

DIVISION OF
Environmental Health



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

2006 Guidebook



Acknowledgements

The following have contributed considerably to this publication and are gratefully acknowledged for their work and editorial comments:

William Bigler, Donald Shroyer, Julia Gill, Valerie Mock and the Interagency Arbovirus Task Force.

This publication succeeds HRS Pamphlet 150-12, Surveillance and Control of Diseases Spread by Mosquitoes and Ticks in Florida, April 28, 1992 and HRS Manual 150-2, St. Louis Encephalitis and Other Selected Arthropod-Borne Viruses, April 20, 1987.

Purpose

This publication establishes guidelines for detecting and monitoring St. Louis Encephalitis, West Nile Fever 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. Carina Blackmore, Bureau of Community Environmental Health, 4052 Bald Cypress Way, Bin A-08, Tallahassee, Florida 32399-1720, (850) 245-4299, FAX (850) 922-8473.

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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, West Nile (WN) 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. Another virus, Powassan, a tick-borne virus, is a minor cause of encephalitis in the northern United States. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In Florida, where arthropods are active late into the year, cases can occur into the winter months. Most human infections are asymptomatic or may result in a nonspecific flu-like syndrome. Onset may be insidious or sudden with fever, headache, myalgias, malaise and occasionally prostration. Infection may, however, lead to encephalitis, with a fatal outcome or permanent neurologic sequelae. Fortunately, only a small proportion of infected people progress to having encephalitis.

Laboratory criteria for arboviral 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., EIA, hemagglutination-inhibition (HI) or neutralization test).

Because the arboviral encephalitides are viral diseases, antibiotics are not helpful for treatment and the effectiveness of antiviral agents has not been shown. Treatment is supportive, attempting to deal with problems such as swelling of the brain, 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 ratites against EEE, WEE and Venezuelan equine encephalitis (VEE). A horse vaccine against WN virus has been on the market since 2001.

Arboviral encephalitis can be prevented through personal and community protective measures. Personal protective measures include reducing time outdoors particularly in early morning and evening hours, wearing long pants and long-sleeved shirts, applying CDC-approved 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, stopped up gutters and buckets and removing/destroying discarded tires) and may include the use of insecticides (larvicides and adulticides) to kill mosquitoes. Repellants containing DEET (N,N-diethyl-m-toluamide) and permethrin are excellent tools for personal protection. Additional options on the market, specifically Picaridin (KBR 3023) and oil of lemon eucalyptus, are registered with the EPA and have performed well in evidence

published in the peer reviewed literature. Advantages stated in some references indicate that these alternatives are reportedly less irritating to the skin. For CDC's latest guidelines, see www.cdc.gov.

Several local, state and federal agencies are involved with the surveillance and control of arboviral diseases. Mosquito-borne encephalitis surveillance activities include 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 utilization of technologies which allow for rapid identification of zoonotic viruses in bird and 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 genomic sequence information for use in polymerase chain reaction (PCR) assays and monoclonal antibodies (MAbs) for use in IFA and ELISA assays. MAbs with avidities sufficiently high to allow for specific binding to virus antigens in a complex protein mixture (e.g., mosquito pool suspensions) have also enhanced the ability to rapidly identify virus agents *in situ*.

A. St. Louis Encephalitis (SLE)

SLE virus, a flavivirus, was the most common mosquito-transmitted human pathogen in the U.S. prior to the introduction of WN virus. 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 Florida.

Infection with SLE virus results in unapparent 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 virus infection includes unapparent infection, mild illness (fever with headache), aseptic meningitis, and encephalitis that can progress to coma and death. Less than 1% of SLE virus 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 virus 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 are maintained in about 30 Florida counties.

B. Eastern Equine Encephalitis

Eastern equine encephalitis (EEE) virus is an alphavirus that was first identified in the 1930s 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. In this usual cycle of transmission, virus does not escape from the swampy areas because the mosquito involved prefers to feed upon birds and does not usually bite humans or other mammals.

For reasons not fully understood, the virus may escape from enzootic foci in swamp areas in birds or bridge vectors such as *Coquillettidia perturbans*, *Ochlerotatus atlanticus*, *Cx. nigripalpus*, *Cx. perturbans*, *Cx. quinquefasciatus*, *Oc. sollicitans*, and *Aedes 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. Native bird species do not seem to be affected by the virus. 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. Migratory birds may introduce the EEE virus to northern states in the spring each year.

It takes from 3-10 days after the bite of an infected mosquito for an individual to develop symptoms of EEE. These symptoms begin with a sudden onset of fever, general muscle pains, and a headache of increasing severity. Many individuals will progress to more severe symptoms such as seizures and coma. Although the majority of human infections are asymptomatic, approximately one-third of all people with clinical encephalitis caused by EEE will die from the disease. 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 and WN virus 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

The West Nile (WN) virus 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. Since then the virus has spread and by the end of 2005, it had been detected in 48 states and more than 19,000 human cases had been confirmed. WN virus was first detected in Florida in July 2001. Twelve human cases were reported in the state that year. In 2002, 35 human cases of WN virus illness were detected in Florida. Included among these cases were two individuals who acquired their infections via organ transplants and one person who became infected from a blood transfusion. Ninety-four cases were confirmed in 2003 and 42 cases were reported in 2004. In 2005, 21 human cases were reported. Since its initial detection, WN virus activity has been reported in all 67 Florida counties. WN virus activity in Florida is focal in nature. In 2001, the epicenter of the WN virus outbreak was in the north-central part of the state. The following year, activity was most intense in northwestern and central counties. The focus in 2003 was the panhandle, while south Florida saw the most activity in 2004. In 2005, 86% of the cases were reported in Pinellas County.

Like SLE virus, which is closely related to WN virus, the natural cycle of WN virus appears to involve *Culex* mosquitoes and wild birds. However, unlike SLE virus, WN virus causes high rates of mortality in certain families of birds, especially in corvids. It is also pathogenic for horses. More than 1,000 cases of equine WN meningo-encephalitis were confirmed in Florida between 2001 and 2005.

The clinical spectrum for human WN virus infection includes asymptomatic infection, mild illness (fever and headache), aseptic meningitis, and encephalitis that can progress to coma and death. Approximately 80% of those infected show no clinical symptoms. Twenty percent have mild symptoms, and less than 1% experience the most severe form of illness. Typically, symptoms appear between 3 and 14 days after the bite of an infected mosquito. In Florida, case fatality rates range from 4% for all cases to 7% among those who develop the neuroinvasive form of the disease.

Because SLE and WN viruses are antigenically related, cross-reactions are observed with some serologic tests. Plaque reduction neutralization testing (PRNT) done to distinguish the two viruses is done at the Department of Health Laboratory, Tampa.

D. Dengue

The last dengue epidemic in Florida occurred in 1934-1935 in the Tampa and Miami areas. Since then, a small number of cases have been reported each year in individuals with recent travel history to a dengue-endemic country. However, the primary vector, *Aedes aegypti*, is found throughout the state and the transmission of dengue within Florida is still possible. Additional information on dengue can be found in Appendix J.

E. Other Arboviral Encephalitides

Other arboviral encephalitides of minor public health significance that occur in Florida are WEE, EVE and Keystone and Jamestown Canyon virus (JCV) (Bunyaviridae; California group). To date, no reported human cases of WEE have been acquired in Florida. While serologic evidence of EVE virus 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. One human case of JCV was confirmed in Lee County in 1993.

II. Malaria

Endemic malaria was eradicated from Florida in the late 1940s. However, *Anopheles* mosquitoes, responsible for transmitting malaria to humans, are common in the state and autochthonous malaria transmission still possible. The last documented outbreak was in Palm Beach County in 2003 when 8 cases of *Plasmodium vivax* malaria were confirmed. For more information on malaria and malaria diagnostics and prevention see Appendix K.

III. 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. Antibiotic treatment during the early stages of the disease may limit the antibody response; however serum samples from persons with disseminated or late-stage LD almost always have a strong IgG reactivity with a typical banding pattern to *B. burgdorferi* antigens by Western immunoblotting. Skin biopsies of the EM lesion may yield *Borrelia* organisms.

LD occurs throughout the continental US with highest incidence in foci in the northeastern, north central, 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 over-diagnosis of LD and the resulting inappropriate treatment.

LD occurs only sporadically in the southern states. Three hundred sixty-six cases were confirmed in Florida from 1999-2005. Most people with LD acquired their infection in the northeast. In the seven-year period 1999-2005, an annual average of 18 cases without a travel history outside of the state was reported to the State Health Office.

LD associated EM rashes appear to be rare in southeastern U.S. because it is generally not possible to recover *B. burgdorferi* organisms from skin biopsies taken from individuals infected there. However, tick-bite associated EM lesions do occur. Studies are under way to determine if a related spirochete, *Borrelia lonestari*, isolated from *Amblyomma americanum*, the Lone Star tick, may be the cause.

IV. Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever (RMSF) 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 (*A. 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 1970s, 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 de-ticking animals 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 1999 and 2004, 81 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.

V. Ehrlichiosis and Anaplasmosis

Bacteria in the genera Ehrlichia and Anaplasma can also cause fever illnesses in humans with a potentially fatal outcome. *E. chaffeensis*, discovered in 1987, causes human monocytic ehrlichiosis (HME). What was originally thought to be a second species of *Ehrlichia* causing human granulocytic ehrlichiosis (HGE) was recently reclassified as *Anaplasma phagocytophilum*, with the associated illness renamed to human granulocytic anaplasmosis (HGA). Nonspecific clinical findings make both diseases difficult to diagnose. They may account for many cases of unexplained tick-associated fevers of unknown origin -- for example, some illnesses misdiagnosed as LD.

HME has been identified in over 1,000 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 *A. 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 2-3% 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 becoming a nationally notifiable disease in 1999, nearly 3,000 cases of HGA have been confirmed in the United States. Infected *Ixodes scapularis* have been found in regions where this disease occurs. HGA 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 HGA, although peripheral blood smears reveal intraneutrophilic morulae in many patients. Therapy with doxycycline results in defervescence within 48 hours. Also, recent reports indicate that LD patients with prolonged illness that is unresponsive to antibiotics, especially amoxicillin, may have concurrent infections with *Ehrlichia* or *Anaplasma sp.* Florida added ehrlichiosis to its list of notifiable diseases in 1996.

In Florida, 41 cases of HME and 9 cases of HGE (now known to be HGA) were reported from 2000-2005. Of these, 34 did not report travel history outside of the state. Most Florida-acquired cases reported exposure in northeastern or panhandle counties.

VI. Babesiosis

Babesiosis is caused by parasites of the genus *Babesia*. Only a few of the over 100 identified species are known to infect humans. *B. microti* is responsible for most human infections in the United States. Human babesiosis is endemic in the northeastern coastal areas of the U.S., with cases also reported in New Jersey, Virginia, Maryland, California, Washington, Minnesota, Wisconsin, Missouri, Georgia, and Mexico. The tick vector, *I. scapularis*, is the same species involved in the transmission of Lyme disease.

After exposure, the incubation period ranges from 1 to 4 weeks. Clinical manifestations include fever, headache, chills, and muscle weakness, with more severe disease often seen in the immunosuppressed or elderly. Most infections are thought to be asymptomatic. In diagnosed cases, treatment with clindamycin and quinine is recommended.

It is important to be aware of babesiosis as human cases continue to be diagnosed in northeastern states. However, it is not currently considered a significant human health issue in Florida.

VII. Other vector-borne diseases of human health importance

There are a number of additional vector-borne diseases that can affect human health. For more information, please refer to the following document:

Eldridge, B.F. and J.D. Edman, (Eds). **2004**. Medical Entomology: A textbook on public health and veterinary problems caused by arthropods. Kluwer Press, Boston.

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.

Roles and Responsibilities:

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

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, WN, EEE, LD, RMSF, ehrlichiosis and other reportable arthropod-borne diseases. Confirmed and probable cases are reportable under Chapter 381, Florida Statutes.
- Participate in appropriate sentinel avian and horse surveillance 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 Community Environmental Health and with mosquito control to issue health alerts to the media or to the public.
- Report human cases in Merlin.

II. DOH Bureau of Laboratory Services

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

- Conduct appropriate tests for detection of arthropod-borne diseases in human, equine 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 Community Environmental Health, and to the attending physician. Follow-up written reports are submitted as soon as possible.
- Report the results of all virus-infected birds electronically to the Bureau of Community Environmental Health and the CHD.
- Prepare weekly summary reports indicating the number of sentinel sera submitted, number tested, and number positive by county.

III. DOH Division of Environmental Health, Bureau of Community Environmental Health

Contact: Bureau of Community Environmental Health, (850) 245-4299.

- Direct statewide surveillance, prevention and control programs for human arthropod-borne diseases.
- Provide guidelines for sentinel SLE and WN virus 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 media including weekly electronic *EpiUpdate*, website development, and as-needed arbovirus conference calls.
- Recommend health alerts to the State Health Officer.
- Conduct active EEE and WN 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

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

V. Department of Agriculture and Consumer Services (DACCS) Bureau of Entomology and Pest Control

Contact: Bureau of Entomology and Pest Control, (850) 921-4177 or (850) 922-7011.

- Coordinate with the Bureau of Community Environmental Health and with local CHDs before releasing vector data to the media or to the public.
- Provide technical support, mosquito control 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

Contact: State Agriculture Veterinarian, (850) 410-0900; State Diagnostic Laboratory (veterinary), (321) 697-1400.

- 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 Community Environmental Health 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 and WN virus activity (maintain and monitor flocks and collect and process blood samples) as feasible.

VIII. Florida Universities

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

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

IX. Department of Environmental Protection (DEP)

Contact: Office of the Director, Florida Park Service, (850) 245-3029.

- Coordinate efforts for intensified mosquito control on protected public lands as needed during health threats.
- Provide consultation and technical assistance as required.

X. Florida Fish and Wildlife Conservation Commission (FWC)

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

- Maintain a database for bird mortality reporting and surveillance
- Provide consultation and technical assistance as needed.

XI. 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.

XII. Physicians and Hospitals

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

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

XIII. Veterinarians

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

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

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

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

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

XV. Notification and Public Information of Arboviral Surveillance Results

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

- The interagency partners, at their discretion and based on the amount of arbovirus activity, will distribute the weekly information as follows:

DACS Bureau of Entomology and Pest Control (BoEPC) will notify:

All organized Mosquito Control Districts

DACS Division of Animal Industry (DAI) will notify:

Animal Industry Organizations

Veterinarians

Florida Fish and Wildlife Conservation Commission (FWC) will notify:

Regional biologists

Wildlife rehabilitators

Department of Environmental Protection (DEP) will notify:

DEP Safety Coordinator and Safety Advisory Board

Florida Park Service district offices and safety coordinators

DEP Boating Safety Officers

DEP Division of Law Enforcement

DEP Office of Greenways and Trails

DEP Office of Coastal and Aquatic Managed Areas

The DOH Bureau of Laboratory will notify:

Sample submitter as results become available

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

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

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

Chapter 3

Arthropod-borne Disease Monitoring Activities

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

I. Sentinel Chicken Serology and Mosquito-Borne Viruses

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

Sentinel chickens are frequently infected with SLE and WN viruses but reports of sentinels with EEE virus infections are less common. This is likely due to the extremely focal distribution of EEE virus in Florida and the low probability that sentinel flocks are located in EEE virus transmission zones. Therefore, sentinel chicken surveillance may be less useful for predicting EEE transmission to humans. However, during years of heavy EEE transmission in Florida, including 1978, 1991, 1997, and 2003 EEE virus transmission was reported in sentinel chickens over a wide area indicating a generalized risk of EEE virus transmission to humans throughout the traditional Florida EEE virus transmission zone.

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

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

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

Note: Chickens are not known to transmit mosquito-borne viruses directly to people.

A. Sentinel Chicken Flock Information

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

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

- Clusters of morbidity or mortality among flocks should be reported to DACS, Division of Animal Industry, at 850-410-0900 or 1-800-342-5869.

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), surrounding vegetation, and weather conditions during the surveillance season.
- **All chickens in the flock should be bled every week.**
- Arboviral positive individuals are confirmed by a second Hemagglutination Inhibition (HI) positive blood specimen, by IgM Elisa and/or Plaque Reduction Neutralization Tests. Antibody positive chickens may revert to false HI negative status on later serum samples; thus, chickens that are reported as confirmed positive should be removed from the flock and replaced with a baseline negative bird from the holding flock.
- The weekly seroconversion rate is the number of arbovirus positive chickens divided by the number of birds tested. Seroconversion rates can be calculated for the state, county, or individual flocks.
- Serologically negative chickens may be bled throughout the season, but all chickens should be replaced annually with new birds early in the year (April-May).
- **Chickens that seroconvert or die should be replaced with a non-immune chicken having a NEW band number.** Notify the laboratory as to dead/missing chickens and their replacements.

D. Instructions for Bleeding Chickens

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

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

- A Stretch out a wing to expose its underside. Alternate wings each time the chicken is bled in order to allow healing. (Some may choose to take samples from jugular veins).
- 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: Latex gloves and a face shield or protective eyewear should be worn during the entire bleeding procedure. Hands should be cleaned with an alcohol based disinfectant after removing gloves and the gloves disposed of. Hand sanitizers containing around 70% alcohol are most effective. Should the Asian strain of Avian Influenza H5N1 be detected in the United States, additional occupational safety measures will be necessary. Draft guidelines are available in Appendix E.

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

Note: Needles should be recapped using a one-handed technique (using the syringe to scoop the cap onto the needle), or by using forceps or a clamp. Uncapped needles can be removed from the syringe by a mechanical unwinding device that deposits the needle directly into the sharps container. If the phlebotomist is stuck by a needle during the bleeding procedure, the chicken blood needs to be tested for virus*. Contact the Tampa Laboratory at 813-974-5990 for shipping directions. In addition, all needles must be deposited into a sharps container at the point of origin, which is defined as the area where the waste is generated. The sharps containers must be transported by a Department of Health-registered transporter to a permitted storage or treatment facility that has an active permit from the Department. Treatment must be achieved by incineration, steam sterilization, or an alternative treatment process approved by the Department.

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

- G Label each vial using a waterproof marking pen or pencil with the following information:
 - correct bird number from the permanent wing tag or leg band -- **important!**
 - 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 1200rpm, trapping the clot in the bottom of the tube.
- J The tube may be shipped directly to the Bureau of Laboratories, Tampa, without decanting the serum. Contact the Tampa Laboratory for shipping containers. See Appendix D for a copy of the laboratory form.

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

E. Serum Testing/Data Dissemination

Sentinel chicken sera are tested at DOH Bureau of Laboratories, Tampa (contact the laboratory at 813-974-8000 or SC 574-8000). The Tampa lab communicates the results weekly to the county coordinator submitting specimens as well as the county health department, the DOH Bureau of Community Environmental Health and the DACS Bureau of Entomology and Pest Control.

II. Dead Bird Reporting and Testing

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

Because of the understanding we have gained about the mortality rates of different bird species infected with WN virus, under most circumstances dead bird testing is not warranted. Instead, ask the public to report bird mortality sightings on the www.MyFWC.com/bird/ website. CHD staff may also assist with the reporting process.

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

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

When collecting a dead bird to submit for testing:

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

http://www.doh.state.fl.us/environment/community/arboviral/protocol_bird.htm

When disposing of a dead bird:

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

III. Surveillance of Human Disease

SLE, WN, EEE, malaria, dengue, yellow fever, LD, RMSF and ehrlichia are reportable human diseases in Florida. County health departments provide case information to the Bureau of Community Environmental Health for data analysis and dissemination. The surveillance case definitions are outlined in Appendix F.

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

IV. Laboratory Testing Protocol

At the DOH Laboratories, sera collected from sentinel chicken flocks, wild birds and animals are tested for EEE, SLE and WN virus with 3 different serological assays according to the following algorithm: All specimens are screened using an HI assay to detect alphavirus (EEE or HJ virus), and/or flavivirus (SLE or WN virus) antibodies. Sentinel chicken sera that are flavivirus positive are tested in an SLE and WN virus IgM ELISA assay. Sentinel sera that are alphavirus positive in the HI assay are tested for IgM antibody to EEE. A repeat serum is tested on IgM - negative chickens. IgM antibody equivocal sera may be assayed by serum neutralization (SN) for confirmation of etiology. HI flavivirus antibody positive wild bird or mammalian sera are assayed by SN to confirm the etiological agent.

Human sera are assayed by IgM and IgG ELISA assays; equivocal results are confirmed by serum neutralization. For interpretation of human test results see Appendix G.

The MIA assay is a new microsphere based assay that is being validated and is planned to be added to the BOL test algorithm for 2007.

V. Equine Surveillance

Equine surveillance is also used to assess the impact of WN and EEE in the state. Veterinarians should send equine sera or brain tissue to the DACS laboratory for evaluation. Results should be available within a week. An equine case definition for arboviral surveillance in Florida is available in Appendix H.

VI. Weather Analysis – Rainfall Monitoring

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

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

Meteorological conditions predispose regions to epidemic arboviral conditions. Specifically, droughts during the Amplification (April-June) and Early Transmission (July-September) phases of the annual Florida arboviral cycle greatly enhances the probability of epidemic transmission. See: Day, 2001, Predicting St. Louis encephalitis virus epidemics: Lessons from recent, and not so recent, outbreaks, *Annual Review of Entomology*, 46:111-138 for a review. Real-time measures of drought are critically important for assessing epidemic risk in Florida. We currently use the Keetch-Byram Drought Index (KBDI) to assess daily surface wetness conditions throughout the state. It has recently become evident that modeled water table data (WTD) provide a much more sensitive measure of ground water pooling and *Culex* reproductive behavior. One of the most reliable epidemic signatures is modeled WTD that can be tracked throughout the year in real-time and used to predict arboviral transmission. See: Shaman et al. 2004, Seasonal forecast of St. Louis encephalitis virus transmission, Florida, *Emerging Infectious Diseases*, 10:802-809 for a review. Unfortunately, modeled WTD are not presently available to workers in the field. This may change in the near future, and once the WTD become available for general use, they will provide a powerful tool for monitoring and predicting arboviral epidemics.

VII. Mosquito Monitoring

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

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 9th Street SE, Vero Beach, Florida 32962, (772) 778-7200, or downloaded from FMEL web page: <http://www.ifas.ufl.edu/~veroweb/wpaper.htm>.

Collections of flying mosquitoes (mostly host-seeking females) can be made by utilizing many different light trap designs (CDC, New Jersey, and updraft to name a few). Light traps can be run with or without added carbon dioxide and other secondary attractants such as octenol. Ovipositing female mosquitoes can be collected in gravid traps. Host-baited traps, including lard can traps and Trinidad traps can be used to collect host-seeking female mosquitoes. Sentinel chicken cages can be fitted with exit traps which collect female mosquitoes (empty and blood fed) as they exit the sentinel cage, usually early in the morning. Resting mosquitoes can be collected with backpack aspirators and large, medium or small hand-held aspirators.

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

B. Viral Assay in Mosquitoes

There is no history of prospective arbovirus surveillance in Florida involving evaluation of SLE, EEE or WN virus infection rates in mosquitoes. It is clear that during epidemic periods, high SLE or WN virus infection rates can be demonstrated in *Cx. nigripalpus* mosquitoes.

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

Each organization performing mosquito viral assays should provide test results to the Department of Health Arbovirus Surveillance Coordinator for inclusion in the statewide database. This should include assay method for positive pools, number of pools and number of individuals per pool, species, date and site collected and agent detected. For negative pools, number of pools of each species should be provided. For further information on using mosquito testing for arbovirus surveillance, see Donald Shroyer's 2001 Wing Beat article.

<http://www.floridamosquito.org/WING/2001/Summer%202001.pdf> For further guidance on commercial assays for WN and EEE virus in mosquitoes (i.e. VecTestTM, RAMP[®] test) see the following article from CDC and Health Canada laboratories. http://www.responsebio.com/pdf/Evaluation_of_Commercial_Assays_for_Detecting_West_Nile_Vi.pdf

It is essential that laboratories conducting viral surveillance with mosquitoes (including, for example, Ramp or VecTests) provide appropriate safety procedures for working with BL-2, BL-3 pathogens. Minimal requirements include latex gloves, eye-face protection, disinfection of all materials and supplies, and protection against potential aerosols generated during homogenization procedures. Note: the test kit buffer may not kill all pathogens present in the specimen. For

guidelines on trapping and testing mosquitoes for WN virus see Appendix I. The laboratory submission form for mosquito testing can be found in Appendix D.

VIII. Tick Monitoring

Diagnosis of LD, RMSF, and ehrlichiosis 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 determining 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.

Four tick species are suspected as potential vectors of LD in the southeastern U.S.: *I. scapularis* (the black-legged tick), *A. americanum* (Lone Star tick), *A. maculatum* (Gulf Coast tick) and *D.r variabilis* (American dog tick). None have been adequately incriminated as the primary vector, though the black-legged tick is the most likely vector of LD in the southeast. 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 human monocytic ehrlichiosis is *A. americanum*; for human granulocytic ehrlichiosis *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 wooded 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 the most common human-biting species in Florida. For additional information about tick removal and identification after diagnosis, please see Appendix L.

Chapter 4

Control Measures and Surveillance Response

I. Personal Protection

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

A. Mosquito-borne Disease

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, *Cx. 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 those 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. Products with concentrations up to 30% DEET (N,N-diethyl-meta-toluamide, or N,N-diethyl-3-methylbenzamide) are generally recommended for most situations where the potential exists for exposure to mosquitoes. Picaridin (KBR 3023), a chemical repellent, and oil of lemon eucalyptus [p-methane 3,8-diol (PMD)], a plant based repellent, are also registered with EPA and have performed well in a small number of recent scientific studies. These products are generally available at local pharmacies. Active ingredients are listed on the product label. 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 will dissolve 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. If additional protection is necessary, a permethrin-containing repellent can be applied directly to clothing. The manufacturer's directions should be read carefully before applying repellent.

Some repellants are not suitable for children. The label will indicate the age range for which the repellent is appropriate. Repellents should not be applied to the hands of children. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing. It is not recommended to use DEET on children less than 2 months old. Instead, infants should be kept indoors or mosquito netting used over carriers when mosquitoes are present. According to the CDC, mosquito repellents containing oil of lemon eucalyptus should not be used on children under the age of 3 years.

For information about DEET and other recommended repellents, see Appendix N.

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 up to 30% N,N -diethyl-m-toluamide (DEET), and/or the clothing-applied insecticide, such as permethrin (e.g., Permanone[®] 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. 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.

When interviewed by the media, remember these arbovirus prevention tips (keeping the message short with only 3 points, 27 words, and 9 seconds):

- Stay indoors at dusk and dawn when mosquitoes are active,
- Use an effective repellent
- Drain standing water around your home where mosquitoes can lay their eggs

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 intensified larviciding programs to reduce future adult populations and elimination of mosquito breeding areas, where applicable, may also be necessary
5. The public also needs to be educated about the difficulty to control *Cx. nigripalpus*, the main vector for SLE and WN. The species has a wide range of larval habitats and the adults are able to fly several miles.

III. Florida Department of Health Response Plan for Mosquito-Borne Diseases

Mosquito-borne disease cycles are complex and often involve insects and several vertebrate host species including humans. Virus transmission can be **very focal**. The response plan for mosquito-borne diseases is intended for use by county health department public information officers and mosquito control districts. The plan can also be used regionally for several counties with similar ecology but is not a response plan for the state as a whole.

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

The CHD Director/Administrator also facilitates the response to mosquito-borne diseases. This includes working closely with the Bureau of Community Environmental Health, mosquito control personnel, physicians, veterinarians, emergency rooms and neighboring counties.

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

In addition to the Florida Department of Health Response Plan, a document has been developed by a team coordinated by Dr. Walter Tabachnick, Florida Medical Entomology Laboratory, to guide the mosquito control response for West Nile virus at various levels of mosquito activity. These response guidelines have been approved by the Florida Coordinating Council on Mosquito Control and are included below. [The Florida Mosquito Control Response Plan – West Nile](#) can be viewed in its entirety in Appendix O.

The Department of Health plan includes the following levels:

Level 1: No activity

This level describes the absence of cycling arboviruses in Florida.

- DOH Response:
 - Surveillance (human and animal sentinel surveillance, mosquito-borne disease surveillance)
 - Distribution of weekly arbovirus surveillance reports
- Mosquito Control Response:
 - Operations targeting nuisance and/or disease-carrying mosquitoes

- Surveillance in sentinel chickens, mosquitoes, and birds

Level 2: Background activity

Describes time periods when mosquito-borne virus activity does not exceed average historical levels.

- DOH Response: (in addition to the response outlined above)
 - Public announcements about personal protection
- Mosquito Control Response: (in addition to the response outlined above)
 - Monitor potential hot spots using surveillance tools.
 - Public announcements about personal protection.
- DACS Bureau of Entomology and Pest Control Response:
 - Monitor activity detected through existing surveillance programs
 - Routinely disseminate surveillance information to mosquito control programs

Level 3: Mosquito-Borne Illness Advisory

Mosquito-Borne Illness Advisories are declared when animal surveillance data indicate a rise in virus transmission activity and an increased potential for human infections, or when a single human case has been confirmed. Mosquito-Borne Illness Advisories may be declared in a county or region where the surveillance data indicate:

1. One sporadic, locally-acquired confirmed human case
OR

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

2. Two or more confirmed horse cases
OR
3. A 10% increase above historical background levels in sentinel chicken seroconversions*
OR
4. A 10% increase above historical background levels in corvid mortality
OR
5. A 10% increase above historical background levels in the minimal infection rate (MIR) of vector mosquitoes

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

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

Mosquito-Borne Illness Advisories are lifted by the CHD when activity has returned to background levels.

*Day, J.F., and L.M. Stark. 1996. Transmission Patterns of St. Louis Encephalitis and Eastern Equine Encephalitis Viruses in Florida: 1978-1993. J. Med. Entomol. 33(1):132-139

Level 4: Mosquito-Borne Illness Alert

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

1. A cluster of two or more locally-acquired confirmed human cases
OR

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

2. Elevated arbovirus antibody detection in sentinel chickens (above historical background levels):
 - a. A 50% increase in sentinel chicken seroconversions in the county OR
 - b. A 50% increase in sentinel chicken seroconversions in a single flock.
OR
3. A 50% increase in corvid mortality above historical background levels

- DOH Response: (in addition to the response outlined above)
 - Work with the local mosquito control districts and the Interagency Arbovirus Task Force as needed to assess the risk of human disease and sufficiency of implemented mosquito control activities.
- Mosquito Control Response: (in addition to the response outlined above)
 - Focus mosquito control efforts to high risk mosquito populations and areas commensurate with arbovirus indicators for risk, adulticiding hot spots
 - Consideration for aerial adulticiding if not already in place with focus in high risk areas where wide area control measures are required to respond to the increased level of risk in a timely manner.
 - Increased surveillance to obtain estimates of mosquito transmission frequency in targeted areas.
- DACS Bureau of Entomology and Pest Control Response: (in addition to the response outlined above)
 - Consideration of aerial or ground control activities through Operational Support Section
 - Deployment of contracted aerial or ground control activities if funding available and requested by local government (county or city)
 - Local government request should include:
 - citizen notification of dates and times

- delineation of areas to be treated, and areas to be avoided including delineation of public lands and sensitive areas
- surveillance support

Mosquito-Borne Illness Alerts are lifted after a significant decrease in animal surveillance activity and 6 weeks or more after the onset of the last human case

Level 5: Mosquito-Borne Illness Threat

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

- DOH Response: (in addition to the response outlined above)
 - Consider distributing daily arbovirus surveillance updates to responsible governmental agencies and other partners.
 - Work with local mosquito control district to assess their resource needs for mosquito control activities.
 - Advise local authorities on the potential need for elevated disease prevention efforts, such as canceling outdoor events/activities, closing campgrounds, etc.
- Mosquito Control Response: (in addition to the response outlined above)
 - Advise county health departments on the justification for elevated disease prevention efforts, such as canceling outdoor events/activities, closing campgrounds, etc.
 - Conduct aggressive aerial / truck adulticiding, considering control on protected lands with approval from DACS, DEP, FWC, private owners etc., as needed, based on justified widespread danger to public health.
 - Provide regional inter-county/district and DACS support as indicated for counties in emergency status.
 - Request state (DACS) and federal emergency (FEMA) support for mosquito control operations as needed.
- DACS Bureau of Entomology and Pest Control Response: (in addition to the response outlined above)
 - Acquire and distribute emergency funds.
 - Activate Emergency Operation Center functions.
 - Implement Incident Command System protocols.

Mosquito-Borne Illness Threats are down-graded after mosquito surveillance data (such as abundance, age structure, or infectivity) indicate a decrease in risk for human arbovirus transmission.

Under a Level 5 threat, the CHD in the affected county will notify:

1. Community health care providers concerning the potential for transmission of SLE, WN 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 mosquito-borne illness threat.

4. Local media, education representatives, senior citizen groups and other citizen groups as appropriate.

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

IV. Personal 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 drain fields.
- Remove old tires.
- Stack containers upside-down so they do not accumulate water.

B. 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-containing insecticide dispensers may be useful in reducing ticks in locations with large deer populations.

Acronyms/Definitions

A.:	Abbreviation for ticks in the genus <i>Amblyomma</i>
Ae.:	Abbreviation for mosquitoes in the genus <i>Aedes</i>
An.:	Abbreviation for mosquitoes in the genus <i>Anopheles</i>
Arbovirus:	Arthropod-borne virus
Arthropod:	Animals in the phylum which includes insects (mosquitoes, flies, etc.) and arachnids (ticks, spiders, etc.)
B.:	Abbreviation for spirochete bacteria in the genus <i>Borrelia</i>
BoEPC:	Bureau of Entomology and Pest Control (DACs)
CDC:	Centers for Disease Control and Prevention
CHD:	County health department
CF test:	Complement fixation test
Cq.:	Abbreviation for mosquitoes in the genus <i>Coquillettidia</i>
Cs.:	Abbreviation for mosquitoes in the genus <i>Culiseta</i>
Cx.:	Abbreviation for mosquitoes in the genus <i>Culex</i>
D.:	Abbreviation for ticks in the genus <i>Dermacentor</i>
DACS:	Department of Agriculture and Consumer Services
DEET:	N,N-diethyl-meta-toluamide; the active ingredient in many insect repellent products
DEN:	Dengue fever
DEP:	Department of Environmental Protection
DOH:	Department of Health
EEE:	Eastern Equine Encephalitis
EIA/ELISA:	Enzyme immunoassay/enzyme-linked immunosorbant assay
EM:	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

Encephalitis: Inflammation of the brain

FMEL: Florida Medical Entomology Laboratory

F.S.: Florida Statutes

FWC: Florida Fish and Wildlife Conservation Commission

Hemostasis: The arrest of bleeding

HGA: Human granulocytic anaplasmosis

HGE: Human granulocytic ehrlichiosis

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

HME: Human monocytic ehrlichiosis

I.: Abbreviation for ticks in the genus *Ixodes*

IFA: Immunofluorescent antibody test

Ig: Immune globulin or antibody (as in IgM, IgG, IgD, IgA or IgE)

LA/LAT: Latex agglutination test

LD: Lyme Disease

MA: Microagglutination test

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

Oc.: Abbreviation for mosquitoes in the genus *Ochlerotatus*

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

PRNT: Plaque Reduction Neutralization Test

RMSF: Rocky Mountain Spotted Fever

Serum/Sera: The clear liquid separated from blood

SLE: St. Louis Encephalitis

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

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

WN: West Nile

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 unapparent 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 WN 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. Cross-reactivity within a virus group (e.g., flaviviruses) is common, and can complicate interpretation of results.

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. Each specimen must be labeled with the patient's name. Hold serum in a refrigerator until shipped. When serum is to be examined only for antibody, it can be shipped at ambient temperature (do not freeze) provided it has been collected and handled aseptically. At least 2ml of serum or CSF are required for antibody testing.

Shipping Specimens

Clinical sera are sent immediately to the assigned DOH laboratory for testing (Jacksonville or Tampa). A DOH Laboratory Submission Form should be completed for each patient, listing all specimens. Follow packaging and shipping guidelines for clinical specimens. (<http://www.doh.state.fl.us/lab/laboratoryservices.htm>). If viral isolation/detection is desired (e.g., for dengue), sera must be shipped frozen on dry ice to the Tampa Laboratory.

Sentinel Chicken sera and other non-human sera should be sent to the Tampa laboratory, packaged as for diagnostic specimens.

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

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

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

OR

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

CONTACTS FOR ESTABLISHING SENTINEL CHICKEN FLOCKS

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

Florida Department of Agriculture (Division of Animal Industry)

- Jennifer Jennings-Glover, Poultry Program (850) 251-1226
jenninj@doacs.state.fl.us
- Dr. Thomas J. Holt, Division of Animal Industry (850) 410-0900
holt@doacs.state.fl.us

Chicken Suppliers (White Leghorn or Rhode Island Reds suggested)

- Ron Nickerson, Tranquility Farms (352) 540-9458
- Zephyr Eggs (813) 782-1521
- Hillandale Farms (386) 397-1300

Wing/Leg Bands

- National Band and Tag Company: (859) 261-2035

Serum Separator Tubes

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

Chicken Cages, Feeders and Waterers

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

Chicken Restrainer Board

- Call (850) 245-4299 for plans to build a chicken restrainer board

Chicken Feed

- Available at local feed store



Bureau of Laboratories
 Tampa Branch Laboratory
 3602 Spectrum Boulevard
 Tampa, FL 33612
 e-mail: Lillian_stark@doh.state.fl.us or Deno_kazanis@doh.state.fl.us

phone: (813) 974-5990
 fax: (813) 974-5776
 suncom: 574-5990
 suncom fax: 574-5776

Appendix D

Arbovirus Surveillance Serology

County _____ page _____ of _____
 Contact name _____
 Address _____

Phone () _____
 Fax: () _____
 E-mail: _____

For Laboratory use only			
Date Received: _____			
Date Reported: _____			
HAI titer			
LAB Number	Flavi*	Alpha*	Comments

Specimen Collection Data

Sample date	Bird #	Site	New	Species	Sex/Age
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

Flavi* = Flavivirus - includes SLE & WN; Alpha* = Alphavirus – includes EEE & HJ

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



Bureau of Laboratories
 Tampa Branch Laboratory
 3602 Spectrum Boulevard
 Tampa, FL 33612
 e-mail: Lillian_stark@doh.state.fl.us or Deno_kazanis@doh.state.fl.us

phone: (813) 974-5990
 fax: (813) 974-5776
 suncom: 574-5990
 suncom fax: 574-5776

Arbovirus Surveillance: Necropsy and Virus Isolation

County _____ **Reported on** <http://www.MyFWC.com/bird/>
 ___yes ___no

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

Organization _____ **Phone:** () _____

Address _____ **Fax:** () _____

Address _____

City/State/zip _____

Specimen Collection Data			For DOH Tampa Laboratory Use Only		
Collection date	Bird Mortality Database #	Site/Address of Collection <i>OR</i> GPS Coordinates	Species of bird	Date Received	
				DoH LAB #	Molecular Assay Results

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

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



Bureau of Laboratories
 Tampa Branch Laboratory
 3602 Spectrum Boulevard
 Tampa, FL 33612
 e-mail: Lillian_stark@doh.state.fl.us or Deno_kazanis@doh.state.fl.us

phone: (813) 974-5990
 fax: (813) 974-5776
 suncom: 574-5990
 suncom fax: 574-5776

Arbovirus Surveillance: Mosquito

County: _____ page _____ of _____

Submitter's name: _____ E-mail: _____

Address: _____

Phone: () _____

Fax: () _____

For DoH Tampa Laboratory Use Only

Date Received _____

Specimen Collection Data

Collection date	Vial #	Species	Site/Address of Collection <i>OR</i> GPS Coordinates	# per pool	DoH LAB #	Molecular Assay Results	Virus Isolation Result

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

2006 Sentinel Chicken Surveillance - Individual Site Information

Contact Information

Flock manager's name _____ Phone _____

Email Address _____

Agency _____

Please confirm the following information regarding your flock(s):

County _____ Unique ID # _____

Street Address _____

City _____

Zip code _____

GPS Coordinates: longitude _____ latitude _____
In decimal degrees

Number of Birds in Your Flock _____ as of _____
date

Comments: _____

Please fill one out for each flock location and fax (or email) to Rebecca Shultz at
FAX (850) 922-8473.

Rebecca_Shultz@doh.state.fl.us

J:hsee/arbo/2006/chickens

DRAFT Infection Control and Personal Protective Equipment Guidelines for persons* involved in surveillance, eradication and control of avian influenza outbreaks in birds in Florida.

Basic Infection Control

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

Specific Guidelines for Animal Workers Handling :

Apparently Healthy Birds in Areas Where HPAI H5N1 is Not Suspected Should:

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

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

- Follow the recommendations above and at a minimum wear protective clothing, including coveralls, rubber boots, latex, nitrile or rubber gloves that can be disinfected or disposed. Personnel working in a poultry house should wear disposable coveralls (such as Tyvek® suits).
- Minimize exposure to mucosal membranes by wearing protective eyewear (goggles) and a particulate surgical mask (NIOSH N95 respirator/mask).
- Disposable particulate respirators (e.g., N-95, N-99, or N-100) are the minimum level of respiratory protection that should be worn. Workers must be fit-tested to the respirator model that they will wear and also know how to check the face-piece to face seal. Workers who cannot wear a disposable particulate respirator because of facial hair or other fit limitations should wear a loose-fitting (i.e., helmeted or hooded) powered air purifying respirator equipped with high-efficiency filters.
- Decontaminate and properly dispose of potentially infectious material including carcasses per DOH and DEP guidelines.
- Decontaminate, remove and properly dispose of all PPE except eyewear and respirator. Wash hands thoroughly. Remove protective eyewear and respirators.

- Wash hand again after removing all PPE.

Wild Birds or Backyard Flocks of Poultry That Are Sick or Associated With a Undiagnosed Mortality Event in Areas Where HPAI H5N1 Has Been Detected Should,

Follow the recommendations above.

- Wear a fluid resistant apron over protective clothing.
- Get vaccinated with the seasonal influenza vaccine

Unvaccinated workers should receive the current season's influenza vaccine to reduce the possibility of dual infection with avian and human influenza viruses. There is a small possibility that dual infection could occur and result in reassortment. The resultant hybrid virus could be highly transmissible among people and lead to widespread infections. Vaccination of all residents of affected areas is not supported by current epidemiologic data.

- Consult with a health care provider regarding any health concern
- If avian influenza infection is suspected, report to the local CHD.
- Follow the latest guidelines from CDC and the WHO for prophylactic medications and precautions for persons involved in avian influenza disease control:

Adapted from joint USDA and CDC recommendations posted at:

<http://www.cdc.gov/flu/avian/professional/protect-guid.htm>

Commercial Poultry Flocks That Are Sick or Associated With a Undiagnosed Mortality Event in Areas Where HPAI H5N1 Has Been Detected:

Personal Protective Equipment

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

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

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

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

Nonvented snug fitting safety goggles should be worn to protect the mucous membranes of eyes.

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

loose-fitting (i.e., helmeted or hooded) powered air purifying respirator equipped with high-efficiency filters.

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

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

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

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

Samples should not be stored in coolers or refrigerators where food or drinks are kept.

Vaccination with Seasonal Influenza Vaccine

Unvaccinated workers should receive the current season's influenza vaccine to reduce the possibility of dual infection with avian and human influenza viruses.

Administration of Antiviral Drugs for Prophylaxis

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

Surveillance and Monitoring of Workers

Instruct workers to be vigilant for the development of fever, respiratory symptoms, and/or conjunctivitis (i.e., eye infections) for 1 week after last exposure to avian influenza-infected or exposed birds or to potentially avian influenza-contaminated environmental surfaces.

Individuals who become ill should seek medical care and, prior to arrival, notify their health care provider that they may have been exposed to avian influenza. In addition, employees should notify their health and safety representative and their local County Health Department.

With the exception of visiting a health care provider, individuals who become ill should be advised to stay home until 24 hours after resolution of fever, unless an alternative diagnosis is established or diagnostic test results indicate the patient is not infected with influenza A virus.

While at home, ill persons should practice good respiratory and hand hygiene to lower the risk of transmission of virus to others.

Evaluation of Ill Workers

Workers who develop a febrile respiratory illness should contact their local County Health Department to have a respiratory sample (e.g., nasopharyngeal swab or aspirate) collected.

The respiratory sample will be tested for both human and avian influenza virus strains at the Florida Department of Health Laboratories.

Optimally, an acute- (within 1 week of illness onset) and convalescent-phase (after 3 weeks of illness onset) serum sample should also be collected and stored at the health department in case testing for antibody to the avian influenza virus should be needed.

¹Respirators should be used in the context of a complete respiratory protection program as required by the Occupational Safety and Health Administration (OSHA). This includes training, fit-testing, and fit-checking to ensure appropriate respirator selection and use. To be effective, respirators must provide a proper sealing surface on the wearer's face. Detailed information on respiratory protection programs is provided at:

www.osha.gov/SLTC/etools/respiratory/index.html and www.cdc.gov/niosh/topics/respirators/.

²Should antivirals be in short supply the drugs will be given out to poultry disease control workers, health care personnel etc. based on the DOH influenza antiviral distribution priority list (reference)

* Includes animal control personnel, back yard poultry handlers, mosquito control workers, veterinarians, veterinary technicians, wildlife biologists, wildlife rehabilitators, zoo animal handlers.

N 95 Fit Testing

When the recommendation is to wear an N95 masks for respiratory protection, the mask chosen must be the correct size and must be fit tested.

It takes about 5- 10 minutes per person to be tested.

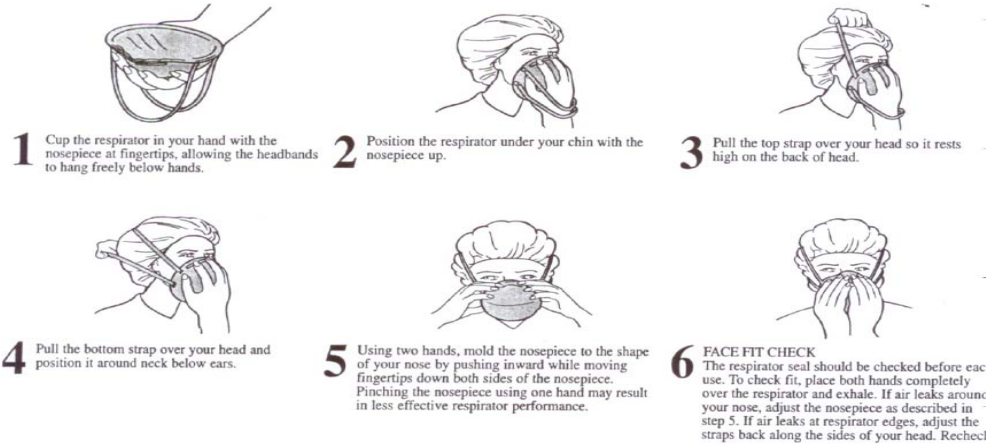
Materials needed:

- Small, Medium, and Large N 95 masks
- Qualitative Fit Test Apparatus Kit
- Donning and Removal Instructions (Figure 1.0)
- Respirator Issuance and Training Form (Figure 2.0)

Testing should be done in a room with a table and not many distractions.

This procedure is done by a person who has been training in the operation of a qualitative fit test apparatus kit. The TB program has personnel that have training from one of the companies who sell N 95's, (for example 3M sales representatives) and experience in this process. The instructions for donning and removing should be reviewed in person and in writing. An example in Figure 1.0 is below:

Donning instructions (to be followed each time product is worn):



NOTE: If you cannot achieve proper fit, do not enter the isolation or treatment area. See your supervisor.

Removal instructions:

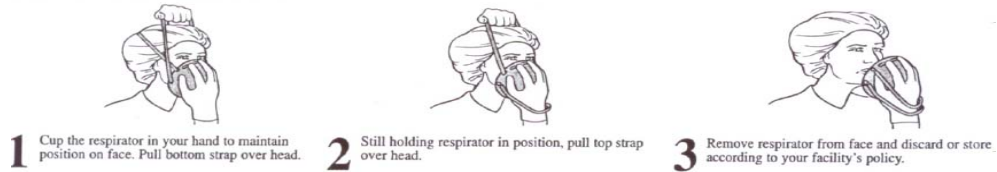


Figure 1.0

Personnel who have been fit tested should have an N 95 respirator certificate of issue, an example provided below in Figure 2.0 below:

Respirator Issuance And Training Form

For additional record-keeping purposes, feel free to duplicate these forms.

Employee <i>Emily Wilson</i>	Employee Number	Title <i>Preparedness Planner</i>	Date Issued <i>3/27/06</i>
RESPIRATOR: Brand and Model Number <input type="checkbox"/> <i>3M</i>		Type <i>N-95</i>	NIOSH Approval Number <i>8242</i>
APPLICATION			
LIMITATIONS <input type="checkbox"/> Beard <input type="checkbox"/> Denture <input type="checkbox"/> Glasses <input type="checkbox"/> None Explain 			
FITTING <input checked="" type="checkbox"/> Satisfactory Qualitative Saccharin Fit Test <input type="checkbox"/> Satisfactory Positive Pressure Fit Check Test <input type="checkbox"/> Satisfactory Negative Pressure Fit Check Test		Instructions For Use - <input checked="" type="checkbox"/> Reviewed: <input checked="" type="checkbox"/> Donning and Removal <input type="checkbox"/> Storage - Replacement Indicators	
Employee Signature <i>Emily Wilson</i>		Date <i>3/27/06</i>	
Approval Signature <i>Harri Beaudin</i>		Date <i>3/27/06</i>	

Figure 2.0

SURVEILLANCE CASE DEFINITIONS FOR ARTHROPOD-BORNE DISEASES IN FLORIDA

Acute Arboviral Disease

reporting code = 06220 Eastern Equine Encephalitis (EEE)
 reporting code = 06230 St. Louis Encephalitis (SLE)
 reporting code = 06620 Venezuelan Equine Encephalitis (VEE)
 reporting code = 06210 Western Equine Encephalitis (WEE)
 reporting code = 06250 California/La Crosse Encephalitis
 reporting code = 06630 West Nile Virus (WNV)
 reporting code = 06631 West Nile Fever
 case report form: Encephalitis Case Report

Clinical description

Arboviral infections may be asymptomatic or may result in febrile illnesses of variable severity sometimes associated with central nervous system (CNS) involvement. When the CNS is affected, clinical syndromes include aseptic meningitis, myelitis and encephalitis, which are clinically indistinguishable from similar syndromes caused by other viruses. Arboviral meningitis is usually characterized by fever, headache, stiff neck, and pleocytosis in cerebrospinal fluid. Arboviral myelitis is usually characterized by fever and acute bulbar or limb paresis or flaccid paralysis. Arboviral encephalitis is usually characterized by fever, headache, and altered mental status ranging from confusion to coma with or without additional signs of brain dysfunction. Less common neurological syndromes can include cranial and peripheral neuritis or other neuropathies, including Guillain-Barré syndrome.

Non-neuroinvasive syndromes caused by these usually neurotropic arboviruses can rarely include myocarditis, pancreatitis, or hepatitis. In addition, they may cause febrile illnesses (e.g., West Nile fever [WNF]) that are non-localized, self-limited illnesses with headache, myalgias, arthralgias, and sometimes accompanied by skin rash or lymphadenopathy. Laboratory-confirmed arboviral illnesses lacking documented fever can occur, and overlap among the various clinical syndromes is common.

Clinical criteria for diagnosis

Cases of arboviral disease are classified either as neuroinvasive or non-neuroinvasive, according to the following criteria:

Neuroinvasive disease requires the presence of fever and at least one of the following, as documented by a physician and in the absence of a more likely clinical explanation:

- Acutely altered mental status (e.g., disorientation, obtundation, stupor, or coma), or
- Other acute signs of central or peripheral neurologic dysfunction (e.g., paresis or paralysis, nerve palsies, sensory deficits, abnormal reflexes, generalized convulsions, or abnormal movements),
or
- Pleocytosis (increased white blood cell concentration in cerebrospinal fluid [CSF]) associated with illness clinically compatible with meningitis (e.g., headache or stiff neck).

Non-neuroinvasive disease requires, at minimum, the presence of documented fever, as measured by the patient or clinician, the absence of neuroinvasive disease (above), and the absence of a more likely clinical explanation for the illness. Involvement of non-neurological organs (e.g., heart, pancreas, liver) should be documented using standard clinical and laboratory criteria.

Laboratory criteria for diagnosis

Cases of arboviral disease are also classified either as confirmed or probable, according to the following laboratory criteria:

- Four-fold or greater change in virus-specific serum antibody titer
OR
- Isolation of virus from or demonstration of specific viral antigen or genomic sequences in tissue, blood, CSF, or other body fluid
OR
- Virus-specific immunoglobulin M (IgM) antibodies demonstrated in CSF by antibody-capture enzyme immunoassay (EIA)
OR
- Virus-specific IgM antibodies demonstrated in serum by antibody-capture EIA and confirmed by demonstration of virus-specific serum immunoglobulin G (IgG) antibodies in the same or a later specimen by another serologic assay (e.g., neutralization, ELISA or hemagglutination inhibition).

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed

Probable: a clinically compatible case occurring during a period when arboviral transmission is likely, and with the following supportive serology: Stable (less than or equal to a two-fold change) but elevated titer of virus-specific serum antibodies, or virus-specific serum IgM antibodies detected by antibody-capture EIA but with no available results of a confirmatory test for virus-specific serum IgG antibodies in the same or a later specimen.

Comment:

Because closely related arboviruses exhibit serologic cross-reactivity, positive results of serologic tests using antigens from a single arbovirus can be misleading. In some circumstances (e.g., in areas where two or more closely related arboviruses occur, or in imported arboviral disease cases), it may be epidemiologically important to attempt to pinpoint the infecting virus by conducting cross-neutralization tests using an appropriate battery of closely related viruses. This is essential, for example, in determining that antibodies detected against St. Louis encephalitis virus are not the result of an infection with West Nile (or dengue) virus, or vice versa, in areas where both of these viruses occur. Because dengue fever and West Nile fever can be clinically indistinguishable, the importance of a recent travel history and appropriate serologic testing cannot be overemphasized. In some persons, West Nile virus-specific serum IgM antibody can wane slowly and be detectable for more than one year following infection. Therefore, in areas where West Nile virus has circulated in the recent past, the co-existence of West Nile virus-specific IgM antibody and illness in a given case may be coincidental and unrelated. In those areas, the testing of serially collected serum specimens assumes added importance.

A COPY OF LABORATORY TEST RESULTS MUST ACCOMPANY THE CASE REPORT FORM.

Dengue Fever

reporting code = 06100
case report form: CDC 56.31A (10/85)
Dengue Case Investigation form

Clinical description

An acute febrile illness characterized by frontal headache, retroocular pain, muscle and joint pain, and rash. The principal vector is the *Aedes aegypti* mosquito and transmission usually occurs in tropical or subtropical areas. Severe manifestations (e.g., dengue hemorrhagic fever and dengue shock syndrome) are rare but may be fatal.

Laboratory criteria for diagnosis

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

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed

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

Comment:

Dengue hemorrhagic fever 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 $\geq 20\%$) or other objective evidence of increased capillary permeability. The definition of dengue shock syndrome follows all of the above criteria for dengue hemorrhagic fever and also includes hypotension or narrow pulse pressure (≤ 20 mm Hg).

Acute and convalescent sera from reported and suspect cases should be acquired and sent to the State Laboratory.

A COPY OF LABORATORY TEST RESULTS MUST ACCOMPANY THE CASE REPORT FORM.

Ehrlichiosis, Human

reporting code = 08381 Human Granulocytic Ehrlichiosis (HGE)
reporting code = 08382 Human Monocytic Ehrlichiosis (HME)
reporting code = 08380 Human Ehrlichiosis, Other
case report form: CDC 55.1 (1/01)
Tick-Borne Rickettsial Disease Case Report

Clinical description

A tick-borne febrile illness most commonly characterized by acute onset, accompanied by headache, myalgia, rigors and/or malaise. Clinical laboratory findings may include intracytoplasmic microcolonies (morulae) in leukocytes of peripheral smear, cerebrospinal fluid (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 immunofluorescence antibody (IFA) test in acute- and convalescent-phase specimens ideally taken ≥ 4 weeks apart. HME diagnosis requires *E. chaffeensis* and HGE currently requires *E. equi* or HGE-agent antigen
- OR**
- Positive polymerase chain reaction assay
 - Intracytoplasmic morulae identified in blood, bone marrow, or CSF leukocytes, **and** an IFA titer $\geq 1:64$

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed

Probable: a clinically compatible case with either a single IFA serologic titer $\geq 1:64$ or intracytoplasmic morulae identified in blood, bone marrow, or CSF leukocytes

Comments:

There are two clinically similar yet serologically distinct forms of ehrlichiosis: a) human granulocytic ehrlichiosis (HGE), caused by infection with an *Ehrlichia equi*-like agent and found primarily in the upper midwest and northeast, and b) human monocytic ehrlichiosis (HME) caused by *Ehrlichia chaffeensis* infection and found primarily in the southeastern quadrant of the United States. Distinct primers are used for the PCR diagnosis of HGE and HME. **Acute and convalescent sera from reported and suspect cases should be acquired on all cases and sent to the State Laboratory.**

A COPY OF LABORATORY TEST RESULTS SHOULD ACCOMPANY THE CASE REPORT FORM.

Lyme Disease

reporting code = 06959
case report form: CDC 52.60 (7/90)
Lyme Disease Case Report Form
MERLIN ELECTRONIC SUBMISSION

Clinical description

A systemic, tick-borne 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
- OR
- Demonstration of diagnostic IgM or IgG antibodies to *B. burgdorferi* in serum or cerebrospinal fluid (CSF) by EIA or IFA screen followed by demonstration of IgM or IgG antibodies by Western Blot (WB) in specimens taken less than 8 weeks after appearance of EM lesions. [IgG WB should be performed on specimens taken >8 weeks after disease onset – IgM WB in the chronic stage does not aid in the diagnosis of late-stage disease]

Case classification

Confirmed: a) a case with EM that is physician and laboratory (EIA and WB) confirmed or b) a case with one late manifestation (as defined below) that is laboratory (EIA and IgG WB) confirmed

Comments:

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

- *Erythema Migrans*. 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 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.
- *Late Manifestations*. These 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, encephalitis. Encephalitis 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 is not criteria for neurologic involvement.
 3. **CARDIOVASCULAR SYSTEM**. acute onset of high-grade (2nd° or 3rd°) 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*.

A COPY OF LABORATORY TEST RESULTS SHOULD ACCOMPANY THE CASE REPORT FORM.

Malaria

reporting code = 08460
case report form: CDC 54.1 (10/97)
Malaria Case Surveillance Report

Clinical description

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

Laboratory criteria for diagnosis

- Demonstration of malaria parasites in blood films

Case classification

Confirmed: an episode of microscopically confirmed malaria parasitemia in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country

Comment

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

Permanent slides from all diagnosed and suspected cases should be sent to the State Laboratory.

Rocky Mountain Spotted Fever

reporting code = 08200
case report form: CDC 55.1 (1/01)
Tick-Borne Rickettsial Disease Case Report

Clinical description

A tick-borne 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 immunofluorescence antibody (IFA), complement fixation (CF), latex agglutination (LA), microagglutination (MA), or indirect hemagglutination antibody (IHA) test in acute and convalescent phase specimens ideally taken ≥ 3 weeks apart

OR

- Positive polymerase chain reaction (PCR) 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

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed

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

Comments:

Acute and convalescent sera should be acquired on all cases and sent to the State Laboratory. A copy of laboratory test results should accompany the case report form.

Yellow Fever

reporting code = 06090
case report form: N/A

Clinical description

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

Laboratory criteria for diagnosis

- Fourfold or greater rise in yellow fever antibody titer in a patient who has no history of recent yellow fever vaccination and cross-reactions to other flaviviruses have been excluded

OR

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

Case classification

Confirmed: a clinically compatible case that is laboratory confirmed

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

HUMAN CASE INVESTIGATION GUIDELINES

Priority

Human arboviral case investigations should be initiated upon receipt.

Case Interview

- History of mosquito bites in 14 days prior to onset of symptoms
- Travel and activity history: travel outside county of residence, state, or country; occupation; hobbies (e.g., gardening, fresh water fishing, hunting); and other outdoor activities
- Environmental investigation: residence with screened windows, residence surrounded by vegetation or surface fresh water (lake, pond, etc)
- **Case report forms** are now available electronically on Merlin, by selecting the Extended Data tab. The form should be filled out when the case is entered in Merlin. If the case report form is submitted electronically through Merlin, it is unnecessary to submit a paper case report form.
- A downloadable copy of the paper **case report form** can be found at: http://www.doh.state.fl.us/environment/community/arboviral/reporting_links.htm

Disease Control Measures

A. Education

The risk of acquiring an arboviral illness is greatly reduced by taking precautions to limit exposure to mosquitoes. Individuals can “Fight the Bite” by practicing the “5 D’s” for prevention:

Stay indoors at **Dusk** and **Dawn** when many mosquitoes are biting

Dress in clothing that covers most of your skin

Use repellents with **DEET** [N, N diethyl-*m*-toluamide]. Picaridin and oil of eucalyptus are other recently approved repellent options.

Drain standing water around your home where mosquitoes can lay their eggs

Additionally, elimination of breeding sites is key to prevention:

- Clean debris out of eaves, troughs and gutters.
- Remove old tires or drill drainage holes in those used in playgrounds
- Turn over or remove empty plastic pots.
- Pick up all beverage containers and cups.
- Check tarps on boats or other equipment that may collect water.
- Pump out bilges on boats.
- Replace water in birdbaths and pet or other animal feeding dishes at least once a week.
- Change water in plant trays, including hanging plants, at least once a week.
- Remove vegetation or obstructions in drainage ditches that prevent the flow of water.

B. Community Intervention

Medical alerts are issued by the DOH when surveillance systems indicate an increase in arboviral activity. CHDs should coordinate with Mosquito Control and Environmental Health Services to provide public information about mosquito bite prevention:

- Don't go outdoors when mosquitoes are biting.
- Use an effective mosquito.
- Drain standing water from around the home.

Laboratory Support

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

A completed Florida Department of Health laboratory submission form should accompany all specimens http://www.doh.state.fl.us/lab/PDF_Files/doh_form.pdf

Proper collection, storage, labeling, and packaging of specimens are essential to ensure accurate test results, see directions at <http://www.doh.state.fl.us/environment/community/arboviral/reporting.htm>. Serum and CSF specimens will be tested for antibodies to SLE, WN, EEE and dengue.

Algorithm for interpretation of laboratory results

Eastern Equine Encephalitis Serology

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

Flavivirus Serology

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

West Nile Virus Serology

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

St Louis Encephalitis Virus Serology

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

Dengue Virus Serology

1a	DEN IgM +	Go to 2
2a	IgG+ by HI, IgG ELISA, IFA assays.....	Probable case
	• IgG titer low (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA)	Suspect primary infection
	• OR IgG titer high (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA)	Suspect secondary infection
2b	IgG - by HI, IgG ELISA, IFA assays	Go to 3
3a	Serum collected < 7 days post onset..... <i>Submit convalescent serum for confirmatory testing</i>	Probable case
3b	Serum collected > 7 days post onset.....	Not a case
1b	DEN IgM –	Go to 4
4a	IgG -	Not a case
4b	IgG +	Go to 5
5a	IgG+ in single serum.....	Go to 6
6a	IgG titer low..... (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA)	Not a case
6b	IgG titer high (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA) <i>Submit convalescent serum for confirmatory testing</i>	Probable Case
5b	IgG + in paired sera.....	Go to 7
7a	Antibody titers in both sera are the same or < fourfold difference between titers.....	Go to 8
8a	IgG titer low..... (<1:320 by HI or <1:160 by PRNT or <1:256 by IFA)	Not a case
8b	IgG titer high (>1:320 by HI or >1:160 by PRNT or >1:256 by IFA)	Probable case
	<i>PRNT assay required for definitively distinguish WNV, SLEV and DENV</i>	
7b	Antibody titers in the two sera ≥ fourfold difference	Confirmed case

Tick-borne illness

Tick-borne illnesses of concern in Florida include ehrlichiosis, Lyme disease, and Rocky Mountain spotted fever. Lyme disease is mostly localized to states in the northeastern, mid-Atlantic, and upper north-central regions (Connecticut, Rhode Island, New York, Pennsylvania, Delaware, New Jersey, Maryland, Massachusetts, and Wisconsin. RMSF cases have been largely reported from the south-Atlantic region and the western south-central region; few cases are reported from the Rocky Mountain region.

Priority

Human tick-borne illness case investigations should be started within three days of receipt.

Case Interview

- History of tick bite in 14-21 days prior to onset of symptoms
- Travel and activity history: occupation, hobbies (e.g., camping, hunting, other outdoor activities, especially in woody areas)
- Environmental investigation: residence surrounded by woods or forest (ticks especially like a grass/forest border from which to quest or wait for the next animal or human to brush by or approach), deer or rodents on property
- Copies of the case report forms for Ehrlichiosis, Lyme Disease and RMSF can be found on Bureau of Epidemiology's website http://www.doh.state.fl.us/disease_ctrl/epi/topics/crforms.htm.

Disease Control Measures

A. Education

The risk of acquiring a tick-borne illness is greatly reduced by taking precautions to limit exposure to ticks.

- Avoid tick habitats if possible
- If exposure to tick habitats cannot be avoided, when outdoors in a tick area, cover up by wearing shoes, socks, long pants and long-sleeved shirts (light colored clothing preferred for spotting ticks)
- Use insect repellent containing DEET or permethrin according to the manufacturer's directions
- Perform daily tick checks

B. Community Intervention

- Control tick populations in yards and on pets
- Protect pets from ticks by consulting with your veterinarian

Laboratory Support

Laboratory criteria differ by tick-borne illness and may be based upon paired sera antibodies, or IgM and IgG antibody detection. Please refer to the Bureau of Epidemiology Surveillance Case Definitions for Select Reportable Diseases in Florida for additional information on laboratory criteria for reporting Ehrlichiosis, Lyme, and RMSF http://www.doh.state.fl.us/disease_ctrl/epi/surv/CaseDefJune2003.pdf Also refer to "Notice to Readers Recommendations for Test Performance and Interpretation from the Second National Conference on Serologic Diagnosis of Lyme Disease" published in the MMWR, August 11, 1995/44(31) 590-591 <http://www.cdc.gov/mmwr/preview/mmwrhtml/00038469.htm>. The Centers for Disease Control and Prevention (CDC) recommends laboratories follow a 2 step process for detection of lyme antibodies, an ELISA or IFA screen with IgM or IgG confirmation by Western Blot (IgM if serum is taken < 4 weeks since symptoms began, IgG if serum is taken > 4 weeks since symptoms began).

For additional information for clinicians on tick-borne diseases, please refer to:
CDC. Diagnosis and Management of Tick-borne Rickettsial Diseases: Rocky Mountain Spotted Fever, Ehrlichioses, and Anaplasmosis --- United States: A Practical Guide for Physicians and Other Health-Care and Public Health Professionals MMWR 2006;55. Available at:
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5504a1.htm>

FLORIDA CONFIDENTIAL ARBOVIRAL INFECTION CASE REPORT

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

- St. Louis Encephalitis
 Eastern Equine Encephalitis
 Dengue
 West Nile Virus Neuroinvasive
 West Nile Fever
 LaCrosse/CA Encephalitis

IDENTIFYING DATA:

County: _____ Merlin Case #: _____

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

Home Address: _____ Homeless Yes No
Street City State Zip

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

Race White Black Hispanic Asian/Pacific Islander American Indian/Alaska Native Unknown/Not specified SSN# _____

Hospitalization: Yes No

If yes, Hospital: _____ Physician: _____ Physician Phone: (____) _____

Date of Admission: ___/___/___ Discharge or death: ___/___/___

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

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

LABORATORY DATA: (must attach laboratory sheets*)

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

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

*Tampa or Jacksonville DOH state lab reports are required for confirmation

Merlin Case # _____ County: _____ Pt's initials: _____

Risk Factor Information:

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

BLOOD DONATION/TRANSFUSION/TRANSPLANT HISTORY/PREGNANCY:

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

VACCINE INFORMATION

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

COMMENTS:

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

Please submit form to the Bureau of Community Environmental Health (HSEC), Dept. of Health, 4052 Bald Cypress Way, Bin A 08, Tallahassee, Florida 32399-1712 or FAX 850-922-8473 or SC 292-8473 (rev. 06/04)

Instructions for completing the arboviral case report form

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

The term "West Nile Neuro-invasive" disease encompasses both encephalitis and/or meningitis. If the patient has neurological symptoms they should be categorized as West Nile Neuro-invasive. The term "West Nile Fever" excludes neurological symptoms.

Identifying data- All identifying data needs to be filled out in full.

County- The county of residence, unless transmission occurred elsewhere. If transmission occurred elsewhere, please inform that jurisdiction. The reporting county should be the county in which the most likelihood of transmission occurred.

Merlin case #- Information gathered after reporting to the Merlin surveillance system

Name- Last, First, MI (optional)

Date of birth- Month/ day/ year

Home address- Include street, city, state, and zip code if no home address is available because person is of transient nature, enter the closest address to current place of occupancy and check yes for homeless.

Home phone- Enter area code followed by 7 digit number or if cell phone given please indicate by writing cell phone.

Employer/School- If the patient is in high school or below enter name, address, and zip code of school or daycare, if patient has graduated and has an employer please list name, address, and zip code if neither apply please just write N/A.

Race- Mark the box that the individual specifies as their race

Hospitalization- If the patient was hospitalized for this recent illness please check the yes box and enter the hospital name, physician seen during the hospital stay, physician phone number, date of admission (month/ day/ year) and date of discharge (month/ day/ year). If no hospitalization simply check the no box and continue with clinical symptoms.

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

Definition of clinical symptoms:

Fever- Documented cases of 101°F or above and indicate highest temperature monitored (if known)

Malaise- A feeling of general discomfort or uneasiness

Mild jaundice-a yellow tone to skin and eyes

Tremor- Involuntary repetitive movements of opposing muscle groups

Confusion- A mental state of being bewildered or perplexed

Disorientation- Unable to orientate oneself

Delirium- An altered state of mind often resulting in illusions and hallucinations

Lethargy- A state of deep and prolonged unconsciousness from which one can be aroused but into which one immediately relapses

Stupor- A state of impaired consciousness in which only continual stimulation arouses the individual

Coma- A state of impaired consciousness in which one cannot be roused

Hyperreflexia- A condition in which the deep tendon reflexes are exaggerated

Rigidity- Stiffness or inflexibility

Cranial Nerve Palsy- Paralysis, usually unilateral, of the facial muscles

Cerebral Malaria-A form of falciparum malaria characterized by cerebral involvement

ARDS-Adult respiratory distress syndrome

Renal Failure-Failure of the kidneys

Rash- Cutaneous eruption (please specify part of the body)

Convulsion- Violent spasm or series of jerking of the face, trunk, or extremities

Paralysis- Loss of power of voluntary movement in a muscle

Hemorrhage- An escape of blood through ruptured or unruptured vessel walls

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

Laboratory data- Begin with the earliest laboratory test and continue down the column to the most recent

laboratory test available.

Serum or CSF- Indicate specimen type and acute or convalescent.

Acute specimens are those specimens that are collected within 14 days of symptom onset.

Convalescent specimens are those specimens that are collected 10 days to 4 weeks after the acute specimen.

Date collected- Month/day/year of specimen collection

Laboratory Name- Where the test was performed (if private lab indicate name of lab)

Test type- Example: HI, ELISA, PRNT, PCR, or other (specify)

Lab Report Date-Date of laboratory report (month/day/year)

Results- Example: WN, EEE or SLE IgM or IgG positive

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

Risk factor information-

Does the primary residence have screens on all of the operable windows?

Does the patient remember being bitten by a mosquito if so, when and where?

Does the patient smoke and if so, do they smoke outdoors?

Does the patient spend time outdoors (example: do they garden, fish, hunt, camp, etc.). If they do, do they practice any of the 5 D's?

Dusk and Dawn- avoid being outdoors during these times

DEET- use an effective mosquito repellent.

Dress – cover your skin with clothing

Drain- standing water from around their home.

Use this time to educate!

Does the patient have a travel history outside of the county, state or country within the last 2 weeks?

Does the patient have any underlying medical conditions (Example: Diabetes, heart disease, etc.)

Blood Donation/Transfusion/Transplant History and Pregnancy-

Has the patient received a transplant or received or donated blood products?

If the patient is female, is she currently pregnant? If yes, ask for the weeks pregnant and an expected due date. Also ask if she is breastfeeding or planning to breastfeed? If yes, provide education or refer her to her physician for advice on the possible transmission of the virus through breast milk.

Vaccine information-

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

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

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

**After completion of the case report form please fax or mail a copy along with the laboratory results to FAX 850-922-8473 or mail to the Bureau of Community Environmental Health (HSEC), Dept. of Health, 4052 Bald Cypress Way, Bin A-08, Tallahassee, Florida 32399-1712. Before faxing please call (850) 245-4444 x2437 or SC 205-4444 x2437 to let us know that you are sending confidential information.

EQUINE CASE DEFINITION FOR ARTHROPOD-BORNE DISEASES IN FLORIDA*

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

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

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

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

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

All samples must be submitted with an Arbovirus Case Information Form for appropriate classification of test results. To obtain a Case Submission form please contact Dr. Michael A. Short, at 850-410-0901, or Ms. Frances Swedmark at 850-410-0952.

* Adapted from Ostlund EN, Crom RL, Pederson DD, Johnson DJ, Williams WO, Schmitt BJ. **Equine West Nile Encephalitis, United States. Emerging Infectious Diseases 2001;7:665-66**



Charles H. Bronson
Commissioner

FLORIDA DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES
 DIVISION OF ANIMAL INDUSTRY
 329 MAYO BLDG., 407 S. CALHOUN ST., TALLAHASSEE, FL 32399-0800
 (850) 410-0900 PHONE; (850) 410-0957 FAX

Arboviral Encephalitis
Case Information Form

SUBMITTER: Please send this completed form along with collected samples to the Kissimmee laboratory. If submitting split samples, send copies of completed form (both pages) to each laboratory used. *If samples are not being submitted, please send the completed form to Dr. William Jeter, Division of Animal Industry, Fax 850-410-0957. Hard copies can be mailed to the address shown above.*

County: _____ Date Reported: _____

GPS Coordinates (if available): _____ N _____ W

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

Reported By	Name	Title/Occupation
	Business/Affiliation	
	Mailing Address	Physical Address (if different)
	Phone #	Fax #
	Mobile #	Pager #
	Email	

Premises Information	Name	Title/Occupation
	Premises/Farm Name	
	Mailing Address	Physical Address (if different)
	Phone #	Fax #
	Mobile #	Pager #
	Email	

Arboviral Encephalitis Case Information Form (continued)

Horse Information	Name/Animal Identification	Date of onset of clinical symptoms
	Breed	Age
	Sex (Male/Female/Gelding)	Vaccination Status (History)
	Status of Horse: <input type="checkbox"/> Alive <input type="checkbox"/> Dead <input type="checkbox"/> Critical Recovering as of (Date):	Date of Death: <input type="checkbox"/> Buried? <input type="checkbox"/> Yes <input type="checkbox"/> No
	Showing clinical symptoms? <input type="checkbox"/> Yes <input type="checkbox"/> No	Method of Death: <input type="checkbox"/> Natural causes <input type="checkbox"/> Euthanasia <input type="checkbox"/> Other:

Samples	Number of samples taken.	Date samples taken:
	Samples submitted to FDACS Kissimmee Diagnostic Laboratory	
	Sample type: <input type="checkbox"/> Blood <input type="checkbox"/> Brain <input type="checkbox"/> Other:	Date Sent:
	Samples submitted to USDA National Veterinary Services Laboratory (NVSL)	
	Sample type: <input type="checkbox"/> Blood <input type="checkbox"/> Brain <input type="checkbox"/> Other:	Date Sent:
Samples submitted to Florida DOH Laboratory		
Sample type: <input type="checkbox"/> Blood <input type="checkbox"/> Brain <input type="checkbox"/> Other:	Date Sent:	

Clinical Presentation/History	History:
	<p>Clinical Presentation:</p> <input type="checkbox"/> Apprehension Other: _____ <input type="checkbox"/> Depression <input type="checkbox"/> Elevated Temperature <input type="checkbox"/> Head Shaking <input type="checkbox"/> Muscle Twitching <input type="checkbox"/> Incoordination <input type="checkbox"/> Weakness of Hind Limbs <input type="checkbox"/> Inability to Stand <input type="checkbox"/> Aimless Wandering <input type="checkbox"/> Head Pressing <input type="checkbox"/> Listlessness

Comments/Additional Information:

Attach additional pages as needed.

ARBOVIRUS MOSQUITO-POOL PROTOCOL

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

Priority 1- Validation and confirmation of commercial testing (VecTest™, RAMP®, PCR, etc.)

Priority 2- Pilot testing, such as well designed transmission studies. Such studies must have prior approval through the arbovirus surveillance program.

Priority 3- Mosquito testing due to clustering of animal or human cases of disease (e.g. to determine local minimum infection rates (MIRs)).

- Contact the lab prior to sending samples.
- Routine mosquito surveillance specimens will not be tested.
- Routine mosquito surveillance testing and testing for other purposes will be available at cost on a space available basis.

Mosquito collection techniques

1.1. Traps:

- 1.1.1. CDC (with or without CO²),
- 1.1.2. Gravid, ABC light traps (with CO²), MM-X traps (a.k.a. pickle jar) (with CO²),
- 1.1.3. Lard can, or
- 1.1.4. Mosquito Magnet traps

1.2. Traps may be set anywhere West Nile (WN) virus transmission is suspected to be ongoing.

Remember that arboviral transmission can be extremely focal in widely dispersed habitats. So other trap sites and collection techniques should also be considered including ground aspirator collections at mosquito daytime resting sites, avian roosts and areas of past virus activity.

1.3. Maintain accurate and detailed nightly records for each collecting bags and each resulting mosquito pool.

1.4. Priority: ornithophilic and opportunistic mosquitoes;

- 1.4.1. *Culex*
- 1.4.2. *Culiseta*
- 1.4.3. *Mansonia*
- 1.4.4. *Coquillettidia*
- 1.4.5. *Aedes*
- 1.4.6. *Ochlerotatus*

2. Mosquitoes should be live or recently (< 2 hr) dead, non-fed or gravid females only.

Do not pool blood-fed mosquitoes because, if positive, it is impossible to tell whether the virus originated in the mosquito or in the blood meal.

3. Sample Processing:

3.1. Hold samples on wet ice in field or transport traps in coolers to laboratory

- 3.1.1. Do not use dry ice to kill or anesthetize collections because the carbon dioxide acidifies the

sample and may kill the virus, thus interfering with tests designed to isolate live virus. However, it *is* desirable to ship mosquitoes that are sealed within proper tubes to the Tampa Laboratory on dry ice (see instructions in section 3.5).

3.1.2. Make sure mosquitoes are kept alive by keeping them in a humid environment with access to cotton balls soaked with 5% sugar water.

3.1.3. Once mosquitoes are killed they must be kept in a freezer maintained at -70° C or colder.

3.2. Use a chill table to sort the specimens. Triethylamine (TEA) can also be used to anesthetize the insects for the sorting process.

3.3. Group female mosquitoes into pools of 50 individual mosquitoes by species, site and week (or night) of collection. Be careful not to contaminate the sample by including loose body parts (e.g. legs) belonging to other mosquito pools.

3.4. Do not combine mosquitoes or mosquito species trapped on different nights, different sites, or in different types of traps at the same site.

3.5. Make sure each mosquito pool is clearly and accurately labeled with a unique identifier number. This information plus any notes or comments for each pool should appear on a master data sheet, which is copied and maintained in two separate locations. Information on the pool should include:

3.5.1. mosquito species

3.5.2. number of specimens

3.5.3. mosquito data (sex and empty or gravid for females)

3.5.4. collection date

3.5.5. collection location

3.5.6. collection method (attractant trap type or non-attractant collection; if traps used, note attractant used as this indicates bias for particular age classes)

3.6. Accurate species identification is essential. If you are unsure of the species identification do not guess. Either have the specimen accurately identified or discard it. Unidentified pools will be not be tested by the Tampa Laboratory.

3.7. Label tubes (preferably 2.0 ml plastic, snap-cap microcentrifuge tubes (Fisher Cat # 02-681-258) with the unique identification number or with the following information: species name and number, site, collection date, numbers of mosquitoes. Seal the tube with plastic film (or plastic electrical tape) and store it at -70° C. A proper seal is essential to prevent intrusion by carbon dioxide gas if the specimens are shipped on dry ice! Maintain accurate records.

3.8. Complete the "Arbovirus Surveillance, virus isolation" form and send with the submitted pools to DOH Tampa Laboratory

3.8.1. Drive to DOH Tampa Laboratory or overnight mail on dry ice.

3.8.2. Laboratory address:

Dr Lillian Stark

Bureau of Laboratories

Tampa Branch Laboratory

3602 Spectrum Blvd

Tampa, FL 33612

Tel: 813-974-5990

4. Sample assay/reporting

4.1. Samples are screened in a molecular assay (TaqMan RT-PCR) for WN virus.

4.1.1. Pools positive for WN virus are reported by email to the submitter.

- 4.1.2. When molecular screening is completed, a report is mailed to the submitter.
 - 4.2. Samples are inoculated onto cell cultures for arbovirus isolation.
 - 4.2.1. When an isolate is detected it is identified by RT-PCR using multiple primer sets. and probes. Gene sequencing may be performed.
 - 4.2.2. Virus isolates are reported by email to the submitter.
 - 4.2.3. When isolation attempts are completed, a report is mailed to the submitter.
5. To benefit arboviral surveillance programs, mosquitoes should be pooled and shipped to the Tampa Laboratory within 24 hours of collection. In addition, the shipments need to arrive at the Laboratory on a weekday to make sure staff is available to process the specimens. Results will be reported back to the collector within two weeks.

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 *Aedes 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. For DEN and YF case definitions see Appendix F.

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).

MALARIA

Introduction

Malaria is one of the world's greatest public health problems. Approximately 500 million of the world's population are infected each year and between 2 and 2.5 million people die from malaria annually. One in 3 people in the world, a total of 2.2 billion people, are at risk from the mosquito-borne parasite *Plasmodium falciparum*. Although malaria is no longer endemic in Florida, it is often seen in travelers returning to the state from endemic malaria regions of the world. Unusual locally acquired cases have been 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 14 *Anopheles* species, all of which are potentially capable of transmitting malaria, however only two, *Anopheles quadrimaculatus* and *An. crucians* are, or have been, major malaria vectors in Florida:

An. quadrimaculatus

- Principal malaria carrier.
- Found in every county, more abundant in northern Florida.
- Breeds in alkaline ponds, lakes and gum swamps in the limestone and red clay regions of northern and western Florida.

An. crucians

- Breeds in acid ponds and cypress swamps.

An. diluvialis

Immatures are found in swamps and temporary pools of water resulting from heavy rains.

An. inundatus

Habitats of immatures similar to those reported for *An. diluvialis*.

An. maverlius

Habitats of immatures similar to those reported for *An. diluvialis*.

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. smaragdinus

Immatures prefer habitats in permanent-water swamps with moderate amounts of emergent vegetation.

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 *P. falciparum* occurred in Broward County in 1996 and were probably related to iatrogenic spread in a hospital setting where a patient was being treated for imported malaria infection. 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. The largest *P. vivax* outbreak in recent Florida history (with eight cases) occurred in Palm Beach County in 2003 in an area located very close to the 1996 Palm Beach County malaria cases.

In the Americas, over 2 million cases occur annually. Approximately 30% of the human population in the Americas resides in areas suitable for malaria transmission. The largest numbers 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.

Specific characteristics

Vivax malaria

Clinical:

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

Pathology:

- Infects new red blood cells, red cell destruction leads to anemia
- Enlarged spleen, pulp tarry, malphigian bodies pale gray, malaria pigment within reticulo-endothelial cells
- Congested and enlarged liver, destruction of the bile canaliculi
- Granular casts 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 *An. quadrimaculatus* and *An. crucians* 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 FMEL of all imported malaria cases by county in Florida.
- Institute annual surveillance programs focused on *An. quadrimaculatus* and *An. crucians* to establish long term baseline data sets to evaluate local changes in abundance of these important malaria vectors in Florida.

Surveillance issues for mosquito control agencies

- Survey and map annually 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. It is important that the specimens are collected before treatment is initiated. Depending on the number of cases (at least two), the county health department may conduct a survey of migrant workers and local residents (family and neighbors) in the immediate area where the malaria cases occurred. The case definition for malaria can be found in Appendix F.

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.

FLORIDA CONFIDENTIAL MALARIA INFECTION CASE ADDENDUM

(To be completed for all laboratory presumptive and confirmed cases in addition to the CDC form 54.1 01/2002.)

Parasitology: Vivax Falciparum Malariae Ovale Not determined

IDENTIFYING DATA:

County: _____ Merlin Case #: _____

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

Home Address: _____ Homeless Yes No
Street City State Zip

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

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

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

YES NO UNK YES NO UNK YES NO UNK
Fever >=101F Malaise Disorientation
Highest Temp. (If known) _____ °F Perspiration Liver
Chills Mild jaundice Enlargement
Sweats Stupor ARDS
Headaches Coma Convulsion
Nausea Cerebral Malaria Renal Failure Confusion
Vomiting Anemia Other _____
Outcome: Survived Died Unknown Date of last follow-up ____/____/____

LABORATORY DATA: (must attach laboratory sheets*)

Risk Factor Information:

- 1. Does the patient's residence have screened windows? Yes No Unknown
- 2. During the month before onset of illness does the patient recall being bitten by mosquitoes? Yes No
If yes, dates and places _____
- 3. Is the patient a smoker? Yes No Unknown
If yes, do they smoke outdoors? Yes No Unknown
- 4. Has the patient spent extended time outdoors in the month prior to onset? Yes No Unknown
If yes, are any prevention measures taken to avoid mosquito bites (5 D's)? Yes No
If yes, list _____
- Does the patient use mosquito repellent when outdoors: Always Sometimes Rarely Never
Does the repellent contain DEET (N, N-diethyl-meta-toluamide, or N, Ndiethyl-3-methylbenzamide), picaridin, or oil of lemon eucalyptus Yes No Unk.
- 5. What is the patient's occupation? _____
- 6. Does the patient have any underlying medical conditions? Yes No Unk. If yes, specify _____
- 7. Has the patient been exposed to tainted needles in the past 12 months? Yes No Unknown
- 11. Has the patient traveled outside of Florida in the month prior to onset? Yes No Unknown
If yes, specify (Please use other page if additional places need to be listed) _____

COMMENTS:

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

Please submit form to the Bureau of Community Environmental Health (HSEC), Dept. of Health, 4052 Bald Cypress Way, Bin A-08, Tallahassee, Florida 32399-1712 or FAX 850-922-8473 or SC 292-8473.

Instructions for completing the Malaria case report form

(this is an addendum to the CDC form 54.1 01/2002)

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

Identifying data- All identifying data needs to be filled out in full.

County- The county of residence unless transmission occurred elsewhere. If transmission occurred elsewhere please inform that jurisdiction. The reporting county should be the county in which the most likelihood of transmission occurred.

Merlin case #- Information gathered after reporting to the Merlin surveillance system

Name- Last, First, MI (optional)

Date of birth- Month/ day/ year

Country of birth- Country where the individual was born

Home address- Include street, city, state, and zip code if no home address is available because person is of transient nature, enter the closest address to current place of occupancy and check yes for homeless.

Home phone- Enter area code followed by 7 digit number or if cell phone given please indicate by writing cell phone.

Employer/School- If the patient is in high school or below enter name, address, and zip code of school or daycare, if patient has graduated and has an employer please list name, address, and zip code if neither apply please just write N/A.

Race- Mark the box that the individual specifies as their race

Hospitalization- If the patient was hospitalized for this recent illness please check the yes box and enter the hospital name, physician seen during the hospital stay, physician phone number, date of admission (month/ day/ year) and date of discharge (month/ day/ year). If no hospitalization simply check the no box and continue with clinical symptoms.

Clinical Symptoms

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

Definition of clinical symptoms:

Fever- Documented cases of 101°F or above and indicate highest temperature monitored (if known)

Malaise- A feeling of general discomfort or uneasiness

Mild jaundice- a yellow tone to skin and eyes

Stupor- A state of impaired consciousness in which only continual stimulation arouses the individual

Coma- A state of impaired consciousness in which one cannot be roused

Cerebral Malaria- A form of falciparum characterized by cerebral involvement

Anemia- A condition in which oxygen carrying blood cells are less than normal

Disorientation- Unable to orientate oneself

ARDS-Adult respiratory distress syndrome

Convulsion- Violent spasm or series of jerking of the face, trunk, or extremities

Confusion- A mental state of being bewildered or perplexed

Renal failure- Failure of the kidneys

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

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

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

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

Risk factor information-

Does the primary residence have screens on all of the operable windows?

Does the patient remember being bitten by a mosquito if so, when and where?

Does the patient smoke and if so, do they smoke outdoors?

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

Dusk and Dawn- avoid outdoors during these times

DEET - use an effective mosquito repellent **Drain** standing water from around their home.

Use this time to educate!

Does the patient have any underlying medical conditions (Example: Diabetes, heart disease, etc.) or has the patient had Malaria in the past, if yes, specify type

Has the patient been in contact with needles that have not been properly sanitized (ex. tattoos, piercings, etc.)

Does the patient have a travel history outside of the state of Florida within the last month?

*If any travel history document location, reason for travel, and beginning and ending dates of each location

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

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

**After completion of the case report form please fax or mail a copy along with the laboratory results to FAX 850-922-8473 or SC 292-8473 or mail to the Bureau of Community Environmental Health (HSEC), Dept. of Health, 4052 Bald Cypress Way, Bin A-08, Tallahassee, Florida 32399-1712. Before faxing please call (850) 245-4444 x2437 to let us know that you are sending confidential information.

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

Dermaacentor 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). 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: _____

Patient's Name/Address/Phone Number: _____

Patient's Age: _____ Sex: _____

Where tick was acquired: City _____ State _____

Specific location/address _____

MODEL MEDIA KIT

St. Louis Encephalitis Public Information Efforts- lessons learned

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

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

Respondents were asked if they currently took any precautions to prevent mosquito bites. Of those answering the survey, 67% in alert counties and 51% in non-alert counties reported currently taking precautions ($p=0.001$). In alert counties, 93% of respondents reported having heard (or read) SLE messages, compared to 75% in non-alert counties ($p=0.001$). Of those who received SLE messages, 72.5% used some kind of anti-mosquito precaution compared to 45.3% of those who did not receive SLE messages ($p=0.001$). Television and newspapers were the most common sources of information on SLE. There were 86% of respondents in alert counties and 74% in non-alert counties who reported receiving SLE information from television ($p=0.002$); and 55% of respondents in alert counties and 39% in non-alert counties who reported receiving information from the newspaper ($p=0.003$). Of respondents who reported receiving SLE information, 41% reported taking additional precautions against mosquito bites after hearing the messages. In alert counties this number was 49%, and in non-alert counties, 27% took additional precautions ($p=0.001$). The most common preventive measures included the following: limiting outdoor activities (45.8% in alert counties versus 17.6% in non-alert counties, $p=0.001$); wearing insect repellent (44.8% in alert counties vs. 38.5% in non-alert counties, $p=0.2$); and wearing long pants and long sleeves (26.9% in alert counties vs. 10% in non-alert counties, $p=0.001$).

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

SAMPLE PRESS RELEASE for MOSQUITO-BORNE DISEASE ALERTS

DRAFT

August XX, 2006

CONTACT: name

XXX-XXX-XXXX

MOSQUITO-BORNE DISEASE ALERT ISSUED FOR XXXXXXX COUNTY

--Human Case of (WN, EEE, SLE, Dengue) Confirmed--

Today, County Health Department Director/Administrator (Dr.) **XXXXX XXXXXX** announced that Florida Department of Health (DOH) Secretary M. Rony François, M.D., M.S.P.H., Ph.D., has issued a medical alert for **XXXXXX** County. Human cases of (West Nile (WN) virus encephalitis/fever, EEE, Dengue, Malaria), have been confirmed and there is a heightened concern that additional residents will become ill. The most recent case involves a XX-year-old (fe)male resident.

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

DOH continues to advise the public to remain diligent in their personal mosquito protection efforts. These should include the "5 D's" for prevention:

- **Dusk and Dawn** -- Avoid being outdoors when mosquitoes are seeking blood. For many species, this is during the dusk and dawn hours.
- **Dress** -- Wear clothing that covers most of your skin.
- **DEET** -- When the potential exists for exposure to mosquitoes, repellents containing DEET (N,N-diethyl-meta-toluamide, or N,N-diethyl-3-methylbenzamide) are recommended. Picaridin and oil of lemon eucalyptus are other repellent options.
- **Drainage** -- Check around your home to rid the area of standing water, which is where mosquitoes can lay their eggs.

Tips on Repellent Use

- Always **read label directions carefully** for the approved usage before you apply a repellent. Some repellants are not suitable for children.
- Products with concentrations of up to 30 percent DEET are generally recommended. Other effective mosquito repellents, as reported by the CDC in April 2005, contain Picaridin or oil of lemon eucalyptus. These products are generally available at local pharmacies. Look for active ingredients to be listed on the product label.
- Apply insect repellent to exposed skin, or onto clothing, but **not under clothing**.
- In protecting children, read label instructions to be sure the repellent is **age-appropriate**. According to the CDC, mosquito repellents containing oil of lemon eucalyptus should not be used on children under the age of 3 years. DEET is not recommended on children younger than 2 months old.
- Infants should be kept indoors or mosquito netting should be used over carriers when mosquitoes are present.
- Avoid applying repellents to the hands of children. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing.
- If additional protection is necessary, apply a permethrin repellent directly to your clothing. Again, always follow the manufacturer's directions.

Tips on Eliminating Mosquito Breeding Sites

- Clean out eaves, troughs and gutters.
- Remove old tires or drill holes in those used in playgrounds to drain.
- Turn over or remove empty plastic pots.
- Pick up all beverage containers and cups.
- Check tarps on boats or other equipment that may collect water.
- Pump out bilges on boats.
- Replace water in birdbaths and pet or other animal feeding dishes at least once a week.
- Change water in plant trays, including hanging plants, at least once a week.
- Remove vegetation or obstructions in drainage ditches that prevent the flow of water.

DOH continues to conduct statewide surveillance for mosquito borne illnesses, including West Nile (WN) virus, Eastern Equine Encephalitis (EEE), St. Louis Encephalitis (SLE), malaria, and dengue. Residents of Florida are encouraged to report dead birds via the Web site <http://www.MyFWC.com/bird>. For more information on mosquito-borne illnesses, visit DOH's Environmental Health website at <http://www.doh.state.fl.us/environment/community/arboviral/index.htm> , call the West Nile Virus Hotline at 1-888-880-5782, or call your local county health department.

SAMPLE PRESS RELEASE for MOSQUITO-BORNE DISEASE ADVISORIES

FOR IMMEDIATE RELEASE
XXXXXX XX, 2006

CONTACT:
Director

FLORIDA DEPARTMENT OF HEALTH X COUNTY – ADVISORY FOR MOSQUITO-BORNE DISEASE

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

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

Your personal mosquito protection efforts should include the “5 D’s” for prevention:

- Dusk and Dawn -- Avoid being outdoors when mosquitoes are seeking blood. For many species, this is during the dusk and dawn hours.
- Dress -- Wear clothing that covers most of your skin.
- DEET -- When the potential exists for exposure to mosquitoes, repellents containing DEET (N,N-diethyl-meta-toluamide, or N,N-diethyl-3-methylbenzamide) are recommended. Picaridin and oil of lemon eucalyptus are other repellent options.
- Drainage -- Check around your home to rid the area of standing water, which is where mosquitoes can lay their eggs.

Elimination of breeding sites is one of the keys to prevention.

Tips on Eliminating Mosquito Breeding Sites

- Clean out eaves, troughs and gutters.
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- Pick up all beverage containers and cups.
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DOH continues to conduct statewide surveillance for mosquito borne illnesses, including West Nile (WN) virus, Eastern Equine Encephalomyelitis (EEE), St. Louis Encephalitis (SLE), malaria, and dengue. Residents of Florida are encouraged to report dead birds via the web site <http://myfwc.com/bird/>. For more information on mosquito-borne illnesses, visit DOH's Environmental Health web site at <http://www.doh.state.fl.us/environment/community/arboviral/index.htm> , call the West Nile Virus Hotline at 1-888-880-5782, or call your local county health department.

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Sample Hurricane Fact Sheet for Mosquito-Borne Illness

For Immediate Release
XXXX, XX, 2006

Contact: Doc Kokol
850-245-4111

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

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

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

DOH continues to advise the public to remain diligent in their protecting themselves from mosquito bites by following the "5 D's," which include:

- **Dusk and Dawn** – Avoid being outdoors when mosquitoes are seeking blood. For many species, this is during the dusk and dawn hours.
- **Dress** – Wear clothing that covers most of your skin.
- **DEET** – When the potential exists for exposure to mosquitoes, repellents containing DEET (N,N-diethyl-meta-toluamide, or N,N-diethyl-3-methylbenzamide) are recommended. Picaridin and oil of lemon eucalyptus are other repellent options. If additional protection is necessary, a permethrin repellent can be applied directly to your clothing. Again, always follow the manufacturer's directions.
- **Drainage** – Check around your home to rid the area of standing water, which is where mosquitoes can lay their eggs.

Tips on Repellent Use

- Always **read label directions carefully** for the approved usage before applying a repellent to skin. Some repellants are not suitable for children.
- Products with concentrations of up to 30 percent DEET are generally recommended. Other potential mosquito repellents, as reported by the Centers for Disease Control and Prevention (CDC) in April 2005, contain picaridin or oil of lemon eucalyptus. These products are generally available at local pharmacies. Look for active ingredients to be listed on the product label.
- Apply insect repellent to exposed skin, or onto clothing, but **not under clothing**.
- In protecting children, read label instructions to be sure the repellent is **age-appropriate**. According to the CDC, mosquito repellents containing oil of lemon eucalyptus should not be used on children under the age of 3 years. DEET is not recommended on children younger than 2 months old.
- Infants should be kept indoors or mosquito netting should be used over carriers when mosquitoes are present.
- **Avoid applying repellents to the hands of children**. Adults should apply repellent first to their own hands and then transfer it to the child's skin and clothing.
- If additional protection is necessary, apply a permethrin repellent directly to your clothing. Again, always follow the manufacturer's directions.

Tips on Eliminating Mosquito Breeding Sites

Elimination of breeding sites is one of the keys to prevention.

- Clean out eaves, troughs and gutters.
- Remove old tires or drill holes in those used in playgrounds to drain.
- Turn over or remove empty plastic pots.
- Pick up all beverage containers and cups.
- Check tarps on boats or other equipment that may collect water.
- Pump out bilges on boats.
- Replace water in birdbaths and pet or other animal feeding dishes at least once a week.
- Change water in plant trays, including hanging plants, at least once a week.
- Remove vegetation or obstructions in drainage ditches that prevent the flow of water.

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

DOH continues to conduct statewide surveillance for mosquito borne illnesses, including West Nile (WN) virus, Eastern Equine Encephalitis (EEE) virus, St. Louis Encephalitis (SLE) virus, malaria and dengue. For more information on mosquito-borne illnesses, visit DOH's Environmental Health Web site at <http://www.doh.state.fl.us/Environment/community/arboviral/index.html>, call the West Nile Virus Hot line at 1-888-880-5782, or call your local county health department.

The Florida Fish and Wildlife Conservation Commission maintains a Web site for reporting wild bird die offs related to West Nile virus. To report a dead bird, visit <http://MyFWC.com/bird>.

Florida Emergency Information Line: 1-800-342-3557

Public Information Emergency Support Function: 850-921-0384

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**Florida Department of Health
Public Service Announcement**

How to Protect Yourself from Mosquito-transmitted Encephalitis

St. Louis encephalitis (SLE)/ West Nile (WN)/ Eastern Equine Encephalitis (EEE) is a serious disease people can get from mosquito bites. Follow the “5 D’s” of arbovirus prevention:

- Stay indoors at Dusk and Dawn when mosquitoes are most active.
- Dress so that your skin is covered.
- DEET (N,N-diethyl-meta-toluamide) : Use an effective mosquito repellent and
- Drain standing water around your home where mosquitoes can breed)

Play it safe and keep mosquitoes from biting you!

SLE/WN MEDICAL ALERT

The onset of St. Louis encephalitis (SLE) usually occurs within 4-21 days (onset of WN virus encephalitis usually occurs within 2-15 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.

Remember the 5 D’s for arbovirus prevention:

- Stay indoors at Dusk and Dawn when mosquitoes are most active.
- Dress so that your skin is covered.
- DEET (N,N-diethyl-meta-toluamide) : Use an effective mosquito repellent and
- Drain standing water around your home where mosquitoes can breed

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

Who is at risk of contracting 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.

West Nile (WN)

Questions and Answers

What is West Nile?

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

What are the symptoms of WN?

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

Who is at risk of contracting WN?

WN 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 WN?

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

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

WN virus outbreak is occurring statewide.

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

Malaria Questions and Answers

What is malaria?

Malaria is a serious disease caused by a parasite and carried by mosquitoes.

How do you get malaria?

You get malaria from the BITE of an infected MOSQUITO.

People who travel to a foreign country where malaria is common have the highest risk for malaria. However, it is possible to get malaria in Florida. The best way to protect yourself from malaria is to not get bitten by mosquitoes.

What are the signs and symptoms of malaria?

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

How soon will a person feel sick after being bitten by an infected mosquito?

For most people, symptoms begin 10 days to 4 weeks after infection.

What is the treatment for malaria?

Malaria **CAN** be treated and cured by the right prescription medications. A doctor **MUST** guide treatment.

How can you lower your chances of getting malaria?

The good news is that you **CAN** lower your chances of getting malaria and other diseases spread by mosquitoes by following the five "D's" :

- Between **Dusk** and **Dawn** (including nighttime): Avoid or limit outdoor activities as much as possible during the dusk, dawn and nighttime hours to avoid being bitten by mosquitoes. Nighttime is when mosquitoes that spread malaria bite.
- **DEET**: Use an effective insect repellent on exposed skin and follow the directions on the label.
- **Dress**: Cover your skin with clothing
- **Doors and screens**: Close windows at night, or install screens in windows and doors if left open at night. If you do not live in a screened or air-conditioned house, sleep under a mosquito bed net that has been dipped in an insecticide containing permethrin.

If you think you have malaria?

See a doctor. Malaria can be treated.

Repellents

DEET Information

Note: Products with concentrations up to 30% DEET are generally recommended for most situations.

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

Q. Is DEET safe?

A. Yes, products containing DEET are very safe when used according to the directions. Because DEET is so widely used, a great deal of testing has been done. When manufacturers seek registration with the U.S. Environmental Protection Agency (EPA) for products such as DEET, laboratory testing regarding both short-term and long-term health effects must be carried out. Over the long history of DEET use, very few confirmed incidents of toxic reactions to DEET have occurred when the product is used properly.

Insect Repellent Use

Q. Why should I use insect repellent?

A. Insect repellents help people reduce their exposure to mosquito bites that may carry potentially serious viruses such as West Nile virus, and allow them to continue to play and work outdoors.

Q. When should I use mosquito repellent?

A. Apply repellent when you are going to be outdoors and will be at risk for getting bitten by mosquitoes.

Q. What time of day should I wear mosquito repellent?

A. Many of the mosquitoes that carry the West Nile virus are especially likely to bite around dusk and dawn. If you are outdoors around these times of the day, it is important to apply repellent. In many parts of the country, there are mosquitoes that also bite during the day, and these mosquitoes have also been found to carry the West Nile virus. The safest decision is to apply repellent whenever you are outdoors.

Q. How often should repellent be reapplied?

A. Follow the directions on the product you are using in order to determine how frequently you need to reapply repellent. Sweating, perspiration or getting wet may mean that you need to re-apply repellent more frequently. If you are not being bitten, it is not necessary to re-apply repellent. Repellents containing a higher concentration of active ingredient (such as DEET) provide longer-lasting protection.

Q. Should I wear repellent while I am indoors?

A. Probably not. If mosquitoes are biting you while you are indoors, there are probably better ways to prevent these bites instead of wearing repellent all the time. Check window and door screens for holes that may be allowing mosquitoes inside. If your house or apartment does not have screens, a quick solution may be to staple or tack screening (available from a hardware store) across the windows. In some areas community programs can help older citizens or others who need assistance.

Q. How does mosquito repellent work?

A. Female mosquitoes bite people and animals because they need the protein found in blood to help

develop their eggs. Mosquitoes are attracted to people by skin odors and carbon dioxide from breath. Many repellents contain a chemical, N,N-diethyl-m-toluamide (DEET), which repels the mosquito, making the person unattractive for feeding. DEET does not kill mosquitoes; it just makes them unable to locate us. Repellents are effective only at short distances from the treated surface, so you may still see mosquitoes flying nearby. As long as you are not getting bitten, there is no reason to apply more DEET.

Q. Which mosquito repellent works the best?

A. The most effective repellents contain DEET (N,N-diethyl-m-toluamide), which is an ingredient used to repel pests like mosquitoes and ticks. DEET has been tested against a variety of biting insects and has been shown to be very effective. The more DEET a repellent contains the longer time it can protect you from mosquito bites. A higher percentage of DEET in a repellent does not mean that your protection is better—just that it will last longer. DEET concentrations higher than 50% do not increase the length of protection.

Q. How does the percentage of DEET in a product relate to the amount of protection it gives?

A. Based on a recent study:

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

Choose a repellent that provides protection for the amount of time that you will be outdoors. A higher percentage of DEET should be used if you will be outdoors for several hours while a lower percentage of DEET can be used if time outdoors will be limited. You can also re-apply a product if you are outdoors for a longer time than expected and start to be bitten by mosquitoes.

Q. Why does CDC recommend using DEET?

A. DEET is the most effective and best-studied insect repellent available. (Fradin, 1998). Studies using humans and mosquitoes report that only products containing DEET offer long-lasting protection after a single application

Q. Are non-DEET repellents effective (e.g. Skin-So-Soft, plant-based repellents)?

A. Some non-DEET repellent products which are intended to be applied directly to skin also provide some protection from mosquito bites. However, studies have suggested that other products do not offer the same level of protection, or that protection does not last as long as products containing DEET. A soybean-oil-based product has been shown to provide protection for a period of time similar to a product with a low concentration of DEET (4.75%).

People should choose a repellent that they will be likely to use consistently and that will provide sufficient protection for the amount of time that they will be spending outdoors. Product labels often indicate the length of time that protection that can be expected from a product. Persons who are concerned about using DEET may wish to consult their health care provider for advice. The National Pesticide Information Center (NPIC) can also provide information through a toll-free number, 1-800-858-7378 or <http://npic.orst.edu/>

Q. I'm confused. Which products contain "DEET"?

A. Most insect repellents that are available in stores are labeled with the chemical name for DEET. Look for N,N-diethyl-m-toluamide or, sometimes, N,N-diethyl-3-methylbenamide. Choose a repellent

that offers appropriate protection for the amount of time you will be outdoors. A higher percentage of DEET should be used if you will be outdoors for several hours while a lower percentage of DEET can be used if time outdoors will be limited.

Using Repellents Safely

Q. What are some general considerations to remember in order to use products containing DEET safely?

A. Always follow the recommendations appearing on the product label.

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

Q. How should products containing DEET be used on children?

A. No definitive studies exist in the scientific literature about what concentration of DEET is safe for children. No serious illness has been linked to the use of DEET in children when used according to the product recommendations. The [American Academy of Pediatrics](#) (AAP) Committee on Environmental Health has recently updated their recommendation for use of DEET products on children, citing: "Insect repellents containing DEET (N,N-diethyl-m-toluamide, also known as N,N-diethyl-3-methylbenzamide) with a concentration of 10% appear to be as safe as products with a concentration of 30% when used according to the directions on the product labels."

The AAP and other experts suggest that it is acceptable to apply repellent with low concentrations of DEET to infants over 2 months old. Other guidelines cite that it is acceptable to use repellents containing DEET on children over 2 years of age.

Repellent products that do not contain DEET are not likely to offer the same degree of protection from mosquito bites as products containing DEET. Non-DEET repellents have not necessarily been as thoroughly studied as DEET, and may not be safer for use on children.

Parents should choose the type and concentration of repellent to be used by taking into account the amount of time that a child will be outdoors, exposure to mosquitoes, and the risk of mosquito-transmitted disease in the area. Persons who are concerned about using DEET or other products on children may wish to consult their health care provider for advice. The National Pesticide Information Center (NPIC) can also provide information through a toll-free number, 1-800-858-7378 or <http://npic.orst.edu/>.

Always follow the recommendations appearing on the product label when using repellent.

- When using repellent on a child, apply it to your own hands and then rub them on your child. Avoid children's eyes and mouth and use it sparingly around their ears.
- Do not apply repellent to children's hands. (Children may tend to put their hands in their mouths.)
- Do not allow young children to apply insect repellent themselves; have an adult do it for them. Keep repellents out of reach of children.

- Do not apply repellent to skin under clothing. If repellent is applied to clothing, wash treated clothing before wearing again.

Using repellents on the skin is not the only way to avoid mosquito bites. Children and adults can wear clothing with long pants and long sleeves while outdoors. DEET or another repellent such as permethrin can also be applied to clothing (don't use permethrin on skin), as mosquitoes may bite through thin fabric. Mosquito netting can be used over infant carriers. Finally, it may be possible to reduce the number of mosquitoes in the area by getting rid of containers with standing water that provide breeding places for the mosquitoes.

Q. Is DEET safe for pregnant or nursing women?

A. There are no reported adverse events following use of repellents containing DEET in pregnant or breastfeeding women.

Q. Are there any risks due to using repellents containing DEET?

A. Use of these products may cause skin reactions in rare cases. If you suspect a reaction to this product, discontinue use, wash the treated skin, and call your local poison control center. There is a new national number to reach a Poison Control Center near you: 1-800-222-1222.

If you go to a doctor, take the product with you. Cases of serious reactions to products containing DEET have been related to misuse of the product, such as swallowing, using over broken skin, and using for multiple days without washing skin in between use, for example. Always follow the instructions on the product label.

Insect Repellents and Sunscreen

Q. Can I use an insect repellent containing DEET and sunscreen at the same time?

A. Yes. People can and should use both sunscreen and DEET when they are outdoors to protect their health. Follow the instructions on the package for proper application of each product. Apply sunscreen first, followed by repellent containing DEET.

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

Q. Has CDC changed its recommendations for use of DEET and sunscreen?

A. No. Based on available research, CDC believes it is safe to use both products at the same time. Follow the instructions on the package for proper application of each product. Apply sunscreen first, then insect repellent containing DEET, to be sure that each product works as specified.

Q. Should I use a combination sunscreen/DEET-based insect repellent?

A. Because the instructions for safe use of DEET and safe use of sunscreen are different, CDC does not recommend using products that combine DEET with sunscreen.

In most situations, DEET does not need to be reapplied as frequently as sunscreen. DEET is very safe when applied correctly. The rare adverse reactions to DEET have generally occurred in situations where people do not follow the product instructions. Sunscreen often requires frequent reapplication, so using a combined product is not recommended. You do not need to reapply insect repellent every time you reapply sunscreen. Follow the instructions on the package for each product to get the best results.

Q. I heard about a study saying that there may be some type of interaction between repellents containing DEET and sunscreen. Is this true?

A. There has been attention to a study concerning the chemicals in DEET and sunscreen presented at a scientific meeting. This is an in vitro study, which means that it is a laboratory study that did not include human or animal testing. The goal of the study was to examine absorption of these

chemicals, and it did not evaluate or make conclusions about health effects related to this issue. The study authors stated that further evaluation of the interaction of these chemicals should be conducted. The study has not yet been published (as of July 2003).

Evaluation by the EPA, which regulates products such as DEET, indicates that it is safe to use insect repellents containing DEET and sunscreen at the same time. CDC recommends using two separate products because sunscreen requires frequent applications while DEET should be used sparingly. Follow the directions on the package for each product, and consult your physician or pharmacist if you have questions. CDC's recommendations for the safe use of insect repellents on children and adults remain unchanged.

Other Repellent Information

Q. Are there any other products besides those containing DEET that may be used?

A. Additional options on the market, specifically Picaridin and oil of lemon eucalyptus, are registered with the EPA and have performed well in evidence published in the peer reviewed literature. According to the CDC, mosquito repellents containing oil of lemon eucalyptus should not be used on children under the age of 3 years.

Q. How does the effectiveness of these products compare to the products containing DEET?

A. CDC's latest guideline (to be published on their website www.cdc.gov) reports that literature summaries indicate that Picaridin (KBR 3023) and oil of lemon eucalyptus have comparable effectiveness to DEET in repelling mosquitoes.

Q. Where can they be purchased?

A. Products containing Picaridin and/or oil of lemon eucalyptus can be found at many chain discount stores, drug stores and pharmacies.

Q. Are there any advantages in using these alternative products?

A. Advantages stated in some references indicate that these alternatives are reportedly less irritating to the skin.

Q. Where can I get more information about repellents?

A. For more information about using repellents safely please consult the EPA Web site: http://www.epa.gov/pesticides/factsheets/alpha_fs.htm or consult the National Pesticide Information Center (NPIC), which is cooperatively sponsored by Oregon State University and the U.S. EPA. NPIC can be reached at: <http://npic.orst.edu/> or 1-800-858-7378.

Florida Mosquito Control Arbovirus Response Plan – West Nile

Guidelines for Mosquito Control Responses

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Florida Department of Health Mosquito Illness Response Plan

- **Level 1 - No activity**
 - Absence of detectable transmission, i.e., DEN, YF, malaria.
- **Level 2 - Background Activity**
 - Native viruses below historic levels, i.e., EEE, SLE, WN.
- **Level 3 - Mosquito-borne Illness Advisory**
 - Surveillance indicates a rise in virus transmission activity.
 - 10% rise in sentinel chickens or corvidae mortality or mosquito infection rates or two or more confirmed horse cases.
- **Level 4 - Mosquito-borne Illness Alert**
 - A confirmed human case.
 - 50% increase in sentinel chicken seroconversions in county or single flock.
 - 50% increase in corvidae mortality above background.
- **Level 5 - Mosquito-borne Illness Threat**
 - Widespread distribution of large numbers of human cases.

Florida Mosquito Control Arbovirus Response Plan – West Nile (FMCARP - WN)

PURPOSE/OVERVIEW

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

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

I. Introduction

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

The Florida Mosquito Control Arbovirus Response Plan – West Nile (FMCARP-WN) must take into account the great diversity in mosquito control organizations in Florida and the diversity of the issues each faces due to the variety of ecologies in different regions, and the variety of available resources for mosquito control in the state. The FMCARP-WN attempts to integrate guidelines for mosquito control agencies in Florida with the companion Florida Department of Health Mosquito Illness Response Plan (pg. 3). Florida mosquito control agencies require a FMCARP-WN containing specific guidelines for mosquito control efforts commensurate with public health risks from mosquitoes. The Department of Health Illness Response Plan is not meant to provide such guidelines.

The plan considers the following factors in interpreting the status of mosquito borne disease that will impact any mosquito control program's assessment of how to respond:

A. Population Size

The absolute size of the human population in any jurisdiction is a critical factor in determining the problem for human health from an arthropod borne disease. It must be understood that even with precisely the same risk of mosquito borne human disease, districts or counties with large numbers of humans will likely have larger number of human cases compared to smaller counties. This is illustrated simply by using the incidence of

disease per human population as the measure of disease in an area. For example, if Indian River County and Miami Dade County have the same disease incidence for West Nile, let us say the actual incidence is 10 cases per 100,000 people in each county. Therefore there is no difference in risk in the two counties. The chances of someone getting West Nile is the same in both. A Miami-Dade resident has the same likelihood of getting West Nile as in Indian River resident. However this means that there are 12.5 cases in Indian River, population size 120,000 but 230 in Miami Dade, population size 2,300,000. This is an important consideration.

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

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

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

B. Time of the Year

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

C. Risk of Disease vs. Actual Occurrence of Disease

The FMCARP-WN provides guidance for the “risk” for human disease when the numbers of human cases are not known, or have not occurred yet, but is projected on the basis of other information. In addition guidance is provided based on the actual “occurrence” of human cases. The other information used to determine “risk” may be any, some, or all of the following: surveillance information (mosquitoes, wild birds, sentinel chickens, equines) in the local jurisdiction or in the absence of surveillance information, information obtained from a geographically associated county that has such surveillance information. The risk of human cases is provided in terms of incidence, and the absolute number of cases in order to provide large populous jurisdictions the option of reacting where appropriate although the risk is at a level that a smaller population may not take the same actions.

Once human cases are occurring then the responses are provided commensurate with these numbers using both incidence and absolute numbers of cases.

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

D. Reporting Interval

The FMCARP-WN provides guidance to account for specific reporting periods. For example, surveillance information is only appropriate for the specific time period in which the information is collected. It is important for agencies to recognize that a 20% rise in surveillance positives totaled over the course of the entire year could be the result of substantial activity in a very short period. Therefore in such cases responses should be geared to only the at risk periods. The surveillance information used in the FMCARP-WN is based on the shortest surveillance time period being implemented usually on a weekly reporting period. Therefore all surveillance indicators in the plan are changes occurring during the weekly reporting period. A 30% seropositive frequency in sentinel birds totaled, for example, over the entire reporting year provides little information concerning the temporal changes in risk to the human population that occurred during the year.

E. Surveillance Information

There is a wide diversity in the available surveillance information throughout Florida. A variety of information may be available that can be used to assess the risk from WN in different localities. Some localities have well developed surveillance information that can be used prior to and during the occurrence of human West Nile cases to assess risk and apply appropriate mosquito and disease control strategies. Each of the different surveillance tools may provide different information which will need to be assessed and evaluated by knowledgeable mosquito and mosquito borne disease epidemiologists relative to the tool being used, location of the information, and time of year.

The most precise surveillance tools are those that provide more direct associations with the actual mosquito transmission frequency for the pathogen in a location. Since dead bird reports and percent WN positive wild birds are often dependant on collection effort and location for actual infection is usually unknown, these types of information are less useful than mosquito infection rates and sentinel chicken surveillance.

No matter the surveillance tool the utility of the resulting surveillance information is critically dependant on the timeliness that the information is collected and reported back to the local mosquito and public health agencies. Surveillance information must be provided in the most efficient, effective and quickest means possible. It is critical that mosquito control and public health agencies have information on WN positive samples within days of their submission for testing. Information that is based on infections that occurred 2-3 or more weeks prior to final positive diagnostic test may be too late for appropriate intervening actions on the part of the responsible agencies. The closer the reporting of surveillance information to the actual day of infection is a requirement and will directly impact the usefulness of surveillance.

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

F. Surveillance Information, Human Population Size and Estimating Risk

Using sentinel chicken seroconversions rates to estimate the frequency of mosquito transmission of WN in a specific area, it is possible to obtain crude estimates of the risk of human West Nile cases. This can be used to gauge the magnitude of overall risk. Of course, any estimates of risk are likely to be more accurate if the risk estimate is confined to the smallest local human population that is near the sentinel chicken flocks. Also information on the mosquito attack rates will greatly improve the estimates. Finally information on the mosquito attack rates on humans will also improve the estimate.

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

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

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

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

- a. Integration with Florida DOH Mosquito Illness Plan.
- b. Appropriate control responses commensurate with human risk of disease.
- c. Dynamic and flexible responses appropriate for variations in the population size and risk for specific counties.
- d. Consideration for public and media perception of the observed “absolute numbers” of human cases and perception of the appropriate vector control efforts commensurate with the absolute number.
- e. Assume that, where available, surveillance data will precede epidemic cases.
- f. Incorporate regional surveillance data to allow for risk assessment in regions with no or little sentinel surveillance.
- g. Conservative use of surveillance information in the absence of human cases. This is a conservative use of surveillance information since high levels of surveillance activity are used as triggers for actions based on only the surveillance indicators. This is meant to avoid constraining mosquito control to expend resources on this information alone if felt unnecessary.
- h. Conservative use of mosquito control resources in the absence of indicators of human risk.
- i. Emphasis on the early impact of mosquito control efforts at the Mosquito Advisory level to reduce potential human cases.
- j. Integration with public policy at Mosquito Emergency level.

III. Mosquito Control Arbovirus Response Levels

- **Level 1 - No activity.**
- **Level 2 – Background.** Many regions of Florida are likely at level 2 year round for WN. Occasional seroconversions at levels indicating that there is little risk of human cases will be geographically and temporarily random and infrequent from December through June.
- **Level 3 – Mosquito Advisory.** Elevated detection in surveillance during any weekly testing period. Any of the following might trigger an advisory:
 - √ 10% above historical background percent levels for sentinel chickens, i.e. if sentinel background is 15%, 25% would be an advisory.
 - √ 20% above WN positives of total birds or 3 fold increase in dead birds above previous years for the same period. Example; previous year level was 2% WN positive birds tested, 20% would be an advisory; previous year 50 dead birds reported then 150 dead bird reports would be medical advisory.
 - √ 50% of any individual sentinel flock.
 - √ Mosquito transmission levels of ca.1/10,000.
 - √ Risk of more than 10 human cases based on human population size and mosquito transmission frequency estimates.
 - √ Risk of 10-50/100,000 humans during any week or reporting period based on mosquito transmission frequency estimates.
 - √ Status of adjoining counties and region if no local surveillance information is available. If surveillance information in adjoining county(s) is appropriate for issuing an advisory, an advisory should be considered in the absence of surveillance information indicated no risk.
- **Level 4 – Mosquito Alert.**
 - **Mosquito Alert A – single human case**
 - **Mosquito Alert B** – Elevated detection in sentinels. Any of the following might trigger level 4.
 - √ 20% above historical background percent levels for sentinel chickens, i.e. if sentinel background is 15%, 35% would be “Mosquito Alert B.”
 - √ 30% increase of WN positives percent of total birds compared to previous year(s) for the same period, example 10% seroconversions in previous years are considered background for reporting period, then 40% seropositive birds would be a medical danger..
 - √ 75% of any individual sentinel chicken flock.
 - √ Mosquito transmission levels ca. 1/1,000.

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

- **Level 5 - Mosquito Emergency.** Elevated detection in sentinels. Any of the following might trigger a medical threat or emergency.

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

IV. Mosquito Control Responses at Response Plan Levels

1. Level 1

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

2. Level 2

- a. Continued Surveillance.
- b. Mosquito control operations targeting nuisance and/or disease carrying mosquitoes.
- c. Monitoring potential hot spots using surveillance tools.
- d. Public Announcements – personal protection.

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

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

V. Level 5 – Mosquito Emergency

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

V. Examples.

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

I. Lee County 2003

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

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

B. Temporal use of the Guidelines per Lee County Information

1. January – June 2003.

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

2. July 2003

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

3. August 2003 - 2 additional human cases (date of onset: 8/22 and 8/29) Mosquito Alert A.

- a. West Nile activity similar to July levels, 6 -15% weekly sentinel seroconversions. Predicted disease incidence based on 1,000 mosquitoes biting each sentinel per week on average gives mosquito transmission of ca. 1/6750 with 15% highest sentinel seroconversion.
b. Predicted no. of human cases with avg. max. 1-10 bites per person throughout Lee County for 10 bites per person (450,000 X 10 X 0.00015 = 675 infections) with 4.5 – 135 cases depending on whether infected: cases are 1:150 or 1:5. At 1 bite per person during a week (450,000 X 1 X 0.00015 = 67.5 infections) with 0 – 13.5 cases depending on whether infected: cases are 1:150 or 1:5.
c. Still mosquito alert based on surveillance
d. Mosquito alert A based on 2 human cases reported in 1 week.

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

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

II. Miami Dade 2004

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

Human Cases (date of onset)

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

Dead Bird Reports

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

Wild Bird positives for WN

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

Aug 9 1

Sentinel Chickens

Jul 26 1

Aug 2 1

Aug 9 1

Aug 13 2

Aug 24 2

Sep 13 1

Sep 28 1

B. Temporal use of the Guidelines per Miami Dade County Information on a county wide level (note consideration should be made using surveillance and population size focused in the Coral Gables/Coconut Grove area as well)

1. January – June 2004.

- a. Miami Dade County surveillance in WN positive dead birds showed some West Nile transmission activity at a low level, likely background (ca. 1%-4% of total sentinel population). Level 2.

2. June 1 –Jul 3, 2004

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

3. July 5 -12

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

4. July 5-30

- a. Continued human cases at level 4 Mosquito Alert B.
- b. 14 WN positive birds of ?? (data unavailable at this time) tested.
- c. 1 Sentinel chicken positive
- d. Human cases are maintaining the medical alert
- e. A total of 47 birds were tested for WN in this period in 2003 of which 4 were positive (8.5%).
- f. Note without human cases dead bird positives would be a mosquito advisory based on 3 fold increase from previous year

5. August 2004

- a. Additional human cases (date of onset: 8/4 and 8/29x2) Mosquito Alert B.
- b. 7 dead bird reports; in Aug. 2003, 81 dead birds tested for WN (3 positives).
- c. 6 sentinel chicken positives (max of 2 per reporting week)
Predicted disease incidence based on 1,000 mosquitoes biting each sentinel per week on average gives mosquito transmission of ca. 1/15000 with 7% highest sentinel seroconversion.

- d. Predicted no. of human cases with avg. max. 1-10 bites per person throughout Miami-Dade County for 10 bites per person (2,300,000 X 10 X 0.00007 = 1610 infections) with 11 – 322 cases depending on whether infected: cases are 1:150 or 1:5. At 1 bite per person during a week (2,300,000 X 1 X 0.00007 = 161infections) with 1 – 32 cases depending on whether infected: cases are 1:150 or 1:5.
 - e. Mosquito advisory or alert based on surveillance from chickens.
 - f. Mosquito advisory based on WN positives in wild birds (7) of ?? (data unavailable at this time) compared to 3 of 81 (4%) tested in 2003 for same period
 - g. Mosquito Alert B based on 3 more human cases with onset reported in 1-2 week.
6. September 2004.
- a. No change from August.
 - b. Dead bird reports, WN positive wild birds suggest reduction in transmission.
5. October 2004
- ii. Consider reducing to mosquito advisory based on surveillance and absence of human cases in September.

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

Pop.Size	# Sent Chick.	Est. bites/chicken/week	Total # bites	# serocon.	Transmission Freq.	Avg # bites / person	Expect # WN Fever Cases	Expected # WN Enceph.
926716	56	1000	56000	3	0.00005	10	99.291	4.96455
926716	56	1000	56000	3	0.00005	1	9.9291	0.496455
926716	56	1000	56000	10	0.00018	10	330.97	16.5485
926716	56	1000	56000	10	0.00018	1	33.097	1.65485
926716	56	1000	56000	25	0.00045	10	827.425	41.37125
926716	56	1000	56000	25	0.00045	1	82.7425	4.137125
926716	56	1000	56000	42	0.00075	10	1390.074	69.5037
926716	56	1000	56000	42	0.00075	1	139.0074	6.95037
926716	56	500	28000	3	0.00011	10	198.582	9.9291
926716	56	500	28000	3	0.00011	1	19.8582	0.99291
926716	56	500	28000	10	0.00036	10	661.94	33.097
926716	56	500	28000	10	0.00036	1	66.194	3.3097
926716	56	500	28000	25	0.00089	10	1654.85	82.7425
926716	56	500	28000	25	0.00089	1	165.485	8.27425
926716	56	500	28000	42	0.00150	10	2780.148	139.0074
926716	56	500	28000	42	0.00150	1	278.0148	13.90074

VIII. Acknowledgements

Many individuals provided constructive comments on various versions of the guidelines. I would like to thank Frank Van Essen, Jeffrey Stivers, Marin Brouillard (Collier County Mosquito Control), Bob Betts (Escambia County Mosquito Control), Doug Carlson, Alan Curtis, Donald Shroyer, John Beidler (Indian River Mosquito Control), Eric Cotsenmeyer (Lake County Mosquito Control), James Burgess, Wayne Gale (Lee County Mosquito Control), Mark Lathem, Robert Frommer (Manatee County Mosquito Control), Thomas Breaud (Orange County Mosquito Control), Dennis Moore, Doug Wassmer (Pasco County Mosquito Control), Nancy Page (Pinellas County Mosquito Control), James David, David Mook (St. Lucie County Mosquito Control), Jonas Stewart (Volusia County Mosquito Control), Jonathan Day, George O'Meara, Roxanne Rutledge (FMEL) and the members of the Florida Coordinating Council on Mosquito Control. The suggestions provided by these individuals greatly improved the guidelines. Although not all of the suggestions could be included in the final document for a variety of reasons, their consideration was valuable in developing the guidelines.