
- Evidence of hemorrhagic manifestation or a positive tourniquet test
- Thrombocytopenia (≤100,000 cells per $mm_3$)
- Evidence of plasma leakage shown by hemoconcentration (an increase in hematocrit ≥20% above average for age or a decrease in hematocrit ≥20% of baseline following fluid replacement therapy), or pleural effusion, or ascites or hypoproteinemia

Dengue shock syndrome (DSS) has all of the criteria for DHF plus circulatory failure as evidenced by:

- Rapid and weak pulse and narrow pulse pressure (<20mm Hg) OR
- Age-specific hypotension and cold, clammy skin and restlessness.

## Laboratory criteria for diagnosis

### Confirmatory

a. Isolation of virus from or demonstration of specific arboviral antigen or genomic sequences in tissue, blood, cerebropspinal fluid (CSF), or other body fluid by polymerase chain reaction (PCR) test, immunofluorescence, or immunohistochemistry, OR
b. Seroconversion from negative for dengue-specific serum IgM antibody in an acute phase (≤ 5 days after symptom onset) specimen to positive for dengue-specific serum IgM antibodies in a convalescent-phase specimen collected ≥5 days after symptom onset, OR
c. Demonstration of a ≥4-fold rise in reciprocal IgG antibody titer or hemagglutination inhibition titer to dengue antigens in paired acute and convalescent serum samples, OR
d. Demonstration of a ≥4-fold rise in PRNT (plaque reduction neutralization test) end point titer (as expressed by the reciprocal of the last serum dilution showing a 90% reduction in plaque counts compared to the virus infected control) between dengue viruses and other flaviviruses tested in a convalescent serum sample, OR
e. Virus-specific immunoglobulin M (IgM) antibodies demonstrated in CSF.

### Supportive

A positive IgM antibody test on a single acute (late)- or convalescent-phase serum specimen to one or more dengue virus antigens).

## Criteria for Epidemiologic Linkage

Travel to a dengue endemic country or presence at a location with an ongoing outbreak within previous two weeks of dengue-like illness OR

Association in time and place with a confirmed or probable dengue case

## Case classification

Confirmed: a clinically compatible case that is laboratory confirmed
Probable: a clinically compatible case with supportive serologic findings
Suspect: a clinically compatible case with both epidemiologic linkage criteria.

## Comment

Dengue hemorrhagic fever is defined as an acute febrile illness with minor or major bleeding phenomena, thrombocytopenia (platelet count <100,000/$mm^3$ ), and evidence of plasma leakage documented by hemoconcentration (hematocrit increased by >20%) or other objective evidence of increased capillary permeability. The definition of dengue shock syndrome follows all of the above criteria for dengue hemorrhagic fever and also includes hypotension or narrow pulse pressure (<20 mm Hg).

| Guide to Interpretation and Classification of Common Dengue Laboratory Tests **Laboratory test** | **Days post-onset of sample collection** | **Interpretation of positive result** | **Explanation** |
|---|---|---|---|
| Real Time-PCR | ≤ 5 days | Confirmatory (*Note) | Patient viremic while febrile; days 0-7 |
| IgM (paired specimens, acute and convalescent) | ≤ 5 days for acute specimen, > 5 days for convalescent. (ideally 2 weeks apart) | Confirmatory | Negative IgM in an acute specimen followed by a positive IgM in a convalescent specimen |
| IgG (paired specimens, acute and convalescent) | ≤ 5 days for acute specimen, > 5 days for convalescent. (ideally 2 weeks apart) | Confirmatory | Must be 4 fold increase in titer between acute and convalescent specimen |
| IgM (single serum specimen) | > 5 days | Probable | IgM can remain positive for ≥ 3 months in cases of acute dengue infection |
| *Note: Only PCR for dengue or IgM ELISA-based antibody test can be used for diagnosis of dengue in single serum specimens | | | |
| NB: Previous flavivirus infections and the high prevalence of dengue IgG antibody in some population (e.g., those resident in, or long-term visitors of dengue endemic countries) complicate interpretation of dengue serological test results. Therefore, a single serum sample tested using a dengue-specific IgG or combined IgM/IgG (“all antibody”) test is generally not helpful for diagnosis of confirmed or probable cases of dengue. For this reason suspect cases are defined clinically and epidemiologically, without IgG or combined IgG/IgM serological testing. If only a single serum sample is available for testing, a test for dengue-specific IgM antibody is preferred. | | | |

# Chapter 4
# Malaria

Malaria is one of the world's greatest public health problems. Approximately 500 million of the world's population are infected each year and between 2 and 2.5 million people die from malaria annually. One in 3 people in the world, a total of 2.2 billion people, are at risk of being infected by the mosquito-borne parasite *Plasmodium falciparum*. Endemic malaria was eradicated from Florida in the late 1940s. Although malaria is no longer endemic in Florida, it is often seen in travelers returning to the state from endemic malaria regions of the world. *Anopheles* mosquitoes, responsible for transmitting malaria to humans, are common in the state and autochthonous malaria transmission is still possible.

Human malaria is caused by four species of protozoan parasites of the genus *Plasmodium: P. vivax, P. falciparum, P. malariae, and P. ovale.* All four are transmitted from person to person via the bite and blood-feeding behavior of mosquitoes of only the genus *Anopheles.* A 5th *Plasmodium* species that can cause severe illness and potentially death in humans is *P. knowlesi*. This species is endemic to southeast Asia and macaque monkeys appear to be the primary reservoir.

**Vector**

In Florida, there are eight identifiable *Anopheles* species, all of which are potentially capable of transmitting malaria, however only one *Anopheles quadrimaculatus,* is a major malaria vector in Florida:

- *An. quadrimaculatus*
  - Principal malaria carrier.
  - Found in every county, more abundant in northern Florida.
  - Breeds in alkaline ponds, lakes and gum swamps in the limestone and red clay regions of northern and western Florida.
- *An. crucians*
  - Breeds in acid ponds and cypress swamps.
- *An. punctipennis*
  - Breeds in winter in slow-flowing alkaline streams of northern and western Florida.
- *An. perplexens*
  - Rare mosquito found in north central Florida.
- *An. atropos*
  - Breed in salt marshes.
- *An. albimanus*
  - Very rare species.
  - Breeds in sunlit pools on the Florida Keys.
  - Major malaria vector in Central America.
- *An. walkeri*
  - More common in central Florida.
  - Breeds in heavily vegetated lakes.
- *An. barberi*
  - Breeds in tree holes.

## Epidemiology

Although now rare in the United States, malaria was once a major scourge of Florida (both *P. vivax* and *P. falciparum),* occurring in all 67 counties. Data collected since 1917 from the Bureau of Vital Statistics (Provost 1946, unpublished) showed 24 counties with annual death rates from malaria of 100 per 100,000; eight had rates above 200; and Dixie County, in 1930, had a death rate above 300. According to the usually accepted ratio of 200 malaria cases per death, these rates meant 20, 40, and 60% of the populations involved had malaria morbidity. The 24 counties having the highest rate of malaria in Florida and the U.S. were Dixie, Taylor, Jefferson, Lafayette, Wakulla, Gilchrist, Madison, Citrus, Levy, Hernando, Gadsden, Suwannee, Leon, Jackson, Calhoun, Franklin, Okeechobee, Hamilton, Washington, Pasco, Sumter, Columbia, Holmes and Liberty. Malaria morbidity reports for Florida show a steady decrease since 1934 with no large outbreak since 1937. This reduction in malaria incidence was probably due to adult mosquito sprays, improved housing including screening, use of repellents, agricultural and other drainage practices and the use of anti-malarial drugs.

Until recently, the last case of malaria from the bite of a naturally infected mosquito occurred in 1948. In June 1990, Florida had its first case of human malaria (*P. vivax*) in 42 years, acquired presumably through the bite of a mosquito in Gulf County. Two induced cases of *P. falciparum* occurred in Broward County in 1996 and were probably related to iatrogenic spread in a hospital setting where a patient was being treated for imported malaria infection. Also in 1996, two cryptic cases of *P. vivax* infection occurred in Palm Beach County. One of these cases was in a homeless male and the other was in a resident living in a nearby area. The largest *P. vivax* outbreak in recent Florida history (with eight cases) occurred in Palm Beach County in 2003 in an area located very close to the 1996 Palm Beach County malaria cases. One Manatee County resident acquired *P. falciparum* via a blood transfusion in 2009. In November, 2010, *P. falciparum* with cryptic origin (possibly Florida acquired) was reported in Duval County. The patient had frequent domestic airline travel, but had not recently been in any airports that received direct flights from malaria endemic countries. Low numbers of *Anopheles* mosquitoes were found around her residence. Genetic typing at CDC was consistent with a *P. falciparum* strain originating in the New World (the America's).

Also in 2010, a temporal cluster of imported cases of *P. falciparum* cases was identified in 4 airline workers (3 Florida residents) with occupational travel to West Africa.[14] Additional airline worker cases outside the temporal cluster were also identified.

The number of malaria cases in the U.S. has been gradually increasing from the early 1970s and may represent increasing cases from migrants and increased travel among U.S. citizens. In 2010, one-hundred and thirty six imported cases were reported as acquired primarily in Haiti (58%), Africa (26 %), and Asia (9%), with a small number from Central and South America (5%), and Caribbean countries other than Haiti (<2%). The population in Florida at greatest risk of infection was immigrants returning to their home countries to visit friends and relatives (VFR's). FAQ sheets for this group are available at: http://www.doh.state.fl.us/Environment/medicine/arboviral/Malaria.html. The number of imported cases from Haiti have increased significantly over the past 2 years; cases include both visiting friends and relatives and emergency responders not routinely using malaria prophylaxis. The recent natural disasters (earthquake, hurricanes) in Haiti are believed to be major contributing factors.

[14] CDC. Notes from the field: malaria imported from West Africa by flight crews---Florida and Pennsylvania, 2010. MMWR. 2010;59:1412.

## Clinical Course

The symptoms of malaria will vary depending on the species, but the initial attack may start with lassitude, headache, anorexia, occasional nausea and vomiting. The fever is comprised of a cold stage (shivering and a feeling of intense cold), a hot stage (distressing heat, dryness, burning, intense headache, nausea, and vomiting) and finally a profuse sweating stage. The typical attack often begins in the early afternoon and lasts from eight to twelve hours. Persons experiencing these symptoms and having been in an area with malaria are encouraged to see a doctor immediately. Emergency treatment consultation advice is available for health care providers through the CDC Malaria Hotline (770-488-7788) from 9:00 am to 5:00 pm Eastern Time. After hours or on weekends and holidays, call the CDC Emergency Operation Center at 770-488-7100 and ask to page the person on call for the Malaria Branch. All cases of malaria should be reported to the appropriate county health department,

*P. vivax* occurs throughout most of the temperate zone, large areas of the tropics, and less commonly in tropical Africa. Severity of the primary attack ranges from mild to severe, usually not resulting in death. *P. falciparum* is generally confined to tropical or subtropical regions and is particularly severe and often fatal in infants, young children and in non-immune persons. *P. malariae* is frequently named "quartan malaria" because the fever recurs on the fourth day after a two-day interval. The fevers of the other three malaria species recur on the third day after a one-day interval. *P. malariae* occurs over both tropical and sub-tropical areas. The disease is less severe, but may have a long persistence. *P. ovale* is similar to *P. vivax* malaria, but with a prolonged latency and generally milder clinical symptoms. It is most common in West Africa.

### Specific characteristics

#### Vivax malaria

Clinical*:*

- Incubation period 12-17 days (9-10 months recorded)
- Primary attack (8-10 hours duration)
- Sudden, shaking chill often for several hours, headache, back pain, nausea, malaise
- Irregular fever during the first 2-4 days up to 104-105 degrees
- Fever terminates by crisis with drenching sweat, up to several hours
- Series of fevers every 48 hours with diminishing intensity for 2 weeks
- Two-week latent period
- Secondary attacks (less intense) for 2 months
- Six- to nine-month latent period
- Long-term relapses - 2.5-3 years

Pathology:

- Infects new red blood cells, red cell destruction leads to anemia
- Enlarged spleen, pulp tarry, malphigian bodies pale gray, malaria pigment within reticulo-endothelial cells
- Congested and enlarged liver, destruction of the bile canaliculi
- Granular casts in urine and fatty degeneration in kidneys
- Infected RBCs are sticky and adhere to capillary, hemorrhages, tissue anoxia and electrolyte imbalance

#### Falciparum malaria

Clinical:

- Incubation period 9-14 days
- Headache, back pain, prostration, chill
- Fever irregular, and no distinct periodicity, sweating may be present even when fever is low, higher temperature up to 105-110 degrees F

- Pulse and respiration rates are rapid
- Nausea, vomiting and diarrhea increase, frequently a cough
- Cerebral manifestations of excitation, depression, behavioral changes with psychotic tendencies, coma without hyperpyrexia
- Bilious form - nausea, vomiting, gastric distress, jaundice
- Algid form - high internal heat, body cold and clammy
- Choleraic form - stools loose ("rice water")
- Severe dehydration and anemia
- If untreated, “pernicious malaria” may develop suddenly
- Frequent recrudescence during first month, radical cure in about 10 months

Pathology:

- Infects all red blood cells
- Few parasites may be present
- Spleen and liver enlargement
- Acute hemolysis of erythrocytes (hemoglobinuria) with dark, mahogany-red urine (blackwater fever)
- Renal failure

**Malariae malaria**

- Clinical symptoms are similar to vivax
- Untreated infections may have relapses 30-50 years later

**Ovale malaria**

- Clinical symptoms similar to vivax
- Spontaneous recovery common, fewer relapses

**Surveillance Issues**

Imported malaria will continue to be an issue for travelers and visitors to Florida, including migrant workers. Locally acquired cases are possible when *An. quadrimaculatus* and *An. Crucians* which are present throughout the state seek blood meals from parasitic human hosts. Surveillance and investigation of reported cases will continue to be important. The surveillance data will be optimized by the following activities.

- Remind physicians and public health workers regularly about the possibility of the importation of malaria among travelers and visitors, including migrant workers, and the danger of not clinically diagnosing malaria from more common febrile illnesses and immediately reporting all confirmed cases.
- Obtain slides and conduct thorough investigations of all cases with special attention to finding secondary cases and preventing further disease.
- Inform public health officials including the state vectorborne disease surveillance coordinator, county health officers and the local mosquito control director, when an imported malaria case has been detected.

Institute annual surveillance programs focused on *An. quadrimaculatus* and *An. crucians* to establish long term baseline data sets to evaluate local changes in abundance of these important malaria vectors in Florida.

**Surveillance issues for mosquito control agencies**

- Survey and map annually for all actual and potential anopheline larval breeding sites in the district.
- Annually map anopheline adult distribution and record the seasonal abundance collections in the county.

- Be informed of all imported and introduced malaria in the county and Florida.

Any case that is not readily explained by foreign travel or visitors (including migrant workers) is strongly suggestive of local transmission. When a case of malaria has been identified, the public should be warned to report any fever of unknown origin to their physician or county health department. County health department should alert the local mosquito control. A blood film smear and whole blood in a purple-top tube are submitted for hemoparasitologic analysis of all fever cases suspected of having malaria. *Babesia* can be mistaken for malaria parasites, and vice versa. It is important that the specimens are collected before treatment is initiated. Depending on the number of cases (at least two), the county health department may conduct a survey of migrant workers and local residents (family and neighbors) in the immediate area where the malaria cases occurred. Useful information and general guidance is provided in: Locally Acquired Mosquito-Transmitted Malaria: A Guide for Investigations in the United States, 2006, MMWR, Vol. 55 / No. RR-13

Depending on circumstances such as abundance of vectors, human population density in the area, number of suspected human cases, etc., mosquito abatement measures may be initiated. Abatement responses are coordinated with DACS Bureau of Entomology and Pest Control.

**Malaria prophylaxis for travelers**

Individuals traveling to malaria-endemic countries should consult with their doctor about anti-malarial prophylaxis. More information can be found at the CDC website: http://www.cdc.gov/malaria/travelers/index.html. Those with *P. falciparum* infection, pregnant women, children, and individuals with no established immunity to malaria are particularly at risk for severe or fatal illness. Any traveler experiencing malaria-like symptoms during or after travel should seek medical attention.

# Case Definition
# **Malaria**

reporting code = 08460
case report form: CDC 54.1 2010
*Malaria Case Surveillance Report*

## Clinical description

Signs and symptoms are variable; however, most patients experience fever. In addition to fever, common associated symptoms include headache, back pain, chills, sweats, myalgia, nausea, vomiting, diarrhea, and cough. Untreated *Plasmodium falciparum* infection can lead to coma, renal failure, pulmonary edema, and death. The diagnosis of malaria should be considered for any person who has these symptoms and who has traveled to an area in which malaria is endemic. Asymptomatic parasitemia can occur among persons who have been long-term residents of areas in which malaria is endemic.

## Laboratory criteria for diagnosis

Detection of malaria parasites in thick or thin peripheral blood films
OR
Detection of species specific parasite DNA in a sample of peripheral blood using a polymerase chain reaction (PCR) test
OR
Detection of circulating malaria-specific antigens using rapid diagnostic test (RDT)

## Case classification

Confirmed: detection and specific identification of malaria parasite by microscopy on blood films in a laboratory with appropriate expertise OR detection of *Plasmodium* species by nucleic acid test in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country.

Suspect: detection of *Plasmodium* species by rapid diagnostic antigen testing **without confirmation by microscopy or nucleic acid testing** in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country.

## Comment

A subsequent attack experienced by the same person but caused by a different *Plasmodium* species is counted as an additional case. A subsequent attack experienced by the same person and caused by the same species in the United States may indicate a relapsing infection or treatment failure caused by drug resistance.

**Permanent slides from all diagnosed and suspected cases must be sent to the Bureau of Laboratories.**

Cases also are classified according to the following World Health Organization categories:
Autochthonous:

- Indigenous: malaria acquired by mosquito transmission in an area where malaria is a regular occurrence
- Introduced: malaria acquired by mosquito transmission from an imported case in an area where malaria is not a regular occurrence

Imported: malaria acquired outside a specific area (e.g., the United States and its territories)

Induced: malaria acquired through artificial means (e.g., blood transfusion, common syringes, or malariotherapy [the treatment of disease by raising the body temperature through infecting the patient with malaria])

Relapsing: renewed manifestation (i.e., of clinical symptoms and/or parasitemia) of malarial infection that is separated from previous manifestations of the same infection by an interval greater than any interval resulting from the normal periodicity of the paroxysms

Cryptic: an isolated case of malaria that cannot be epidemiologically linked to additional cases

**A copy of laboratory test results must accompany the paper case report form.**

# Chapter 5
# Other Exotic Mosquito-borne Diseases of Interest

The diseases described in this chapter are currently not endemic in the United States, but there is risk of introduction by an infected traveler or immigrant. Although not all are nationally notifiable, cases of any of these diseases, whether imported or locally-acquired, should be reported to the Bureau of Environmental Public Health Medicine. Recognition of transmission in Florida requires an immediate response by local mosquito control personnel.

## Yellow Fever

Yellow fever (YF) is caused by infection with yellow fever virus (YFV), a flavivirus in the same family as West Nile Virus and dengue virus. Like dengue, it is transmitted to humans by infected *Aedes aegypti* mosquitoes and there is no animal reservoir. Yellow fever was previously a major public health concern in the United States, but it currently occurs only in tropical regions of Africa and parts of South America. The last epidemic in North America occurred in New Orleans in 1905.

Yellow fever is a rare cause of illness in U.S. travelers to endemic countries. Fortunately, it can be prevented by vaccination. Travelers should be vaccinated for YF before visiting areas where it occurs. International regulations require proof of vaccination for travel to and from certain countries. Travelers should also take the precautions against mosquito bites found in this guide. Additional travel information can be found in CDC's Yellow Book or at http://www.cdc.gov/vaccines/vpd-vac/yf/default.htm.

The incubation period of YF is usually 3-6 days. Illness ranges in severity from a self-limited febrile illness to severe hepatitis and hemorrhagic fever. Symptoms of severe infection are high fever, chills, headache, muscle aches, vomiting, and backache. After a brief recovery period, the infection can lead to shock, bleeding, and kidney and liver failure. Liver failure causes jaundice, the yellowing of the skin and the whites of the eyes. Severe infections can be fatal. There is no specific treatment, only supportive care and treatment of symptoms. Aspirin should be avoided.

Yellow fever is a nationally reportable disease. Cases should be reported into Merlin using the Vector-borne Disease Infection Case Report in Appendix B.

### Yellow Fever Case Definition

*reporting code = 06090*
*case report form: N/A*

**Clinical description**
A mosquito-borne viral illness characterized by acute onset and constitutional symptoms followed by a brief remission and a recurrence of fever, hepatitis, albuminuria, and symptoms and, in some instances, renal failure, shock, and generalized hemorrhages

**Laboratory criteria for diagnosis**
- Four-fold or greater rise in yellow fever antibody titer in a patient who has no history of recent yellow fever vaccination and cross-reactions to other flaviviruses have been excluded

OR

- Demonstration of yellow fever virus, antigen, or genome in tissue, blood, or other body fluid

**Case classification**
Confirmed: a clinically compatible case that is laboratory confirmed
Probable: a clinically compatible case with supportive serology (stable elevated antibody titer to yellow fever virus [e.g., ≥32 by complement fixation, ≥256 by immunofluorescence assay, ≥320 by hemagglutination inhibition, ≥160 by neutralization, or a positive serologic result by IgM-capture enzyme immunoassay]. Cross-reactive serologic reactions to other flaviviruses must be excluded, and the patient must not have a history of yellow fever vaccination.

## Chikungunya

Chikungunya fever (CHIK) is caused by infection with chikungunya virus (CHIKV), an alphavirus in the family *Togaviridae*. It is also transmitted by *Ae. aegypti* (primarily) and *Ae. albopictus* mosquitoes. It is primarily found in parts of Africa and Asia; however, outbreaks have been documented in Europe. A 2007 outbreak in Italy was especially concerning as the country has a public health and vector control infrastructure similar to that of the U.S. Also, the vector implicated was *Ae. albopictus*, the species with a wider distribution in Florida.

The incubation period of CHIK is typically 3-7 days, but can range from 2-12. Symptoms can be debilitating, with fever, headache, fatigue, nausea, vomiting, muscle pain, rash, and joint pain. Infection is believed to provide life-long immunity. Illness usually lasts a few days to weeks, but some patients have prolonged fatigue lasting several weeks. Fatalities related to chikungunya infection are rare.

There is no vaccine available for CHIK, so travelers to endemic areas should use measures to avoid mosquitoes. Diagnosis in travelers is rare, but has occurred in Florida and throughout the U.S., particularly during epidemics in epidemic countries. Since 2006, four imported cases have been reported in Florida residents.

## Rift Valley Fever

Rift Valley fever (RVF) is caused by infection with the RVF virus (RVFV), in the family *Bunyaviridae*. It is generally found in regions of eastern and southern Africa, but also exists in sub-Saharan Africa and Madagascar. In 2000, it was first documented outside Africa in Saudi Arabia and Yemen. The virus primarily affects livestock, such as cattle, buffalo, sheep, goats, and camels, and can cause large epizootics. Humans, primarily those exposed to diseased animals, can also be infected.

RVFV is transmitted by a number of different species of mosquitoes. Humans can also get the disease if they are exposed to the blood, body fluids, or tissues of infected animals. Many infected individuals have no illness or mild symptoms. People who become ill usually experience fever, generalized weakness, back pain, dizziness, and extreme weight loss. However, some patients (less than 1%) can experience ocular disease, hemorrhagic fever, or encephalitis that can be fatal. Case fatality rates are significantly higher in infected animals.

If introduced to Florida, RVF would be a significant threat to the agriculture industry, with cattle and small ruminants especially affected. This could result in a four year export ban on beef to other countries, causing billions of dollars of economic loss.

# Chapter 6
# Human Arthropod-borne Disease Surveillance

SLEV, WNV, and EEEV infection, malaria, dengue, yellow fever, Lyme disease, Rocky Mountain Spotted Fever, and ehrlichiosis/anaplasmosis are reportable human diseases in Florida. County health departments provide case information to the Bureau of Environmental Public Health Medicine for data analysis and dissemination.

When dealing with imported cases of exotic human arthropod-borne diseases, close communication and coordination between partner agencies is essential to prevent local transmission. The county health department should notify both the Division of Environmental Health and their local mosquito control district (see guidance below) immediately upon receiving notification of a suspected case when, based on the onset date and virus/parasite incubation period, the potential exists for Florida mosquitoes to become infected and for local transmission to occur. If the Bureau of Environmental Public Health Medicine receives the information prior to the CHD, the CHD will be notified immediately and asked to contact their local mosquito control district. The Interagency Partners group will be notified and updated about all potentially imported arthropod-borne diseases.

The Florida Department of Health (DOH) protects the confidentiality of all persons who may have arboviral or other notifiable diseases (Ch. 381.0055, F.S.). However, when there is a need to protect the public's health, the Department is allowed to share confidential information with people who need to know (Ch. 381.0031, F.S.) Such instances include sharing mosquito exposure information of human arbovirus cases with recent disease onset with mosquito control districts to ensure appropriate mosquito surveillance and control. The information should be shared between one contact at the CHD (the case investigator) and one contact at the Mosquito Control District (mosquito control operations chief) and the information shared should be limited to ONLY that necessary for effective mosquito control. Information should be shared over the phone; email correspondence with the Department of Health is public record and should not contain personal identifiers of persons with arboviral disease. Necessary information could vary on a case-by-case basis, but may include a case ID, travel history, any outdoor activities, disease onset date and timing of the exposure. The exact address of the human case may or may not be needed to ensure effective mosquito control. In urban areas, a city block or neighborhood may be sufficient while in rural areas, it may be necessary to share the exact address of the patient's residence. It is expected that those in possession of confidential information treat it in such a way that the privacy of the individual is maintained. It is expected that mosquito control district personnel will shred notes with confidential information when they are no longer needed.

## Case Investigation

Human arboviral case investigations should be initiated upon receipt.

1. CHDs, may receive notification of cases from a variety of sources including physicians, hospitals, laboratories, or DOH headquarters. When a CHD receives notice of a potential case of vector-borne disease, the designated staff person shall gather information about the case and risk factors for infection through an interview with the patient and/or physician.
2. It is often necessary to collect and submit a convalescent blood sample in order to confirm infection with a vector-borne disease. The CHD designee shall arrange for blood collection and submission to the state laboratory.

3. If the potential case meets the case definition for a confirmed, probable, or suspect case, the CHD is responsible for reporting all required information in Merlin. In cases of mosquito-borne disease, the CHD should also notify the local mosquito control district and issue a press release to the public as advised in the Florida Response Plan for Mosquito-borne Diseases (available in the guidebook).

**Interview**

- Use case report form found in Appendix B and electronically on Merlin in Extended Data. It is unnecessary to submit a paper case report form to the state if it is submitted electronically.
- Obtain history of mosquito bites 14 days prior to onset of symptoms
- Ask for travel and activity history
  - Travel outside county of residence, state, or country
  - Occupation
  - Hobbies (gardening, fresh water fishing, hunting)
  - Other outdoor activities
- Collect history of blood transfusions or organ transplants
- Conduct an environmental investigation
  - Residence with screened windows
  - Residence surrounded by vegetation
  - Fresh water near residence (lake, pond, etc.)
- Provide education on prevention of mosquito-borne disease

## Laboratory Evaluation

The Department of Health (DOH) laboratories provide testing services for patients with clinical signs of arboviral disease. These signs may include headache, fever, fatigue, dizziness, weakness and confusion. Due to the cross-reactivity between WNV and other closely related flaviviruses, positive commercial laboratory test results for antibodies to WNV or other arboviruses should be confirmed by the DOH Bureau of Laboratories (i.e., specimens testing positive at private laboratories should be forwarded to the state laboratory for confirmation). Physicians should submit serum and cerebrospinal fluid samples to either the Tampa or Jacksonville state laboratories. In addition, if enterovirus is one of the differential etiologies, submission of an acute stool specimen or an acute throat swab is recommended. Even though a very early acute serum may be negative it is recommended that it be collected and submitted without waiting for the convalescent specimen. The convalescent specimen (drawn 2 weeks later) should be routinely sent to confirm negative and positive results.

It is important to confirm identification of a specific agent in instances of a suspected arbovirus infection. This results in appropriate patient therapy and also permits vector control operations designed to limit transmission to additional susceptible human hosts. Confirmation is dependent upon viral isolation/detection or antibody detection by serologic assays such as the hemagglutination-inhibition (HI), serum-neutralization (SN), enzyme-linked immunosorbent assay (ELISA), microbead immunoassay (MIA) and immunofluorescent antibody (IFA) tests. Interpretation of each of the tests is dependent upon the time of specimen collection relative to the date of virus exposure, the patient's previous infection with arthropod-borne viruses and serum cross-reactivity within the antigenic complex. In Florida, previous dengue virus infection or previous yellow fever vaccination are the most common factors that can complicate the interpretation of antibody tests.

Human sera are assayed by IgM and IgG ELISA assays; equivocal results are confirmed by serum neutralization.

**Available Laboratory Testing**

Virus Isolation (culture) and detection (RT-PCR assays) -- It is rare to isolate SLEV from blood or cerebrospinal fluid taken during the acute phase of encephalitis due to brief viremic stage prior to onset of illness. SLEV and WNV can be detected in brain tissue collected at necropsy. EEE and WEE viruses are also usually only isolated from the brain. The dengue viruses, however, frequently may isolated/detected from blood during the first few days after onset of illness. Virus may also be detected in blood donated prior to development of clinical symptoms.

Serum Neutralization (SN) or Plaque Reduction Neutralization test (PRNT)-- Neutralizing antibody is primarily IgG. SN antibody rises late in the course of infection, and may persist for life after some viral infections.

Serum IgM Antibody -- IgM can be detected in either serum or cerebrospinal fluid (CSF) using a capture enzyme immunoassay. The presence of significant levels of IgM is generally a reliable indicator of recent infection. However, a subset of case patients may have serum IgM antibody to flaviviruses persisting for over a year, thus somewhat limiting the value of the assay as a measure of recent infection. Since IgM antibody does not cross the blood-brain barrier, its presence in CSF indicates local antibody synthesis in response to a central nervous system infection and is usually diagnostic. Cross-reactivity within a virus group (e.g., flaviviruses) is common.

Serum Hemagglutination-Inhibition Antibody (HI) -- Both the IgG and IgM antibody fractions are responsible for the HI reaction. HI titers can become positive quite early in the course of infection and a rise in titer is diagnostic of recent infection. Cross-reactivity within a virus group (e.g., flaviviruses) is common, and can complicate interpretation of results.

**Specimen Collection**

When virus isolation/detection is attempted, blood serum, CSF and tissue samples are placed on dry ice immediately after collection and kept frozen on dry ice while in transit to the laboratory. Fluids are kept in standard sterile airtight tubes, and tissue in an airtight sterile container. Each specimen must be labeled with the patient's name. Hold serum in a refrigerator until shipped. When serum is to be examined only for antibody, it can be shipped at ambient temperature (do not freeze) provided it has been collected and handled aseptically. At least 2ml of serum or CSF are required for antibody testing.

**Shipping Specimens**

Clinical sera are sent immediately to the assigned DOH laboratory for testing (Jacksonville or Tampa, addresses below). Ship serology specimens to either DOH laboratory. Molecular testing (PCR) is currently only available in Tampa. A DOH Laboratory Submission Form should be completed for each patient, listing all specimens. Follow packaging and shipping guidelines for diagnostic specimens (Biological Substance, Category B, UN3373). (http://www.doh.state.fl.us/lab/laboratoryservices.htm ). If viral isolation/detection is desired (e.g., for dengue), sera must be shipped frozen on dry ice to the Bureau of Laboratories in Tampa. A completed Florida Department of Health laboratory submission form should accompany all specimens: http://www.doh.state.fl.us/lab/PDF_Files/doh_form.pdf or in Appendix B.

NOTE: UNSEPARATED, WHOLE BLOOD MUST NOT BE SHIPPED TO THE LABORATORY

To expedite receipt of specimens at the laboratory, overnight or 2-day express shipment is suggested. If sera are shipped on Friday, the package must be clearly marked for "Saturday Morning Delivery". The following must appear on the shipping label:

DOH Bureau of Laboratories - Virology
1217 Pearl Street
Jacksonville, FL 32202
Phone (904) 791-1539, 791-1540

OR

DOH Bureau of Laboratories - Virology
3602 Spectrum Boulevard
Tampa, FL 33612
Phone (813) 974-5990

## Transfusion and Transplant Associated Infections

Although uncommon, a number of arthropod-borne diseases can also be transmitted via blood transfusion or tissue transplant. Blood banks in the U.S. test donated samples for West Nile virus and viremic blood donors are reported to CDC. Donors are typically questioned about travel to malaria-endemic countries and not permitted to donate within a year of travel or within three years of last malaria symptoms. Despite these precautions, infections can still occur.

When investigating a case of West Nile infection, malaria, dengue, or other arthropod-borne diseases such as chagas disease or babesiosis, it is important to inquire about history of transfusions or transplants, particularly when no obvious exposure can be identified. In 2009, a malaria infection with *Plasmodium falciparum* was confirmed in an individual with no history of international travel following a blood transfusion and through blood center traceback, one donor was confirmed as malaria positive.

# Chapter 7
# Non-Human Arthropod-borne Disease Monitoring Activities

The ideal arboviral surveillance program measures the amount of viral amplification and transmission in nature and reliably provides information on the risk of human disease. A complete surveillance program consists of monitoring arboviral seroconversion rates in sentinel chickens, weather patterns, the abundance of vector and amplification host species, and the incidence of human and animal disease. The ultimate goal of surveillance is to increase our ability to predict when and where arboviral transmission to humans is likely to occur so that vector and disease control activities can be implemented prior to the beginning of an epidemic. Continuous local surveillance is also invaluable in monitoring both the progress and the cessation of periods of epidemic risk to humans**.**

## Sentinel Chickens

Arboviruses are found in mosquitoes throughout Florida during most of the year. Sentinel chickens can be infected with mosquito-borne viruses via the bite of an infected mosquito during any month, but transmission is most often reported between August and November.

Historically, sentinel chickens have been more frequently infected with SLEV and WNV than EEEV. This is likely due to the focal distribution of EEEV in Florida and the low probability that sentinel flocks are located in EEEV transmission zones. Therefore, sentinel chicken surveillance may be less useful for predicting EEEV transmission to humans. However, during years of heavy EEEV transmission in Florida, including 1978, 1991, 1997, 2003, 2005, 2008, and 2009, EEEV transmission was reported in sentinel chickens over a wide area indicating a generalized risk of transmission to humans throughout the traditional Florida EEEV transmission zone.

Local health and mosquito control agencies should use sentinel chicken flocks to assess local mosquito transmission of WNV and other arboviruses. Local governments without mosquito control and/or sentinel chicken surveillance capabilities should work to establish programs in uncovered areas. Testing of sentinel chicken sera for virus and/or antibody will be conducted by the DOH Bureau of Laboratories in Tampa, and results reported to submitters and participating programs as quickly as possible.

Sentinel chicken programs are maintained by mosquito control districts and/ or CHDs, depending on local resources and priorities. Such programs entail determining flock placement; flock care; weekly collection, processing, and shipping of blood specimens; and notification of appropriate agencies and persons regarding seroconversion data. Under certain conditions, “backyard” juvenile (birds hatched during the sample year) chickens (i.e., birds maintained for other purposes) can be monitored.

Under ideal circumstances, sentinel chicken flocks should be located in every Florida county because mosquito-borne arbovirus transmission can be quite focal and spread rapidly. When flocks are not maintained in a county, that CHD often relies on the results of sentinel chicken surveillance in contiguous counties to aid in decision-making. Because of the introduction of WNV into Florida in 2001, chicken surveillance should be conducted throughout the state.

Chickens are not known to transmit mosquito-borne viruses directly to people. They are also not effective virus amplifying hosts. Mosquitoes that bite an infected chicken are unlikely to become infected.

**Sentinel Chicken Flock Information**

- The surveillance site should be permanently located in an area free from public access and vandalism. Mosquito control personnel should be consulted for advice on flock placement in counties where CHDs maintain flocks.
- The location of each flock (i.e., maps and GPS coordinates) should be reported to the Bureau of Environmental Public Health Medicine each January. The reporting form can be found in Appendix D.
- The number of flocks maintained in each county depends on the size of the county and the resources available for maintaining a sentinel chicken surveillance program. However, a minimum of six chickens per flock is suggested to maintain uninterrupted arboviral surveillance around the vicinity of the flock.
- Sentinel flocks should be located in a variety of habitats throughout the county. These should include, but are not limited to, hardwood hammocks, pine flatwoods, coastal habitats, freshwater marshes, saltwater marshes, residential areas, city and county parks, and urban centers.
- Backyard chicken flocks selected for retrospective surveys should be located within two to three miles of mosquito breeding areas. During a medical alert, chicken flocks within a two-mile radius of a human case may be sampled.
- Female Leghorn, Barred Rock, Rhode Island Red or Minorcan chickens that reach the age of 10-12 weeks before being placed in the field are ideal for surveillance (game chickens are not recommended). All-hen flocks may be preferred in some urban areas when cocks crowing might annoy residents.
- The local county agricultural extension agent can be contacted to obtain information for contacting local chicken breeders. If a local source of chickens is not available, assistance may be obtained from neighboring counties or mosquito control personnel at FDACS (Contact Jennifer Jennings Glover at 850-251-1226 or jennifer. jenningsglover@freshfromflorida.com).
- Each chicken must be properly identified by a uniquely numbered wing or leg band–(e.g., available from National Band and Tag Company at 859-261-2035, or http://www.nationalband.com/).
- Animal care workers should take precautionary measures when handling chickens and when conducting routine maintenance of cages. Workers should wear latex gloves to protect against contact with chicken feces. Arboviruses are not transmitted by contact with chicken feces, but other illness-causing organisms can be found in the excreta. Chicken feces should be treated carefully and properly disinfected and disposed. Dust masks may be used to protect against respiratory irritants when performing work with significant dust levels such as cleaning cages. See Appendix E

**Husbandry**

- Housing should be constructed in such a manner that the chickens can be protected from the elements (shade and protection from rain is required) and from predators. It is recommended that cages be maintained above the ground.

- A raccoon/fox-proof wired (or double wiring) coop with a strong door and a secure lock to the entrance used for feeding and bleeding purposes should be sufficient to protect the chickens. Mosquitoes must have free access to the coop interior.
- Housing should be adapted to the condition of the terrain and should have adequate slope to keep the ground dry.
- Chickens should be fed in accordance with feed manufacturer's recommendations, including the addition of chicken scratch. Sufficient amounts of fresh water should be supplied to the flocks and cages should be cleaned on a regular basis.
- A separate flock of chickens should be kept in a mosquito-proof building, to replace chickens lost due to seroconversion or mortality.
- Clusters of morbidity or mortality among flocks should be reported to DACS, Division of Animal Industry, at 850-410-0900 or 1-800-342-5869.

**Bleeding Schedules/Record Keeping**

- Accurate records should be maintained for future reference with detailed information on the location of the site (exact address and GPS coordinates), surrounding vegetation, and weather conditions during the surveillance season.
- *All chickens in the flock should be bled every week.*
- Blood samples are screened initially using the Hemagglutination Inhibition (HI) test. This test is broadly reactive and will indicate the presence of flavivirus or alphavirus antibodies. The samples with a positive HAI to either alpha or flavivirus are then tested using the IgM ELISA. This test will indicate which virus the sample has antibodies for. Sometimes, the HAI test will be positive and the IgM ELISA test will be negative. When this happens, the samples are tested using serum neutralization.
- Antibody positive chickens may revert to false HI negative status on later serum samples; thus, chickens that are reported as confirmed positive should be removed from the flock and replaced with a baseline negative bird from the holding flock.
- The weekly seroconversion rate is the number of confirmed arbovirus antibody positive chickens divided by the number of birds tested. Seroconversion rates can be calculated for the state, county, or individual flocks.
- Serologically negative chickens may be bled throughout the season, but all chickens should be replaced annually with new birds early in the year (April-May).
- *Chickens that seroconvert or die should be replaced with a non-immune chicken having a NEW band number.* The new band number must not duplicate the band number of other chickens at that site. Notify the laboratory as to dead/missing chickens and their replacements.

**Instructions for Bleeding Chickens**

A blood "collection kit" should be assembled for use in the field. A plastic craft tray or small, light tool box should contain: needles, syringes, serum separator tubes, latex gloves, two pencils or sharpie markers, a small tightly closed plastic container of alcohol-soaked cotton balls, a checklist of chicken wingband numbers by site, insect repellent and waterless hand disinfectant/cleaner for the worker. Hand sanitizers containing around 70% alcohol are most effective. In addition, bring a sharps safety disposal container, appropriate disposal bags for waste, and a small cooler of ice (ice is useful for hemostasis if gentle pressure fails to assist with clotting).

Bleeding should be undertaken only by appropriately trained professionals. A person working alone may bleed chickens (a chicken restrainer to facilitate this is described in *Mosquito News 3(2):357-359, 1986)*. Two field personnel can make the process easier. Once securely restrained, the bird should be placed on its side and the opposite wing extended for easiest access to the vein that is to be bled:

1. Stretch out a wing to expose its underside. Alternate wings each time the chicken is bled in order to allow healing. (Some may choose to take samples from jugular veins).
2. Pluck feathers where the wing joins the body to expose the vein. Wet the area with alcohol to make the vein more readily visible and to clean the venipuncture site.
3. Carefully insert into the vein, bevel side up, a 23 or 25-gauge 0.5-inch needle (depending on the size of the vein) fitted to a 3cc syringe. Use a new needle and syringe for each chicken.
4. Withdraw 1.5 to 2.0cc of whole blood by drawing on the plunger *slowly* in order to keep the vein from collapsing.
5. Remove needle and apply gentle pressure with alcohol-soaked cotton ball at the site of venipuncture for hemostasis.

*Note: Latex gloves and a face shield or protective eyewear should be worn during the entire bleeding procedure. Hands should be cleaned with an alcohol based disinfectant after removing gloves and the gloves disposed of. Hand sanitizers containing around 70% alcohol are most effective. Should a novel strain of avian influenza be detected in the United States, additional occupational safety measures will be necessary. Draft guidelines are available in Appendix E.*

6. Dispense the blood slowly into a 4-inch commercial serum separator tube. (Tubes can be purchased from Fisher Scientific, 1-800-766-7000). To reduce hemolysis, uncork the tube, carefully recap and remove the needle from the syringe and slowly express the blood into the tube. The use of these tubes precludes the need to transfer serum and label to a second sterile tube, thus reducing the chance of mislabeling a specimen, and saving technician time. The use of such tubes reduces the rate of bacterial contamination and produces more useable serum.

*Note: Needles should be recapped using a one-handed technique (using the syringe to scoop the cap onto the needle), or by using forceps or a clamp. Uncapped needles can be removed from the syringe by a mechanical unwinding device that deposits the needle directly into the sharps container. If the phlebotomist is stuck by a needle during the bleeding procedure, the chicken blood needs to be tested for virus*. Contact the DOH Bureau of Laboratories in Tampa at 813-974-8000 for directions.*

*In addition, all needles must be deposited into a sharps container at the point of origin, which is defined as the area where the waste is generated. The sharps containers must be transported by a Department of Health-registered transporter to a permitted storage or treatment facility that has an active permit from the Department. Treatment must be achieved by incineration, steam sterilization, or an alternative treatment process approved by the Department.*

**If an arbovirus is detected in the chicken blood, the phlebotomist should contact his/her local county health department to facilitate testing.*

7. Label each vial using a waterproof marking pen or pencil with the following information:

a. Correct bird number from the permanent wing tag or leg band -- *important!*
b. Flock site location
c. Collection date

8. Lay tubes on their side (this increases serum yield). Keeping tubes on wetpacks helps reduce hemolysis (rupturing of red blood cells).
9. If possible, centrifuge for 15 minutes at 1200rpm, trapping the clot in the bottom of the tube.
10. The tube may be shipped directly to the Bureau of Laboratories, Tampa, without decanting the serum. See Appendix B for a copy of the laboratory form.

*Include a completed "Chicken Arbovirus Surveillance Serology" sheet with serum shipped to the Bureau of Laboratories.* Samples received before noon on Wednesday will have HI test results reported on the following Friday.

**Serum Testing/Data Dissemination**

Sentinel chicken sera are tested at DOH Bureau of Laboratories, Tampa (contact the laboratory at 813-974-8000). The Tampa laboratory communicates the results weekly to the county coordinator submitting specimens as well as the county health department, the DOH Bureau of Environmental Public Health Medicine and the DACS Bureau of Entomology and Pest Control.

## Dead Bird Reporting and Testing

West Nile virus (WNV) infection causes morbidity and mortality in many bird species in the United States. In some species, especially crows and blue jays (corvids), there has been substantial mortality due to WNV infection. Detection of local bird mortality may indicate the presence of the virus in a geographic area. Thus, monitoring of dead bird mortality is considered an important tool for WNV surveillance. The FWC coordinates the monitoring efforts of dead bird mortality in the state. Dead bird sightings may be reported on their website: http://www.MyFWC.com/bird/. The data are used to detect focal areas with intense WNV activity.

Because of the understanding we have gained about the mortality rates of different bird species infected with WNV, under most circumstances dead bird testing is not warranted. Instead, ask the public to report bird mortality sightings on the http://www.MyFWC.com/bird/ website. CHD staff and other agency personnel should assist with the reporting process as needed.

The DOH Bureau of Laboratories, Tampa, accepts dead bird specimens. When there is a need to verify the cause of an increased corvid or overall bird mortality, a representative sample may be submitted to the Tampa laboratory for WNV testing. When dead bird carcasses are in the appropriate condition for WNV diagnostic testing, the carcass and a laboratory form may be submitted by DOH Environmental Health, DACS, FWC, mosquito control staff, veterinarians or wildlife rehabilitators to the DOH Tampa laboratory to be sampled and tested using PCR assay and/or virus isolation. The laboratory submission form can be found in Appendix D. Initial testing should take about one week. Clusters of mortality of single non-corvid species or families of birds such as doves, ducks or pelicans are usually not caused by WNV and should not be submitted for WNV testing. However, the findings need to be reported. The FWC tracks all clusters of wild bird mortality in the state and investigates select mortality clusters reported at the website above.

General precautionary measures should be observed when handling a dead bird.

**When collecting a dead bird to submit for testing:**

Avoid touching the bird with your bare hands. Wear disposable gloves, or place a plastic bag over your hand to pick up the bird. After the bird is placed in a plastic bag, seal it tightly. Remove the gloves or plastic bag from your hands by turning them inside out. Dispose of the gloves or plastic bag in a trash bag. Place the bag containing the bird in a second plastic bag, and tie securely. Place the double-bagged bird in a cooler with blue ice. Wash your hands thoroughly with soap and water. Ship the bird in either a hard-sided cooler, or a Styrofoam cooler placed in a cardboard box. It is important to specify that the package be shipped via ground transportation. The shipping company should let you know if the package is unable to be shipped by ground to a certain location. If this is the case, a pressure container will need to be used to ship the package via air. Additional packaging and shipping information can be found at: http://www.doh.state.fl.us/environment/medicine/arboviral/protocol_bird.htm

**When disposing of a dead bird:**

Avoid touching the bird with your bare hands. Wear disposable gloves, or place a plastic bag over your hand to pick up the bird. Bury the bird two feet deep, **or** place the bird in a plastic bag and tie securely. Remove the gloves or plastic bag from your hands by turning them inside out. Dispose of the gloves or plastic bag in the trash bag. Place the bag containing the bird in a second bag, and tie securely. Place the double-bagged bird in the garbage. Wash your hands thoroughly with soap and water. Wash any clothing that has come into contact with the bird with normal household detergent at normal temperatures.

### Laboratory Testing Protocol

At the DOH Bureau of Laboratories in Tampa, sera collected from sentinel chicken flocks and wild birds and animals are tested for antibody to EEEV, SLEV and WNV with three different serological assays according to the following algorithm: All specimens are screened using an HI assay to detect alphavirus (EEEV or HJV), and/or flavivirus (SLEV or WNV) antibodies. Sentinel chicken sera that are flavivirus positive are tested in an SLEV and WNV IgM ELISA assay. Sentinel sera that are alphavirus positive in the HI assay are tested for IgM antibody to EEEV. IgM antibody negative sera and IgM antibody equivocal sera may be assayed by serum neutralization (SN) for confirmation of etiology. HI flavivirus antibody positive wild bird or mammalian sera are assayed by SN to confirm the etiological agent. Forms for submission of samples are located in Appendix-B.

## Veterinary Surveillance

Cases of equine and other animal arboviral disease are also used to assess the impact of WNV and EEEV in the state. Veterinarians should send equine sera or brain tissue to the DACS laboratory for evaluation. Results should be available within a week. Positive animals are reported to DOH by DACS.

#### Equine Case Definition

A **confirmed case** of an arboviral infection is illness in an equine with clinical signs, plus one or more of the following, in an antemortem test:

1. Isolation of an arbovirus from tissue, blood, or CSF;
2. An associated four-fold or greater change in neutralizing or HI antibody titer to an arbovirus in appropriately timed, paired sera (nonvaccinated or known vaccine history); or
3. Detection of IgM antibody to an arbovirus by MAC-ELISA.

In a post-mortem sample, a confirmed arbovirus case is positive by:

1. Polymerase chain reaction (PCR) for arbovirus genomic sequences in tissue, blood, or CSF;
2. Positive immunohistochemistry for arbovirus antigen in tissue; or
3. Isolation of an arbovirus from those samples.

**Clinical signs** should include one or more of the following: depression, ataxia (including stumbling, staggering, wobbly gait, or incoordination), weakness, inability to stand, death, elevated rectal temperature, change in mentation, and cranial nerve abnormalities (primarily weakness of the tongue). Horses are also commonly hyperaesthetic for one to several days. In certain arbovirus, horses can present with rapid onset of head pressing, coma, aimless wandering, and blindness.

All samples must be submitted with an Arbovirus Case Information Form for appropriate classification of test results. This form is located in Appendix B

## Mosquito Monitoring

The accurate measurement of vector abundance and population structure is a critical component of arboviral surveillance. Factors such as vector movement, blood feeding, egg laying and the age of the population determine whether there is a high or low risk of viral transmission and the potential for human infection. The number of mosquitoes collected is not as important as the day-to-day changes in the number collected. Therefore, it is the quality of collections, not the quantity, which is important. Ideally, the method of surveillance and sampling sites should remain constant from year-to-year, allowing comparison between years.

Laboratory testing of pooled mosquitoes is available from the Bureau of Laboratories. However, it is important to note that such testing need only be conducted when specific aims of the surveillance program have been defined, and it has been determined that the testing is necessary to enhance the ultimate goal of risk reduction.

### Trapping Mosquitoes

Current methodologies for trapping mosquitoes are available from the Florida Coordinating Council on Mosquito Control or local mosquito control agencies. Printed or diskette copies of Florida Mosquito Control: The State of the Mission as defined by mosquito controllers, regulators, and environmental managers are available from the Florida Medical Entomology Laboratory, University of Florida/IFAS, 200 9$^{th}$ Street SE, Vero Beach, Florida 32962, (772) 778-7200, or downloaded from FMEL web page: http://fmel.ifas.ufl.edu/white_paper/FWP09.pdf

Collections of flying mosquitoes (mostly host-seeking females) can be made by utilizing many different light trap designs (CDC, New Jersey, and updraft to name a few). Light traps can be run with or without added carbon dioxide ($CO_2$) and other secondary attractants such as octenol. Ovipositing female mosquitoes can be collected in gravid traps. Host-baited traps,

including lard can traps and Trinidad traps can be used to collect host-seeking female mosquitoes. Sentinel chicken cages can be fitted with exit traps which collect female mosquitoes (empty and blood fed) as they exit the sentinel cage, usually early in the morning. Resting mosquitoes can be collected with backpack aspirators and large, medium or small hand-held aspirators.

Once collections are counted, the number of mosquitoes in each group for each species should be entered into a database for graphical presentation or plotted manually so that day-to-day changes in mosquito abundance can be readily seen. Age determinations allow for identification of periods in which the risk of viral transmission is highest.

**Collection Techniques**

1. Traps
    a. CDC (with or without $CO_2$)
    b. Gravid, ABC light traps (with $CO_2$), MM-X traps (a.k.a. pickle jar) (with $CO_2$)
    c. Lard can
    d. Mosquito Magnet traps
2. Traps may be set anyplace WNV transmission is suspected to be ongoing. Remember that arboviral transmission can be extremely focal in widely dispersed habitats. So other trap sites and collection techniques should also be considered including ground aspirator collections at mosquito daytime resting sites, avian roosts and areas of past virus activity.
3. Maintain accurate and detailed nightly records for each collecting bag and each resulting mosquito pool
4. Priority: ornithophilic (mainly feeds on birds) and opportunistic mosquitoes
    a. *Culex*
    b. *Culiseta*
    c. *Mansonia*
    d. *Coquillettidia*
    e. *Aedes*
5. Mosquitoes should be live or recently (<2 hr) dead, non-fed or gravid females only. Do not pool blood-feed mosquitoes because, if positive, it is impossible to tell whether the virus originated in the mosquito or in the blood meal.

**Sample Processing**

1. Hold samples on wet ice in field or transport traps in coolers to laboratory
    a. Do not use dry ice to kill or anesthetize collections because the carbon dioxide acidifies the sample and may kill the virus, thus interfering with tests designed to isolate live virus. However, it is desirable to ship mosquitoes that are sealed within proper tubes to the Tampa Laboratory on dry ice (see instructions below).
    b. Make sure mosquitoes are kept alive by keeping them in a humid environment with access to cotton balls soaked with 5% sugar water
    c. Once mosquitoes are killed they must be kept in a freezer maintained at -70°C or colder
2. Use a chill table to sort the specimens. Triethylamine (TEA) can also be used to anesthetize the insects for the sorting process
3. Group female mosquitoes into pools of 50 individual mosquitoes by species, site, and week (or night) of collection. Be carefull not to contaminate the sample by including loose body parts (e.g. legs) belonging to other mosquito pools.
4. *Do not combine mosquitoes or mosquito species trapped on different nights, different sites, or in different types of traps at the same site.*

5. Make sure each mosquito pool is clearly and accurately labeled with a unique identifier number. This information plus any notes or comments for each pool should appear on a master data sheet, which is copied and maintained in two separate locations. Information on the pool should include:
    a. Mosquito species
    b. Number of specimens
    c. Mosquito data (sex and empty or gravid for females)
    d. Collection date
    e. Collection location
    f. Collection method (attractant trap type or non-attractant collection; if traps used, note attractant used as this indicates bias for particular age classes)
6. Accurate species identification is essential. If you are unsure of the species identification do not guess. Either have the specimen accurately identified or discard it. Unidentified pools will be not be tested by the Tampa Laboratory.
7. Label tubes (preferably 2.0 ml plastic, snap-cap microcentrifuge tubes (Fisher Cat # 02-681-258) with the unique identification number or with the following information: species name and number, site, collection date, numbers of mosquitoes. Seal the tube with plastic film (or plastic electrical tape) and store it at $-70^0$ C. A proper seal is essential to prevent intrusion by carbon dioxide gas when the specimens are shipped on dry ice! Maintain accurate records.
8. Complete the "Arbovirus Surveillance, virus isolation" form and send with the submitted pools to DOH Tampa Laboratory
    a. Drive to DOH Tampa Laboratory or overnight mail on dry ice.
    b. Contact the laboratory prior to sending samples
    c. Laboratory address:
    Virology
    Bureau of Laboratories
    3602 Spectrum Blvd
    Tampa, FL 33612
    Tel: 813-974-5990
9. To benefit arboviral surveillance programs, mosquitoes should be pooled and shipped to the Tampa Laboratory within 24 hours of collection. In addition, the shipments need to arrive at the laboratory on a weekday to make sure staff is available to process the specimens. Results will be reported back to the collector within two weeks.

**Viral Assay of Mosquitoes**

Samples are screened in a molecular assay (TaqMan RT-PCR) for WNV. Pools positive for WNV are reported by email to the submitter. When molecular screening is completed, a report is mailed to the submitter. Samples are then inoculated onto cell cultures for arbovirus isolation. When an isolate is detected, it is identified using multiple primer sets and probes. Gene sequencing may be performed. Virus isolates are reported by email to the submitter. When isolation attempts are complete, a report is mailed to the submitter.

Mosquito pools testing at the Tampa Laboratory will be given priorities and tested based upon the following guidelines:

- Priority 1- Validation and confirmation of commercial testing (VecTest™, RAMP®, PCR, etc.)
- Priority 2- Pilot testing, such as well designed transmission studies. Such studies must have prior approval through the arbovirus surveillance program
- Mosquito testing due to clustering of animal or human cases of disease (e.g. to determine local minimum infection rates (MIRs).

- Routine mosquito surveillance testing and testing for other purposes will be available at the submitter's expense, and only on a space available basis.

In Florida, no surveillance has been done to prospectively evaluate SLEV, EEEV or WNV infection rates in mosquitoes. It is clear that during epidemic periods, high SLEV or WNV infection rates can be demonstrated in *Cx. nigripalpus* mosquitoes.

If implemented, surveillance based on viral assay of mosquitoes would require several years of operation to evaluate its sensitivity and specificity for detecting periods of elevated risk of arbovirus transmission. Surveillance of mosquito infections should not supplant other sources of information pertinent to arbovirus activity (e.g., transmission to sentinel and/or wild vertebrates, real-time monitoring of local *Cx. nigripalpus* population dynamics, and rainfall data).

Each organization performing mosquito viral assays should provide test results to the Department of Health Arbovirus Surveillance Coordinator for inclusion in the statewide database. This should include assay method for positive pools, number of pools and number of individuals per pool, species, date and site collected and agent detected. For negative pools, number of pools of each species should be provided. For further information on using mosquito testing for arbovirus surveillance, see Donald Shroyer's 2001 Wing Beat article, http://www.floridamosquito.org/WING/2001/Summer%202001.pdf. For further guidance on commercial assays for WNV and EEEV in mosquitoes (i.e. VecTest™, RAMP® test) see the article Evaluation of Commercial Assays for Detecting West Nile Virus, by Burkhalter, KL, et.al, Journal of the American Mosquito Control Association; Vol. 22 :1 (2006); 64-69.

It is essential that laboratories conducting viral surveillance with mosquitoes (including, for example, RAMP or VecTests) provide appropriate safety procedures for working with BL-2, BL-3 pathogens. For appropriate standards of practice, refer to Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th edition, at http://www.cdc.gov/od/ohs/biosfty/bmbl5/bmbl5toc.htm. It is important to remember that homogenization can produce dangerous aerosols and appropriate protective measures should be observed. Note: the test kit homogenization reagent may not kill all pathogens present in the specimen.

Laboratories also conducting polymerase chain reactions (PCR), should be aware that the reagents, even if not contaminated by virus, may be hazardous materials requiring appropriate chemical hazard protocols and disposal.

In addition, EEEV is considered a "select agent" (potential to pose a severe threat to public health and safety) by the Department of Health and Human Services (HHS) and the United States Department of Agriculture (USDA). CDC is responsible for the regulation of these agents. Restrictions on having EEEV in the laboratory can be found at: http://www.cdc.gov/od/sap/.

*The DOH laboratory submission form for mosquito testing can be found in Appendix B.*

## Weather Analysis – Rainfall Monitoring

Daily rainfall and groundwater accumulations are important meteorological factors when attempting to predict changes in vector abundance, as well as viral amplification and transmission. Monitoring daily rainfall is important for three reasons. First, the length of the Florida dry season is an important factor in determining the potential survival of overwintering and

potentially infected mosquito vectors. During years with a long dry season (i.e., January through June), there is a lower potential for virus transmission during the following autumn. If the dry season is short, as in 1990, viral amplification and transmission can begin as early as May or June. Second, once the dry season ends, heavy spring rains allow a quick, early season buildup of vector mosquitoes. Finally, daily rainfall patterns are responsible for driving the overall behavior of *Culex* vectors by determining when and where eggs are laid, when host seeking and biting occurs, and when the virus is transmitted. This theory is applicable to SLEV and WNV. The same may not apply to north Florida since vectors, habitat, and environmental conditions are very different in this part of the state.

Rainfall data are available from the National Weather Service (NOAA). For more localized information, however, it is often necessary to use independent measurements. To monitor daily rainfall, fence post style rain gauges are read, emptied, and the amount of rainfall recorded at roughly the same time each day. Annual rainfall records include the timing, amount, and intensity of rain at the beginning of the wet season. This alerts personnel to a potential buildup of the vector population. Daily rainfall records throughout the wet season may show patterns of heavy rain (> 2 inches) followed by 10 to 14 day droughts. These conditions are ideal for completion of extrinsic incubation of the virus in infected vectors and for synchronizing vector egg laying, blood feeding and potential virus transmission. Finally, it is important to know when the dry season begins, as this may mark the end of virus transmission for that year.

Meteorological conditions predispose regions to epidemic arboviral conditions. Specifically, droughts during the Amplification (April-June) and Early Transmission (July-September) phases of the annual Florida arboviral cycle greatly enhances the probability of epidemic transmission. See: Day J, Predicting St. Louis encephalitis virus epidemics: Lessons from recent, and not so recent, outbreaks, *Annual Review of Entomology*, 2001. 46:111-138 for a review. Real-time measures of drought are criticallly important for assessing epidemic risk in Florida. We currently use the Keetch-Byram Drought Index (KBDI) to assess daily surface wetness conditions throughout the state. It has recently become evident that modeled water table data (WTD) provide a much more sensitive measure of ground water pooling and *Culex* reproductive behavior. One of the most reliable epidemic signatures is modeled WTD that can be tracked throughout the year in real-time and used to predict arboviral transmission. See: Shaman et al. Seasonal forecast of SLEV transmission, Florida, *Emerging Infectious Diseases*, 2004.10:802-809 for a review. Unfortunately, modeled WTD are not presently available to workers in the field. This may change in the near future, and once the WTD become available for general use, they will provide a powerful tool for monitoring and predicting arboviral epidemics.

# Chapter 8
# Florida Department of Health Response Plan for Mosquito-borne Diseases

Mosquito-borne disease cycles are complex and often involve multiple mosquito species and several vertebrate host species including humans. Virus transmission can be sporadic (spatially and temporally dispersed) or focal (spatially and temporally isolated). This response plan for mosquito-borne diseases is intended for use by county health department public information officers and mosquito control districts. The plan can also be used regionally for adjoining counties with similar habitats and ecologies, but it is not a response plan for the state as a whole.

The need for mosquito-borne disease advisories and alerts is determined by the CHD Director/Administrator after consultation with local mosquito control experts and the State Health Office. A number of important factors should be considered prior to the issuance of an advisory or alert. These include, but are not limited to: animal surveillance activity (sentinel chicken surveillance, wild bird surveillance, and domestic animals) in the same or surrounding counties, weather information, the time of year, vector surveillance (the abundance and age structure of known vectors), epidemiology of the virus in question, historic arbovirus distribution records, and the presence of human and equine cases in the same or contiguous counties.

The CHD Director/Administrator also facilitates the response to mosquito-borne diseases. This includes working closely with the Bureau of Environmental Public Health Medicine, local and state mosquito control personnel, physicians, veterinarians, emergency room personnel, and officials in neighboring counties.

The DACS Bureau of Entomology and Pest Control may provide technical support and leadership to effected counties, mosquito surveillance in areas lacking capability, coordination and delegation of mosquito control activity, aerial mosquito control through their Operational Support Section, and emergency mosquito control funds. The DACS Bureau of Entomology and Pest Control response plan is included below.

In addition to the Florida Department of Health Response Plan, a document has been developed by a team coordinated by Dr. Walter Tabachnick, Florida Medical Entomology Laboratory, to guide the mosquito control response for WNV at various levels of mosquito activity. These response guidelines have been approved by the Florida Coordinating Council on Mosquito Control and are included below as Appendix F.

The Department of Health response plan is also appropriate for the response to outbreaks of locally-acquired exotic or non-endemic arthropod-borne diseases such as Chikungunya virus. However, animal surveillance data will not always be available or utilized in the evaluation of these introductions and outbreaks.

The Department of Health response plan is intended for use by CHD's and differs from the Florida Mosquito Control Response Plan in Appendix F. The Department of Health (DOH) plan includes the following levels:

**Level 1: No activity**
This level describes the absence of cycling arboviruses in Florida.

- DOH Response:
  - Surveillance (human and animal sentinel surveillance, mosquito-borne disease surveillance)
  - Distribution of weekly arbovirus surveillance reports

- Mosquito Control Response:
  - Operations targeting nuisance and/or disease-carrying mosquitoes
  - Surveillance in sentinel chickens, mosquitoes, and birds
  - Coordinate communication with county health department regarding real time surveillance results.

**Level 2: Background activity**
Describes time periods when mosquito-borne virus activity does not exceed average historical levels.

- DOH Response: (in addition to the response outlined above)
  - Public announcements about personal protection

- Mosquito Control Response: (in addition to the response outlined above)
  - Monitor potential hot spots using surveillance tools
  - Public announcements about personal protection
  - Coordinate communication with county health department regarding real time surveillance results

- DACS Bureau of Entomology and Pest Control Response:
  - Monitor activity detected through existing surveillance programs
  - Routinely disseminate surveillance information to mosquito control programs

**Level 3: Mosquito-Borne Illness Advisory**
Mosquito-Borne Illness Advisories are declared when animal and mosquito surveillance data indicate a rise in virus transmission activity and an increased potential for human infections, or when a locally-acquired single human case of exotic or endemic arboviral disease has been confirmed. Mosquito-Borne Illness Advisories may be declared in a county or region where the surveillance data indicate:

1. One sporadic, locally-acquired confirmed human case or blood donor
   OR
   where the animal surveillance data over a two-week period indicate:

2. Two or more confirmed horse cases
   OR
3. 10% higher than baseline seroconversion rate in the sentinel chickens in a single county (11% current year vs. 1% baseline)
   OR
4. 10% higher than historical background levels in corvid mortality
   OR
5. 10% higher than historical background levels in the minimal infection rate (MIR) of vector mosquitoes

- DOH Response: (in addition to the response outlined above)
  - Dissemination of health care provider advisories

- Disseminate internally via EpiCom

- Mosquito Control Response: (in addition to the response outlined above)
  - Mosquito control targeting high risk vector mosquito populations and areas commensurate with arbovirus indicators for risk by performing repetitive nightly spraying operations in high risk areas until vector is suppressed to background levels
  - Consideration for increased surveillance using sentinels in high risk areas with attention to measuring mosquito transmission frequencies using chicken baited mosquito traps or exit traps on sentinel chicken coops
  - Coordinate communication with county health department regarding real time surveillance results
  - Preventive ULV and aerial post-epic rainfall brood reduction directed at vector species, and control of nuisance mosquitoes as a lower priority

- DACS Bureau of Entomology and Pest Control Response: (in addition to the response outlined above)
  - Support of surveillance of adult mosquitoes in Level 2 areas not covered by a county or district
  - Assist in public information dissemination

Mosquito-Borne Illness Advisories are lifted by the CHD when activity has returned to background levels. The Arbovirus Surveillance Coordinator at DOH should be notified of the status change. A press release stating the reason for lifting the advisory can also be issued if desired by the CHD. CHDs should also notify local partners when advisories are lifted.

**Level 4: Mosquito-Borne Illness Alert**

Mosquito-Borne Illness Alerts are declared when additional human cases of locally-acquired endemic or exotic arboviral disease have been confirmed, suggestive of a potential disease clustering, or when evidence of intense virus transmission activity has been detected in animal surveillance systems. Mosquito-Borne Illness Alerts may be declared in a county or region where the surveillance data indicate:

1. A cluster of two or more locally-acquired confirmed human cases and/or blood donors

   OR

   where the animal surveillance data over a two-week period indicate:

2. Elevated arbovirus antibody detection in sentinel chickens (above historical background levels):
   a. 50% higher than baseline seroconversion rate in sentinel chickens in a county
      OR
   b. 50% higher than baseline seroconversion rate in sentinel chickens in a single flock.

   OR
3. 50% increase in corvid mortality above historical background levels

- DOH Response: (in addition to the response outlined above)
  - Work with the local mosquito control districts and the Interagency Arbovirus Task Force as needed to assess the risk of human disease and sufficiency of implemented mosquito control activities

- Mosquito Control Response: (in addition to the response outlined above)
  - Focus mosquito control efforts to high risk mosquito populations and areas commensurate with arbovirus indicators for risk, adulticiding hot spots
  - Consideration for aerial adulticiding if not already in place with focus in high risk areas where wide area control measures are required to respond to the increased level of risk in a timely manner
  - Increased surveillance to obtain estimates of mosquito transmission frequency in targeted areas
  - Coordinate communication with county health department regarding real time surveillance results.
- DACS Bureau of Entomology and Pest Control Response: (in addition to the response outlined above)
  - Consideration of aerial or ground control activities through Operational Support Section
  - Deployment of contracted aerial or ground control activities if funding available and requested by local government (county or city)
  - Local government request should include:
    -citizen notification of dates and times
    -delineation of areas to be treated, and areas to be avoided including delineation of public lands and sensitive areas
    -surveillance support

Mosquito-Borne Illness Alerts are lifted after a significant decrease in animal surveillance activity and 6 weeks or more after the onset of the last human case (or sample date in the case of blood donors). The Arbovirus Surveillance Coordinator at DOH should be notified of the status change. A press release stating the reason for lifting the advisory can also be issued if desired by the CHD. CHDs should also notify local partners when advisories are lifted.

**Level 5: Mosquito-Borne Illness Threat**

When there is a potential for a widespread distribution of large numbers of human cases, the State Health Officer may declare a Mosquito-Borne Illness Threat. A mosquito-borne illness threat is a declaration by the State Health Officer that "a threat to the public health exists" as per Ch. 388.45, F.S. The same statute provides the Commissioner of Agriculture the authority to declare "a Threat to Animal Health". These official declarations also allow DACS to respond with actions allowing more liberal use of arthropod control measures on certain public lands and movement of mosquito control personnel and equipment into affected counties from other areas of the state as appropriate.

- DOH Response: (in addition to the response outlined above)
  - Consider distributing daily arbovirus surveillance updates to responsible governmental agencies and other partners
  - Work with local mosquito control district to assess their resource needs for mosquito control activities
  - Advise local authorities on the potential need for elevated disease prevention efforts, such as canceling outdoor events/activities, closing campgrounds, etc

- Mosquito Control Response: (in addition to the response outlined above)
  - Advise county health departments on the justification for elevated disease prevention efforts, such as canceling outdoor events/activities, closing campgrounds, etc
  - Conduct aggressive aerial / truck adulticiding, considering control on protected lands with approval from DACS, DEP, FWC, private owners etc., as needed, based on justified widespread danger to public health

  - Provide regional inter-county/district and DACS support as indicated for counties in emergency status
  - Request state (DACS) and federal emergency management agency (FEMA) support for mosquito control operations as needed
  - Coordinate communication with county health department regarding real time surveillance results

- DACS Bureau of Entomology and Pest Control Response: (in addition to the response outlined above)
  - Acquire and distribute emergency funds
  - Activate Emergency Operation Center functions
  - Implement Incident Command System protocols

Mosquito-Borne Illness Threats are down-graded after mosquito surveillance data (such as abundance, age structure, or infectivity) indicate a decrease in risk for human arbovirus transmission. If disease risk still exists but no longer meets the standard for a Threat declaration, a new Mosquito-borne Disease Advisory or Alert should be issued as appropriate.

Under a Level 5 threat, the CHD in the affected county will notify:
1. Community health care providers concerning the potential for transmission of SLEV, WNV or EEEV to people, and the need for physicians and veterinarians to report new cases
2. The County Mosquito Control Director
3. CHD Directors/Administrators and Mosquito Control Directors in contiguous counties of the mosquito-borne illness threat
4. Local media, education representatives, senior citizen groups and other citizen groups as appropriate

The Division of Environmental Health will notify DACS and DEP within 24 hours of the declaration of a mosquito-borne illness threat (Ch. 388.45, F.S.)

**Non-disease Mosquito Control Emergencies:**

State declared emergencies following hurricane or other flooding events may result in elevated mosquito populations that hinder emergency response without posing an immediate mosquito-borne disease threat. In such cases DACS will coordinate response within the state Emergency Management structure, and a FEMA developed protocol with requirements to qualify for federal re-imbursement for local mosquito control efforts will be distributed to impacted local Emergency Management Centers.

# Chapter 9
# Public Education

Education messages should be targeted to at-risk populations (e.g., emphasize high risk of SLEV and WNV illness for homeless and the elderly) in low-literacy forms and in languages appropriate to the local population. Media should be used, including radio, newspaper, and television public service announcements.

People can protect themselves from mosquito bites (and therefore arboviruses) by:

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

## COVER skin with clothing or repellent

- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
- REPELLENT - Apply mosquito repellent to bare skin and clothing.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective. Some repellents are not suitable for children. The label will indicate the age range for which the repellent is appropriate. Repellents should not be applied to the hands of children. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing. It is not recommended to use DEET on children less than 2 months old. Instead, infants should be kept indoors or mosquito netting used over carriers when mosquitoes are present. According to the CDC, mosquito repellents containing oil of lemon eucalyptus should not be used on children under the age of 3 years.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios. The ordinary window screen with 16x16 or 14x18 meshes to the inch will keep out most mosquitoes. Frequently, mosquitoes follow people into buildings or enter on the host. For this reason, screen doors should open outward and have automatic closing devices. Residual insecticide applications, on and around screen doors, give added protection.

The goals of public education are to inform the public about personal protection measures (described above), provide information and prevent panic. CHDs in coordination with the county mosquito control programs may:

- Issue advisories to minimize outside activities for citizens of affected counties (e.g., activities such as camping, evening and nighttime fishing, etc., are ill advised). Sample advisories and alerts are at the end of this chapter.
- Educate the public about the nature of the public health threat that exists and the level of risk involved (including age-specific risk).
- For EEEV, attempt to gain immediate control of infected adult mosquito populations by use of insecticides applied by ground or aerial applications, as appropriate. Implementation of intensified larviciding programs to reduce future adult populations and elimination of mosquito breeding areas, where applicable, may also be necessary.
- The public also needs to be educated about the difficulty to control *Cx. nigripalpus*, the main vector for SLEV and WNV. The species has a wide range of larval habitats and the adults are able to fly several miles.

Arbovirus message maps for county health department staff can be found at http://dohiws.doh.state.fl.us/ clicking "Crisis & Risk Communications" then "Outbreaks & Incidents" and finally clicking on "Arboviruses.

## St. Louis Encephalitis Public Information Efforts – Lessons Learned

During the summer of 1997, activity among sentinel chicken flocks indicated the potential for widespread human cases of SLE. Because personal prevention of mosquito bites is known to reduce the risk of arboviral infection, the Department of Health (DOH), county health departments and mosquito control agencies undertook many activities to more adequately inform the public about the prevention of this dangerous disease. Three main public health messages were widely disseminated. The public was warned to: (1) minimize outdoor activities from dusk to dawn; (2) but, when outdoors during these hours, cover up with clothing; and (3) use mosquito repellents, as directed, on exposed skin. To draw attention to the potential danger and reinforce suggested preventive measures, the DOH issued a medical alert for 27 central and southern Florida counties. Significant media attention was generated by this alert and was used by the department both to reiterate the preventive messages and to communicate current viral activity in humans and chickens. During the season, nine cases of human illness, including one death, were recorded.

In an attempt to assess the effectiveness of the DOH's media campaign, several questions were appended to the Behavioral Risk Factor Surveillance System surveys for November and December [the alert was in place from August through mid-December]. Results of the survey follow: A total of 468 persons completed the SLE section of the survey, of which 184 were male and 284 were female. The mean age of respondents was 51 years. There were 286 respondents who lived in a county that had been placed on SLE alert. There were no differences between alert and non-alert counties with respect to age, sex or race/ethnicity.

Respondents were asked if they currently took any precautions to prevent mosquito bites. Of those answering the survey, 67% in alert counties and 51% in non-alert counties reported currently taking precautions ($p=0.001$). In alert counties, 93% of respondents reported having heard (or read) SLE messages, compared to 75% in non-alert counties ($p=0.001$). Of those who received SLE messages, 72.5% used some kind of anti-mosquito precaution compared to 45.3% of those who did not receive SLE messages ($p=0.001$). Television and newspapers were the most common sources of information on SLE. There were 86% of respondents in alert counties and 74% in non-alert counties who reported receiving SLE information from television ($p=0.002$); and 55% of respondents in alert counties and 39% in non-alert counties who reported receiving information from the newspaper ($p=0.003$). Of respondents who reported receiving SLE

information, 41% reported taking additional precautions against mosquito bites after hearing the messages. In alert counties this number was 49%, and in non-alert counties, 27% took additional precautions (p=0.001). The most common preventive measures included the following: limiting outdoor activities (45.8% in alert counties versus 17.6% in non-alert counties, p=0.001); wearing insect repellent (44.8% in alert counties vs. 38.5% in non-alert counties, p=0.2); and wearing long pants and long sleeves (26.9% in alert counties vs. 10% in non-alert counties, p=0.001).

Widespread dissemination of these important preventive messages did not require large expenses for media airtime or print space by public agencies, but seemed to have been widely heard and practiced. Press releases, websites, toll-free hotlines and interviews with media representatives were commonly used to increase awareness of the message. These efforts probably prevented a large amount of morbidity as well as mortality during the 1997 SLE season and could be applied to other vector-borne diseases.

**SAMPLE PRESS RELEASE for MOSQUITO-BORNE DISEASE ALERTS**

**DRAFT** CONTACT: name
August XX, 2011 XXX-XXX-XXXX

**MOSQUITO-BORNE DISEASE ALERT ISSUED FOR XXXXXXX COUNTY**
*--Additional Human Case of (WNV, EEEV, SLEV, Dengue) Infection Confirmed--*

Today, County Health Department Director/Administrator (Dr.) **XXXXX XXXXXX** announced that the Florida Department of Health (DOH) has issued a mosquito-borne illness alert for **XXXXXX** County. Human cases of (West Nile (WNV) encephalitis/fever, EEE, Dengue, Malaria), have been confirmed and there is a heightened concern that additional residents will become ill. The most recent case involves a XX-year-old (fe)male resident.

Symptoms of West Nile virus may include headache, fever, fatigue, dizziness, weakness and confusion. Physicians should contact their county health department if they suspect an individual may meet the case definition for a mosquito-borne illness. DOH laboratories provide testing services for physicians treating patients with clinical signs of mosquito-borne disease.

DOH continues to advise the public to remain diligent in their personal mosquito protection efforts. These should include remembering **"Drain and Cover".**

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

## COVER skin with clothing or repellent

- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
- REPELLENT - Apply mosquito repellent to bare skin and clothing.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

**Tips on Repellent Use**

- Always read label directions carefully for the approved usage before you apply a repellent. Some repellents are not suitable for children.

- Products with concentrations of up to 30 percent DEET are generally recommended. Other EPA-approved repellents contain Picaridin, oil of lemon eucalyptus, or IR3535. These products are generally available at local pharmacies. Look for active ingredients to be listed on the product label.
- Apply insect repellent to exposed skin, or onto clothing, but not under clothing.
- In protecting children, read label instructions to be sure the repellent is age-appropriate. According to the CDC, mosquito repellents containing oil of lemon eucalyptus should not be used on children under the age of 3 years. DEET is not recommended on children younger than 2 months old.
- Avoid applying repellents to the hands of children. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing.
- If additional protection is necessary, apply a permethrin repellent directly to your clothing. Again, always follow the manufacturer's directions.

DOH continues to conduct statewide surveillance for mosquito borne illnesses, including West Nile virus infections, Eastern equine encephalitis, St. Louis encephalitis, malaria, and dengue.

Residents of Florida are encouraged to report dead birds via the website http://www.MyFWC.com/bird. For more information on mosquito-borne illnesses, visit DOH's Environmental Public Health website at http://www.doh.state.fl.us/Environment/medicine/arboviral/index.html or call your local county health department.

**SAMPLE PRESS RELEASE for MOSQUITO-BORNE DISEASE ADVISORIES**

**FOR IMMEDIATE RELEASE** CONTACT:
XXXXXX XX, 2011 Director

FLORIDA DEPARTMENT OF HEALTH
X COUNTY –MOSQUITO-BORNE ILLNESS ADVISORY

**X COUNTY--**This is to advise that there has been increased mosquito-borne disease activity in areas of **X** County. Several of our sentinel chicken flocks/horses/mosquito pools have tested positive for West Nile/EEE/SLE virus. **The risk of transmission to humans has been increased**.

**X** County Health Department reminds residents and visitors to avoid being bitten by mosquitoes that may cause encephalitis disease. **X** County Mosquito Control and the health department continue surveillance and prevention efforts and encourage everyone to take basic precautions to help limit exposure by following the department of health recommendations.

To protect yourself from mosquitoes, you should remember **"Drain and Cover":**

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

## COVER skin with clothing or repellent

- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
- REPELLENT - Apply mosquito repellent to bare skin and clothing.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

**Tips on Repellent Use**

- Always read label directions carefully for the approved usage before you apply a repellent. Some repellents are not suitable for children.
- Products with concentrations of up to 30 percent DEET are generally recommended. Other EPA-approved repellents contain Picaridin, oil of lemon eucalyptus, or IR3535.

These products are generally available at local pharmacies. Look for active ingredients to be listed on the product label.

- Apply insect repellent to exposed skin, or onto clothing, but not under clothing.
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- Avoid applying repellents to the hands of children. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing.
- If additional protection is necessary, apply a permethrin repellent directly to your clothing. Again, always follow the manufacturer's directions.

DOH continues to conduct statewide surveillance for mosquito borne illnesses, including West Nile virus infections, Eastern equine encephalitis, St. Louis encephalitis, malaria, and dengue. Residents of Florida are encouraged to report dead birds via the web site http://www.myfwc.com/bird/. For more information, visit DOH's Environmental Public Health web site at http://www.doh.state.fl.us/Environment/medicine/arboviral/index.html or call your local county health department.

**Sample Hurricane Fact Sheet for Mosquito-Borne Illness**

**FOR IMMEDIATE RELEASE** **CONTACT: COMMUNICATIONS OFFICE**
XXXX, XX, 2011 850-245-4111

****HURRICANE X FACT SHEET****

**DEPARTMENT OF HEALTH URGES PRECAUTIONARY MEASURES TO PREVENT WEST NILE VIRUS AND OTHER MOSQUITO-BORNE ILLNESSES**

**TALLAHASSEE –** Due to floodwaters from Hurricane X, Florida Department of Health (DOH) officials emphasize the importance of Florida's residents and visitors protecting themselves against mosquito-borne diseases.

DOH continues to advise the public to remain diligent in their protecting themselves from mosquito bites by remembering "**Drain and Cover"**:

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

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    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

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**Tips on Repellent Use**

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- Products with concentrations of up to 30 percent DEET are generally recommended. Other EPA-approved repellents contain Picaridin, oil of lemon eucalyptus, or IR3535. These products are generally available at local pharmacies. Look for active ingredients to be listed on the product label.

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- Avoid applying repellents to the hands of children. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing.
- If additional protection is necessary, apply a permethrin repellent directly to your clothing. Again, always follow the manufacturer's directions.

Symptoms of West Nile virus may include headache, fever, fatigue, dizziness, weakness and confusion. Physicians should contact their county health department if they suspect an individual may have a mosquito-borne illness. DOH laboratories provide testing services for physicians treating patients with clinical signs of mosquito-borne disease.

DOH continues to conduct statewide surveillance for mosquito borne illnesses, including West Nile virus infections, Eastern equine encephalitis, St. Louis encephalitis, malaria and dengue. For more information on mosquito-borne illnesses, visit DOH's Environmental Public Health Web site at http://www.doh.state.fl.us/Environment/medicine/arboviral/index.html or call your local county health department.

Residents of Florida are encouraged to report dead birds via the website http://www.MyFWC.com/bird.
Florida Emergency Information Line: 1-800-342-3557

Public Information Emergency Support Function: 850-921-0384

**SAMPLE PRESS RELEASE for LIFTING MOSQUITO-BORNE DISEASE ADVISORIES**

**FOR IMMEDIATE RELEASE** **CONTACT**:
XXXXXX XX, 2011 Director

**FLORIDA DEPARTMENT OF HEALTH**
**X COUNTY –MOSQUITO-BORNE ILLNESS ADVISORY**

**X COUNTY—**The **X** County Health Department is lifting the public health advisory for mosquito-borne disease. The advisory has been in place since **April** when a number of **horses/sentinel chickens/a human** was reported to have been infected with **Eastern Equine Encephalitis/ West Nile Virus.**

The cooler weather means there is very little mosquito activity in the area. This is any appropriate time to lift the health advisory. However, in Florida there is a risk of mosquito-borne disease transmission year round.

To protect yourself from mosquito-borne diseases, remember "**Drain and Cover"**:

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

## COVER skin with clothing or repellent

- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
- REPELLENT - Apply mosquito repellent to bare skin and clothing.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

The Department of Health (DOH) continues to conduct statewide surveillance for mosquito-borne illnesses, including West Nile virus infections, Eastern equine encephalitis, St. Louis encephalitis, malaria, and dengue.

For more information on mosquito-borne disease, visit DOH's Environmental Public Health website at http://www.doh.state.fl.us/environment/medicine/arboviral/index.html, or call the **X** County Health Department.

# Repellents
## Questions and Answers

Source: Centers for Disease Control and Prevention (CDC)
http://www.cdc.gov/

General Questions

**Q. Why should I use insect repellent?**
A. Insect repellents can help reduce exposure to mosquito bites that may carry viruses such as West Nile virus that can cause serious illness and even death. Using insect repellent allows you to continue to play and work outdoors with a reduced risk of mosquito bites.

**Q. When should I use mosquito repellent?**
A. Apply repellent when you are going to be outdoors. Even if you don't notice mosquitoes there is a good chance that they are around. Many of the mosquitoes that carry West Nile virus bite between dusk and dawn. If you are outdoors around these times of the day, it is especially important to apply repellent. In many parts of the country, there are mosquitoes that also bite during the day, and some of these mosquitoes have also been found to carry West Nile virus.

**Q. How often should repellent be reapplied?**
A. In general you should re-apply repellent if you are being bitten by mosquitoes. Always follow the directions on the product you are using. Sweating, perspiration or getting wet may mean that you need to re-apply repellent more frequently.

Repellents containing a higher concentration (higher percentage) of active ingredient typically provide longer-lasting protection.

**Q. How does mosquito repellent work?**
A. Female mosquitoes bite people and animals because they need the protein found in blood to help develop their eggs. Mosquitoes are attracted to people by skin odors and carbon dioxide from breath. The active ingredients in repellents make the person unattractive for feeding. Repellents do not kill mosquitoes. Repellents are effective only at short distances from the treated surface, so you may still see mosquitoes flying nearby.

***Active Ingredients (Types of Insect Repellent)***

**Q. Which mosquito repellents work best?**
A. CDC recommends using products that have been shown to work in scientific trials and that contain active ingredients which have been registered with the US Environmental Protection Agency (EPA) for use as insect repellents on skin or clothing. When EPA registers a repellent, they evaluate the product for efficacy and potential effects on human beings and the environment. EPA registration means that EPA does not expect a product, when used according to the instructions on the label, to cause unreasonable adverse effects to human health or the environment.

Of the active ingredients registered with the EPA, CDC believes that two have demonstrated a higher degree of efficacy in the peer-reviewed, scientific literature (See Publications page). Products containing these active ingredients typically provide longer-lasting protection than others:

• DEET (N,N-diethyl-m-toluamide)
• Picaridin (KBR 3023)

Oil of lemon eucalyptus [active ingredient: p-menthane 3,8-diol (PMD)], a plant- based repellent, is also registered with EPA. In two recent scientific publications, when oil of lemon eucalyptus was tested against mosquitoes found in the US it provided protection similar to repellents with low concentrations of DEET.

**Q. How does the percentage of active ingredient in a product relate to the amount of protection it gives?**
A. Typically, the more active ingredient a product contains the longer it provides protection from mosquito bites. The concentration of different active ingredients cannot be directly compared (that is, 10% concentration of one product doesn't mean it works exactly the same as 10% concentration of another product.)

DEET is an effective active ingredient found in many repellent products and in a variety of formulations. Based on a 2002 study (Fradin and Day, 2002. See Publications page).

• A product containing 23.8% DEET provided an average of 5 hours of protection from mosquito bites.
• A product containing 20% DEET provided almost 4 hours of protection
• A product with 6.65% DEET provided almost 2 hours of protection
• Products with 4.75% DEET were both able to provide roughly 1 and a half hour of protection.

These examples represent results from only one study and are only included to provide a general idea of how such products may work. Actual protection will vary widely based on conditions such as temperature, perspiration, and water exposure.

Choose a repellent that provides protection for the amount of time that you will be outdoors. A product with a higher percentage of active ingredient is a good choice if you will be outdoors for several hours while a product with a lower concentration can be used if time outdoors will be limited. Simply re-apply repellent (following label instructions) if you are outdoors for a longer time than expected and start to be bitten by mosquitoes.

**Q. Why does CDC recommend certain types of insect repellent?**
A. CDC recommends products containing active ingredients which have been registered with US Environmental Protection Agency (EPA) for use as insect repellents on skin or clothing.

All of the EPA-registered active ingredients have demonstrated repellency however some provide more longerlasting protection than others. Additional research reviewed by CDC suggests that repellents containing DEET (N,N-diethyl-m-toluamide) or picaridin (KBR 3023) typically provide longer-lasting protection than the other products and oil of lemon eucalyptus (p-menthane-3,8-diol) provides longer lasting protection than other plant-based repellents. Permethrin is another long-lasting repellent that is intended for application to clothing and gear, but not directly to skin. In general, the more active ingredient (higher concentration) a repellent contains, the longer time it protects against mosquito bites.

People who are concerned about using repellents may wish to consult their health care provider for advice. The National Pesticide Information Center (NPIC) can also provide information through a toll-free number, 1-800-858-7378 or npic.orst.edu

**Q. How can you know which active ingredient a product contains?**
A. Check the product label if you have questions—repellents must specify their active ingredients. In some cases you will note the chemical name in addition to/instead of the “common” name:

• DEET is N,N-diethyl-m-toluamide
• Picaridin is KBR 3023, sometimes known as “Bayrepel” outside the US
• The active ingredient in oil of lemon eucalyptus is p-menthane 3,8-diol (PMD)

**Q. What is permethrin?**
A. Certain products which contain permethrin are recommended for use on clothing, shoes, bed nets, and camping gear, and are registered with EPA for this use. Permethrin is highly effective as an insecticide and as a repellent. Permethrin-treated clothing repels and kills ticks, mosquitoes, and other arthropods and retains this effect after repeated laundering. The permethrin insecticide should be reapplied following the label instructions. Some commercial products are available pretreated with permethrin.

**Q. Where can I find these repellents?**
A. Most of these repellents are sold at multiple retail, discount and drug stores. A wider selection may be available at “outdoor” stores or in hunting and camping sections. At this time picaridin is not yet registered with the state pesticide programs in NY and CA, and thus is not available in those areas.

**Q. Where can I find more information about picaridin?**
A. A technical fact sheet covering picaridin is available from EPA (http://www.epa.gov/opprd001/factsheets/picaridin.pdf)

**Q. What are some general considerations to remember when using insect repellents?**
A. Always follow the recommendations appearing on the product label.

• Use enough repellent to cover exposed skin or clothing. Don't apply repellent to skin that is under clothing. Heavy application is not necessary to achieve protection.
• Do not apply repellent to cuts, wounds, or irritated skin.
• After returning indoors, wash treated skin with soap and water. (This may vary depending on the product. Check the label.)
• Do not spray aerosol or pump products in enclosed areas.
• Do not spray aerosol or pump products directly to your face. Spray your hands and then rub them carefully over the face, avoiding eyes and mouth.

**Q. What are some reactions to be aware of when using insect repellents?**
A. Use of repellents products may cause skin reactions in rare cases. Most products also note that eye irritation can occur if product gets in the eye. If you suspect a reaction to a product, discontinue use, wash the treated skin, and call a poison control center. If product gets in the eyes flush with water and consult health care provider or poison control center. If you go to a doctor, take the product with you.

There is a national number to reach a Poison Control Center near you: 1-800-222-1222.

***Children***

**Q. Can insect repellents be used on children?**
A. Repellent products must state any age restriction. If there is none, EPA has not required a restriction on the use of the product.

According to the label, oil of lemon eucalyptus products should NOT be used on CHILDREN UNDER 3 YEARS.

In addition to EPA's decisions about use of products on children, many consumers also look to the opinion of the American Academy of Pediatrics (AAP). The AAP does have an opinion on the use of DEET in children (see below). AAP has not yet issued specific recommendations or opinion concerning the use of picaridin or oil of lemon eucalyptus for children. CDC will post a link to such information from the Academy when/if it becomes available.

Since it is the most widely available repellent, many people ask about the use of products containing DEET on children. No definitive studies exist in the scientific literature about what concentration of DEET is safe for children. No serious illness has been linked to the use of DEET in children when used according to manufacturer's recommendations.

The AAP Committee on Environmental Health has updated their recommendation for use of DEET products on children in 2003, citing: "Insect repellents containing DEET (N,N-diethyl-m-toluamide, also known as N,N-diethyl-3-methylbenzamide) with a concentration of 10% appear to be as safe as products with a concentration of 30% when used according to the directions on the product labels." AAP recommends that repellents with DEET should not be used on infants less than 2 months old.

Parents should choose the type and concentration of repellent to be used by taking into account the amount of time that a child will be outdoors, exposure to mosquitoes, and the risk of mosquito-transmitted disease in the area.

If you are concerned about using repellent products on children you may wish to consult a health care provider for advice or contact the National Pesticide Information Center (NPIC) through their toll-free number, 1-800-858-7378 or npic.orst.edu

**Q. What guidelines are available for using a repellent on children?**
A. Always follow the recommendations appearing on the product label when using repellent:

• When using repellent on a child, apply it to your own hands and then rub them on your child. Avoid children's eyes and mouth and use it sparingly around their ears.
• Do not apply repellent to children's hands. (Children may tend to put their hands in their mouths.)
• Do not allow young children to apply insect repellent to themselves; have an adult do it for them.
• Keep repellents out of reach of children.
• Do not apply repellent under clothing. If repellent is applied to clothing, wash treated clothing before wearing again. (May vary by product, check label for specific instructions.)

**Q. How else can I protect children from mosquito bites?**
A. Using repellents on the skin is not the only way to avoid mosquito bites. Children (and adults) can wear clothing with long pants and long sleeves while outdoors. DEET or other repellents such

as permethrin can also be applied to clothing (but is not registered for use on skin), as mosquitoes may bite through thin fabric.

Mosquito netting can be used over infant carriers.

Finally, it may be possible to reduce the number of mosquitoes in the area by getting rid of containers with standing water that provide breeding places for mosquitoes.

**Q. Can insect repellents be used by pregnant or nursing women?**
A. Other than the routine precautions noted earlier, EPA does not recommend any additional precautions for using registered repellents on pregnant or lactating women. Consult your health care provider if you have questions.

***Insect Repellents containing DEET and Sunscreen***

**Q. Can I use an insect repellent and a product containing sunscreen at the same time? What are the recommendations for combination sunscreen/insect repellent products?**
A. Yes. People can, and should, use both a sunscreen and an insect repellent when they are outdoors. Follow the instructions on the package for proper application of each product. In general, the recommendation is to apply sunscreen first, followed by repellent.

It is recommended NOT to use a single product that combines insect repellent containing DEET and sunscreen, because the instructions for use of insect repellents and use of sunscreen are different. In most situations, insect repellent does not need to be reapplied as frequently as sunscreen. While no recommendations are available at this time regarding products that combine other active ingredients and sunscreen, it is important to always follow the label on whatever product you are using.

To protect from sun exposure and insect bites, you can also wear long sleeves and long pants. You can also apply insect repellent to your clothing, rather than directly to your skin.

**Q. Where can I get more information about repellents?**
A. For more information about using repellents, please consult the Environmental Protection Agency (EPA) Web site or consult the National Pesticide Information Center (NPIC), which is cooperatively sponsored by Oregon State University and the U.S. EPA. NPIC can be reached at: npic.orst.edu or 1-800-858-7378.

# St. Louis Encephalitis Virus (SLEV)
# Questions and Answers

**What is St. Louis encephalitis?**

St. Louis encephalitis is a rare disease that is caused by a virus spread by infected mosquitoes. St. Louis encephalitis virus (SLEV) is one of a group of mosquito-transmitted viruses that can cause inflammation of the brain (encephalitis). In an average year, Florida has from one to 10 cases of SLEV infection. Several large outbreaks involving as many as 200 cases have occurred in Florida in recent decades.

**How do people get infected with SLEV?**

SLEV is transmitted by the bite of an infected mosquito. SLEV is not transmitted directly from person to person.

**Where and when have most cases of SLEV disease occurred?**

Cases have been reported throughout the country, but periodic outbreaks and epidemics have primarily occurred in the Mississippi Valley and along the Gulf Coast. In temperate areas of the United States, SLEV disease cases occur primarily in the late summer or early fall. In southern states, cases can occur year round.

**Who is at risk for infection with SLEV?**

Anyone bitten by a mosquito in an area where the virus is circulating can get infected with SLEV. The risk is highest for persons who engage in outdoor work and recreational activities and those living in low-income areas. Elderly persons are at increased risk of severe disease if they are infected.

**How soon do people get sick after getting bitten by an infected mosquito?**

It takes 5 to 15 days after the bite of an infected mosquito to develop symptoms of SLEV disease.

**What are the symptoms of SLEV disease?**

Most people who are infected with SLEV have no symptoms or only mild non-specific flu-like illness. However, in some individuals, especially the elderly, SLEV can cause serious illness that affects the central nervous system. Symptoms often include fever, headache, stiff neck, disorientation, and altered level of consciousness. Coma, convulsions, and paralysis may also occur.

**How is SLEV disease diagnosed?**

Diagnosis is based on tests of blood or spinal fluid. These tests typically look for antibodies that the body makes against the viral infection.

**Is there a vaccine for SLEV?**

No. There is no vaccine because the virus occurs in humans so infrequently.

**What is the treatment for SLEV disease?**

There is no specific treatment for SLEV disease. Antibiotics are not effective against viruses. Severe illnesses are treated by supportive therapy which may include hospitalization, respiratory support, IV fluids, and prevention of other infections.

**How can people reduce the chance of getting infected with SLEV?**

Prevention is the key. The best way to avoid infection is to avoid getting mosquito bites. Remember "**Drain and Cover**":

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.

- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

## COVER skin with clothing or repellent

- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
- REPELLENT - Apply mosquito repellent to bare skin and clothing.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

**What should I do if I think a family member might have SLE?**

If you or anyone in your household has symptoms that are causing you concern, consult a healthcare provider for proper diagnosis.

**When was the last outbreak of SLEV in Florida?**

In the fall of 1997, 9 people contracted SLEV infections. Florida's largest epidemic of SLEV occurred in 1990, with 223 cases and 10 fatalities in central and southern areas of the state.

**How do we know that SLEV is in an area and that people might become infected?**

Mosquito Control Districts located throughout the state continually monitor the distribution and density of mosquito populations known to carry the SLEV. In many areas, these agencies and county health departments also keep chicken flocks and monitor these chickens for evidence of exposure to SLEV.

**How is this information communicated to the public?**

State and county agencies monitor this information regularly and issue warnings to the public when mosquito populations are large and virus activity is detected.

**What parts of the State of Florida are most at risk?**

Historically, SLEV has been detected throughout the state although outbreaks have tended to occur more in Central Florida from coast to coast.

**What measures are government agencies taking to protect the population?**

Mosquito control activities targeted against adult and larval populations have increased as a direct response to the reports of increased SLEV activity. In addition, a number of press releases and public education activities have been undertaken to increase awareness of personal protective measures.

# West Nile Virus (WNV)
# Questions and Answers

**What is West Nile virus?**

West Nile virus (WNV) is a mosquito-borne virus that causes inflammation (swelling) of the brain. More than 200 cases have been reported since West Nile virus was first detected in the state in 2001.

**What are the symptoms of WNV?**

Many infections with WNV are unapparent but when symptoms occur they can range from fever with headache to coma. Other symptoms include: fatigue, dizziness, weakness and confusion.

**Who is at risk of contracting WNV?**

WNV is maintained in a bird-mosquito cycle. People may get the virus by being bitten by infected mosquitoes. While the virus can affect anyone, it has its greatest impact on people over the age of 50.

**Is there a vaccine for WNV?**

No. There is no vaccine because the virus occurs in humans so infrequently.

**How can a person prevent infection?**

Prevention is the key. The best way to avoid infection is to avoid getting mosquito bites. Remember "**Drain and Cover**":

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

## COVER skin with clothing or repellent

- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
- REPELLENT - Apply mosquito repellent to bare skin and clothing.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

**How do we know that WNV is in an area and that people might become infected?**

Mosquito Control Districts located throughout the state continually monitor the distribution and density of mosquito populations known to carry WNV. In many areas, these agencies and county health departments also keep chicken flocks and monitor these chickens for evidence of exposure to WNV.

**How is this information communicated to the public?**

State and county agencies monitor this information regularly and issue warnings to the public when mosquito populations are large and virus activity is detected.

**What parts of the State of Florida are most at risk?**

WNV occurs throughout the state.

**What measures are government agencies taking to protect the population?**

Mosquito control activities targeted against adult and larval populations have increased as a direct response to the reports of increased WNV activity. In addition, a number of press releases and public education activities have been undertaken to increase awareness of personal protective measures.

# Eastern Equine Encephalitis Virus (EEEV)
## Questions and Answers

**What is Eastern equine encephalitis (EEE)?**

EEE is a rare disease that is caused by a virus spread by infected mosquitoes. EEE virus (EEEV) is one of a group of mosquito-transmitted viruses that can cause inflammation of the brain (encephalitis). In the United States, approximately 5-10 EEE cases are reported annually.

**How do people get infected with EEEV?**

EEEV is transmitted through the bite of an infected mosquito. Disease transmission does not occur directly from person to person.

**Who is at risk for infection with EEEV?**

Anyone in an area where the virus is circulating can get infected with EEEV. The risk is highest for people who live in or visit woodland habitats, and people who work outside or participate in outdoor recreational activities, because of greater exposure to potentially infected mosquitoes.

**How soon do people get sick after getting bitten by an infected mosquito?**

It takes 4 to 10 days after the bite of an infected mosquito to develop symptoms of EEE.

**What are the symptoms of EEEV disease?**

Severe cases of EEEV infection (EEE, involving encephalitis, an inflammation of the brain) begin with the sudden onset of headache, high fever, chills, and vomiting. The illness may then progress into disorientation, seizures, and coma. Approximately a third of patients who develop EEE die, and many of those who survive have mild to severe brain damage.

**How is EEE diagnosed?**

Diagnosis is based on tests of blood or spinal fluid. These tests typically look for antibodies that the body makes against the viral infection.

**What is the treatment for EEE?**

There is no specific treatment for EEE. Antibiotics are not effective against viruses, and no effective anti-viral drugs have been discovered. Severe illnesses are treated by supportive therapy which may include hospitalization, respiratory support, IV fluids, and prevention of other infections.

**Is there a vaccine for EEEV?**

No. There is no vaccine because the virus occurs in humans so infrequently.

**How can people reduce the chance of getting infected with EEEV?**

Prevention is the key. The best way to avoid infection is to avoid getting mosquito bites. Remember "**Drain and Cover**":

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- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.

- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
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- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
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    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

# Dengue
## Questions and Answers

**What is dengue?**

Dengue is a disease caused by any one of four closely related dengue viruses (DENV 1, DENV 2, DENV 3, or DENV 4). The viruses are transmitted to humans by the bite of an infected mosquito.

**What is dengue hemorrhagic fever (DHF)?**

DHF is a more severe form of dengue infection. It can be fatal if unrecognized and not properly treated in a timely manner. DHF is caused by infection with the same viruses that cause dengue fever. With good medical management, mortality due to DHF can be less than 1%.

**How are dengue and dengue hemorrhagic fever spread?**

Dengue is transmitted to people by the bite of an *Aedes* mosquito that is infected with a dengue virus. Dengue cannot be spread directly from person to person.

**What are the symptoms of the disease?**

The principal symptoms of dengue fever are high fever, severe headache, severe pain behind the eyes, joint pain, muscle and bone pain, rash, and mild bleeding (e.g., nose or gums bleed, easy bruising). Dengue hemorrhagic fever is characterized by a fever that lasts from 2 to 7 days, with general signs and symptoms consistent with dengue fever. When the fever declines, symptoms including persistent vomiting, severe abdominal pain, and difficulty in breathing may develop. This marks the beginning of a 24- to 48-hour period when the smallest blood vessels (capillaries) become excessively permeable ("leaky"), allowing the fluid component to escape from the blood vessels into the peritoneum (causing ascites) and pleural cavity (leading to pleural effusions). This may lead to failure of the circulatory system and shock, followed by death, if circulatory failure is not corrected. In addition, the patient with DHF has a low platelet count and hemorrhagic manifestations, tendency to bruise easily or other types of skin hemorrhages, bleeding nose or gums, and possibly internal bleeding.

**What is the treatment for dengue?**

There is no specific medication for treatment of a dengue infection. Persons who think they have dengue should use analgesics (pain relievers) with acetaminophen and avoid those containing aspirin. They should also rest, drink plenty of fluids, and consult a physician. If they feel worse (e.g., develop vomiting and severe abdominal pain) in the first 24 hours after the fever declines, they should go immediately to the hospital for evaluation.

**Is there an effective treatment for dengue hemorrhagic fever?**

As with dengue fever, there is no specific medication for DHF. It can however be effectively treated by fluid replacement therapy if an early clinical diagnosis is made. DHF management frequently requires hospitalization. Physicians who suspect that a patient has DHF may want to consult the Dengue Branch at CDC, for more information.

**Where can outbreaks of dengue occur?**

Outbreaks of dengue occur primarily in areas where *Ae. aegypti* (sometimes also *Ae. albopictus*) mosquitoes live. This includes most tropical urban areas of the world. Dengue viruses may be introduced into areas by travelers who become infected while visiting other areas of the tropics where dengue commonly exists. People who travel to a foreign country where dengue is common have the highest risk for dengue.

**What can be done to reduce the risk of acquiring dengue?**

Prevention is the key. There is no vaccine for preventing dengue. The best way to avoid infection is to avoid getting mosquito bites. Remember "**Drain and Cover**":

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
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## COVER skin with clothing or repellent

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    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

**How can we prevent epidemics of dengue fever and Dengue hemorrhagic fever?**

The emphasis for dengue prevention is on sustainable, community-based, integrated mosquito control, with limited reliance on insecticides (chemical larvicides, and adulticides). Preventing epidemic disease requires a coordinated community effort to increase awareness about dengue fever/DHF, how to recognize it, and how to control the mosquito that transmits it.

# Malaria
## Questions and Answers

**What is malaria?**
Malaria is a serious disease caused by a parasite and carried by mosquitoes.

**How do you get malaria?**
You get malaria from the bite of an infected mosquito.
People who travel to a foreign country where malaria is common have the highest risk for malaria. However, it is possible to get malaria in Florida. The best way to protect yourself from malaria is to not get bitten by mosquitoes. People traveling to a malaria endemic area should take the appropriate antimalarial drug for the travel destination.

**How will I know which antimalarial drug is the correct one for me?**
Many effective antimalarial drugs are available. Your health-care provider will decide the best drug for you based on the country you plan to visit and your health status. To allow enough time for the drug to become effective and for a pharmacy to prepare any special doses of medicine, especially doses for children and infants, visit your health-care provider 4-6 weeks before travel.

**What are the signs and symptoms of malaria?**
Symptoms of malaria include fever and flu-like illness, including chills, headache, muscle aches, and tiredness. Loss of appetite, nausea, vomiting, and diarrhea may also occur. Malaria may cause anemia and jaundice (yellow coloring of the skin and eyes) because the malaria parasites destroy red blood cells.

**How soon will a person feel sick after being bitten by an infected mosquito?**
For most people, symptoms begin 10 days to 4 weeks after the bite of an infected mosquito.

**What is the treatment for malaria?**
Malaria ***CAN*** be treated and cured by the right prescription medications. A doctor ***MUST*** guide treatment.

**How can you lower your chances of getting malaria?**
The good news is that you ***CAN*** lower your chances of getting malaria and other diseases spread by mosquitoes by remembering "**Drain and Cover**":

## DRAIN standing water to stop mosquitoes from multiplying

- Drain water from garbage cans, house gutters, buckets, pool covers, coolers, toys, flower pots or any other containers where sprinkler or rain water has collected.
- Discard old tires, drums, bottles, cans, pots and pans, broken appliances and other items that aren't being used.
- Empty and clean birdbaths and pet's water bowls at least once or twice a week.
- Protect boats and vehicles from rain with tarps that don't accumulate water.
- Maintain swimming pools in good condition and appropriately chlorinated. Empty plastic swimming pools when not in use.

## COVER skin with clothing or repellent

- CLOTHING - Wear shoes, socks, and long pants and long-sleeves. This type of protection may be necessary for people who must work in areas where mosquitoes are present.
- REPELLENT - Apply mosquito repellent to bare skin and clothing.
    - Always use repellents according to the label. Repellents with DEET, picaridin, oil of lemon eucalyptus, and IR3535 are effective.
    - Use mosquito netting to protect children younger than 2 months old.

## COVER doors and windows with screens to keep mosquitoes out of your house

- Repair broken screening on windows, doors, porches, and patios.

**If you think you have malaria?**

See a doctor. Malaria can be treated

# Appendix A

## Acronyms/Definitions

***Ae.***: Abbreviation for mosquitoes in the genus *Aedes*

***An.:*** Abbreviation for mosquitoes in the genus *Anopheles*

**AAP**: American Academy of Pediatrics

**Arbovirus**: Arthropod-borne virus

**Arthropod**: Animals in the phylum which includes insects (mosquitoes, flies, etc.) and arachnids (ticks, spiders, etc.)

**BoEPC**: Bureau of Entomology and Pest Control (DACS)

**BOL**: Bureau of Laboratories (DOH)

**CDC**: Centers for Disease Control and Prevention

**CHD**: County health department

**CHIK**: Chikungunya fever

**CHIKV**: Chikungunya virus

**CF test**: Complement fixation test

***Cq.***: Abbreviation for mosquitoes in the genus *Coquillettidia*

***Cs.***: Abbreviation for mosquitoes in the genus *Culiseta*

**CSF**: Cerebrospinal fluid

***Cx.*:** Abbreviation for mosquitoes in the genus *Culex*

**DACS**: Department of Agriculture and Consumer Services

**DEET**: N,N-diethyl-meta-toluamide; the active ingredient in many insect repellent products

**DEN**: Dengue fever

**DENV**: Dengue virus

**DEP**: Department of Environmental Protection

**DHF**: Dengue hemorrhagic fever

**DOH**: Department of Health

**DSS**: Dengue shock syndrome

**EEE:** Eastern Equine Encephalitis

**EEEV**: Eastern Equine Encephalitis virus

**EIA/ELISA**: Enzyme immunoassay/enzyme-linked immunosorbant assay

**Encephalitis**: Inflammation of the brain

**EPA**: U.S. Environmental Protection Agency

**EVEV**: Everglades virus

**FMEL**: Florida Medical Entomology Laboratory

**F.S.**: Florida Statutes

**FWC**: Florida Fish and Wildlife Conservation Commission

**Hemostasis**: The arrest of bleeding

**HHS**: U.S. Department of Health and Human Services

**HI/HAI**: Hemagglutination (and antibody) inhibition test used by the DOH Tampa Branch Laboratory for avian serosurveillance

**IFA**: Immunofluorescent antibody test

**Ig**: Immunoglobulin or antibody (as in IgM, IgG, IgD, IgA or IgE)

**LA/LAT**: Latex agglutination test

**MA**: Microagglutination test

**MAbs**: Monoclonal antibodies

**MCD**: Mosquito control district

**NAT**: Nucleic acid-amplification test

**NOAA**: National Weather Service

**PCR**: polymerase chain reaction

**PHEREC**: John A. Mulrennan, Sr., Public Health Entomology Research and Education Center (Florida A&M University)

**PPE**: Personal Protective Equipment

**PRNT**: Plaque Reduction Neutralization Test

**PVD**: presumptively viremic donor

**RVF**: Rift Valley fever

**RVFV**: Rift Valley fever virus

**Serum/Sera**: The liquid fraction of blood remaining after cells and fibrinogen removed

**SLE**: St. Louis Encephalitis

**SLEV**: St. Louis Encephalitis virus

**SN**: Serum neutralization test; gold standard test for arbovirus serology

**Surveillance**: Close observation for disease detection. The ongoing systematic collection and analysis of data and the provision of information which leads to action being taken to prevent and control a disease, usually one of an infectious nature.

**UF**: University of Florida

**USF**: University of South Florida

**USDA**: United States Department of Agriculture

**Vector**: A carrier which transfers infective agents from one host to another

**VEEV**: Venezuelan equine encephalitis virus

**Venipuncture**: Puncture of a vein as for drawing blood

**WEE**: Western equine encephalitis

**WNF**: West Nile fever

**WNV**: West Nile virus

**WTD**: Water table data

**YF**: Yellow fever

**YFV**: Yellow fever

**Zoonosis**: Disease of animals transmissible to people

# Appendix B
# Forms

Forms available in this section:

1. Florida Confidential Vector-borne Disease Infection Case Report & instructions
2. Florida Confidential Malaria Infection Case Addendum & instructions
3. Arboviral Encephalitis Case Information Form – Veterinary
4. Arbovirus Surveillance Serology – Sentinels
5. Arbovirus Surveillance: Necropsy and Virus Isolation – Dead birds and other animals
6. Arbovirus Surveillance – Mosquitoes

# FLORIDA CONFIDENTIAL VECTOR-BORNE DISEASE INFECTION CASE REPORT

(To be completed for all laboratory presumptive and confirmed cases)

☐ St. Louis Encephalitis ☐ Eastern Equine Encephalitis ☐ West Nile virus ☐ Dengue
☐ LaCrosse/CA Encephalitis ☐ Venezuelan Equine Encephalitis ☐ Western Equine Encephalitis ☐ Yellow Fever
☐ Other_____ **Check one**: ☐ Neuroinvasive ☐ Non-neuroinvasive

---

**IDENTIFYING DATA:** County:_____ Merlin Case #:_____

Name: _____ Date of Birth: ___/___/___ Gender: ☐ Male ☐ Female
Last First MI mm dd yyyy

Home Address: _____
Street City State Zip

Home Phone: (____)_____ Employer/School: _____
Name Address Zip

---

Race/Ethnicity: ☐ White ☐ Black ☐ Hispanic ☐ American Indian/Alaska Native ☐ Asian/Pacific Islander ☐ Unknown/Not specified

Homeless: ☐ Yes ☐ No

Hospitalized: ☐ Yes ☐ No
If yes, Hospital: _____ Physician:_____ Physician Phone:(____)_____
Date of Admission:___/___/_____ Discharge or death:___/___/_____

---

**CLINICAL SYMPTOMS:** Date of Illness Onset (**Required Field**) (mm/dd/yyyy):___/___/____

| | YES | NO | UNK | | YES | NO | UNK | | YES | NO | UNK |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fever ≥100F | ☐ | ☐ | ☐ | Disorientation | ☐ | ☐ | ☐ | Rigidity | ☐ | ☐ | ☐ |
| Highest Temp. | _____°F | | | Delirium | ☐ | ☐ | ☐ | Cranial Nerve Palsy | ☐ | ☐ | ☐ |
| Headache | ☐ | ☐ | ☐ | Lethargy | ☐ | ☐ | ☐ | Stiff Neck | ☐ | ☐ | ☐ |
| Myalgia | ☐ | ☐ | ☐ | Confusion | ☐ | ☐ | ☐ | Paralysis | ☐ | ☐ | ☐ |
| Arthralgia | ☐ | ☐ | ☐ | Coma | ☐ | ☐ | ☐ | Muscle Weakness | ☐ | ☐ | ☐ |
| Rash | ☐ | ☐ | ☐ | Convulsion | ☐ | ☐ | ☐ | Hemorrhage | ☐ | ☐ | ☐ |
| Vomiting | ☐ | ☐ | ☐ | Tremor | ☐ | ☐ | ☐ | Retroorbital pain | ☐ | ☐ | ☐ |
| Nausea | ☐ | ☐ | ☐ | Hyperreflexia | ☐ | ☐ | ☐ | Other_____ | | | |
| Lymphadenopathy | ☐ | ☐ | ☐ | | | | | | | | |

**Outcome**: ☐ Survived ☐ Died ☐ Unknown Date of death (mm/dd/yyyy)_____/_____/_____
Date of Last follow-up _____/_____/_____

---

**LABORATORY DATA: (*must attach laboratory sheets**)**

Acute specimens must be collected within 14 days of onset of symptoms. Convalescent specimens should be collected 10 days to 4 weeks later.

| Serum or CSF (specify acute or convalescent) | Date Collected (mm/dd/yyyy) | Laboratory Name | Test Type | Lab Report Date (mm/dd/yyyy) | Results |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

***Department of Health Bureau of Laboratories - Tampa or Jacksonville Branch results are required for confirmation**

Merlin Case #_____County:_____ Pt's initials:____

**RISK FACTOR INFORMATION:**

1. Does the patient's residence have screened windows? ☐ Yes ☐ No ☐ Unknown
2. During the two weeks before onset of illness does the patient recall being bitten by mosquitoes?
   ☐ Yes ☐ No If yes, dates and places _____
3. Is the patient a smoker? ☐ Yes ☐ No ☐ Unknown
   If yes, do they smoke outdoors? ☐ Yes ☐ No ☐ Unknown
4. Has the patient spent extended time outdoors in the two weeks prior to onset? ☐ Yes ☐ No ☐ Unknown
5. Does the patient use any prevention measures to avoid mosquito bites? ☐ Yes ☐ No ☐ Unknown
   If yes, list_____
   Does the patient use mosquito repellant when outdoors: ☐Always ☐Sometimes ☐Rarely ☐Never
   Does the repellant contain DEET (N, N-diethyl-meta-toluamide, or N, Ndiethyl-3-methylbenzamide)
   ☐Yes ☐No ☐Unknown
6. During the two weeks before onset did the patient travel outside the county of residence?
   ☐Yes ☐No ☐Unk If yes, specify when and where: _____
7. Has the patient traveled outside of Florida in the two weeks prior to onset? ☐ Yes ☐ No ☐ Unknown
   If yes, specify when and where: _____
8. Has the patient traveled outside the U.S. in the two weeks prior to onset? ☐ Yes ☐ No ☐ Unknown
   If yes, specify when and where: _____
9. Does the patient have any underlying medical conditions? ☐ Yes ☐ No ☐ Unknown
   If yes, specify _____
10. What is the patient's occupation?_____

---

**BLOOD DONATION/TRANSFUSION/TRANSPLANT HISTORY/PREGNANCY:**

11. Has the patient received transplant or blood product transfusions in the month prior to onset? ☐ Yes ☐No ☐ Unknown
    If yes, specify when and where: _____
12. Has patient donated blood products in the one month prior to onset? ☐ Yes ☐ No ☐ Unknown
    If yes, specify when and where: _____
13. Is the patient currently pregnant? ☐ Yes ☐ No ☐ Unknown ☐ Not applicable
    If yes, weeks pregnant_____ due date ___/___/_____
14. Is the patient breastfeeding or planning to breastfeed? ☐ Yes ☐ No ☐ Unknown

---

**VACCINE INFORMATION**

15. Has patient received yellow fever (YF) vaccine? ☐Yes (date:__/__/__) ☐No ☐Unknown
16. Has patient received Japanese encephalitis (JE) vaccine? ☐Yes (date:__/__/__) ☐No ☐Unknown
17. Has patient received Central European encephalitis (CEE) vaccine? ☐Yes (date:__/__/__) ☐No ☐Unknown

**COMMENTS:** _____

_____

_____

Date _____ Investigator _____ Phone (____) _____
(Please print)

**Please submit form to the Division of Environmental Health (HSEM), Dept. of Health by uploading electronically into Merlin**

## Instructions for completing the arbovirus case report form

**Diagnosis**- Check the appropriate disease classification at the top of the page. Check the appropriate box to indicate if the disease is neuroinvasive or non-neuroinvasive.
**Identifying data**- All identifying data needs to be filled out in full.
**County**- The county of residence. If transmission occurred elsewhere, please inform that jurisdiction and indicate such in the risk factor section of the form. However, the reporting county should be the county of residence.
**Merlin case #**- Information gathered after reporting to the Merlin surveillance system
**Name**- Last, First, MI (optional)
**Date of birth**- Month/ day/ year
**Home address**- Include street, city, state, and zip code. If no home address is available because person is of transient nature, enter the closest address to current place of occupancy and check yes for homeless.
**Home phone**- Enter area code followed by 7 digit number or if cell phone given please indicate by writing cell phone.
**Employer/School**- If the patient is in high school or below enter name, address, and zip code of school or daycare. If patient has graduated and has an employer please list name, address, and zip code. If neither apply please just write N/A.
**Race**- Mark the box that the individual specifies as their race
**Hospitalization**- If the patient was hospitalized for this recent illness please check the yes box and enter the hospital name, physician seen during the hospital stay, physician phone number, date of admission (month/ day/ year) and date of discharge (month/ day/ year). If the patient was not hospitalized, check the no box and continue with clinical symptoms.
**Date Onset of Illness**- Month/ day/year that symptoms started, if patient is unsure or you are unable to contact the patient, please enter the first positive laboratory date and indicate that it is a laboratory date and not an onset date.

**Definition of select clinical symptoms**:
**Fever**- Documented cases of 101°F or above and indicate highest temperature monitored (if known)
**Tremor**- Involuntary repetitive movements of opposing muscle groups
**Confusion**- A mental state of being bewildered or perplexed
**Disorientation**- Unable to orientate oneself
**Delirium**- An altered state of mind often resulting in illusions and hallucinations
**Lethargy**- A state of deep and prolonged unconsciousness from which one can be aroused but into which one immediately relapses
**Coma**- A state of impaired consciousness in which one cannot be roused
**Hyperreflexia**- A condition in which the deep tendon reflexes are exaggerated
**Rigidity**- Stiffness or inflexibility
**Cranial Nerve Palsy**- Paralysis, usually unilateral, of the facial muscles
**Rash**- Cutaneous eruption (please specify part of the body)
**Convulsion**- Violent spasm or series of jerking of the face, trunk, or extremities
**Paralysis**- Loss of power of voluntary movement in a muscle
**Hemorrhage**- An escape of blood through ruptured or unruptured vessel walls

**Outcome**- Check outcome at time of investigation. If death occurred put month/ day/ year of expiration.

**Laboratory data**- Begin with the earliest laboratory test and continue down the column to the most recent laboratory test available.
**Serum or CSF-** Indicate specimen type and acute or convalescent.
Acute specimens are those specimens that are collected within 14 days of symptom onset.
Convalescent specimens are those specimens that are collected 10 days to 4 weeks after the acute specimen.
**Date collected**- Month/day/year of specimen collection
**Laboratory Name**- Where the test was performed (if private lab indicate name of lab)
**Test type**- Example: HI, ELISA, PRNT, PCR, or other (specify)
**Lab Report Date**-Date of laboratory report (month/day/year)
**Results**- Example: WNV, EEEV or SLEV IgM or IgG positive

* **YOU MUST ATTACH LAB REPORTS WITH THIS CASE REPORT FORM**

**Risk factor information**-
Does the primary residence have screens on all of the operable windows?
Does the patient remember being bitten by a mosquito if so, when and where?
Does the patient smoke and if so, do they smoke outdoors?
Does the patient spend time outdoors (example: do they garden, fish, hunt, camp, etc.). If they do, do they practice personal mosquito protection?
Does the patient have a travel history outside of the county, state or country within the last 2 weeks?
Does the patient have any underlying medical conditions (Example: Diabetes, heart disease, etc.)

**Blood Donation/Transfusion/Transplant History and Pregnancy-**
Has the patient received a transplant or received or donated blood products?
If the patient is female, is she currently pregnant? If yes, ask for the weeks pregnant and an expected due date. Also ask if she is breastfeeding or planning to breastfeed? If yes, provide education or refer her to her physician for advice on the possible transmission of the virus through breast milk.

**Vaccine information-**
Circle yes, no or unknown and provide a date if applicable for vaccination with yellow fever, Japanese encephalitis, or Central European encephalitis.

**Comments**- Please add any other comments in the comment field and feel free to add additional sheets if necessary.

**Investigator's contact information-** Date of investigation (month/day/year), Investigator's name, and a phone number with area code where the investigator can be reached.

**After completion of the case report form please fax or mail a copy along with the laboratory results to FAX 850-922-8473 or mail to the Division of Environmental Health (HSEM), Dept. of Health, 4052 Bald Cypress Way, Bin A-08, Tallahassee, Florida 32399-1712. Before faxing please call (850) 245-4444 x2437 to let us know that you are sending confidential information.

**FLORIDA CONFIDENTIAL MALARIA INFECTION CASE ADDENDUM**

(To be completed for all laboratory presumptive and confirmed cases in addition to the CDC form 54.1 2010.)

☐Vivax ☐Falciparum ☐Malariae ☐Ovale ☐Not determined

**IDENTIFYING DATA:** County: _____ Merlin Case #: _____

Name: _____ Date of Birth: ___/___/___ Country of Birth_____
Last First MI mm dd yyyy

Home Address: _____ Homeless ☐Yes ☐No
Street City State Zip

Home Phone: (_____)_____ Employer/School: _____
Name address zip

Hospitalization: ☐ Yes ☐ No If yes, Hospital: _____
Date of Admission:___/___/____ Discharge or death:___/___/____

**CLINICAL SYMPTOMS:** Date of Illness Onset (**Required Field**) (mm/dd/yyyy):___/___/_____

| | YES NO UNK | | YES NO UNK | | YES NO UNK |
|---|---|---|---|---|---|
| Fever ≥101F | ☐ ☐ ☐ | Malaise | ☐ ☐ ☐ | Disorientation | ☐ ☐ ☐ |
| Highest Temp. | | Perspiration | ☐ ☐ ☐ | Liver | |
| (If known) | _____ºF | Mild jaundice | ☐ ☐ ☐ | Enlargement | ☐ ☐ ☐ |
| Chills | ☐ ☐ ☐ | Stupor | ☐ ☐ ☐ | ARDS | ☐ ☐ ☐ |
| Sweats | ☐ ☐ ☐ | Coma | ☐ ☐ ☐ | Convulsion | ☐ ☐ ☐ |
| Headaches | ☐ ☐ ☐ | Cerebral | | Confusion | ☐ ☐ ☐ |
| Nausea | ☐ ☐ ☐ | Malaria | ☐ ☐ ☐ | Renal Failure | ☐ ☐ ☐ |
| Vomiting | ☐ ☐ ☐ | Anemia | ☐ ☐ ☐ | Other_____ | |

**Outcome**: ☐Survived ☐Died ☐Unknown Date of last follow-up _____/_____/_____

**LABORATORY DATA**: *(must attach laboratory sheets*)*

**Risk Factor Information:**

1. Does the patient's residence have screened windows? ☐Yes ☐No ☐Unknown
2. During the month before onset of illness does the patient recall being bitten by mosquitoes? ☐ Yes ☐ No

   If yes, dates and places _____
3. Is the patient a smoker? ☐Yes ☐No ☐Unknown

   If yes, do they smoke outdoors? ☐Yes ☐No ☐Unknown
4. Has the patient spent extended time outdoors in the month prior to onset? ☐Yes ☐No ☐Unknown

   If yes, are any prevention measures taken to avoid mosquito bites (5 D's)? ☐Yes ☐ No

   If yes, list_____

   Does the patient use mosquito repellent when outdoors: ☐Always ☐Sometimes ☐Rarely ☐Never
   Does the repellent contain DEET (N, N-diethyl-meta-toluamide, or N, Ndiethyl-3-methylbenzamide), picaridin, or oil of lemon eucalyptus? ☐Yes ☐No ☐Unk.
5. What is the patient's occupation?_____
6. Does the patient have any underlying medical conditions? ☐Yes ☐No ☐Unk. If yes, specify _____
7. Has the patient been exposed to tainted needles in the past 12 months? ☐Yes ☐No ☐Unknown
11. Has the patient traveled outside of Florida in the month prior to onset? ☐Yes ☐No ☐Unknown

    If yes, specify (Please use other page if additional places need to be listed)_____

**COMMENTS:** _____

Date _____ Investigator _____ Phone (_____)_____
(Please print)

Please submit form to the Division of Environmental Health (HSEM), Dept. of Health by uploading electronically into Merlin.

## Instructions for completing the Malaria case report form

(this is an addendum to the CDC form 54.1 2010 (http://www.cdc.gov/malaria/resources/pdf/report/malaria_form.pdf)

**Diagnosis**- Check the appropriate disease classification at the top of the page.

**Identifying data**- All identifying data needs to be filled out in full.
**County**- The county of residence. If transmission occurred elsewhere, please inform that jurisdiction and indicate such in the risk factor section of the form. However, the reporting county should be the county of residence.
**Merlin case #**- Information gathered after reporting to the Merlin surveillance system
**Name**- Last, First, MI (optional)
**Date of birth**- Month/ day/ year
**Country of birth**- Country where the individual was born
**Home address**- Include street, city, state, and zip code if no home address is available because person is of transient nature, enter the closest address to current place of occupancy and check yes for homeless.
**Home phone**- Enter area code followed by 7 digit number or if cell phone given please indicate by writing cell phone.
**Employer/School**- If the patient is in high school or below enter name, address, and zip code of school or daycare, if patient has graduated and has an employer please list name, address, and zip code if neither apply please just write N/A.
**Race**- Mark the box that the individual specifies as their race
**Hospitalization**- If the patient was hospitalized for this recent illness please check the yes box and enter the hospital name, physician seen during the hospital stay, physician phone number, date of admission (month/ day/ year) and date of discharge (month/ day/ year). If no hospitalization simply check the no box and continue with clinical symptoms.

**Clinical Symptoms**
**Date Onset of Illness**- Month/ day/year that symptoms started. If patient is unsure or you are unable to contact the patient, please enter the first positive laboratory date and indicate that it is a laboratory date and not an onset date.

**Definition of clinical symptoms**:
**Fever**- Documented cases of 101°F or above and indicate highest temperature monitored (if known)
**Malaise**- A feeling of general discomfort or uneasiness
**Mild jaundice-** a yellow tone to skin and eyes
**Stupor**- A state of impaired consciousness in which only continual stimulation arouses the individual
**Coma**- A state of impaired consciousness in which one cannot be roused
**Cerebral Malaria**- A form of falciparum characterized by cerebral involvement
**Anemia**- A condition in which oxygen carrying blood cells are less than normal
**Disorientation**- Unable to orientate oneself
**ARDS**-Adult respiratory distress syndrome
**Convulsion**- Violent spasm or series of jerking of the face, trunk, or extremities
**Confusion**- A mental state of being bewildered or perplexed
**Renal failure**- Failure of the kidneys

**Outcome**- Check outcome at time of investigation. If death occurred put month/ day/ year of expiration.

**Laboratory data**- Laboratory information should be specified on the CDC form as well as attaching the appropriate lab reports with this case report form.

* **YOU MUST ATTACH LAB REPORTS WITH THIS CASE REPORT FORM**

**Blood Donation/Transfusion/Transplant History and Pregnancy**- This information should be reported on the CDC form.

**Risk factor information**-
Does the primary residence have screens on all of the operable windows?
Does the patient remember being bitten by a mosquito? If so, when and where?

Does the patient smoke and if so, do they smoke outdoors?
Does the patient spend time outdoors (example: do they garden, fish, hunt, camp, etc.). If they do, do they practice mosquito bite preventive actions?

Does the patient have any underlying medical conditions (Example: Diabetes, heart disease, etc.) or has the patient had Malaria in the past, if yes, specify type
Has the patient been in contact with needles that have not been properly sanitized (ex. tattoos, piercings, etc.)
Does the patient have a travel history outside of the state of Florida within the last month?
*If any travel history document location, reason for travel, and beginning and ending dates of each location

**Comments**- Please add any other comments in the comment field and feel free to add additional sheets if necessary.

Date of investigation (month/day/year), Investigator's name, and a phone number with area code where the investigator can be reached.

**After completion of the case report form please fax or mail a copy along with the laboratory results to FAX 850-922-8473 or mail to the Division of Environmental Health Dept. of Health, 4052 Bald Cypress Way, Bin A-08, Tallahassee, Florida 32399-1712. Before faxing please call (850) 245-4444 x2437 to let us know that you are sending confidential information.

ADAM H. PUTNAM
COMMISSIONER

Florida Department of Agriculture & Consumer Services
Division of Animal Industry
Bureau of Animal Disease Control

# Arboviral Encephalitis Case Information Form

585.145, Florida Statutes

Contact:

Equine Programs Office
407 S. Calhoun St.
Tallahassee, FL 32399-0800
850/410-0900
Fax: 410-0919

www.freshfromflorida.com/ai

Note: All documents and attachments submitted with this request are subject to public review pursuant to Chapter 119, F.S.

**Submitter: Please send this completed form along with collected samples to the Bronson Animal Disease Diagnostic Laboratory at:**
**2700 N John Young Pkwy, Kissimmee, FL 34741 Phone (321) 697-1400**

FOR LAB USE ONLY

If submitting split samples, send copies of completed form (both pages) to each laboratory used. If samples are not being submitted, please send the completed form to Equine Programs Office, Division of Animal Industry, Fax 850-410-0919. Hard copies can be mailed to the address shown above.

County _____ Date Reported _____

**Premises GPS** (5 decimal digits)

Latitude _____ Longitude _____ Premises ID Number _____

FDACS/USDA Veterinarian(s) or Inspector(s) Assigned: _____

| | | |
|---|---|---|
| **Reported By** | Name | Title/Occupation |
| | Business/Affiliation | |
| | Mailing Address | Physical Address (if different) |
| | Phone # | Fax # |
| | Mobile # | Pager # |
| | Email | |
| **Premises Information** | Name | Title/Occupation |
| | Premises/Farm Name | |
| | Mailing Address | Physical Address (if different) (***Where Horse Resides***) |
| | Phone # | Fax # |
| | Mobile # | Pager # |
| | Email | |

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Florida Department of Agriculture and Consumer Services — Division of Animal Industry/Office of the State Veterinarian

# Arboviral Encephalitis
## Case Information Form (continued)

| | | |
|---|---|---|
| **Horse Information** | Name/Animal Identification | Date of onset of clinical symptoms |
| | Breed | Age |
| | Sex (Male/Female/Gelding) | Vaccination Status (History) |
| | Status of Horse: ___ Alive ____ Dead ____ Critical<br>Recovering as of (Date): | Date of Death: Buried?___ Yes ___ No |
| | Showing clinical symptoms?____ Yes ____ No | Method of Death: _____ Natural causes<br>_____ Euthanasia _____ Other: |

| | | |
|---|---|---|
| **Samples** | Number of samples taken. | Date samples taken: |
| | Samples submitted to FDACS Kissimmee Diagnostic Laboratory<br>Sample type:____ Blood ____ Brain_____ Other: Date Sent: | |
| | Samples submitted to USDA National Veterinary Services Laboratory (NVSL)<br>Sample type:____ Blood____ Brain____ Other: Date Sent: | |
| | Samples submitted to Florida DOH Laboratory<br>Sample type: ____ Blood ____ Brain ____ Other: Date Sent: | |

| | |
|---|---|
| **Clinical Presentation/History** | History: |
| | Clinical Presentation:<br>___Apprehension Other:<br>___Depression<br>___Elevated Temperature<br>___Head Shaking<br>___Muscle Twitching<br>___Incoordination<br>___Weakness of Hind Limbs<br>___Inability to Stand<br>___Aimless Wandering<br>___Head Pressing<br>___Listlessness |

Comments/Additional Information:
Attach additional pages as needed.

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FLORIDA DEPARTMENT OF HEALTH

Bureau of Laboratories
Tampa Branch Laboratory
3602 Spectrum Boulevard
Tampa, FL 33612

phone: (813) 974-5990
fax: (813) 974-5776
e-mail: Lillian_stark@doh.state.fl.us

# Arbovirus Surveillance Serology

County _____ page_____ of_____

Contact name _____

Address _____

_____

Phone ( )

Fax: ( )

E-mail:

For Laboratory use only

Date Received: _____

Date Reported: _____

## Specimen Collection Data

## HAI titer

| Sample date | Bird # | Site | New | Species | Sex/Age | LAB Number | Flavi* | Alpha* | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 1. | | | | | | | | | |
| 2. | | | | | | | | | |
| 3. | | | | | | | | | |
| 4. | | | | | | | | | |
| 5. | | | | | | | | | |
| 6. | | | | | | | | | |
| 7. | | | | | | | | | |
| 8. | | | | | | | | | |
| 9. | | | | | | | | | |
| 10. | | | | | | | | | |
| 11. | | | | | | | | | |
| 12. | | | | | | | | | |

Flavi* = Flavivirus - includes SLEV & WNV; Alpha* = Alphavirus – includes EEEV & HJV

This form must accompany all serum specimens submitted for serologic examination.
Submitter should fill out left side of form completely. **DO NOT SKIP LINES** when listing collected specimens
If bird is new to the flock or first time bled, place an X in the "New" column. Please **Do not write below this line**

FLORIDA DEPARTMENT OF HEALTH

Bureau of Laboratories
Tampa Branch Laboratory
3602 Spectrum Boulevard
Tampa, FL 33612

phone: (813) 974-5990
fax: (813) 974-5776
e-mail: Lillian_stark@doh.state.fl.us

# Arbovirus Surveillance: Necropsy and Virus Isolation

**County** _____ **Reported on http://www.MyFWC.com/bird/** **__yes ___no**

**Contact name** _____ **E-mail:** _____

**Organization** _____ **Phone:** (  ) _____

**Address** _____ **Fax:** (  ) _____

**Address** _____

**City/State/zip** _____

## Specimen Collection Data

| Collection date | Bird Mortality Database # | Site/Address of Collection *OR* GPS Coordinates | Species of bird | For DOH Tampa Laboratory Use Only<br>Date Received<br>DoH LAB # | Molecular Assay Results | Virus Isolation Result |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

***Please send birds (only recently dead within the past 24 hours) to:***

*Florida Department of Health, Bureau of Laboratories, 3602 Spectrum Blvd., Tampa, FL 33612-9401, Attention: Virology (B)*

FLORIDA DEPARTMENT OF HEALTH

Bureau of Laboratories
Tampa Branch Laboratory
3602 Spectrum Boulevard
Tampa, FL 33612

phone: (813) 974-5990
fax: (813) 974-5776
e-mail: Lillian_stark@doh.state.fl.us

# Arbovirus Surveillance: Mosquito

**County:** _____ **page____of____**

**Submitter's name:** _____ **E-mail:**

**Address:** _____

**Phone:** (  )

**Fax:** (  )

For DoH Tampa Laboratory Use Only

Date Received

## Specimen Collection Data

| Collection date | Vial # | Species | Site/Address of Collection *OR* GPS Coordinates | # per pool | DoH LAB # | Molecular Assay Results | Virus Isolation Result |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

***Mosquitoes must be shipped frozen on dry ice. Send overnight to***
Florida Department of Health, Bureau of Laboratories, 3602 Spectrum Blvd.,
Tampa, FL 33612-9401, Attention: Virology

# Appendix C
# Contacts for Establishing Sentinel Chicken Flocks

(*Note: Listing does not necessarily denote endorsement. Contact established sentinel sites for more information.)*

**Florida Department of Agriculture (Division of Animal Industry)**

- Jennifer Jennings-Glover, Poultry Program (850) 251-1226
  jennifer.jennin@freshfromflorida.com

- Dr. Thomas J. Holt, Division of Animal Industry (850) 410-0900
  thomas.holt@freshfromflorida.com

**Chicken Suppliers (White Leghorn or Rhode Island Reds suggested)**

- Clyde Mizell, Inc. (904) 879-1196

**Wing/Leg Bands**

- National Band and Tag Company: (859) 261-2035 or http://www.nationalband.com/

**Serum Separator Tubes**

- Fisher Scientific: (800) 766-7000, catalog # 02-65714 (13x75mm)

**Chicken Cages, Feeders and Waterers**

- Stromberg's: (800) 720-1134
- Call (850) 245-4299 for plans to construct self-feeders, self-waterers, and for building cages

**Chicken Feed**

- Available at local feed store

# Appendix D

**Infection Control and Personal Protective Equipment Guidelines for persons involved in surveillance, eradication and control of avian influenza outbreaks in birds in Florida.**
From the Florida Department of Health Emergency Operations Plan, Pandemic Influenza Annex, Appendix 5: Zoonotic Avian Influenza Surveillance and Response Protocol

**i. Basic Infection Control**

Strict adherence to and proper use of hand hygiene after contact with wild and domestic birds, contact with contaminated surfaces, and after removing gloves is very important. Hand hygiene should consist of washing with soap and water for 15-20 seconds or the use of hand-disinfectants with 70% alcohol. Hand disinfectants are less effective when hands are soiled. Soiled hands should be washed with soap and water. Gloves should be changed between procedures.

**ii. Specific Guidelines for Animal Workers Handling :**

**Apparently Healthy Birds in Areas Where highly pathogenic avian influenza (HPAI) H5N1 virus is Not Suspected Should:**

- When possible, work in well-ventilated areas if working indoors. When working outdoors work upwind of animals, to the extent practical, to decrease the risk of inhaling aerosols such as dust, feathers, or dander.
- Wear rubber, nitrile or latex gloves that can be disinfected or disposed of and protective eyewear or a face shield while handling animals.
- Wash hands with soap and water often and disinfect work surfaces and equipment between sites.
- Use protective clothing (such as a protective coverall or apron) that can be disinfected or disposed when there is extensive physical contact with the bird.
- Wear a dust mask to protect against respiratory irritants when performing work with significant dust levels such as cleaning cages.
- Carry a bottle of hand sanitizer for hand hygiene when hand washing stations are not readily accessible.
- Not eat, drink, smoke, apply cosmetics or lip balm while handling animals.
- Not place laboratory specimens in coolers or refrigerators holding food.
- Disinfect or wash protective clothing at the end of the day.

**Wild Birds or Poultry That Are Sick or Associated With a Undiagnosed Mortality Event in Areas Where HPAI H5N1 is Not Suspected** Should**:**

- Follow the recommendations above and at a minimum wear protective clothing, including coveralls, rubber boots, latex, nitrile or rubber gloves that can be disinfected or disposed. Personnel working in a poultry house should wear disposable coveralls (such as Tyvek® suits).
- Minimize exposure to mucosal membranes by wearing protective eyewear (goggles) and a particulate respirator (NIOSH N95 respirator or higher).

- Disposable particulate respirators (e.g., N-95, N-99, or N-100) are the minimum level of respiratory protection that should be worn. Workers must be fit-tested to the respirator model that they will wear and also know how to check the face-piece to face seal. Workers who cannot wear a disposable particulate respirator because of facial hair or other fit limitations should wear a loose-fitting (i.e., helmeted or hooded) powered air purifying respirator equipped with high-efficiency filters.
- Decontaminate and properly dispose of potentially infectious material including carcasses per DOH and DEP guidelines.
- Decontaminate, remove and properly dispose of all Personal Protective Equipment (PPE) except eyewear and respirator. Wash hands thoroughly. Remove protective eyewear and respirators.
- Wash hand again after removing all PPE.

**Wild Birds or Backyard Flocks of Poultry That Are Sick or Associated With a Undiagnosed Mortality Event in Areas Where HPAI Has Been Detected Should**,

- Follow the recommendations above.
- Wear a fluid resistant apron over protective clothing.
- Get vaccinated with the seasonal influenza vaccine
- Unvaccinated workers should receive the current season's influenza vaccine to reduce the possibility of dual infection with avian and human influenza viruses. There is a small possibility that dual infection could occur and result in reassortment. The resultant hybrid virus could be highly transmissible among people and lead to widespread infections. Vaccination of all residents of affected areas is not supported by current epidemiologic data.
- Consult with a health care provider regarding any health concern
- If avian influenza infection is suspected, report to the local CHD.
- Follow the latest guidelines from CDC and the WHO for prophylactic medications and precautions for persons involved in avian influenza disease control:

Adapted from joint USDA and CDC recommendations posted at:
http://www.cdc.gov/flu/avian/professional/protect-guid.htm

**Commercial Poultry Flocks That Are Sick or Associated With a Undiagnosed Mortality Event in Areas Where HPAI Has Been Detected:**

iii. Personal Protective Equipment (PPE)

Disposable gloves made of lightweight nitrile or vinyl or heavy duty rubber work gloves that can be disinfected should be worn. To protect against dermatitis, which can occur from prolonged exposure of the skin to moisture in gloves caused by perspiration, a thin cotton glove can be worn inside the external glove. Gloves should be changed if torn or otherwise damaged. Remove gloves promptly after use, before touching non-contaminated items and environmental surfaces.

Personnel should carry a bottle of hand sanitizer and use it, at a minimum, before changing gloves. The bottle should be disposed with other PPE at the end of the day.

Protective clothing, preferably disposable outer garments or coveralls such as Tyvex® suits, an impermeable apron or surgical gowns with long cuffed sleeves, plus an impermeable apron should be worn.

Rubber or polyurethane boots with shallow treads that can be cleaned and disinfected should be worn.

Non-vented snug fitting safety goggles should be worn to protect the mucous membranes of eyes.

Disposable particulate respirators (e.g., N-95, N-99, or N-100) are the minimum level of respiratory protection that should be worn. This level or higher respiratory protection [negative or positive pressure respirators] may already be in use in poultry operations due to other hazards that exist in the environment (e.g., other vapors, manure, dust) and for improved vision or comfort. Workers must be fit-tested to the respirator model that they will wear and also know how to check the face-piece to face seal. Workers who cannot wear a disposable particulate respirator because of facial hair or other fit limitations should wear a loose-fitting (i.e., helmeted or hooded) powered air purifying respirator equipped with high-efficiency filters.

Personnel should receive appropriate personal protective equipment, instructions and training in PPE use, and respirator fit-testing.

Disposable PPE should be properly discarded, and non-disposable PPE and underwear should be cleaned and disinfected as specified in the Department of Agriculture and Consumer Services Avian Influenza Response Plan.

Protective clothing and gloves should be removed and discarded before removing respirators and goggles. Thorough hand hygiene measures should be performed before removing the respirator and goggles and after removal of all PPE.

Personnel should shower, and put on clean clothing before leaving the premises at the end of the day.

iv. Administration of Antiviral Drugs for Prophylaxis

Workers participating in the eradication and control of an avian influenza outbreak should receive an influenza antiviral drug daily for the duration of time during which direct contact with infected poultry or contaminated surfaces occurs and 7 days post exposure. The choice of antiviral drug should be based on sensitivity testing when possible. In the absence of sensitivity testing, a neuraminidase inhibitor (oseltamavir) is the first choice since the likelihood is smaller that the virus will be resistant to this class of antiviral drugs than to amantadine or rimantadine.

# Appendix E
# 2010 Surveillance Data Charts: WNV and EEEV Infections

| West Nile Virus Infections | | | | | | | |
|---|---|---|---|---|---|---|---|
| COUNTIES | Human | Dead Birds | Sentinels | Equines | Live Wild Birds | Mosquito Pools | Other Animals |
| ALACHUA | | | 13 | | | | |
| BAKER | | | | | | | |
| BAY | | | | | | | |
| BRADFORD | | | | 1 | | | |
| BREVARD | 1(1*)=2 | | 57 | | | | |
| BROWARD | 1 | | | | | | |
| CALHOUN | | | | | | | |
| CHARLOTTE | | | 4 | | | | |
| CITRUS | | | 15 | 2 | | | |
| CLAY | | | | | | | |
| COLLIER | 2 | | | | | | |
| COLUMBIA | | | | | | | |
| DESOTO | 1 | | | 4 | | | |
| DIXIE | | | | | | | |
| DUVAL | 1 | | 5 | | | | |
| ESCAMBIA | | | | | | | |
| FLAGLER | | | 10 | | | | |
| FRANKLIN | | | | | | | |
| GADSDEN | | | | | | | |
| GILCHRIST | | | | | | | |
| GLADES | | | | 1 | | | 4** |
| GULF | | | | | | | |
| HAMILTON | | | | | | | |
| HARDEE | | | | | | | |
| HENDRY | | | 14 | 1 | | | |
| HERNANDO | | | 3 | | | | |
| HIGHLANDS | 1 | | | | | | |
| HILLSBOROUGH | | | 38 | 1 | | 1 | |
| HOLMES | | | | | | | |
| INDIAN RIVER | | | 50 | | | | |
| JACKSON | | | | | | | |
| JEFFERSON | | | | 1 | | | |
| LAFAYETTE | | | | | | | |
| LAKE | | | | | | | |
| LEE | 1 | | 56 | | | | |
| LEON | | | 6 | | | | |
| LEVY | | | | | | | |
| LIBERTY | | | | | | | |
| MADISON | | | | | | | |
| MANATEE | | | 20 | | | | |

| West Nile Virus Infections | | | | | | | |
|---|---|---|---|---|---|---|---|
| **COUNTIES** | **Human** | **Dead Birds** | **Sentinels** | **Equines** | **Live Wild Birds** | **Mosquito Pools** | **Other Animals** |
| **MARION** | | | | 1 | | | |
| **MARTIN** | | | 14 | 2 | | | |
| **MIAMI/DADE** | | | 1 | | | | |
| **MONROE** | | | | | | | |
| **NASSAU** | | | 5 | | | | |
| **OKALOOSA** | | | | | 5 | | |
| **OKEECHOBEE** | | | | | | | |
| **ORANGE** | 2 | | 45 | 1 | | | |
| **OSCEOLA** | 1 | | | 6 | | | |
| **PALM BEACH** | | | 55 | 2 | | | |
| **PASCO** | | | | | | | |
| **PINELLAS** | | | 3 | | | | |
| **POLK** | | | | 2 | | | |
| **PUTNAM** | | | 13 | | | | |
| **SANTA ROSA** | | | | | | | |
| **SARASOTA** | | | 11 | | | | |
| **SEMINOLE** | | | 11 | | | | |
| **ST. JOHNS** | | | 33 | | | | |
| **ST. LUCIE** | | | 9 | | | | |
| **SUMTER** | | | | | | | |
| **SUWANNEE** | 1 | | | | | | |
| **TAYLOR** | | | | | | | |
| **UNION** | | | | 1 | | | |
| **VOLUSIA** | | | 24 | | | | |
| **WAKULLA** | | | | | | | |
| **WALTON** | | | 54 | | | | |
| **WASHINGTON** | | | | | | | |
| **TOTALS** | 13 | | 569 | 26 | 5 | 1 | 1 |

* Blood donor
** reptile

| Eastern Equine Encephalitis Virus Infections | | | | | | | |
|---|---|---|---|---|---|---|---|
| **COUNTIES** | **Humans** | **Dead Birds** | **Sentinels** | **Equines** | **Live Wild Birds** | **Mosquito Pools** | **Other Animals** |
| **ALACHUA** | | | **4** | **1** | | | |
| **BAKER** | | | | **1** | | | |
| **BAY** | | | | | | | |
| **BRADFORD** | | | | **1** | | | |
| **BREVARD** | | | **1** | | | | |
| **BROWARD** | | | | | | | |
| **CALHOUN** | | | | | | | |
| **CHARLOTTE** | | | | | | | |
| **CITRUS** | | | **5** | | | | |
| **CLAY** | | | | **1** | | | |
| **COLLIER** | | | | **4** | | | |
| **COLUMBIA** | | | | | | | |
| **DESOTO** | | | | | | | |
| **DIXIE** | | | | | | | |
| **DUVAL** | | | **5** | **1** | | | |
| **ESCAMBIA** | | | | **1** | | | |
| **FLAGLER** | | | **19** | | | **3** | |
| **FRANKLIN** | | | | | | | |
| **GADSDEN** | | | | | | | |
| **GILCHRIST** | | | | | | | |
| **GLADES** | | | | **3** | | | |
| **GULF** | | | | **1** | | | |
| **HAMILTON** | | | | | | | |
| **HARDEE** | | | | **1** | | | |
| **HENDRY** | | | | **1** | | | |
| **HERNANDO** | | | | | | | |
| **HIGHLANDS** | | | | | | | |
| **HILLSBOROUGH** | **2** | | **2** | **5** | | | |
| **HOLMES** | | | | **2** | | | |
| **INDIAN RIVER** | | | | | | | |
| **JACKSON** | | | | **4** | | | |
| **JEFFERSON** | | | | **3** | | | |
| **LAFAYETTE** | | | | | | | |
| **LAKE** | | | | **6** | | | |
| **LEE** | | | | | | | |
| **LEON** | **1** | | **11** | **2** | | | |
| **LEVY** | | | | | | | |
| **LIBERTY** | | | | **1** | | | |
| **MADISON** | | | | **2** | | | |
| **MANATEE** | | | | **1** | | | |
| **MARION** | | | | **6** | | | |
| **MARTIN** | | | **2** | **1** | | | |

| Eastern Equine Encephalitis Virus Infections | | | | | | | |
|---|---|---|---|---|---|---|---|
| **COUNTIES** | **Humans** | **Dead Birds** | **Sentinels** | **Equines** | **Live Wild Birds** | **Mosquito Pools** | **Other Animals** |
| **MIAMI/DADE** | | | **2** | **4** | | | |
| **MONROE** | | | | | | | |
| **NASSAU** | | | **6** | | | | |
| **OKALOOSA** | | | | **1** | **19** | | |
| **OKEECHOBEE** | | | | **4** | | | |
| **ORANGE** | | | **23** | **1** | | | |
| **OSCEOLA** | | | | **6** | | | **1*** |
| **PALM BEACH** | | | | **2** | | | |
| **PASCO** | | | **3** | **3** | | | |
| **PINELLAS** | | | **3** | | | | |
| **POLK** | | | | **4** | | | |
| **PUTNAM** | | | **7** | **2** | | | |
| **SANTA ROSA** | | | | **1** | **20** | | |
| **SARASOTA** | | | **3** | | | | |
| **SEMINOLE** | | | **1** | **3** | | | |
| **ST. JOHNS** | | | **3** | **1** | | | |
| **ST. LUCIE** | | | | | | | |
| **SUMTER** | | | | | | | |
| **SUWANNEE** | | | | | | | |
| **TAYLOR** | | | | | | | |
| **UNION** | | | | | | | |
| **VOLUSIA** | | | **16** | **2** | | **3** | |
| **WAKULLA** | **1** | | | | | | |
| **WALTON** | | | **62** | **1** | **10** | | |
| **WASHINGTON** | | | | **7** | | | |
| **TOTALS** | **4** | | **178** | **91** | **49** | **6** | **1** |

* Donkey

| Imported Dengue and Malaria Cases by County | | | | | |
|---|---|---|---|---|---|
| **COUNTIES** | **Dengue** | **Malaria** | **COUNTIES** | **Dengue** | **Malaria** |
| ALACHUA | 3 | 1 | MARTIN | | |
| BAKER | | | MIAMI/DADE | 53 | 34 |
| BAY | | | MONROE | 1 | |
| BRADFORD | | | NASSAU | | |
| BREVARD | 1 | 2 | OKALOOSA | | |
| BROWARD | 19 | 24 | OKEECHOBEE | | |
| CALHOUN | | | ORANGE | 8 | 17 |
| CHARLOTTE | | 1 | OSCEOLA | 6 | 3 |
| CITRUS | | 2 | PALM BEACH | 9 | 17 |
| CLAY | | | PASCO | 1 | 1 |
| COLLIER | 2 | 4 | PINELLAS | 1 | 2 |
| COLUMBIA | | | POLK | 2 | 2 |
| DESOTO | | | PUTNAM | | |
| DIXIE | | | SANTA ROSA | | |
| DUVAL | 3 | 5 | SARASOTA | 1 | 1 |
| ESCAMBIA | 1 | 3 | SEMINOLE | 3 | 3 |
| FLAGLER | 1 | | ST. JOHNS | | |
| FRANKLIN | | | ST. LUCIE | 3 | 1 |
| GADSDEN | | | SUMTER | | |
| GILCHRIST | | | SUWANNEE | | |
| GLADES | | | TAYLOR | | |
| GULF | | | UNION | | |
| HAMILTON | | | VOLUSIA | 3 | 2 |
| HARDEE | | | WAKULLA | | 1 |
| HENDRY | 1 | | WALTON | | |
| HERNANDO | | | WASHINGTON | | |
| HIGHLANDS | | | TOTALS | 134 | 136 |
| HILLSBOROUGH | 7 | 5 | | | |
| HOLMES | | | | | |
| INDIAN RIVER | | | | | |
| JACKSON | | | | | |
| JEFFERSON | | | | | |
| LAFAYETTE | | | | | |
| LAKE | 1 | 1 | | | |
| LEE | 1 | 1 | | | |
| LEON | | 1 | | | |
| LEVY | | | | | |
| LIBERTY | | | | | |
| MADISON | | | | | |
| MANATEE | 1 | 2 | | | |
| MARION | 2 | | | | |

This response plan was developed for the Florida Coordinating Council for Mosquito Control in order to provide additional guidance to mosquito control districts dealing with West Nile virus events. The Florida Mosquito Control Response Levels outlined here are intended to guide mosquito control districts on appropriate responses based on their professional evaluation of real time local mosquito surveillance data. When appropriate, mosquito control districts have an obligation to make necessary vector control responses to rapidly developing arboviral threats, even if the responses differ from existing Florida DOH guidelines. Public information should be coordinated between health departments and mosquito control districts. However, it is ultimately the responsibility of the CHD administrator or director to issue public health advisories and alerts.

## Appendix F

# Florida Mosquito Control
# Arbovirus Response Plan – West Nile

# Guidelines for Mosquito Control Responses

**Walter J. Tabachnick**
**Florida Medical Entomology Laboratory, University of Florida – IFAS**

# Table of Contents

# Florida Department of Health Mosquito Illness Response Plan

- **Level 1 - No activity**
  - Absence of detectable arbovirus transmission.

- **Level 2 - Background Activity**
  - Native viruses below historic levels, i.e., EEE, SLE, WNV.

- **Level 3 - Mosquito-borne Illness Advisory**
  - Surveillance indicates a rise in virus transmission activity.
  - 10% rise in sentinel chickens or corvidae mortality or mosquito infection rates or two or more confirmed horse cases.

- **Level 4 - Mosquito-borne Illness Alert**
  - A confirmed human case.
  - 50% increase in sentinel chicken seroconversions in county or single flock.
  - 50% increase in corvidae mortality above background.

- **Level 5 - Mosquito-borne Illness Threat**
  - Widespread distribution of large numbers of human cases.

# Florida Mosquito Control Arbovirus Response Plan – West Nile virus (FMCARP - WNV)

**PURPOSE/OVERVIEW**

The purpose of the following plan is to provide guidelines to assist Florida mosquito control organizations in providing appropriate mosquito control operational responses to West Nile virus (WNV). The guidelines are presented as a starting basis for mosquito control organizations to use to assess information on the risk for WN in their jurisdictions and apply mosquito control operations commensurate with risk of human disease.

These are recommended guidelines only, and are intended for the use of professional mosquito control organizations. Each mosquito control organization must use all available information and the best professional assessment in using the recommended guidelines. For example, the guidelines provide a framework to assess surveillance information. Depending on the time of year that the surveillance information is collected, local circumstances, and other information, the recommended surveillance levels used to make an assessment in the guidelines may have to be changed. This requires the best professional judgment of the local mosquito control organization.

## I. Introduction

Florida mosquito control organizations have the responsibility to mitigate the impact of mosquito borne disease on human health and well-being through the efficient, effective, and environmentally proper use of mosquito control methods. The objective of this document is to provide guidelines for mosquito control organizations to assist them in interpreting mosquito borne disease information that may be available to their local jurisdictions. These guidelines provide a framework for mosquito control agencies to use available arthropod borne pathogen and disease information to apply mosquito control efforts commensurate with the extent of arthropod borne disease and/or the risk of disease to their human clientele.

The Florida Mosquito Control Arbovirus Response Plan – West Nile virus (FMCARP-WNV) must take into account the great diversity in mosquito control organizations in Florida and the diversity of the issues each faces due to the variety of ecologies in different regions, and the variety of available resources for mosquito control in the state. The FMCARP-WNV attempts to integrate guidelines for mosquito control agencies in Florida with the companion Florida Department of Health Mosquito Illness Response Plan (Chapter 8). Florida mosquito control agencies require a FMCARP-WNV containing specific guidelines for mosquito control efforts commensurate with public health risks from mosquitoes. The Department of Health Illness Response Plan is not meant to provide such guidelines.

The FMCARP-WNV plan considers the following factors in interpreting the status of WNV transmission and disease prevalence that will impact any mosquito control program's assessment of how to respond:

A. Human Population Size

The absolute size of the human population in any jurisdiction is a critical factor in determining the problem for human health from an arthropod borne disease. It must be understood that even with precisely the same risk of mosquito borne human disease,

districts or counties with large numbers of humans will likely report a larger number of human cases compared to smaller counties. This is illustrated simply by using the incidence of disease per human population as the measure of disease in an area. For example, if Indian River County and Miami Dade County have the same disease incidence for West Nile (for example, the actual incidence is 10 cases per 100,000 people in each county), there is no difference in the transmission risk in the two counties. The chance of someone getting West Nile is the same in both counties. A Miami-Dade resident has the same likelihood of getting West Nile as in Indian River resident. However this means that there are 12.5 cases in Indian River (population size 120,000) but 230 cases will be reported in Miami Dade (population size 2,300,000). It is important to consider population difference when evaluating actual case numbers.

The above consideration of risk contingent on the numbers of the exposed human population is also relevant within jurisdictions. Surveillance information and/or disease information may be useful only for specific regions within larger jurisdictions such as counties or mosquito control districts. For example, the at risk human population in Miami during the late summer of 2004 was the ca. 60,000 people living in the Coconut-Coral Gables neighborhoods and not the entire 2.3 million people living in Dade County. Likewise, sentinel chicken surveillance information is relevant to the immediate local human population living close to the sentinel chicken flock and not to district or county wide populations.

The mosquito control guidelines recognize that the absolute number of human cases that occur in any area will be an important consideration in determining the need for increased mosquito control responses. It could be acceptable for any mosquito control program to respond aggressively to the appearance of 20 human cases during a surveillance week. However this does mean that a very populous district might expend greater resources at a lower level of risk then a less populous county.

The guidelines address this issue by using two different measures of the numbers of human West Nile cases in establishing response recommendations. Incidence of disease in the population is used which gives the equivalent risk to humans regardless of the population size of the at risk population. The absolute number of human cases is used but note that this number depends on the size of the at risk population and will result in more aggressive responses in some jurisdictions, likely those with large human populations, although there is no difference in actual risk compared to areas with small human population size.

B. Time of the Year

Information addressed in the guidelines must be viewed with consideration to the time of the year that the surveillance data are collected. Mosquito control organizations recognize that the same surveillance information collected early in the transmission season (May-August) may demand a more aggressive response then this same data collected later in the year (September-December).

C. Risk of Disease vs. Actual Occurrence of Disease

The FMCARP-WNV provides guidance for the “risk” for human disease when the numbers of human cases are not known, or have not yet occurred, but is projected on the basis of other information. In addition guidance is provided based on the actual “occurrence” of human cases. The other information used to determine “risk” may be any, some, or all of the following: surveillance information (mosquitoes, wild birds, sentinel

chickens, equines) in the local jurisdiction or in the absence of surveillance information, information obtained from a geographically adjacent county that has surveillance information. The risk of human cases is provided in terms of incidence and the absolute number of cases in order to provide large and small jurisdictions the option of reacting where and when the data indicate that a response is necessary. Once human cases are reported, mosquito control responses are provided commensurate with these numbers using both incidence and the absolute numbers of human cases.

**Note:** A DOH Medical Alert is triggered by the appearance of a single human case regardless of other surveillance indicators. The FMCARP-WNV provides guidance for various situations with the occurrence of more than 1 human case. Since the appearance of a single human case establishes a Medical Alert by itself, the FMCARP-WNV provides guidance for the appearance (actual occurrence) of more then the single human case, also taking account for the appearance of cases during different time intervals. The Mosquito Alert B and Mosquito Emergency levels are the two levels that pertain to more than a single human case.

D. Reporting Interval

The FMCARP-WNV provides guidance to account for specific reporting periods. For example, surveillance information is only appropriate for the specific time period in which the information is collected. It is important for agencies to recognize that a 20% rise in surveillance positives totaled over the course of the entire year could be the result of substantial activity reported during a short time period. In this case mosquito control responses should be focused in the actual periods of transmission risk. The surveillance information used in the FMCARP-WNV is based on the shortest surveillance time period, which is usually a one week reporting period. Therefore all surveillance indicators in the FMCARP-WNV plan are based on a one week surveillance data reporting period. A 30% annual seropositive rate in sentinel chickens provides little information concerning the temporal changes in risk to the human population that occurred during the year. However, a 30% increase in the number of WNV-positive sentinel chickens reported in a one week surveillance period may indicate a significant increase in the local transmission rate of WNV.

E. Surveillance Information

There is a wide diversity in the abundance and quality of arboviral surveillance data collected in jurisdictions throughout Florida. A variety of information may be available that can be used to assess WNV transmission risk in different Florida localities. Some localities have well developed surveillance information that can be used prior to and during the occurrence of human West Nile cases to assess risk and apply appropriate mosquito and disease control strategies. Each of the different surveillance tools provide different information which needs to be assessed and evaluated by knowledgeable mosquito control and mosquito borne disease epidemiologists.

The most precise surveillance tools are those that provide direct associations with actual mosquito transmission frequencies. Dead bird reports and the percent of WN positive wild birds are dependent on collection effort and the original infection site for these wild birds is usually unknown. Therefore, this type of information is less useful then mosquito infection rates and sentinel chicken surveillance data where the location of infection is more clearly defined.

No matter what surveillance technique is used, the utility of the resulting surveillance data is critically dependent on the timeliness of the data collection and the summary reports.

Surveillance information must be provided in the most efficient, effective, and quickest means possible. It is critical that mosquito control and public health agencies have information on WN positive samples within days of their submission for testing. Information that is based on infections that occurred 2-3 or more weeks prior to final positive diagnostic test may be too late for appropriate intervening actions on the part of the responsible agencies. Surveillance data must be collected in a way that minimizes the time between actual infection and the issuing of a positive report. Any significant gaps between infection and reporting severely compromise the effectiveness of an arboviral surveillance program.

The FMCARP-WNV assumes timely and accurate reporting of surveillance information to make full use of the information for risk assessment. Delays in reporting of diagnostic results will serve to increase confusion on the risks due to WNV transmission in a location.

F. Surveillance Information, Human Population Size, and Estimating Risk

It is possible to obtain crude estimates of the risk of human West Nile cases by using sentinel chicken seroconversion rates to estimate the frequency of mosquito transmission of WNV in a specific area. Weekly sentinel chicken seroconversion rates can be used to gauge the magnitude of overall risk. Of course, any estimates of risk are likely to be more accurate if the risk estimate is confined to the smallest local human population that is near the sentinel chicken flocks. Also information about mosquito abundance and mosquito age structure will greatly improve these estimates. Finally information about the mosquito attack rates on humans will also improve the estimate.

Despite having to use estimates of some parameters, the sentinel chicken information can be used to assess the magnitude of WNV transmission risk. By using a variety of estimates for mosquito biting intensities the magnitude of the risk can be discerned.

Attached is a simple spread sheet using Pinellas County sentinel chicken information to gauge the risk of human WN infection based on sentinel chicken seroconversion rates and the size of the human population at risk.

The attached spreadsheet can be used by any mosquito control jurisdiction and is available for use through request to the Florida Medical Entomology Laboratory, University of Florida IFAS.

## II. Issues Considered in developing the Florida Mosquito Control Arbovirus Response Plan – West Nile virus

a. Integration with Florida DOH Mosquito Illness Plan.
b. Appropriate control responses commensurate with human risk of disease.
c. Dynamic and flexible responses appropriate for variations in the human population size and WNV transmission risk for specific counties.
d. Consideration for public and media perception of the observed "absolute numbers" of human cases and perception of the appropriate vector control efforts commensurate with the absolute number.
e. Assume that, where available, surveillance data will precede human cases.
f. Incorporate regional surveillance data to allow for risk assessment in regions with little or no arboviral sentinel surveillance.
g. Conservative use of surveillance data in the absence of human cases. The conservative use of surveillance data in the absence of human cases allows mosquito control to conserve resources when WNV transmission is reported, but human risk is at a minimum due to seasonal and environmental factors.
h. Conservative use of mosquito control resources in the absence of indicators of human transmission risk.
i. An emphasis on the early impact of mosquito control efforts at the Mosquito Advisory level to minimize human cases.
j. Integration with public policy at Mosquito Emergency level.

## III. Mosquito Control Arbovirus Response Levels

- **Level 1 - No activity.**

- **Level 2 – Background.** Many regions of Florida are likely to be at level 2 for much of the year. Occasional sentinel chicken seroconversions are frequently reported and these sporadic seroconversion rates do not indicate an elevated human WNV transmission risk.

- **Level 3 – Mosquito Advisory.** Elevated detection in surveillance during any weekly testing period. Any of the following might trigger an advisory:
  - √ 10% above historical background percent levels for sentinel chickens, i.e. if sentinel background is 15%, 25% would be an advisory.
  - √ 20% above WN positives of total birds or three-fold increase in dead birds above previous years for the same period. Example; previous year level was 2% WN positive birds tested, 20% would be an advisory; previous year 50 dead birds reported then 150 dead bird reports would be medical advisory.
  - √ 50% of any individual sentinel flock.
  - √ Mosquito transmission levels of ca.1/10,000.
  - √ Risk of more then 10 human cases based on human population size and mosquito transmission frequency estimates.
  - √ Risk of 10-50/100,000 humans during any week or reporting period based on mosquito transmission frequency estimates.
  - √ Status of adjoining counties and region if no local surveillance information is available. If surveillance information in adjoining county(s) is appropriate for issuing an advisory, an advisory should be considered in the absence of surveillance information indicated no risk.

- **Level 4 – Mosquito Alert.**
  - **Mosquito Alert A – single human case**
  - **Mosquito Alert B –** Elevated detection in sentinels. Any of the following might trigger level 4.
    - √ 20% above historical background percent levels for sentinel chickens, i.e. if sentinel background is 15%, 35% would be "Mosquito Alert B."
    - √ 30% increase of WN positives percent of total birds compared to previous year(s) for the same period, example 10% seroconversions in previous years are considered background for reporting period, then 40% seropositive birds would be a medical danger..
    - √ 75% of any individual sentinel chicken flock.
    - √ Mosquito transmission levels ca. 1/1,000.

- √ Risk of 50-100/100,000 humans based on estimates of mosquito transmission frequency.
- √ Risk of 50+ human cases based on the total at risk human population size and the mosquito transmission frequency.
- √ The occurrence of 3 or more human cases with disease onset showing infection during the same 1-2 week period.
- √ Status of adjoining counties and region if no local surveillance information is available. If surveillance information in adjoining county(s) is appropriate for issuing an alert, an alert should be considered in the absence of surveillance information indicating no risk.

- **Level 5 - Mosquito Emergency.** Elevated detection in sentinels. Any of the following might trigger a medical threat or emergency.
  - √ 50% above historical background percent levels for sentinel chickens for the same reporting period, i.e. if sentinel background is 15%, 65% would be an emergency/threat.
  - i. 75% increase in WN positive of total birds compared to previous years for the same period.
  - ii. 100% of the individuals in two or more individual sentinel chicken flocks.
  - iii. Mosquito transmission frequency greater then 1/1,000.
  - iv. Risk of 100/100,000 humans based on estimates of the mosquito transmission frequency.
  - v. Risk of 200+ human cases based on the human population size at risk and estimates of the mosquito transmission frequency.
  - vi. Occurrence of 20 human cases during any week or reporting period showing that the date of onset or infection occurred during the same 1-2 week period.
  - vii. Status of adjoining counties and region if no local surveillance information is available. If surveillance information in adjoining county(s) is appropriate for issuing an emergency/threat, an emergency/threat should be issued in the absence of surveillance information indicated no risk.

## IV. Mosquito Control Responses at Response Plan Levels

### 1. Level 1

- Mosquito operations targeting nuisance and/or disease carrying mosquitoes.
- Surveillance – sentinel chickens, mosquitoes, birds.

### 2. Level 2

a. Continued Surveillance.
b. Mosquito control operations targeting nuisance and/or disease carrying mosquitoes.
c. Monitoring potential hot spots using surveillance tools.

d. Coordinate communication with county health department regarding real time surveillance results.

e. Coordinated Public Announcements with the county health department – personal protection.

- **Level 3 –Mosquito Advisory**
  - Mosquito control targeting high risk vector mosquito populations and areas commensurate with arbovirus indicators for risk by performing repetitive nightly spraying operations in high risk areas until vector is suppressed to background levels.
  - Consideration for increased surveillance using sentinels in high risk areas with attention to measuring mosquito transmission frequencies using chicken baited mosquito traps.
  - Preventive ULV and aerial post-epic rainfall brood reduction, and control of nuisance mosquitoes as a lower priority.
  - Coordinate communication with county health department regarding real time surveillance results.
  - Coordinated Public Announcements with the county health department – avoid mosquitoes and use personal protection.

- **Level 4 –Mosquito Alert**
  - **Mosquito Alert A** – as Level 3.
  - **Mosquito Alert B**
    - Focus mosquito control efforts to high risk mosquito populations and areas commensurate with arbovirus indicators for risk, adulticiding hot spots
    - Consideration for aerial adulticiding if not already in place with focus in high risk areas where wide area control measures are required to respond to the increased level of risk in a timely manner.
    - Increased surveillance to obtain estimates of mosquito transmission frequency in targeted areas.
    - Coordinate communication with county health department regarding real time surveillance results.
    - Coordinated Public Announcements with the county health department – avoid mosquitoes and use personal protection.

**V. Level 5 – Mosquito Emergency**

- Public Announcements – personal protection
- Mosquito control remains in close contact with local County Health Departments and other responsible government agencies providing them timely information about the increased public health risk for mosquito-borne diseases and advising them about potential strategies for increased disease prevention efforts (such as canceling outdoor events/activities, closing parks to overnight campers, etc.).
- Aggressive aerial, truck adulticiding, consideration for control on protected lands with approval from DACS, DEP, Fish and Wildlife, private owners etc. as needed, based on justified wide spread danger to public health.
- Regional inter-County/District and DACS support as indicated for Counties in Emergency status.

- Increased surveillance to obtain estimates of mosquito transmission frequency in targeted areas.
- Coordinate communication with county health department regarding real time surveillance results.
- Request for state (DACS) and federal emergency (FEMA) support for mosquito control operations
- Coordinated Public Announcements with the county health department – avoid mosquitoes and use personal protection.

**V. Examples.**

The following examples are based on historical West Nile information from selected Florida counties. It is meant to illustrate how the proposed guidelines might have been used in specific realistic situations.

I. Lee County 2003

A. Background – In 2003 Lee County (pop. ca. 450,000) had 3 human West Nile cases reported on July 28 (incidence 1 case/150,000). The following represents the dates of reports from the Lee County sentinel chicken surveillance system (18 flocks X 6 birds ea. = 108 birds) indicating the number of positive birds and the date of report:

| | |
|---|---|
| 1/7 - 1 | 7/29 - 9 |
| 1/9 - 4 | 8/4 - 12 |
| 1/21 - 1 | 8/10 - 9 |
| 2/12 - 1 | 8/18 - 6 |
| 4/8 - 1 | 8/25-26 - 12 |
| 4/29 - 1 | 9/8-9 – 16 |
| 6/17 - 1 | 9/16 - 3 |
| 7/8 - 3 | 9/23 - 7 |
| 7/14 - 4 | |
| 7/21 - 4 | |

B. Temporal use of the Guidelines per Lee County Information

1. January – June 2003.
   a. Lee County surveillance showed some West Nile transmission activity at a low level, likely background (ca. 1%-4% of total sentinel population). Level 2, although concern that the numbers of mosquitoes per chicken is likely lower then later in the year. Activity at this time cause for concern for later in the season.

2. July 2003
   a. West Nile transmission activity increased from 1-4% per week to 4-8%. Estimated incidence of cases based on ca. 1000 mosquitoes biting each sentinel bird is Level 2.
   b. First Human Cases onset 7/15. This is Level 3 a Mosquito Alert A.

3. August 2003 - 2 additional human cases (date of onset: 8/22 and 8/29) Mosquito Alert A.
   a. West Nile activity similar to July levels, 6 -15% weekly sentinel seroconversions. Predicted disease incidence based on 1,000 mosquitoes biting each sentinel per week on average gives

mosquito transmission of ca. 1/6750 with 15% highest sentinel seroconversion.

b. Predicted no. of human cases with avg. max. 1-10 bites per person throughout Lee County for 10 bites per person (450,000 X 10 X 0.00015 = 675 infections) with 4.5 – 135 cases depending on whether infected: cases are 1:150 or 1:5. At 1 bite per person during a week (450,000 X 1 X 0.00015 = 67.5 infections) with 0 – 13.5 cases depending on whether infected: cases are 1:150 or 1:5.
c. Still mosquito alert based on surveillance
d. Mosquito alert A based on 2 human cases reported in 1 week.

4. September 2003.
   a. No change from August.

5. October 2003
   i. Consider reducing to mosquito advisory based on surveillance and absence of human cases in September.

II. Miami Dade 2004

A. Background - In 2004 Miami-Dade had a total of 20 WN human cases (incidence 1 case/115,000). The following represents the dates of reports from Miami-Dade surveillance through the Florida Dept. of Health including human cases, dead bird reports, WN positives in dead birds, the Miami-Dade County sentinel chicken surveillance system (initiated in late July with 5 flocks of 5 birds = 25 birds, changed to 5 flocks of 6 birds each = 30 birds in August). Surveillance information by week with number of individuals:

Human Cases (date of onset)

| | |
|---|---|
| Jun 16 | 1 |
| Jun 27 | 1 |
| Jun 30 | 1 |
| Jul 3 | 1 |
| Jul 5 | 1 |
| Jul 7 | 1 |
| Jul 8 | 1 |
| Jul 12 | 1 |
| Jul 20 | 1 |
| Jul 29 | 1 |
| Aug | 3 |
| Aug 7 | 1 |

Dead Bird Reports

| | | | |
|---|---|---|---|
| May 29 | 2 | Aug 14 | 4 |
| June 12 | 12 | Aug 21 | 3 |
| June 19 | 23 | Sept 4 | 2 |
| July 3 | 43 | Sept 11 | 3 |
| July 10 | 66 | Sept 25 | 0 |
| July 24 | 81 | Oct | 0 |
| July 31 | 15 | | |

Wild Bird positives for WN

| | |
|---|---|
| Jan 14 | 1 |
| Jun 19 | 1 |
| Jul 10 | 2 |
| Jul 16 | 1 |
| Jul 19 | 6 |
| Jul 21 | 4 |
| Jul 22 | 1 |
| Aug 2 | 1 |
| Aug 4 | 2 |
| Aug 5 | 3 |
| Aug 9 | 1 |

Sentinel Chickens

| | |
|---|---|
| Jul 26 | 1 |
| Aug 2 | 1 |
| Aug 9 | 1 |
| Aug 13 | 2 |
| Aug 24 | 2 |
| Sep 13 | 1 |
| Sep 28 | 1 |

B. Temporal use of the Guidelines per Miami Dade County Information on a county wide level (note consideration should be made using surveillance and population size focused in the Coral Gables/Coconut Grove area as well)
    1. January – June 2004.
        a. Miami Dade County surveillance in WN positive dead birds showed some West Nile transmission activity at a low level, likely background (ca. 1%-4% of total sentinel population). Level 2.

    2. June 1 –Jul 3, 2004
        a. 78 dead birds were reported. 1 WN positive of ?? (data unavailable at this time) tested. In the same period in 2003, Miami Dade had 28 dead birds tested for WNV (4 were positive).
        b. Three human cases, 2 with onset in the same week. Note reporting did not have both cases in a timely fashion – but this would have triggered a medical alert if this information had been known.

    3. July 5 -12
        a. Several human cases within a 1-2 week period. This is Level 4, a Mosquito Alert B.

    4. July 5-30
        a. Continued human cases at level 4 Mosquito Alert B.
        b. 14 WN positive birds of ?? (data unavailable at this time) tested.
        c. 1 Sentinel chicken positive
        d. Human cases are maintaining the medical alert
        e. A total of 47 birds were tested for WN in this period in 2003 of which 4 were positive (8.5%).

f. Note without human cases dead bird positives would be a mosquito advisory based on three-fold increase from previous year

5. August 2004
   a. Additional human cases (date of onset: 8/4 and 8/29x2) Mosquito Alert B.
   b. 7 dead bird reports; in Aug. 2003, 81 dead birds tested for WN (3 positives).
   c. 6 sentinel chicken positives (max of 2 per reporting week) Predicted disease incidence based on 1,000 mosquitoes biting each sentinel per week on average gives mosquito transmission of ca. 1/15000 with 7% highest sentinel seroconversion.
   d. Predicted no. of human cases with avg. max. 1-10 bites per person throughout Miami-Dade County for 10 bites per person (2,300,000 X 10 X 0.00007 = 1610 infections) with 11 – 322 cases depending on whether infected: cases are 1:150 or 1:5. At 1 bite per person during a week (2,300,000 X 1 X 0.00007 = 161infections) with 1 – 32 cases depending on whether infected: cases are 1:150 or 1:5.
   e. Mosquito advisory or alert based on surveillance from chickens.
   f. Mosquito advisory based on WN positives in wild birds (7) of ?? (data unavailable at this time) compared to 3 of 81 (4%) tested in 2003 for same period
   g. Mosquito Alert B based on 3 more human cases with onset reported in 1-2 week.

6. September 2004.
   a. No change from August.
   b. Dead bird reports, WN positive wild birds suggest reduction in transmission.

5. October 2004
   ii. Consider reducing to mosquito advisory based on surveillance and absence of human cases in September.

**VI. Spreadsheet to Estimate Human Risk – Pinellas County as an example**

| Pop.Size | # Sent Chick. | Est. bites/ chicken/week | Total # bites | # serocon. | Transmission Freq. | Avg # bites / person | Expect # WN Fever Cases | Expected # WN Enceph. |
|---|---|---|---|---|---|---|---|---|
| 926716 | 56 | 1000 | 56000 | 3 | 0.00005 | 10 | 99.291 | 4.96455 |
| 926716 | 56 | 1000 | 56000 | 3 | 0.00005 | 1 | 9.9291 | 0.496455 |
| 926716 | 56 | 1000 | 56000 | 10 | 0.00018 | 10 | 330.97 | 16.5485 |
| 926716 | 56 | 1000 | 56000 | 10 | 0.00018 | 1 | 33.097 | 1.65485 |
| 926716 | 56 | 1000 | 56000 | 25 | 0.00045 | 10 | 827.425 | 41.37125 |
| 926716 | 56 | 1000 | 56000 | 25 | 0.00045 | 1 | 82.7425 | 4.137125 |
| 926716 | 56 | 1000 | 56000 | 42 | 0.00075 | 10 | 1390.074 | 69.5037 |
| 926716 | 56 | 1000 | 56000 | 42 | 0.00075 | 1 | 139.0074 | 6.95037 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 926716 | 56 | 500 | 28000 | 3 | 0.00011 | 10 | 198.582 | 9.9291 |
| 926716 | 56 | 500 | 28000 | 3 | 0.00011 | 1 | 19.8582 | 0.99291 |
| 926716 | 56 | 500 | 28000 | 10 | 0.00036 | 10 | 661.94 | 33.097 |
| 926716 | 56 | 500 | 28000 | 10 | 0.00036 | 1 | 66.194 | 3.3097 |
| 926716 | 56 | 500 | 28000 | 25 | 0.00089 | 10 | 1654.85 | 82.7425 |
| 926716 | 56 | 500 | 28000 | 25 | 0.00089 | 1 | 165.485 | 8.27425 |
| 926716 | 56 | 500 | 28000 | 42 | 0.00150 | 10 | 2780.148 | 139.0074 |
| 926716 | 56 | 500 | 28000 | 42 | 0.00150 | 1 | 278.0148 | 13.90074 |

## VIII. Acknowledgements

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