



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

**2000**



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

## Purpose

This publication establishes guidelines for detecting and monitoring SLE and other 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. Lisa Conti, Bureau of Epidemiology, 4052 Blad Cypress Way, Bin A-12, Tallahassee, Florida 32399-1720, (850) 245-4401, FAX (850) 922-9299.

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# Chapter 1

## General Information -- Selected Arthropod-borne Diseases

### I. Arboviruses

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). Arboviruses that cause human encephalitis are members of three 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 encephalitides have a global distribution. Arboviral agents of encephalitis in the United States include: St. Louis encephalitis (SLE) virus, eastern equine encephalitis (EEE) virus, western equine encephalitis (WEE) virus, Venezuelan equine encephalitis (VEE) virus, Everglades virus (EVE), California encephalitis (CE) virus and LaCrosse (LAC) encephalitis virus, all of which are transmitted by mosquitoes. During 1999, a novel virus to the United States, West Nile virus, was identified in people and animals in northeastern states. Another virus, Powassan, is a minor cause of encephalitis in the northern United States, and is transmitted by ticks. 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. The majority of 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 encephalitis diagnosis include: a four-fold or greater change in serum antibody titer between acute and convalescent samples; virus isolation or viral antigen identified in tissue, blood or cerebrospinal fluid (CSF); or specific immunoglobulin M (IgM) in blood or CSF identified by enzyme immunoassay (EIA) antibody confirmed by demonstration of IgG via another serologic assay (e.g., hemagglutination-inhibition (HI) or neutralization test).

Because the arboviral encephalitides are viral diseases, antibiotics are not effective for treatment and the role of antiviral agents has not been shown. Treatment is supportive, attempting to deal with problems such as swelling of the brain, loss of automatic breathing activity and other treatable complications like bacterial pneumonia. There are no commercially

available human vaccines for these U.S. diseases. A vaccine is available for horses and ruminants against EEE, WEE and Venezuelan equine encephalitis (VEE).

Arboviral encephalitis can be prevented through personal and community protective measures. Personal protective measures include reducing time outdoors particularly in early evening hours, wearing long pants and long-sleeved shirts, applying mosquito repellent to exposed skin areas 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., dumping water collected in flowerpots, wading pools and buckets and removing/destroying discarded tires) and may include the use of insecticides (larvicides and adulticides) to kill mosquitoes.

Several local, state and federal agencies are involved with the surveillance and control of arboviral diseases. Mosquito-borne encephalitis surveillance activities include evaluating mosquito populations, sentinel chickens, wild birds, and other animal cases to detect the risk of disease before it occurs in people and to intervene to reduce that risk substantially. 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 detect risk is being increasingly refined by the potential utilization of new technologies which allow for rapid identification of dangerous viruses in mosquito populations. Virus isolation and identification are useful in defining viral agents in mosquito vectors. While virus isolation still depends upon growth of virus in cell culture or neonatal mice, virus identification has been greatly facilitated by the availability of virus-specific monoclonal antibodies (MAbs) for use in IFA and ELISA assays. Similarly, MAbs with avidities sufficiently high to allow for specific binding to virus antigens in a complex protein mixture (e.g., mosquito pool suspensions) have enhanced the ability to rapidly identify virus agents *in situ*. While polymerase chain reaction (PCR) has been developed to identify a number of viral agents, such tests have not yet been validated for routine rapid identification.

#### **A. St. Louis Encephalitis (SLE)**

SLE virus, a flavivirus, is the most common mosquito-transmitted human pathogen in the U.S. During the summer season, SLE virus 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 central and south Florida.

Infection with SLE 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 SLE infection includes inapparent infection, mild illness (fever with headache), aseptic meningitis, and encephalitis that can progress to coma and death. Less than 1% of SLE viral 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 in the elderly. The case fatality rate in Florida SLE epidemics has ranged from 4 to 30 percent. Deaths were almost exclusively among people age 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 expected.

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 have been maintained in several Florida counties.

## **B. Eastern Equine Encephalitis (EEE)**

EEE virus is an [alphavirus](#) that was first identified in the 1930's and currently occurs in focal locations of the United States. EEE virus occurs in natural cycles involving birds and *Culiseta melanura* in freshwater swampy areas with a peak of activity between May and August. Where the virus resides or how it survives in the winter is unknown. Migratory birds may introduce it in the spring, or it may remain dormant in some yet undiscovered part of its life cycle. With the onset of spring, the virus reappears in the birds (native bird species do not seem to be affected by the virus) and mosquitoes of the swamp. In this usual cycle of transmission, virus does not escape from these 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 enzootic foci in swamp areas in birds or bridge vectors such as *Aedes sollicitans*, *Coquillettidia perturbans*, *Aedes atlanticus*, *Culex nigripalpus*, *Cx. perturbans*, *Cx. quinquefasciatus* and *Ae. vexans*. These species feed on both birds and mammals and can transmit the virus and cause disease in people, horses, puppies and some birds such as pheasants, quail, ostriches and emus. While small outbreaks of human disease have occurred in the United States, equine epizootics can be a common occurrence in unvaccinated populations because horses are outdoors and 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.

It takes from 4-10 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 EEE will die from the disease and, of those who recover, many will suffer permanent brain damage requiring long-term medical care.

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. Continuous surveillance for the past forty years (1957-97) has documented only 62 sporadic cases in people (average 1.6 cases per year; range 0-5). Additionally, avian serosurveillance does not appear to be as useful as for predicting SLE cases in people. Still, health officials can maintain surveillance for EEE virus activity with the aid of mosquito control officials. If the level of activity is sufficiently high, mosquito control and personal protection are recommended to reduce the risk to humans.

Whereas *Cs. melanura* is distributed statewide, human (and equine) cases have predominantly been in areas north of Lake Okeechobee. In particular, 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.

### **C. West Nile Virus (WNV)**

WNV is a flavivirus that is serologically closely related SLE. WNV can infect a wide range of vertebrates. In humans, it usually produces either asymptomatic infection or mild febrile disease. Within its normal geographic distribution of Africa, the Middle East, western Asia, and Europe, WNV has not been documented to cause epizootics in birds; crows with antibodies to WNV are common, suggesting that asymptomatic or mild infection usually occurs among crows in those regions. As with SLE and EEE, the basic transmission cycle of WNV involves mosquitoes feeding on infected birds. Like SLE virus, WNV is transmitted principally by *Culex* species mosquitoes, but also can be transmitted by *Aedes*, *Anopheles*, and other species.

The WNV outbreak in the northeastern U.S. in the summer and fall of 1999 represented the first known incursion of this exotic arbovirus into the U.S. As of December 9, 1999, 59 confirmed or probable human cases of WNV infection had been identified, including seven deaths. During this outbreak investigation, 23 bird species were found to be seropositive for exposure to WNV, generally with high seropositivity rates (and deaths) among crows. In addition, several horses and a cat with clinical disease were found to be infected with WNV. An epizootic producing high mortality in crows and other bird species is unusual for either WNV or SLE virus and may represent introduction to a native bird population. This virus outbreak occurred during the peak southerly bird migration, and the effect this migration had on the spread of the virus beyond the outbreak epicenter is unknown.

Because SLE and WNV are antigenically related, cross-reactions are observed with some serologic tests. During 1999, Florida submitted SLE-positive sera from humans and animals to CDC for further WNV testing. All three human sera, 18 sentinel chicken sera and one horse serum were negative for WNV. In addition, 18 wild bird carcasses tested negative for WNV. Surveillance activities in place for SLE and EEE will help determine if WNV enters Florida.

### **D. Other Arboviral Encephalitides**

Other arboviral encephalitides of minor public health significance that occur in Florida are WEE, EVE and Keystone in the California group of arboviruses. To date no reported human cases of WEE have been acquired in Florida. While serologic evidence of EVE infection has been documented in south Florida, only three clinical cases have ever been identified, two near Homestead and Florida City in Dade County (1968 and 1971) and one near Vero Beach (1968). The only recorded human case of Keystone virus occurred in a young child from Sarasota in 1964.

## II. Lyme Disease

Lyme disease (LD) is caused by a spirochete bacterium known as *Borrelia burgdorferi*. The disease derives its name from Lyme, Connecticut, where cases of unusual juvenile arthritis were first studied in the early 1970s, and the agent later identified as being transmitted through infected ticks. The black-legged tick, *Ixodes scapularis*, is the suspected vector in the southeast, although *Amblyomma* ticks may also be important. Ticks acquire the spirochete by feeding on wild mice and other rodents that serve as the primary reservoir of infection. The spirochete thrives and multiplies within certain species of ticks and during subsequent feeding is transmitted to other hosts. The presence of larger animals, such as deer, is known to be important in maintaining large tick populations in an endemic area.

If bitten by an infected tick (often nymphal stages), most people will experience a red, “bull’s eye” rash (erythema migrans or EM) three to 30 days later. The rash does not always occur at the site of the bite, but may appear at the armpit, groin or back of the knee. Other symptoms of LD include fatigue, neck stiffness, muscle aches and flu-like symptoms such as headaches, chills, fever or dizziness. Later stage symptoms may not appear until weeks, months, or years after the tick bite and can include neurologic, musculoskeletal and cardiac problems. Unless treated with antibiotics within the first few months of infection, LD can become a highly debilitating, but rarely fatal illness capable of producing symptoms in both humans and domestic animals (i.e., dogs, cats, horses and cattle).

Serologic tests available for LD diagnostics include IFA, EIA, and immunoblotting. Poorly standardized tests must be interpreted cautiously. False-positive reactions may result from cross-reacting IFA and EIA antibodies in patients with syphilis, leptospirosis, Rocky Mountain spotted fever, infectious mononucleosis, lupus or rheumatoid arthritis. For early diagnosis, EIA for IgM using a recombinant surface protein (rOspC) may be more sensitive than whole-cell EIA or immunoblot assay. Skin biopsies of the EM lesion may yield *Borrelia* organisms.

LD occurs throughout the continental US with highest incidence in foci in the northeastern, northcentral, mid-Atlantic and northern Pacific regions. LD case reporting has risen substantially over the last decade, at least in part, because of greater awareness of the illness. Some are concerned about overdiagnosis of LD and the resulting, inappropriate treatment.

LD occurs only sporadically in the southern states. In Florida, most people with LD acquired their infection in the northeast. In the five-year period 1994-1998, an annual average of 17 cases without a travel history outside of the state have been reported to the State Health Office. Physicians are reminded that diagnosis of Lyme disease is required to be reported.

## III. Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever (RSMF) was first recorded in 1896 when human cases were described in Idaho. Unlike its name implies, RMSF, is now rarely reported from the Rocky Mountain regions. Synonyms for the disease include tick-borne typhus or tick typhus.

Disease is caused by infection with the intracellular coccobacillary bacteria, *Rickettsia rickettsii*, following tick exposure. Ninety percent of the thousand rickettsial disease cases that occur annually in the United States are RMSF. The principal tick vectors in Florida are

probably the dog tick (*Dermacentor variabilis*) and the Lone Star tick (*Amblyomma americanum*). A tick bite may or may not be apparent and malaise, muscle pain, headache and chills are not uncommon. In most cases a mild febrile illness develops after an incubation period of a few days to 2 weeks. About one-half of the cases also develop a maculo-papular rash that appears first on the extremities and spreads to the trunk.

In the early 1970's an increase in cases of reported RMSF in Florida paralleled national trends. Prior to that time, this disease was diagnosed infrequently in the state with only 25 confirmed cases reported in the 31 year period between 1942 and 1972. Documentation of the travel history on these cases indicated that only two may have been acquired in Florida. Between 1973 and 1976 the HRS Division of Health investigated 15 confirmed cases and found that 12 (80%) had no travel history outside of the state. In 1985, Sacks and Janowski reviewed the histories of 49 confirmed RMSF cases reported in Florida between 1973 and 1983. Analysis of the 25 cases believed to have been acquired in the state showed that RMSF infections tended to occur during the warmer months, March through November, with a peak in August. Cases ranged in age from 2 to 72 years; the median age was 24 years. Males accounted for 68% and whites 88% and exposure was linked to 21 different counties. Sixteen of the cases (64%) had a known tick bite or attachment, three (12%) had been deticking an animal and six (24%) had no known tick exposure. However, those in the latter group had a history of contact with dogs or outdoor activities.

Between 1983 and 1998, 24 cases of RMSF were reported in Florida. Historically, more cases have occurred in northern counties. Still, it appears that there is a potential risk for RMSF wherever people are exposed to ticks.

#### **IV. Human Ehrlichiosis**

Bacteria in the genus *Ehrlichia* cause two recently recognized and potentially fatal diseases. *E. chaffeensis*, discovered in 1990, causes human monocytic ehrlichiosis (HME). A species of *Ehrlichia* closely related to *E. phagocytophilia* and *E. equi* causes human granulocytic ehrlichiosis (HGE). Nonspecific clinical findings make these diseases difficult to diagnose. They may account for many cases of unexplained tick-associated fevers of unknown origin -- for example, some illnesses misdiagnosed as Lyme disease.

HME has been identified in over 360 patients in the United States, Europe, and Africa. Most cases in the U.S. occur in adults from rural areas of southern states between April and September. The most likely tick vector is *Amblyomma americanum*. The spectrum of illness ranges from asymptomatic to fatal. Most cases have a nonspecific febrile illness without rash, with over 60% hospitalized. About 15% have severe infections, including renal failure, disseminated intravascular coagulopathy, seizures, and coma, and 2 to 5% die. Laboratory findings often include leukopenia, thrombocytopenia, and elevated serum hepatic enzymes. Early diagnosis is rare because morulae of *E. chaffeensis* are seldom found in peripheral blood, seroconversion does not occur until convalescence and in vitro cultivation has been accomplished only twice. HME is easily treated with doxycycline; delayed therapy increases the risk of severe disease and *E. chaffeensis* is not susceptible to chloramphenicol in vitro.

Since 1990, at least 43 patients in Wisconsin, Connecticut, New York, Maryland, Florida and Arkansas have been infected with an as yet unnamed *Ehrlichia* species that causes HGE. Infected *Ixodes scapularis* have been found in regions where this disease occurs. HGE is clinically similar to HME, and usually presents as an undifferentiated fever

without rash. Leukopenia, thrombocytopenia and mildly elevated liver function tests are frequent. Elderly patients are more likely to have severe disease. Half of the diagnosed patients have been hospitalized, with 9% admitted to intensive care and approximately 5% dying. Cultivation of the causative agent has not yet been achieved, and seroconversion does not occur until convalescence. Serologic tests for HME do not cross-react with tests for HGE, although peripheral blood smears reveal intraneutrophilic morulae in many patients. Therapy with doxycycline results in defervescence within 48 hours. Also, recent reports indicate that Lyme disease patients with prolonged illness that is unresponsive to antibiotics, especially amoxicillin, may have concurrent infections with *Ehrlichia sp.* Florida added ehrlichiosis to its list of notifiable diseases in 1996.

In Florida, 17 cases of ehrlichiosis have been reported between 1996-1998, of which 15 do not have a travel history outside of the state. Most Florida-acquired cases reported exposure in northeastern or panhandle counties.

## Chapter 2

# Arthropod-borne Disease Control Coordination

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.

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

*Contact: local county health departments*

- Conduct epidemiologic investigation to search for new, undetected cases and classify cases as to time (chronological distribution of cases), place (geographic distribution of residence and place of likely exposure) and person (demographics of cases).
- Facilitate submission of diagnostic specimens from physicians and hospitals as required.
- Collect reports of suspected, probable, and confirmed human cases of SLE, EEE, LD, RMSF and ehrlichia. Confirmed and probable cases are reportable under Chapter 381, Florida Statutes.
- Participate in appropriate sentinel avian serosurveillance activities.
- Communicate 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 Bureau of Epidemiology and with mosquito control to issue health alerts to the media or to the public.
- Submit weekly reports of reportable diseases to the Bureau of Epidemiology.

### **II. DOH Bureau of Laboratory Services Activities**

*Contact: Tampa Branch Laboratory, (813) 871-7465; Jacksonville Laboratory, (904) 791-1526.*

- Conduct appropriate tests for detection of arthropod-borne diseases in human samples and avian surveillance samples.
- Report by telephone the results of all probable and confirmed human serologic or virologic tests to the CHD, the Bureau of Epidemiology, and to the attending physician. Follow-up written reports are submitted as soon as possible.
- Prepare weekly summary reports indicating the number of sentinel sera submitted, number tested, and number positive by county.

### **III. DOH Division of Disease Control and Bureau of Epidemiology Activities**

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

- Direct statewide surveillance, prevention and control programs for human arthropod-borne diseases.
- Provide guidelines for sentinel SLE surveillance.
- Conduct epidemiologic analyses of data from CHDs and laboratories.
- Conduct or participate in epidemiologic investigations.
- Distribute epidemiologic reports to CHDs, mosquito control agencies, physicians and veterinarians, CDC and other interested parties.
- Maintain information connectivity among agencies via appropriate medium including weekly electronic *EpiUpdate*, website development and as needed SLE conference calls.
- Recommend health alerts to the State Health Officer.
- Conduct active EEE case surveillance program with Florida veterinarians.
- Coordinate prevention and control activities with DACS, DEP, Florida Tourism Board, mosquito control agencies and other key organizations.
- Coordinate with CDC in interstate and national research, prevention and control efforts.

### **IV. DOH State Health Office**

*Contact: Public Information Office, (850) 245-4111*

- Provide press releases as appropriate.
- Issue medical alerts.
- Coordinate media response to medical alerts.

### **V. Department of Agriculture and Consumer Services (DACS) Bureau of Entomology and Pest Control Activities**

*Contact: Bureau of Entomology and Pest Control, (850) 921-4177.*

- Coordinate with the Bureau of Epidemiology and with local county health departments before releasing vector data to the media or to the public.
- Provide mosquito control, technical support and other services as needed to local mosquito control programs and CHDs.
- Facilitate the sharing of mosquito control personnel and equipment between districts, as allowed for in Florida Statutes 388.231 and 388.351.

### **VI. DACS Division of Animal Industry and Bureau of Diagnostic Laboratory Activities**

*Contact: State Agriculture Veterinarian, (850) 410-0900; State Diagnostic Laboratory (veterinary), (407) 846-5200.*

- Direct statewide surveillance for animal arthropod-borne diseases.
- Conduct appropriate tests for detection of arthropod-borne diseases in animals.
- Report findings to the DOH Bureau of Epidemiology on a regular basis.

## **VII. 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.
- Provide larvicide and adulticide applications as appropriate and feasible.
- Provide adequate avian serosurveillance of most likely sites of SLE activity (maintain and monitor flocks and collect and process blood samples) as feasible.

## **VIII. Florida Universities**

*Contact: FMEL, (561) 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) as well as Florida A&M University and University of South Florida.
- Distribute research findings.
- Provide consultation and technical assistance to disease and arthropod control agencies.

## **IX. Department of Environmental Protection**

*Contact: Fisheries Management, (850) 922-4340.*

- Coordinate efforts for intensified mosquito spraying in protected wetlands as needed during health alerts.
- Provide consultation and technical assistance as required.

## **X. Florida Tourism Marketing Corporation**

*Contact: Visit Florida USA, (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.

## **XI. Physician/Hospital Activities**

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

- Report suspected cases of arthropod-borne diseases to the 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).

## **XII. Veterinarians**

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

- Report suspected cases of EEE, LD and ehrlichiosis to the State Veterinarian and the CHD as required by law.

**XIII. Centers for Disease Control and Prevention, Bureau of Vector-Borne Infectious Diseases**

*Contact: Bureau of Vector-borne Diseases, (970) 221-6400.*

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

## Chapter 3

# Arthropod-borne Disease Monitoring Activities

The ideal surveillance program measures the amount of microbe amplification and transmission in nature and reliably provides information on the occurrence of human disease. A complete surveillance program consists of monitoring seroconversion rates in sentinel chickens, weather analysis, vector identification and abundance, and the incidence of human and animal disease. The value of surveillance is to increase the ability to predict when and where transmission to humans is likely to occur so that prevention activities can be implemented.

### I. Avian Serosurveillance for Mosquito-borne Viruses

SLE virus is present in mosquitoes throughout much of central and south Florida during most of the year. Sentinel chickens can be infected during any month, but transmission is most likely from August through November.

Avian serosurveillance may be less useful for monitoring EEE. Where sentinel chicken flocks in Florida are used to monitor SLE, historical data on EEE in those flocks is used with caution for operational decisions. The suitability of sentinel chickens to monitor for EEE is unknown. In the absence of historical sentinel data in the area, sporadic or low level (<40% in a single flock) EEE seroconversions in the current year are valuable only in confirming that the virus is endemic.

Sentinel chicken programs are maintained by mosquito control districts and county health departments, depending on local resources and priorities. Maintaining such a program includes flock placement; flock care; periodic collection, processing and shipping of blood specimens; and notification of appropriate agencies and persons regarding seroconversion data. Under certain conditions, "backyard" chickens (i.e., birds maintained for other purposes) can be monitored.

Under ideal circumstances, sentinel chicken flocks would be located in every county at elevated risk for SLE because the virus transmission can either be quite localized or spread rapidly. However, if no flocks are maintained in a county, the CHD relies on the results of sentinel chicken surveillance in contiguous counties to aid in decision-making. Sentinel chicken surveillance is usually conducted from June through November of each year, though monitoring can be done year-round.

*Note: Chickens cannot transmit SLE or EEE directly to people.*

#### A. Flock Selection

- The site is permanently located in an area free from public access and vandalism. Mosquito control personnel should be consulted for flock placement advice.
- Flock sites (i.e., maps or other location data) should be reported to the Bureau of Epidemiology at the beginning of each season.
- Six flocks of six birds each are suggested for each participating county.

- Sites should be located within two to three miles of active *Cx. nigripalpus* breeding areas (swamps, sewage pools, stagnant ponds, heavy shrubbery or tall dense grass). Sentinel chickens are positioned both in swamps and at the edge of residential areas.
- Backyard chicken flocks selected for retrospective surveys are 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 by the first week of May are ideal for this purpose (game chickens are not recommended). All-hen flocks may be used in some urban areas to avoid annoyance by cocks crowing. However, the use of roosters reduces the occurrence of false positives in the HI test.
- The local county agricultural extension agent is contacted to obtain information about local chicken breeders. If no such breeds are available, assistance may be obtained from neighboring counties or mosquito control personnel.
- Each chicken must be properly identified by numbered wing or leg bands (available from National Band and Tag Company at 606-261-2035).

### **B. 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 off of the ground.
- A raccoon/fox-proof wire (or double wiring) should be sufficient to protect the chickens and a strong door and secure lock should provide enough entrance to the house for feeding and bleeding purposes.
- 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, as replacements are needed due to seroconversion or mortality.

### **C. 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, if possible), surrounding vegetation, and weather conditions during the surveillance season.
- **All chickens in the flock should be bled every week.**
- Serology is confirmed after a second blood specimen is positive. Because some chickens may not confirm, only information about confirmed serology should be released to avoid the reporting of false positives.
- The seroconversion rate is the number of chickens that seroconverted during a given weekly sampling period divided by the number of birds that were seronegative at the beginning of that period.

- An alternative seroconversion rate that allows more useful comparison is to use “chicken-days” of exposure per flock as the denominator. When a conversion occurs, the time from last test (i.e., 7 or 14 days) is divided by two and added to other exposure days.
- Chickens with negative serology may be bled throughout the season.
- **Chickens that seroconvert should be replaced with a non-immune chicken having a NEW band number.**
- If there are chicken casualties, explain cause of death on the sera submission form.

#### D. Instructions for Bleeding Chickens

Several experienced sites recommend compiling a “blood collection kit” for use in the field. A plastic craft tray or small, light tool box should contain: needles, syringes, serum separator tubes, two pencils or sharpie markers, a small tupperware of alcohol-soaked cotton balls, insect repellent for the worker and a checklist of chicken wingband numbers by site. In addition, bring a sharps container and a small cooler of ice (ice is useful for hemostasis after gentle pressure fails to assist with clotting).

A person working alone may bleed chickens. However, two participants can be used, depending on the technique used for restraint. 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:

- A. Stretch out a wing to expose its underside. Alternate between wings each time the chicken is bled in order to allow healing. (Some may choose to take samples from jugular veins).
- B. 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.
- C. 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.
- D. Withdraw 1.5 to 2.0cc of whole blood by drawing on the plunger *slowly* in order to keep the vein from collapsing.
- E. Remove needle and apply gentle pressure with alcohol-soaked cotton ball at the site of venipuncture for hemostasis. Note: It is recommended to wear gloves during venipuncture.
- F. Dispense the blood slowly into a 4-inch commercial serum separator tube. (Tubes can be purchased from Fisher Scientific, 1-800-766-7000.) 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. When such tubes are used, the result is a lowered rate of bacterial contamination and a larger quantity of better quality serum.
- G. Identify each vial using a waterproof marking pen or pencil with the:
  - bird number from the permanent wing tag or leg band -- **this is important to have documented correctly**
  - flock site location
  - collection date

- H. Lay tubes on their side (this increases serum yield). Keeping tubes on wetpacks helps reduce hemolysis (rupturing of red blood cells).
- I. If possible, centrifuge for 15 minutes at 1200g, trapping the clot in the bottom of the tube.
- J. The tube may be shipped directly to the lab without decanting the serum. Contact the Tampa Branch Laboratory for shipping containers.

*NOTE: All needles should be disposed in appropriate "sharps" containers.*

**Include a completed "Chicken Arbovirus Surveillance Serology" sheet with serum shipped to assigned DOH laboratories.** Please send in sera by Tuesday close of business to have data available by Friday.

### **E. Serum Testing/Data Dissemination**

- Sentinel chicken sera are tested at DOH Bureau of Laboratories Services, Tampa Branch Laboratory (contact the laboratory at 813-871-7465 or SC 512-6278).
- The Tampa lab communicates the results weekly to the county coordinator submitting specimens as well as the county health department, the DOH Bureau Epidemiology and the DACS Bureau of Entomology and Pest Control.

## **II. Weather analysis – Rainfall Monitoring**

Daily rainfall is an important meteorological factor to track 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 south Florida dry season is an important factor in determining the potential survival of overwintering and potentially infected *Cx. nigripalpus* mosquitoes. 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 this mosquito species by determining when and where eggs are laid, when host seeking and biting occurs and when the virus is transmitted.

Rainfall data may be available from the National Weather Service. 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 allowing 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.

### III. 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 of 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.

#### A. 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<sup>th</sup> Street SE, Vero Beach, Florida 32962, (561) 778-7200, or downloaded from FMEL web page: <http://www.ifas.ufl.edu/~veroweb/whitep/whitep.htm>.

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.

#### B. Viral Assay in Mosquitoes

There is no history of prospective arbovirus surveillance in Florida involving evaluation of SLE virus infection rates in mosquitoes. It is clear that during epidemic periods, high SLE infection rates can be demonstrated in *Culex 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 SLE transmission. Surveillance of mosquito infections should not supplant other sources of information pertinent to SLE activity (e.g., transmission to sentinel and/or wild vertebrates, real-time monitoring of local *Cx. nigripalpus* population dynamics, rainfall data).

### IV. Tick Monitoring

Diagnosis of Lyme disease (LD), Rocky Mountain Spotted Fever (RMSF), and ehrlichia cannot be accurately or reliably accomplished through tick identification or by examining ticks for the presence of the disease agents. However, tick collections may be helpful in substantiating vector species and foci of infection, but only after tick-borne disease has been medically confirmed. Tick surveys are advisable in counties where tick-borne diseases are known to be endemic and when sufficient information exists concerning a specific locality where transmission has occurred. Technical assistance in conducting such surveys may be arranged by contacting the PHEREC, phone (850) 872-4184.

Currently, four species of ticks are suspected as potential vectors of LD in the southeastern U.S. They are: *Ixodes scapularis* (the black-legged tick), *Amblyomma americanum* (Lone star tick), *Amblyomma maculatum* (Gulf Coast tick) and *Dermacentor*

*variabilis* (American dog tick). None have been adequately incriminated as the primary vector, though the black-legged tick is the leading candidate in the southeast to vector LD. This is because it has exhibited a greater capability of transmitting *B. burgdorferi* under laboratory conditions and has been more commonly found naturally infected in the field. Important tick vectors in the southeast for RMSF include *D. variabilis* and *A. americanum*. The most likely tick vector for HME is *A. americanum*, for HGE is *I. scapularis*.

All of these ticks require three different hosts to complete a life cycle consisting of egg, larval, nymphal and adult stages. After hatching from eggs deposited on the ground usually in grassy, brushy or treed areas, tiny six-legged larval ticks (also known as "seed" ticks) climb on vegetation and wait to cling upon passing hosts. Small rodents (woodland mice), ground birds and reptiles (lizards and snakes) most commonly serve as hosts for larval and nymphal ticks. After obtaining blood meals, larval ticks drop to the ground, molt (i.e., shed their "skin") and develop to eight-legged nymphs. Nymphs follow a similar sequence feeding on a different host before molting to the adult stage. Adult ticks usually seek larger hosts such as deer, cattle and possibly humans. Under field conditions, each of these species require 1-2 years to complete their life cycle. This period may span, for some, over 3 calendar years for eggs deposited late in the season.

Based on submissions for tick identification to the then HRS Entomology Services office (currently Florida Department of Agriculture and Consumer Services, Bureau of Entomology and Pest Control), the Lone star tick and the Gulf coast tick are far more common human-biting species in Florida.

## **V. Surveillance of Human Disease**

SLE, EEE, LD, RMSF and ehrlichia are reportable human diseases in Florida. County health departments provide case information to the Bureau of Epidemiology for data analysis and dissemination.

### **A. Arboviral Infection**

Arboviral encephalitides should be considered in the list of possible diagnoses for any person who develops encephalitis in Florida, especially if the encephalitis has onset from August through December, occurs in an older person, or is of unusual severity. Serologic testing for SLE, EEE and WN viruses can be obtained from the DOH Bureau of Laboratories.

**Clinical Description:** Arboviral infection may result in a febrile illness of variable severity associated with neurologic symptoms ranging from headache to aseptic meningitis or encephalitis. Arboviral encephalitis cannot be distinguished clinically from other central nervous system (CNS) infections. Symptoms can include headache, confusion or other alteration in sensorium, nausea, and vomiting. Signs may include fever, cranial nerve palsies, paresis or paralysis, sensory deficits, altered reflexes, convulsions, abnormal movements, and coma of varying degree.

**Laboratory Criteria for Diagnosis:**

- Fourfold or greater change in serum antibody titer between acute and convalescent samples taken 2 to 4 weeks apart, or
- Isolation of virus from or demonstration of viral antigen or genomic sequences in tissue, blood, cerebrospinal fluid (CSF), or other body fluid, or

- Specific immunoglobulin M (IgM) antibody by enzyme immunoassay (EIA) antibody captured in CSF or serum. Serum IgM antibodies alone should be confirmed by demonstration of immunoglobulin G antibodies by another serologic assay (e.g., neutralization or hemagglutination inhibition).

Probable Case: viral transmission is likely, and with the following supportive serology: a stable ( $\leq$  twofold change) elevated antibody titer to an arbovirus (e.g.,  $\geq 320$  by HI,  $\geq 128$  by CF,  $\geq 256$  by IFA, and  $\geq 160$  by SN, or  $\geq 400$  EIA IgM).

*Note: Rapid confirmation of the diagnosis is best made by simultaneous submission of CSF and acute serum, when available and clinically indicated.*

Confirmed case: a clinically compatible case that is laboratory confirmed.

## **B. Lyme Disease**

This surveillance case definition was developed for national reporting of Lyme disease; it is not intended to be used in clinical diagnosis.

Clinical Description: A systemic, tickborne disease with protean manifestations, including dermatologic, rheumatologic, neurologic, and cardiac abnormalities. The best clinical marker for the disease is the initial skin lesion (i.e., erythema migrans [EM]) that occurs in 60%-80% of patients).

Laboratory Criteria for Diagnosis:

- Isolation of *Borrelia burgdorferi* from a clinical specimen (clinicians interested in submitting punch biopsy for *Borrelia* isolation should call Dr. Martin Schriefer of the CDC at 970-221-6479 for appropriate sample transport medium), or
- Demonstration of diagnostic IgM or IgG antibodies to *B. burgdorferi* in serum or CSF. A two-test approach using a sensitive enzyme immunoassay or immunofluorescence antibody followed by Western blot is recommended.

Confirmed Case: a) a case with EM or b) a case with at least one late manifestation (as defined below) that is laboratory confirmed.

Definition of terms used in the clinical description and case definition:

- Erythema migrans (EM): For purposes of surveillance, EM is defined as a skin lesion that typically begins as a red macule or papule and expands over a period of days to weeks to form a large round lesion, often with partial central clearing. A single primary lesion must reach greater than or equal to 5 cm in size. Secondary lesions also may occur. Annular erythematous lesions occurring within several hours of a tick bite represent hypersensitivity reactions and do not qualify as EM. For most patients, the expanding EM lesion is accompanied by other acute symptoms, particularly fatigue, fever, headache, mildly stiff neck, arthralgia or myalgia. These symptoms are typically intermittent. A physician must make the diagnosis of EM. Laboratory confirmation is recommended for persons with no known exposure.
- Late manifestations: Late manifestations include any of the following when an alternate explanation is not found:

1. Musculoskeletal system: Recurrent, brief attacks (weeks or months) of objective joint swelling in one or a few joints, sometimes followed by chronic arthritis in one or a few joints. Manifestations not considered as criteria for diagnosis include chronic progressive arthritis not preceded by brief attacks and chronic symmetrical polyarthritis. Additionally, arthralgia, myalgia, or fibromyalgia syndromes alone are not criteria for musculoskeletal involvement.
  2. Nervous system: Any of the following, alone or in combination: lymphocytic meningitis; cranial neuritis, particularly facial palsy (may be bilateral); radiculoneuropathy; or, rarely, encephalomyelitis. Encephalomyelitis must be confirmed by demonstration of antibody production against *B. burgdorferi* in the CSF, evidenced by a higher titer of antibody in CSF than in serum. Headache, fatigue, paresthesia, or mildly stiff neck alone are not criteria for neurologic involvement.
  3. Cardiovascular system: Acute onset of high-grade (2nd-degree or 3rd-degree) atrioventricular conduction defects that resolve in days to weeks and are sometimes associated with myocarditis. Palpitations, bradycardia, bundle branch block, or myocarditis alone are not criteria for cardiovascular involvement.
- Exposure: Exposure is defined as having been (<= 30 days before onset of EM) in wooded, brushy, or grassy areas (i.e., potential tick habitats) in a county in which Lyme disease is endemic. A history of tick bite is not required.
  - Disease endemic to county: A county in which Lyme disease is endemic is one in which at least two confirmed cases have been previously acquired or in which established populations of a known tick vector are infected with *B. burgdorferi*.

It is important to realize that it generally takes 3-4 weeks after LD infection for antibody titers to rise to detectable levels. Blood samples taken before this time are likely to yield negative results. Administration of antibiotics prior to taking a blood sample may also confound results. The Association of State and Territorial Public Health Laboratory Directors and the CDC has found that the sensitivity (likelihood of false-negative test results) and specificity (likelihood of false-positive test results) of the many commercially-available test kits are generally quite poor. Consequently, an accurate and thorough assessment of clinical signs and symptoms will continue to be essential for accurate diagnosis of LD. Updated information on improved test kits and methods can be obtained by contacting the Florida Department of Health (FDOH) Laboratory Services at: (904) 791-1539/1540 or SC 866-1539/1540.

### **C. RMSF**

**Clinical Description:** A tickborne febrile illness most commonly characterized by acute onset and usually accompanied by myalgia, headache and petechial rash (on the palms and soles in two-thirds of the cases).

**Laboratory Criteria for Diagnosis:**

- Fourfold or greater rise in antibody titer to *Rickettsia rickettsii* antigen by IFA, CF, LA, MA, or indirect hemagglutination antibody (IHA) test in acute- and convalescent-phase specimens ideally taken >= 3 weeks apart, or
- Positive polymerase chain reaction assay to *R. rickettsii*, or
- Demonstration of positive immunofluorescence of skin lesion (biopsy) or organ tissue (autopsy), or
- Isolation of *R. rickettsii* from clinical specimen

Probable Case: a clinically compatible case with a single IFA serologic titer of  $\geq 64$  or a single CF titer of  $\geq 16$  or other supportive serology (fourfold change in titer or a single titer  $\geq 320$  by Proteus OX-19 or OX-2, or a single titer  $\geq 128$  by an LA, IHA, or MA test)

Confirmed Case: a clinically compatible case that is laboratory confirmed.

#### **D. Ehrlichiosis**

There are two clinically similar yet serologically distinct forms of ehrlichiosis: a) human granulocytic ehrlichiosis (HGE), caused by infection with *Ehrlichia equi*-like agent and found primarily in the upper midwest and northeast, and b) human monocytic ehrlichiosis (HME) caused by *E. chaffeensis* infection and found primarily in the southeastern United States.

Clinical Description: A tickborne febrile illness most commonly characterized by acute onset and usually accompanied by myalgia, rigors and/or malaise. Clinical laboratory findings may include intracytoplasmic microcolonies (morulae) in leukocytes of peripheral smear, CSF or bone marrow aspirate or biopsy, cytopenias (especially thrombocytopenia and leukopenia) and elevated liver enzymes (especially alanine aminotransferase or aspartate aminotransferase).

Laboratory Criteria for Diagnosis:

- Fourfold or greater change in antibody titer to *Ehrlichia spp.* antigen by IFA test in acute- and convalescent-phase specimens ideally taken  $\geq 4$  weeks apart. HME diagnosis requires *E. chaffeensis* and HGE currently requires *E. equi* or HGE-agent antigen, or
- Positive polymerase chain reaction assay. Distinct primers are used for the diagnosis of HGE and HME, or
- Intracytoplasmic morulae identified in blood, bone marrow, or CSF leukocytes, and IFA antibody titer  $\geq 64$ .

Probable Case: a clinically compatible case with either a single IFA serologic titer of  $\geq 64$  or intracytoplasmic morulae identified in blood, bone marrow or CSF leukocytes.

Confirmed Case: a clinically compatible case that is laboratory confirmed.

### **VI. Animal Disease Surveillance**

#### **A. Arboviruses**

Horse or ratite (ostrich, emu, rhea, or cassowary) cases can be monitored for EEE in three ways:

- Following cases reported to the State Agriculture or Public Health Veterinarians' offices.
- From results of diagnostic services of the Florida Department of Agriculture Consumer Services' Animal Diagnostic Lab in Kissimmee (407) 846-5200.
- Establishing personal contact with large animal veterinarians, horse or ratite clubs, breeders and dealers in the county.

Laboratory Criteria for Diagnosis: In general, EEE antibody titer four times that of WEE is suggestive of possible EEE infection. (Vaccinated animals will show some increase in titer; however, this increase usually occurs both with EEE and WEE antigens.) The DACS Diagnostic Laboratory will test sera for antibodies to EEE, WEE, VEE and SLE viruses. Sera

that show an animal SLE titer of >1:20 are forwarded to the DOH Tampa Branch Laboratory for WNV testing.

Wild bird mortality, especially corvids (crows), may be a good indicator for the presence of WNV. We encourage reporting of dead birds to local Fish and Wildlife Conservation Commission biologists.

## **B. LD**

Pets and livestock showing symptoms of LD (i.e., lameness, swollen joints, poor appetite and lethargy) should be taken to a local veterinarian for diagnosis and treatment. It should be noted that the effectiveness of available canine vaccines has not been well established and vaccination may interfere with laboratory confirmation.

At present, few surveys for LD in wildlife have been conducted in Florida and these have been confined to very limited areas. It is possible to test blood and/or tissue samples from wildlife suspected of maintaining LD.

## **VII. Response to Surveillance**

Review of surveillance data triggers one or more of the following responses:

- **continued routine surveillance**
- **increased human disease surveillance**
- **increased mosquito surveillance**  
(e.g., seroconversions in areas with a negative EEE history of three or more consecutive years prompt an increase in mosquito surveillance, particularly in residential areas and of *Cq. perturbans* and other potential bridge vectors. More frequent and widespread trapping is indicated.)
- **increased animal disease surveillance**
- **public education/Medical Alert**
- **enhanced vector control**

# Chapter 4

## Control Measures

### I. Personal Protection

Education messages should be targeted to at-risk populations (e.g., emphasize high risk of SLE for 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 (see Appendix G).

#### A. Mosquito-borne Diseases

The effectiveness of public education as a control measure for SLE was demonstrated in the 1997 outbreak. A study of the outbreak by the DOH Bureau of Epidemiology showed that people who had received public health messages were significantly more likely to reduce their exposure to mosquitoes than those who had not heard the messages.

People can protect themselves from mosquito bites (and therefore arboviruses) by using proper window screens, protective clothing and insect repellent. The principal vector of SLE, *Culex nigripalpus*, blood feeds from dusk through dawn with activity most intense at dusk and dawn. Consequently, in an actual or potential epidemic situation, people should be encouraged to avoid mosquito contact at these times of day. The ordinary window screen with 16x16 or 14x18 meshes to the inch will keep out most mosquitoes, including arbovirus vectors. 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.

Long-sleeved clothing of tight-woven material offers considerable protection against mosquito bites. Sleeves and collars can be kept buttoned and trousers tucked in socks when mosquitoes are biting. This type of protection may be necessary for people who must work in areas where infected vector mosquitoes are particularly abundant. The use of mosquito netting to protect infants in their cribs may also be indicated in high-risk circumstances.

Applying insect repellent to the skin and clothing may offer relief from mosquito attack. The use of N,N-diethyl-m-toluamide (DEET) in concentrations of no more than 30% confers effective protection (concentrations of greater than 30% increase the risk of adverse reactions while not increasing the efficacy of the product). Repellents are available as liquids in bottles, in pressurized spray cans and in stick form. When applied to the neck, face, hands and arms, liquid repellent will prevent mosquito bites for two hours or more, depending on the person, the species of mosquito attacking and the abundance of mosquitoes. These repellents can also be sprayed on clothes (DEET will not affect nylon). Many repellents are solvents of paints, varnishes and plastics (including watch crystals, rayon fabrics and fountain pens). Care should be taken not to apply repellents to the eyes, lips or mucous membranes. Adults should apply repellent to young children. (For information about DEET, see Appendix G).

Pressurized aerosol insecticide dispensers can be used in the home to kill adult mosquitoes. Insecticide label directions must be followed. Most of these contain pyrethrin or allethrin. These insecticides have low human toxicity and cause a quick knockdown of mosquitoes. These aerosol dispensers may also contain a synergist such as piperonyl butoxide

and another insecticide, such as diazinon, to kill the insects. Release of the aerosol for a few seconds usually kills most insects in an ordinary-sized room, tent or trailer.

## **B. Tick-borne Disease**

Prevention is the best way to avoid diseases vectored by ticks. Persons involved in outdoor activities in tall grass, brushy or treed areas should follow these instructions:

1. Tuck trouser legs into boots or socks.
2. Use repellents containing 30% or less N,N -diethyl-m-toluamide (DEET, e.g., Off<sup>®</sup>, Cutters<sup>®</sup>) and/or the clothing-applied insecticide, such as permethrin (e.g., Permanone<sup>®</sup> Tick Repellent) according to labeled directions.
3. Check to remove crawling ticks at least every three hours while outdoors. Wearing light-colored clothing will make spotting ticks easier.
4. Before going to sleep or after returning indoors, remove and wash clothing or place in a tightly sealed bag for storage until washing. Conduct a full-body check for ticks followed by a shower or bath.
5. Outdoor pets should be checked frequently and treated with an acaricidal shampoo according to labeled directions.

## **II. Arbovirus Medical Alert**

A medical alert is a declaration by the State Health Officer that “a threat to the public health exists” as per Florida Statutes, 388.45. This official declaration allows 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. The need for a medical alert is determined by the CHD director/administrator after consultation with the State Health Office. Increased sentinel chicken seroconversion rates to SLE or EEE, identification of WNV in Florida, weather information, vector surveillance (mosquito trapping), historic arbovirus distribution and the presence of human cases in the same or contiguous counties are important factors to consider when initiating a medical alert.

A medical alert may be initiated in any specific geographic area of the state where there has been:

1. A confirmed human case of SLE, EEE, or other arbovirus of comparable significance thought to have been contracted in Florida  
OR
2. Substantial increases over county norms in number of sentinel chickens seroconverting, in the proportion of flocks containing seroconverting sentinels, or in unseasonal timing of multiple sentinels seroconverting  
OR
3. A high SLE or EEE seroconversion rate in a single bird flock over a two-week period  
OR
4. Isolation of EEE virus from mosquitoes  
OR
5. A cluster of equine or ratite EEE cases (e.g., two or more cases within five miles and ten days of each other).  
OR
6. Identification of WNV in Florida.

The CHD Director/Administrator facilitates arbovirus medical alert activities. This includes working closely with the Bureau of Epidemiology, mosquito control personnel, physicians, veterinarians, emergency rooms and neighboring counties. DACS Bureau of Entomology and Pest Control provides technical support and leadership to CHDs and county mosquito control programs as needed during a medical alert. SLE epidemic activity may remain localized to a city or county; however, Florida's last two outbreaks were more widespread, with several counties affected. Further, SLE viral activity can have "hot spots" of activity interspersed with areas of little or no activity. Therefore, epidemic and medical alerts and control measures cannot at this time be uniformly applied in all areas of the state.

- The CHD in the affected county will notify:
  1. Community health care providers concerning the potential for transmission of SLE or EEE virus 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 medical alert.
  4. Local media, education representatives, senior citizen groups and other citizen groups as appropriate.
- The Bureau of Epidemiology will notify DACS and DEP within 24 hours of the declaration of a medical alert (Florida Statutes 388.45).

#### **A. Intensified Public Education**

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:

1. Issue advisories to minimize outside evening and early morning activities for citizens of affected counties (e.g., activities such as camping, evening and nighttime fishing, etc. are ill advised).
2. Advise persons who do continue to spend time out-of-doors in the evening, nighttime or early morning hours to wear protective clothing (long-sleeved shirts, long pants) and to use insect repellent.
3. Educate the public about the nature of the public health threat that exists and the level of risk involved (including age-specific risk).
4. For EEE, attempt to gain immediate control of infected adult mosquito populations by use of insecticides applied by ground or aerial applications, as appropriate. Implementation of intensification of larviciding programs to reduce future adult populations and elimination of mosquito breeding areas, where applicable, may also be necessary.

### **III. Vector Control**

#### **A. Reduce Mosquito Breeding Areas**

Communities and residents should:

- Eliminate standing water in depressions, barrels, containers and drains.
- Repair leaking septic tanks, cesspools and drainfields.
- Remove old tires.

- Stack containers upside-down so they do not accumulate water.

### **B. Mosquito Control**

When a sentinel chicken flock located at the edge of a swamp seroconverts to EEE, mosquito control is conducted within one mile of the perimeter of the swamp. If the flock is located in a residential area more than one mile from a swamp, control efforts are increased in any swampy areas within five miles of the seroconverting flock. Control efforts are concentrated in areas where the parity of *Cq. perturbans* and other vector species (other than *Cs. melanura*) are highest.

Sections 388.231 and 388.351, Florida Statutes, authorize the movement of mosquito control personnel and equipment into affected counties from other counties. This is coordinated through the DACS Bureau of Entomology and Pest Control Office.

The main vector for SLE, *Cx. nigripalpus*, is difficult to control due to the adults' ability to fly several miles and its wide range of larval habitats. The public should be educated about the challenges to controlling this vector.

### **C. Tick Control**

Area pesticide spraying programs for ticks are not practical for many situations. Consultation with PHEREC is advisable before considering this procedure. Deer feeders equipped with self-treating permethrin insecticide dispensers may be useful in reducing ticks in locations with large deer populations.

## ACRONYMS/DEFINITIONS

<b>Ae.:</b>	Abbreviation for mosquitoes in the genus <i>Aedes</i>
<b>Arbovirus:</b>	Arthropod-borne virus
<b>Arthropod:</b>	Animals in the phylum which includes insects (mosquitoes, flies, etc.) and arachnids (ticks, spiders, etc.)
<b>CHD:</b>	County health department
<b>CF test:</b>	Complement fixation test
<b>Cq.:</b>	Abbreviation for mosquitoes in the genus <i>Coquillettidia</i>
<b>Cs.:</b>	Abbreviation for mosquitoes in the genus <i>Culiseta</i>
<b>Cx.:</b>	Abbreviation for mosquitoes in the genus <i>Culex</i>
<b>DACS:</b>	Department of Agriculture and Consumer Services
<b>DEP:</b>	Department of Environmental Protection
<b>DOH:</b>	Department of Health
<b>EIA/ELISA:</b>	Enzyme immunoassay/enzyme-linked immunosorbant assay
<b>EM:</b>	Erythema migrans. EM is defined as a skin lesion that typically begins as a red macule or papule and expands over a period of days to weeks to form a large round lesion, often with partial central clearing
<b>Encephalitis:</b>	Inflammation of the brain
<b>FMEL:</b>	Florida Medical Entomology Laboratory
<b>Hemostasis:</b>	The arrest of bleeding
<b>HGE:</b>	Human granulocytic ehrlichiosis
<b>HI/HAI:</b>	Hemagglutination (and antibody) inhibition test used by the DOH Tampa Branch Laboratory for avian serosurveillance
<b>HME:</b>	Human monocytic ehrlichiosis
<b>IFA:</b>	Immunofluorescent antibody test
<b>Ig:</b>	Immune globulin or antibody (as in IgM, IgG, IgD, IgA or IgE)

**LA/LAT:** Latex agglutination test

**MA:** Microagglutination test

**Morulae:** Spherical mass (from the word "mulberry")

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

**Serum/Sera:** The clear liquid separated from blood

**SN Index:** Serum neutralization index

**Surveillance:** Close observation for disease detection

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

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

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

**>=:** Greater than or equal to

**<=:** Less than or equal to

## DOH LABORATORY EVALUATION OF ARTHROPOD-BORNE VIRAL DISEASES IN PEOPLE

### Introduction

A number of clinical syndromes accompany arboviral infection including fever, rash, myalgia, arthralgia, hemorrhagic fever and encephalitis. Serologic surveys indicate that the ratio of inapparent to apparent infections is sometimes quite high. These viruses usually cause an abortive infection characterized by fever, headache and other benign signs. However, a few individuals will develop a clinical infection that may be severe or fatal.

It is important to confirm a specific agent in instances of a suspected infection. This enables appropriate patient therapy and also permits vector control operations designed to limit transmission to additional susceptible human hosts. Confirmation is dependent upon direct viral detection or serologic examinations such as the hemagglutination-inhibition (HI), complement-fixation (CF), serum-neutralization (SN), enzyme-linked immuno-sorbent assay (ELISA) and fluorescent antibody (FA) tests. Interpretation of each of the tests is dependent upon the time after onset of illness, the patient's previous infection with arthropod-borne viruses and serum cross-reactivity within the antigenic complex. In Florida, previous dengue infection or previous Yellow Fever vaccine are the most common factors that can complicate the interpretation of antibody tests.

### Available Laboratory Testing

Virus Isolation -- It is rare to isolate SLE virus from blood or cerebrospinal fluid taken during the acute phase of encephalitis due to rapid completion of the viremic stage prior to onset of illness. SLE and WNV viruses can be detected in brain tissue collected at necropsy. EEE and WEE viruses are also usually only isolated from the brain. Dengue virus, however, frequently may be isolated from blood during the first few days after onset of illness.

Serum Neutralization (SN) -- Neutralizing antibody contains both IgG and IgM antibody fractions. SN antibody rises early in the course of infection, and may persist for life after some viral infections, specifically SLE or dengue.

Serum IgM Antibody -- The IgM serum fraction is involved in both the SN and HI reactions, but IgM can be detected independently in either serum or cerebrospinal fluid (CSF) using a capture enzyme immunoassay. The presence of IgM is generally a reliable indicator of recent infection. However, a subset of case patients may have persisting serum IgM antibody to flaviviruses, 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.

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. Crossreactivity within a virus group (e.g., flaviviruses) is common, and can complicate interpretation of results.

Complement Fixation (CF) Antibody -- Compared to HI antibody, CF antibody is later-appearing, more complex-specific and shorter-lived, and can therefore be useful in diagnosing recent infection.

### **Specimen Collection**

When virus isolation 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 airtight tubes, and tissue in an airtight container. 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.

Throat washings and fecal specimens, while not useful for confirmation of an arboviral infection, are also collected. They frequently yield enteroviruses and thus provide a means of incriminating other likely causes of a central nervous system illness.

### **Shipping Specimens**

Sera are sent immediately to the assigned DOH laboratory for HI testing. Tubes are wrapped individually in paper or placed in cardboard containers having dividers so that tubes do not touch (being sure that the vial will not leak). Such containers are readily available from county health departments.

These containers are placed inside a second shipping container. Sera need not be shipped on ice. However, to retard bacterial growth, sera are stored in a refrigerator or freeze, until shipped. Sera are not shipped on a Thursday or Friday because they may arrive at the DOH laboratory on a weekend.

*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. The following must appear on the shipping label:

DOH Central Laboratory - Viral Center  
1217 Pearl Street  
Jacksonville, FL 32202  
Phone (904) 791-1539, 791-1540

OR

DOH Tampa Branch Laboratory - Virology Unit  
3952 West Dr. Martin Luther King Jr. Blvd.  
Tampa, FL 33614  
Phone (813) 871-7465.

**CONTACTS FOR ESTABLISHING SENTINEL CHICKEN FLOCKS**

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

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

- Tampa Farms Service: (941) 357-1515
- Keith Salmi: (941) 294-9011

**Wing/Leg Bands**

- National Band and Tag Company: (606) 261-2035

**Serum Separator Tubes**

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

**Chicken Cages, Feeders and Waterers**

- Stromberg's: (800) 720-1134
- Plans for building cages provided upon request: 850-245-4401 (Hardrick Gay and Delores Miller are gratefully acknowledged)
- Plans for self-feeder, self-waterer provided upon request: 850-245-4401 (Robert Betts is gratefully acknowledged)

**Chicken Restrainer Board**

- Plans for restrainer available upon request: 850-488-2905 (Delores Miller is gratefully acknowledged)

**Chicken Feed**

- Available at local feed store

## MALARIA

### Introduction

Malaria is one of the world's greatest public health problems. Approximately 300 million of the world's population are infected each year and between 1 and 1.5 million people die from malaria annually. Although malaria is no longer endemic in Florida, it is often seen in travelers and unusual locally acquired cases can be seen in the state.

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*. Thus, part of the complex life cycle occurs in humans and part in the mosquito.

### Vector

In Florida, there are 13 *Anopheles* species, all of which are potentially capable of transmitting malaria:

#### *Anopheles quadrimaculatus* A, B, C and D

- 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* and *An. bradleyi*

- Breeds 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. georgianus*

- Rare species.
- Breeds in seepage areas.

#### *An. barberi*

- Breeds in tree holes.

### Epidemiology

Although now rare in the United States, malaria was once the 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, 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. 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 included 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 that became infected after biting a migrant worker with malaria. Two induced cases of *Plasmodium 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. Two cryptic cases occurred in Palm Beach County also in 1996 and resulted in *P. vivax* infection. One of these cryptic cases was in a homeless male and the other was in a resident living in a nearby area.

In the Americas, over 1 million cases occur annually and approximately 30% of its population reside in areas suitable for malaria transmission. The largest number of cases are reported from Brazil, which accounted for 50% of the total in 1994, followed by the Andean countries, which reported 29% of all cases. The CDC received reports of 1,800 cases in 1996 for the U.S. The number of 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. Of the less than 100 Florida cases per year reported in recent years, more cases originated from exposure in Central American countries than any other area.

## **Clinical Course**

In humans, the symptoms will vary depending on the malaria 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.

*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.

## Case Definition

A confirmed case of malaria is defined as a clinically compatible illness that is laboratory confirmed. Laboratory confirmation requires demonstration of malaria parasites in blood films. Usually blood films stained with Giemsa stain should demonstrate parasites. Non-immunes with symptoms, especially those taking or having recently taken anti-malarial drugs, may have fewer detectable parasites. Detection of parasites in thick films requires some experience. Thin blood films are used to assist in species identification of doubtful cases of malaria.

The State Laboratory requests that all suspect malaria slides be sent to them for species determination. Also, they participate in a national network that allows slide images to be digitalized and transmitted to parasitologists at the CDC for review and consultation.

A number of tests are available that can measure the parasite or the antibody: immuno-precipitation, immuno-fluorescence (IFA), indirect (IHA) or passive (PA) hemagglutination, indirect enzyme linked immunosorbent assay (ELISA), radio-immuno assay (RIA), and merozoite inhibition in culture. These highly sensitive techniques are now used for research and epidemiological surveillance and not generally diagnosis, but in the future may replace the blood films. They are available in a large outbreak.

### Specific characteristics

#### Vivax malaria

##### *Clinical:*

- Incubation period 8-27 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 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 similar to vivax, but may be more severe
- 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 from travelers and visitors to Florida, including migrant workers. Locally acquired cases are possible due to the presence of *Anopheles* throughout the state in the presence of 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 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 all public health officials including state and county health officers, mosquito control directors, and the Director of the Florida Medical Entomology Laboratory of all imported malaria cases by county in Florida.
- Survey and map annually 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 is warned to report any fever of unknown origin to their physician or county

health department. A blood film and purple-top tube are submitted for hemoparasitologic analysis of all fever cases suspected of having malaria. 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.

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.

## DENGUE AND YELLOW FEVER

### Introduction

Dengue (DEN) and yellow fever (YF) are two important mosquito-borne diseases that have historically plagued Florida, although not for more than 50 years. Yellow fever is the result of a single virus species that typically causes profound hemorrhagic disease, which is often fatal. The syndromes collectively referred to as "dengue" and dengue hemorrhagic fever (DHF) are caused by any of four closely related virus subtypes. Classical dengue (so-called "break-bone fever") is a painful, debilitating febrile disease that is rarely fatal. This illness is characterized by 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 principally in children but may also occur in adults. In those with severe disease, shock is the predominant sign. Case fatality rate can be as high as 40-50% untreated, but can be drastically lowered with appropriate fluid therapy. Encephalitis is a rare consequence of dengue infection. The pathogenesis and risk factors associated with DHF-DSS are controversial but appear to be related to second or greater infection with dengue serotypes.

In past Florida epidemics, the sole vector of both DEN and YF was undoubtedly *Aedes aegypti*. The recent arrival of *Ae. albopictus* to many parts of Florida is disturbing, since this species is an important vector of DEN viruses in Asia. *Ae. aegypti* is highly domesticated, and almost exclusively utilizes artificial containers as larval habitats. In contrast, *Ae. albopictus* is fundamentally a treehole- and leaf axil-dwelling species that is secondarily an artificial container dweller.

In parts of Asia having both DEN vectors, there is a tendency for urban DEN cases to be *Ae. aegypti*-transmitted, while suburban and rural cases are *Ae. albopictus*-transmitted. Major DEN epidemics have also occurred in large Asian cities inhabited by *Ae. albopictus*, but not *Ae. aegypti*. Most experimental comparisons have shown *Ae. albopictus* to be a more efficient vector of DEN viruses than *Ae. aegypti*. North American strains of *Ae. albopictus* have been shown competent to serve as vectors of YF virus as well, and the biology of this species offers the potential to establish a "sylvatic" transmission cycle in Florida. Possibly because the geographic ranges of YF virus and *Ae. albopictus* have only recently begun to overlap, there is no documented evidence of YF transmission in the Americas by this species.

DEN and YF have become increasingly common diseases in the Caribbean, Central America, the Pacific and South America during the past two decades. Humans are the only important vertebrate hosts of DEN viruses. So-called "urban" YF involves transmission between humans and *Ae. aegypti*, and is manifest in large epidemics. Puerto Rico and other Caribbean islands experience DEN epidemics annually. Florida's proximity to the Caribbean suggests that outbreaks of DEN are likely to recur in the state, despite their absence since the 1930's. A focus of YF transmission is probably less likely to appear in Florida. It would be possible for either DEN or YF viruses to be imported into Florida by inadvertent transport of infected mosquitoes. However, the occurrence of at least one vector species in many parts of Florida increases the probability that Florida *Ae. aegypti* or *Ae. albopictus* females will be

exposed to imported DEN or YF viruses after feeding on viremic travelers returning from the Caribbean or Central America.

### Case Definitions

**Dengue Fever:** *Clinical description:* An acute febrile illness characterized by frontal headache, retroocular pain, muscle and joint pain and rash. The principal vector is the *Ae. aegypti* mosquito and transmission usually occurs in tropical or subtropical areas. Severe manifestations (e.g., DHF-DSS) are rare but may be fatal.

#### *Laboratory criteria for diagnosis :*

- Isolation of dengue virus from serum and/or autopsy tissue samples
- Demonstration of a fourfold or greater change in reciprocal IgG or IgM antibody titers to one or more DEN virus antigens in paired serum samples, or
- Demonstration of DEN virus antigen in autopsy tissue or serum samples by immunohistochemistry or by viral nucleic acid detection.

Probable Case: A clinically compatible case with supportive serologic findings (a reciprocal IgG antibody titer of greater than or equal to 1280 or a positive IgM antibody test on a single acute- or convalescent-phase serum specimen to one or more dengue virus antigens).

Confirmed Case: A clinically compatible case that is laboratory confirmed.

*Comment:* DHF is defined as an acute febrile illness with minor or major bleeding phenomena, thrombocytopenia ( $\leq 100,000/\text{mm}^3$ ), and evidence of plasma leakage documented by hemoconcentration (hematocrit increased by greater than or equal to 20%) or other objective evidence of increased capillary permeability. The definition of DSS follows all of the above criteria for dengue hemorrhagic fever and also includes hypotension or narrow pulse pressure ( $\leq 20$  mm Hg).

**Yellow fever:** *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, in some instances, renal failure, shock and generalized hemorrhages.

#### *Laboratory criteria for diagnosis:*

- Fourfold or greater rise in YF antibody titer in a patient who has no history of recent YF vaccination and cross-reactions to other flaviviruses have been excluded, or
- Demonstration of YF virus, antigen, or genome in tissue, blood or other body fluid.

Probable Case: A clinically compatible case with supportive serology (stable elevated antibody titer to yellow fever virus [e.g.,  $\geq 32$  by complement fixation,  $\geq 256$  by immunofluorescence assay,  $\geq 320$  by HI,  $\geq 160$  by SN, or a positive serologic result by IgM-capture EIA]. Cross-reactive serologic reactions to other flaviviruses must be excluded, and the patient must not have a history of YF vaccination.)

Confirmed Case: A clinically compatible case that is laboratory confirmed.

## Surveillance

Importation and establishment of DEN or YF viruses in Florida will occur unpredictably, perhaps not for many years. Unfortunately, isolated outbreaks of classic DEN typically grow to involve hundreds of cases before local health authorities correctly identify them. Minimal surveillance in Florida involves annual notification of physicians and public health authorities of the possibility of DEN (or YF) cases in Florida. Clinical differentiation of these exotic diseases from more common febrile illnesses may be difficult. Therefore, immediate submission of sera from all suspect cases to the DOH viral serology laboratory is needed for confirmation. Humans will clearly play the role of "sentinel host" for imported and/or locally transmitted DEN, DHF-DSS, or YF in Florida.

Appropriate, recurring education of medical and public health personnel is a theoretically effective means of minimizing the impact of an introduction of one of these viruses. Although an effective vaccine has long been available for YF virus, widespread immunization of the resident population to preclude establishment of imported YF would not be appropriate or feasible. There are no reliable vaccines available for any of the dengue viruses.

Recognition of a focus of DEN or YF transmission in Florida requires an immediate and energetic response by local mosquito control personnel to reduce exposure of residents to *Ae. aegypti* and *Ae. albopictus* vectors. This 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 encourages residents to take appropriate personal protection measures and assist in the effort to eliminate artificial container habitats.

Identification of a focus of local DEN or YF transmission anywhere in Florida elicits immediate notification of physicians and public health workers due to the potentially explosive nature of these diseases.

Since neither disease is currently endemic, ANY case of DEN or YF that is not readily explained by recent foreign travel is strongly suggestive of local transmission. In such a situation the threat of additional cases in the near-term is substantial. Likewise, there is the possibility that virus may become endemic if local populations of *Ae. aegypti* or *Ae. albopictus* are large. As a practical matter, a single human case that is not imported but of local origin, elicits an immediate "medical alert" (see Chapter 4 for definition of and response to a medical alert).

**TICK REMOVAL/STORAGE AND IDENTIFICATION AFTER TICK-BORNE DISEASE DIAGNOSIS**

Ticks suspected as potential disease vectors in the southeastern US are among the following:

***Ixodes scapularis***

**Common name:** Black-legged Tick



Adult Female

**Seasonal Abundance:** Larvae and Nymphs: April - August  
 Adults: September - May

**Hosts:** Larvae and Nymphs: Reptiles (skinks and snakes), birds and to much lesser degree rodents.  
 Adults: Larger animals including cattle and humans.

***Amblyomma americanum***

**Common Name:** Lone Star Tick



Adult Female

**Seasonal Abundance:** Larvae: June - November  
 Nymphs: February - October  
 Adults: April - August with peaks in July

**Hosts:** Larvae and Nymphs: Small mammals and birds. Do not feed on rodents.  
 Adults: Deer, cattle and humans.

***Amblyomma maculatum***

**Common Name:** Gulf Coast Tick



Adult Female

**Seasonal Abundance:** Larvae: June - September  
Nymphs: February - October  
Adults: June - September

**Hosts:** Larvae and Nymphs: Ground birds and small rodents  
Adults: Larger mammals including cattle, deer, dogs and humans

***Dermacentor variabilis***

**Common Name:** American Dog Tick



Adult Female

**Seasonal Abundance:** Larvae: July - February  
Nymphs: January - March  
Adults: March - September

**Hosts:** Larvae and Nymphs: Almost exclusively small rodents, particularly mice and cotton rats  
Adults: Large variety of mammals and humans

**Tick Removal and Storage for Possible Identification**

Ticks are best removed using spoon-type devices to wedge the tick off without touching it (for example, Ticked Off<sup>®</sup>). Without such a device, ticks can be removed by firmly grasping the tick at the point of attachment with tissue-covered fingers and applying slow, steady traction.

Tick identification may be of interest to the person or the physician; however, it will not predict whether or not the person will become infected with a particular disease. For this reason, many entomologists suggest using tick identification ***as a supplement to diagnosis by a physician of a tick-borne disease.***

Ticks may be placed separately in small jars or vials stuffed to about 1/2" depth with paper towels and sealed with a top containing air holes. The containers should be placed inside a zip-lock plastic bag containing moistened cotton balls or paper towels and stored in a refrigerator. Ticks will survive for several weeks to months using this technique. The bag should be labeled with: name of patient, date, location and contact person's phone number. Specimens must be mailed along with a completed tick submittal form (below).

# Tick Identification Submittal Form

After the physician has made a presumptive diagnosis of a tick-borne disease, a completed copy of this form should be sent along with the tick specimen to:

Dr. John P. Smith  
John A. Mulrennan, Sr. Public Health Entomology Research and Education Center  
Florida A & M University  
4000 Frankford Avenue  
Panama City, Florida 32405

Date: \_\_\_\_\_ Submitter's Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Submitter's address: \_\_\_\_\_

Reason for submitting tick: \_\_\_\_\_

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Patient's Name/Address/Phone Number: \_\_\_\_\_

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Patient's Age: \_\_\_\_\_ Sex: \_\_\_\_\_

Where tick was acquired: City \_\_\_\_\_ State \_\_\_\_\_

Specific location/address \_\_\_\_\_

**MODEL MEDIA KIT****St. Louis Encephalitis Public Information Efforts**

During the summer of 1997, activity among sentinel chicken flocks indicated the potential for widespread human cases of St. Louis Encephalitis (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 MEDICAL ALERT**

FOR IMMEDIATE RELEASE  
October 16, 1998

Contact: Pam Potter-Ricco  
Erika Ragland  
850-487-3220

### **STATE HEALTH OFFICIALS ISSUE ST. LOUIS ENCEPHALITIS ALERT IN FOUR FLORIDA COUNTIES**

TALLAHASSEE - - State health officials today issued a medical alert in Palm Beach, Martin, Glades and Hendry counties for St. Louis Encephalitis, a viral disease transmitted by mosquitoes. The alert was issued after test results in sentinel chicken flocks confirmed an increased presence of the virus in the alert counties.

“Thankfully, there have been no human cases of St. Louis Encephalitis in Florida so far this year,” said Deputy State Health Officer Richard Hunter, Ph.D. “Through this alert, we want to remind people about the importance of taking precautions to avoid exposure to mosquitoes, and prevent infection.”

Health officials in Florida routinely test chicken flocks for the presence of the St. Louis Encephalitis virus. The chicken flocks serve as an early warning system to determine the level of viral activity. Since August 14, health officials have observed sporadic confirmed test results from the chicken flocks, but the number of confirmed test results increased significantly during the past week.

“The annual total as of last week was 68 confirmed test results from chicken flocks in nine Florida counties. Today, an additional 30 confirmed results came back from the state labs,” said Hunter.

While most of the viral activity is being observed in the alert counties, health officials advise that all Florida residents and visitors, especially people over age 60 should take precautions to guard against mosquito bites since they are a nuisance, and have the potential to carry serious diseases. Health officials recommend the following precautions:

- Minimize outdoor activities between dusk and dawn when mosquitoes are most active;
- When outdoors and mosquitoes are present, wear shoes and socks, long pants, and a long-sleeved shirt;
- Use mosquito repellent on exposed skin when it is necessary to be outdoors;
- Check residential screening, including porches and patios, for tears and other openings; and
- Eliminate stagnant water in birdbaths, lily ponds, flowerpots and any other receptacles in which mosquitoes might breed.

The medical alert is an official state action that requires health departments in the four affected counties to contact local physicians to encourage increased surveillance for the

disease. Additionally, health departments will work with mosquito control districts to reduce mosquito populations, coordinate local action with school districts and organizers of outdoor events and provide information to the public about limiting exposure to mosquitoes.

“This medical alert is not intended to keep residents and visitors of Florida indoors,” said Hunter. “Instead, it is an effort to advise people how they can protect themselves so they can stay active, safe and healthy while continuing their normal activities.”

The mosquito found to carry the virus most often is the *Culex nigrapalpus*, a small, brown mosquito with a soft bite that is hard to detect. The onset of St. Louis Encephalitis usually occurs within 4 to 21 days after being bitten by a mosquito carrying the disease. Symptoms include fever, headache, stiff neck, dizziness, weakness, confusion, swelling of the brain, and, in the most severe cases, coma and death.

The presence of St. Louis Encephalitis in chicken flocks is not uncommon in Florida. When the activity increases significantly, the state issues a medical alert in affected counties. The largest St. Louis Encephalitis outbreak in recent history occurred in 1990 when 223 people were infected with the virus. In 1997, the state issued a medical alert in 27 Florida counties. Nine people in Florida contracted the disease last year and one of those cases resulted in the death of 68-year-old Hillsborough County man.

Florida residents and visitors can call the Department of Health’s toll free hotline for weekly updates on St. Louis Encephalitis at 1-888-880-5782. Information is available on the hotline in both English and Spanish.

## Sample Letter to Health Care Providers during an SLE Medical Alert

Dear Colleague:

Recent events in our county indicate that at present there is potential for the transmission of St. Louis encephalitis (SLE) virus to people. SLE virus is an arbovirus that is transmitted to people by the bite of an infected mosquito. The mosquito vector in Florida is *Culex nigripalpus*, a species that is found throughout central and South Florida. Viral amplification is effected by transmission from mosquitoes to many species of wild birds. Man is an incidental, dead-end host. The last major outbreaks of SLE occurred in Florida during 1990 and 1997. Study of these outbreaks demonstrated that people who knew of the warnings and who followed personal precautions were less likely to be diagnosed with SLE during the outbreak.

SLE causes a spectrum of disease in people, most commonly asymptomatic infection. Older persons are more likely to have symptomatic illness. Symptoms may range from fever with a headache to aseptic meningitis to encephalitis. At its most severe, SLE can result in coma and death; 3 to 30% of all detected cases in previous studies have died. Both coma and death are more likely to occur in those over age 55.

SLE should be considered in the differential diagnosis for any person with the above range of symptoms. Although serologic testing can be obtained through private laboratories, we encourage health care providers to use testing offered through the state health department. Additionally, cerebrospinal fluid can be tested for IgM antibody. This test is obtained by sending the specimen to the appropriate DOH laboratory. The following case classification should be used:

*Clinical Description:* Arboviral infection may result in a febrile illness of variable severity associated with neurologic symptoms ranging from headache to aseptic meningitis or encephalitis. Arboviral encephalitis cannot be distinguished clinically from other central nervous system (CNS) infections. Symptoms can include headache, confusion or other alteration in sensorium, nausea, and vomiting. Signs may include fever, meningismus, cranial nerve palsies, paresis or paralysis, sensory deficits, altered reflexes, convulsions, abnormal movements, and coma of varying degree.

*Laboratory Criteria for Diagnosis:*

- Fourfold or greater change in paired sera antibody titer, or
- Isolation of virus from or demonstration of viral antigen or genomic sequences in tissue, blood, CSF, or other body fluid, or
- Specific IgM antibody by EIA antibody captured in CSF or serum. Serum IgM antibodies alone should be confirmed by demonstration of IgG antibodies by another serologic assay (e.g., SN or HI).

**Probable Case:** viral transmission is likely, and with the following supportive serology: a stable ( $\leq$  twofold change) elevated antibody titer to an arbovirus (e.g.,  $\geq$  320 by HI,  $\geq$  128 by CF,  $\geq$  256 by immunofluorescence, and  $\geq$  160 by SN, or  $\geq$  400 by EIA IgM).

**Confirmed Case:** a clinically compatible case that is laboratory confirmed

**NOTE: SLE is a reportable disease. Please complete "St. Louis/Eastern Equine Encephalitis Case Report Form (rev. 3/98) and mail to the local county health department.**

**Florida Department of Health  
Public Service Announcement**

## **How to Protect Yourself From Mosquito-transmitted Encephalitis**

St. Louis encephalitis (SLE) is a serious disease people can get from mosquito bites. Take these simple steps to protect yourself and your family:

- Between dusk and dawn minimize the time you spend outdoors
- Wear long pants and long sleeve shirts when outside
- Use mosquito repellent when you are outdoors
- Eliminate stagnant water where mosquitoes can lay their eggs in containers around your home (e.g., in birdbaths, buckets, flower pots, wading pools).
- Keep mosquitoes from entering your home by fixing screens in windows and doors.

Play it safe and keep mosquitoes from putting the bite on you!

## SLE MEDICAL ALERT

The onset of St. Louis encephalitis (SLE) usually occurs within 4-21 days after being bitten by a mosquito carrying the virus. Symptoms include fever, headache, stiff neck, dizziness, weakness, confusion, swelling of the brain, and, in the most severe cases among the elderly, coma and death. See your physician if you feel you have this disease.

Residents and visitors, especially the elderly, in alert counties are advised take basic precautions to reduce their exposure to mosquitoes and prevent encephalitis infection:

- Minimize outdoor activities during dusk through dawn hours if possible.
- When outdoors and mosquitoes are present, wear shoes and socks, long pants, and a long-sleeved shirt.
- Use mosquito repellent on exposed skin when outdoors.
- Repair screens and windows to keep mosquitoes outside.
- Eliminate stagnant water around your home.

Note: While the Department of Health has long-recommended that residents and visitors to counties under medical alerts limit their outdoor activities during dusk through dawn, the department is not recommending a large-scale ban of evening activities. Residents are advised to follow the common-sense precautions, such as wearing mosquito repellent and long-sleeve shirts and long pants, to make their time outside safer.

# St. Louis Encephalitis (SLE)

## Questions and Answers

### **What is St Louis Encephalitis?**

St. Louis Encephalitis (SLE) is a mosquito-borne viral disease that causes inflammation (swelling) of the brain. In an average year, Florida has from one to 10 cases of SLE. Several large outbreaks involving as many as 200 cases-have occurred in Florida in recent decades.

### **What are the symptoms of SLE?**

Many infections with SLE are inapparent 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 SLE?**

SLE virus 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 SLE?**

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.

Recommendations are:

- Check residential screening, including porches and patios
- Avoid outdoor activities between dusk and dawn
- If you must be outdoors when mosquitoes are active, cover up by wearing shoes, socks, long pants and shirts and use mosquito repellent on skin that will be exposed.
- Eliminate stagnant water in any receptacles in which mosquitoes might breed

### **When was the last outbreak of SLE in Florida?**

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

### **How do we know that SLE 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 SLE virus. In many areas, these agencies and county health departments also keep chicken flocks and monitor these chickens for evidence of exposure to SLE virus.

### **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, SLE virus 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 SLE activity. In addition, a number of press releases and public education activities have been undertaken to increase awareness of personal protective measures.

*Note: The use of products containing DEET in concentrations above 30% is not recommended.*

## DEET Information

(Source: Environmental Protection Agency (EPA)  
<http://www.epa.gov/opp00001/citizens/deet.htm>)

### 1. What is DEET?

DEET (chemical name, N,N-diethyl-meta-toluamide) is the active ingredient in many insect repellent products. It is used to repel biting pests such as mosquitoes and ticks, including ticks that may carry Lyme disease. Every year, approximately one-third of the U.S. population is expected to use DEET. Products containing DEET currently are available to the public in a variety of liquids, lotions, sprays, and impregnated materials (e.g., wrist bands). Formulations registered for direct application to human skin contain from 4 to 100% DEET. Except for a few veterinary uses, DEET is registered for use by consumers, and it is not used on food. DEET is designed for direct application to human skin to repel insects, rather than kill them. After it was developed by the U.S. Army in 1946, DEET was registered for use by the general public in 1957. Approximately 230 products containing DEET are currently registered with EPA by about 70 different companies.

### 2. What recent decision did EPA make concerning the use of DEET?

EPA recently issued a Reregistration Eligibility Decision (RED) for the chemical DEET. After completing a comprehensive re- assessment of DEET, EPA concluded that, as long as consumers follow label directions and take proper precautions, insect repellents containing DEET do not present a health concern. Human exposure is expected to be brief, and long-term exposure is not expected. Based on extensive toxicity testing, the Agency believes that the normal use of DEET does not present a health concern to the general population. Most of the changes to DEET registrations required by EPA concern label directions and claims. The Agency also is encouraging companies to provide a company telephone number or toll-free number on all product labels for consumers to call for additional product information and to report incidents. The Agency has determined that registrants may distribute and sell DEET products bearing old labels for 26 months from the date of issuance of the RED, and stores may continue to sell these products for 50 months from the date of issuance.

**What is RED?** EPA evaluates existing pesticides that originally were registered when the standards for government approval were less stringent. This comprehensive evaluation and risk mitigation process is complete when EPA is satisfied that the pesticide(s), used in accordance with approved labeling, will not pose unreasonable risks to human health or the environment. EPA's regulatory conclusion about each case is presented in a document called a Reregistration Eligibility Decision (RED). Later, once product-specific data and revised labeling are submitted to EPA and approved, the Agency reregisters products containing the eligible pesticide(s). A pesticide product is not reregistered, however, until all of its active ingredients are eligible for registration.

**How to use DEET products safely:**

Consumers can reduce their own risks when using DEET by reading and following products labels. Statements on all DEET product labels will be revised to include the following directions:

- Read and follow all directions and precautions on this product label.
- Do not apply over cuts, wounds, or irritated skin.
- Do not apply to hands or near eyes and mouth of young children.
- Do not allow young children to apply this product.
- Use just enough repellent to cover exposed skin and/or clothing.
- Do not use under clothing.
- Avoid over-application of this product.
- After returning indoors, wash treated skin with soap and water.
- Wash treated clothing before wearing it again.
- Use of this product may cause skin reactions in rare cases. The following additional statements will appear on the labels of all aerosol and pump spray formulation labels:
  - Do not spray in enclosed areas.
  - To apply to face, spray on hands first and then rub on face. Do not spray directly onto face.

**3. How is EPA changing cosmetic claims on DEET product labels?**

When DEET products make cosmetic claims, EPA is requiring that labeling for insect repellency be displayed prominently -- first on the label and in large, bold-faced type -- before cosmetic claims. The Agency is concerned that prominent cosmetic claims on DEET labels distracts consumers from label directions that instruct users to apply cautiously and sparingly.

**4. Why is EPA changing child safety claims on DEET product labels?**

EPA is no longer allowing child safety claims on product labels. These claims currently appear on certain products containing a DEET concentration of 15% or less. The scientific data on DEET do not support product label claims of child safety based on the percentage of active ingredient.

**5. What should consumers do in the event of a potential reaction to DEET?**

If you suspect that you or your child is having an adverse reaction to this product, discontinue use of the product, wash treated skin, and call your local poison control center or physician for help. If you go to a doctor, take the repellent container with you.

**6. What benefits do DEET products offer?**

DEET's most significant benefit is its ability to repel potentially disease-carrying insects and ticks. The Centers for Disease Control (CDC) receives nearly 10,000 reports of Lyme disease (transmitted by deer ticks) and 1,000 reports of encephalitis (transmitted by mosquitoes) annually. Both of these diseases can cause serious health problems or even death in the case of encephalitis. Where these diseases are endemic, the CDC recommends use of insect repellents when out-of-doors. Studies submitted to

EPA indicate that DEET repels ticks for about three to eight hours, depending on the percentage of DEET in the product.