February 16, 2022 | Volume 2 | Issue 1| 2021 Year In Review

Welcome to Volume 2 of the Florida Disease Activity Update! This year's publication season begins with a 2021 Year in Review Report from Dr. Jonathan Day.

It continues to be Clarke's privilege to share Dr. Day's weekly analysis of arbovirus disease activity in Florida with mosquito control professionals across the state. Our shared goal with Dr. Day is to provide timely and actionable information that mosquito control programs can use to make operational decisions and protect public health from vector-borne diseases.

A Question from Our Readers

Dennis from Vero Beach, FL asks: "What factors do you use to predict arboviral transmission risk in Florida?"

A: There are five factors that I monitor and use as indicators of potential real-time arboviral transmission risk in Florida.

First, the spatial and temporal disease transmission patterns and introductions in Florida during the previous three months. The Florida Department of Health publishes weekly updates summarizing the current status of vector-borne disease transmission and introductions. These updates are invaluable for identifying and gaining an understanding of current disease transmission hot zones. Transmission and disease introductions during the recent past (i.e., past three months) are indicative of potential high-risk transmission zones.

Second, the daily surface moisture levels on a 4 km^2 resolution throughout Florida as measured by the Florida Department of Agriculture and Consumer Services Keetch-Byram Drought Index (KBDI). The KBDI is a continuous reference scale that estimates the moisture content of the top eight inches of the soil layer. The index scale ranges from 100 (totally saturated soil layer) to 750 (desert conditions). Arboviral transmission is known to be associated with the cycling of rainfall and

drought and the KBDI provides an excellent mechanism to track surface moisture levels in real time.

Third, vector mosquito abundance and age structure as inferred by the KBDI data. *Culex* vectors of arboviruses thrive on the wet-dry cycles we sometimes see during the Florida summer. Daily drought or wetting conditions can be accurately tracked with KBDI data. These data can be used to identify areas where viral amplification is likely to be occurring.

Fourth, avian amplification host abundance and reproductive success as measured by line transects in Indian River County and as inferred by KBDI data for the rest of Florida. Line transects to identify wild bird abundance, breeding status, and age are conducted daily in Indian River County. Avian species of interest are: Mourning Dove, Blue Jay, Common Grackle, Northern Cardinal, and Northern Mockingbird. The daily KBDI outputs are used to identify other parts of Florida where avian breeding may be accelerated or depressed.

Finally, indicators of real-time arthropod disease transmission as reported in the Florida Department of Health, Florida Arbovirus Surveillance Weekly Report. These reports are tracked weekly to gain an understanding of where disease transmission and disease introductions are occurring in Florida.

What Does History Tell Us About Arboviral Transmission in Florida?

In Florida, four arboviruses currently account for the greatest human disease risk; dengue viruses (DENV), eastern equine encephalitis virus (EEEV), St. Louis encephalitis virus (SLEV), and West Nile virus (WNV). Three additional pathogens are periodically introduced into Florida and sometimes result in locally-acquired human infections: Chikungunya virus (CHIKV), Zika virus (ZIKAV), and malaria.

Vector-borne disease transmission and pathogen introductions into Florida during 2021 were below average. A summary for each is provided below.

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A Summary of Vector-Borne Diseases in Florida During 2021

Eastern Equine Encephalitis (EEEV) Activity in 2021

Eastern equine encephalitis virus was the most active mosquito-borne pathogen in Florida during 2021. While there were no reported human EEE cases in the state during the year, there were 185 sentential chicken seroconversions to EEEV reported in 21 Florida counties (Figure 1). The 12 year (2010-2021) mean EEEV annual seroconversion rate for Florida sentinel chickens is 116 per year, so the 2021 seroconversion rate was above normal. There were 21 EEE-positive equines reported in 16 Florida Counties during 2021 (Figure 2), well below the 18-year (2004-2021) average of 45 equine cases per year.

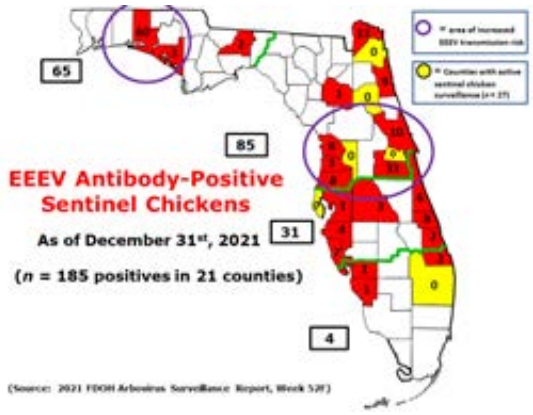

Figure 1. The distribution of EEE antibody-positive sentinel chickens in Florida during 2021. Two areas of EEEV transmission concern (Central Florida and the Florida Panhandle) were identified in 2021.

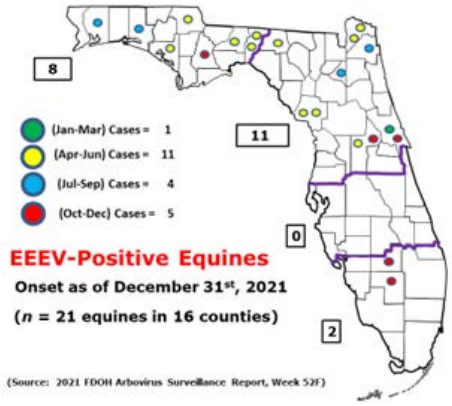

Figure 2. The distribution of EEE-positive equines in Florida during 2021. The cases are color-coded by three month periods of infection. Twelve infections occurred early in the year (January-June), which is typical for EEEV.

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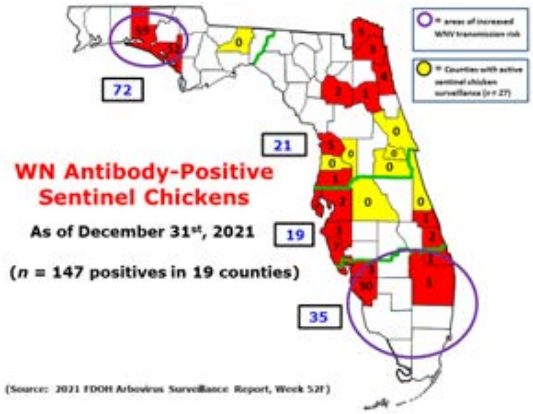
West Nile Virus (WNV) Activity in 2021

West Nile virus transmission was below normal in Florida during 2021. There were seven (7) human WN cases reported in four Florida Counties during 2021 (Figure 4), compared with a 21-year (2001-2021) annual average of 23 cases per year. One hundred forty-seven (147) sentinel chicken seroconversions to WNV were reported in 19 Florida Counties (Figure 3) compared with a 12-year (2010-2021) annual average of 421 WNV seroconversions per year. There were eight (8) WNV-positive mosquito pools reported in two Florida Counties during 2021.



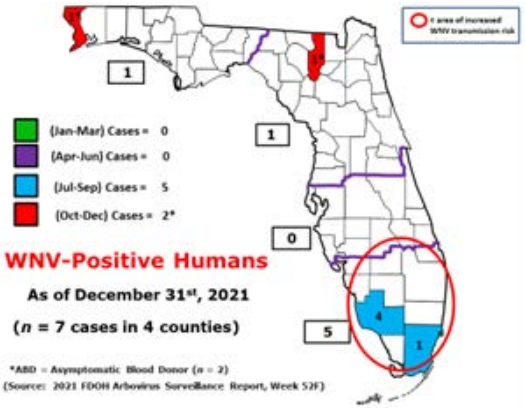


Figure 3. The distribution of WNV antibody-positive sentinel chickens in Florida during 2021. Two areas of WNV transmission concern (South Florida and the Florida Panhandle) were identified in 2021.

Figure 4. The distribution of WN human cases in Florida during 2021. Five neuroinvasive cases were reported in June-September. Two WNV-positive blood donors were reported in North Florida and the Florida Panhandle in October-December.

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St. Louis Encephalitis Virus (SLEV) Activity in 2021

St. Louis encephalitis virus transmission was below normal in Florida during 2021. There were no human SLE cases reported in Florida during 2021. Twenty-four (24) sentinel chicken seroconversions to SLEV were reported in 12 Florida Counties (Figure 5) compared with a 12-year (2010-2021) annual average of 34 SLEV seroconversions per year. There was one (1) SLEV-positive mosquito pool reported in Florida during 2021.

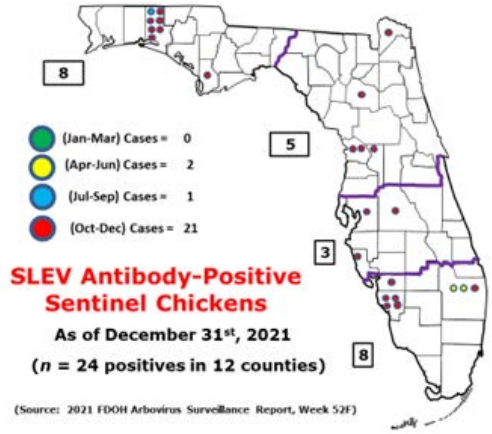

Figure 5. The distribution of SLE antibody-positive sentinel chickens in Florida during 2021. The antibody-positive sentinels are color-coded by three month infection periods. Two positives were reported in the first half of 2021 while 22 positive sentinels were reported during the second half of the year. I suspect that this reflects the movement of SLEV by migrating birds.

Dengue Virus (DENV) Activity in 2021

There were no locally-acquired dengue cases reported in Florida during 2021 compared with a 12-year (2010-2021) average of 16 locally-acquired cases per year. There were 37 travel-related dengue cases reported in 11 Florida Counties in 2021 (Figure 6) compared with a 12-year average of 105 travel-related cases per year.

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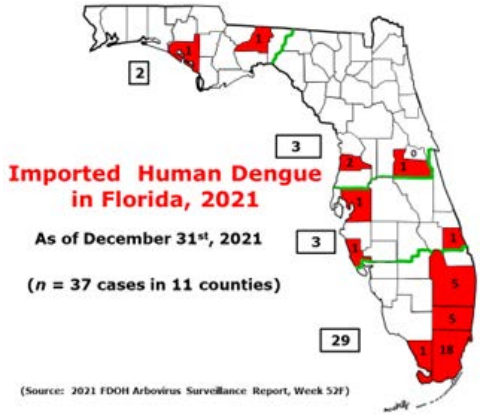

Figure 6. The distribution of travel-related dengue cases reported in Florida during 2021. The reduction in travel-related dengue cases may be an indication of reduced travel due to COVID-19 travel restrictions. The introduction of dengue virus into South Florida Counties (Monroe, Miami-Dade, Collier, and Broward) is of special concern because these Counties are areas where the establishment of locally-acquired dengue infections is most likely to occur.

Chikungunya Virus (CHIKV) Activity in 2021

There were no locally-acquired chikungunya cases reported in Florida during 2021 compared with a 12-year (2010-2021) average of one (1) locally-acquired case per year. There was one (1) travel-related chikungunya case reported in Florida in 2021 compared with a 12-year average of 552 travel-related cases per year.

Zika Virus (ZIKAV) Activity in 2021

There were no locally-acquired nor travel-related Zika cases reported in Florida during 2021 compared with a 7-year average of 206 travel-related and 40 locally-acquired human cases.

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Malaria Activity in 2021

There were no locally-acquired malaria cases reported in Florida during 2021. There were 49 travel-related malaria cases reported in 17 Florida Counties during 2021 (Figure 7) compared with a 12-year (2010-2021) average of 810 travel-related cases per year.

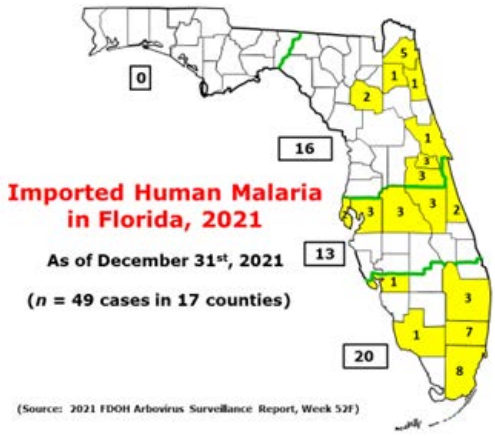

Figure 7. The distribution of travel-related malaria cases reported in Florida during 2021. The reduction in travel-related malaria cases in Florida may be a reflection of reduced travel due to COVID-19 travel restrictions. Even when introduced by infected travelers, malaria has an extremely difficult time re-establishing in Florida as a local transmission cycle.

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Operational Strategies to Consider

Vector and arboviral surveillance remain some of the most important tools that vector control agencies currently have at their disposal. Arboviral transmission indices (sentinel chickens, positive equines, positive exotics (i.e., emus), positive humans, and positive mosquito pools) provide indicators of local virus transmission, although sometimes not in a timely manner. Monitoring mosquito populations and their age structure provide added information about potential transmission risk. Additional vector control efforts in and around sites where virus transmission is known or suspected of recently occurring provides another potential mechanism to mitigate viral transmission.

Specific operational strategies will be discussed during the 2022 arboviral transmission season depending on where and when vector-borne disease transmission becomes evident in the state of Florida.

"The mosquito control decisions we make today affects disease transmission levels tomorrow."

– DR. DAY

Acknowledgments

This analysis would not be possible without the tireless efforts of multiple agencies across Florida. At least 27 Florida agencies collect serum samples from sentinel chickens each week and mail them to the Florida Department of Health Tampa Branch Laboratory for analysis, compilation, and reporting. Data are summarized by researchers at the Florida Department of Health in Tallahassee and reported weekly as the Florida Arbovirus Surveillance Report.

Contributors to the weekly Florida Arbovirus Surveillance Report include: Andrea Morrison, PhD, MSPH, Rebecca Zimler, PhD, MPH, and Danielle Stanek, DVM, FLDOH; Lea Heberlein-Larson, DrPH; Alexis LaCrue, PhD, MS; Maribel Castaneda, and Valerie Mock, BS, FLDOH Bureau of Epidemiology; Carina Blackmore, DVM, PhD, FLDOH Division of Disease Control and Health Protection; and, Dr. Rachel Lacey, Florida Department of Agriculture and Consumer Services, Animal Disease Diagnostic Laboratory in Kissimmee, FL. Daily updates of the Keetch-Byram Drought Index (KBDI) are produced by the Florida Department of Agriculture and Consumer Services, Forest Service .

All of the graphics used in issues of this Newsletter are designed and developed by Gregory Ross.

About Dr. Day

Jonathan Day, Professor Emeritus of Medical Entomology from the University of Florida, is a national expert on mosquitoes and other blood-feeding arthropods that transmit diseases to humans, domestic animals, and wildlife. In collaboration with other researchers, Dr. Day has developed an effective system for monitoring and predicting epidemics of mosquito-borne diseases.