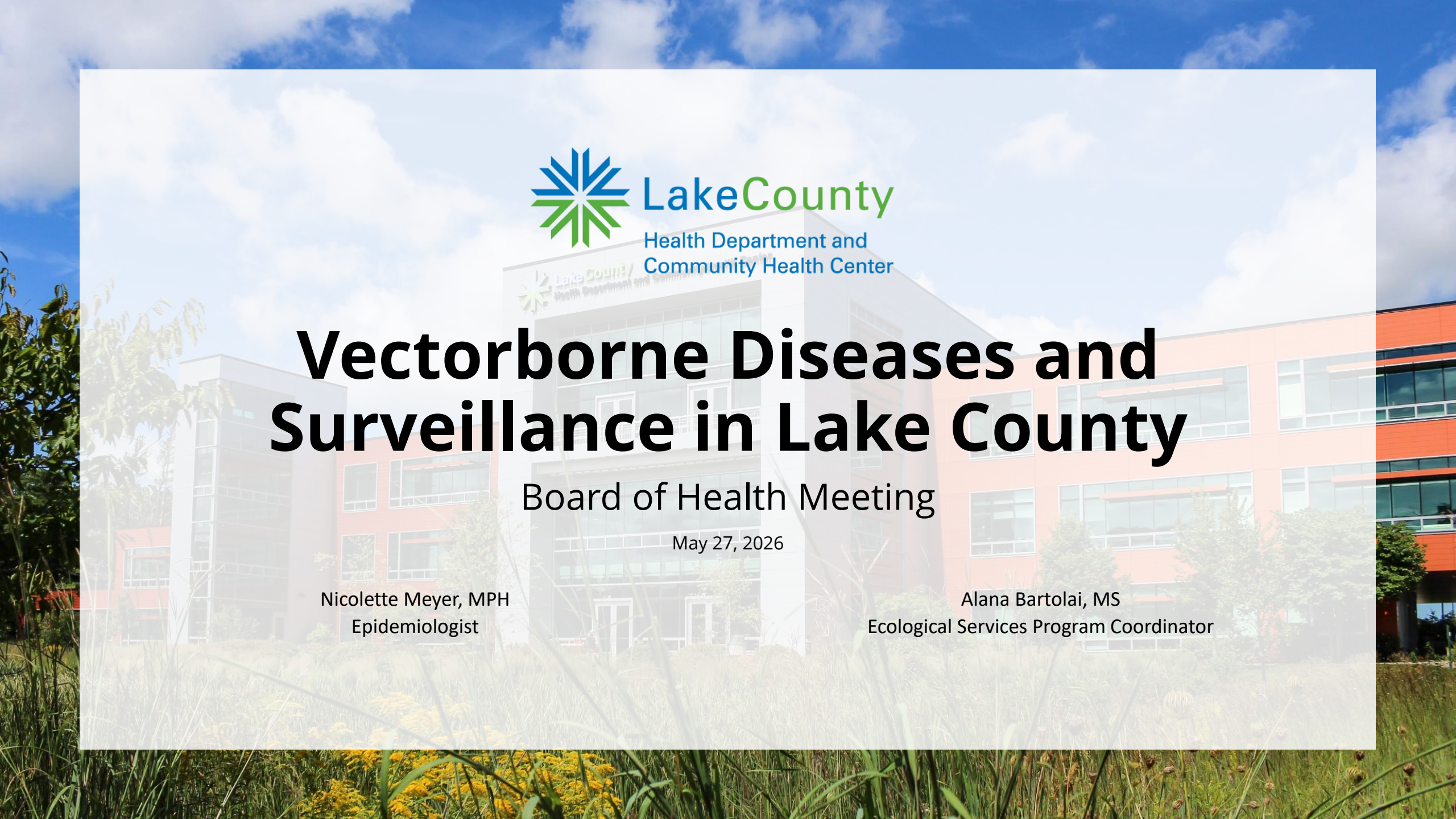


LakeCounty
Health Department and
Community Health Center

Vectorborne Diseases and Surveillance in Lake County

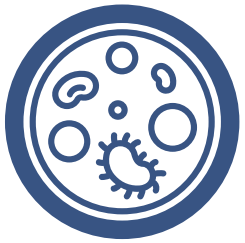
Board of Health Meeting

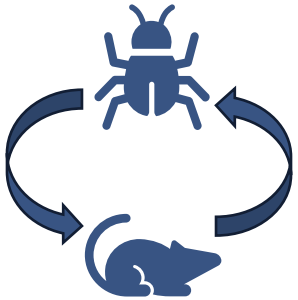
May 27, 2026

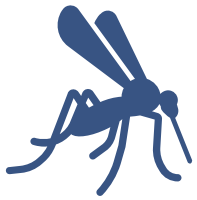
Nicolette Meyer, MPH
Epidemiologist

Alana Bartolai, MS
Ecological Services Program Coordinator

What are Vector-borne Diseases?







Caused by pathogens (e.g., bacteria, viruses, or parasites) transmitted to humans through the bites of infected vectors	**Pathogens are maintained in the environment through vector-animal transmission cycles**	**Humans acquire vector-borne diseases when they are bitten by infected ticks and mosquitoes**

Communicable Disease (CD) and Environmental Health (EH) programs work together to conduct mosquito and tick surveillance, investigate human cases, and educate the public to prevent bites and reduce exposure

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Mosquito Surveillance & West Nile Virus

Mosquito Species of Concern:

Culex pipiens (House Mosquito)

- Transmits West Nile Virus (WNV) and St. Louis Encephalitis virus

Surveillance

- 18-20 LCHD traps located throughout the County.
- Mosquito testing preformed on batches, or pools, of up to 50 mosquitoes
- Surveillance data analyzed weekly and compared to both historical averages and previous years to track WNV activity

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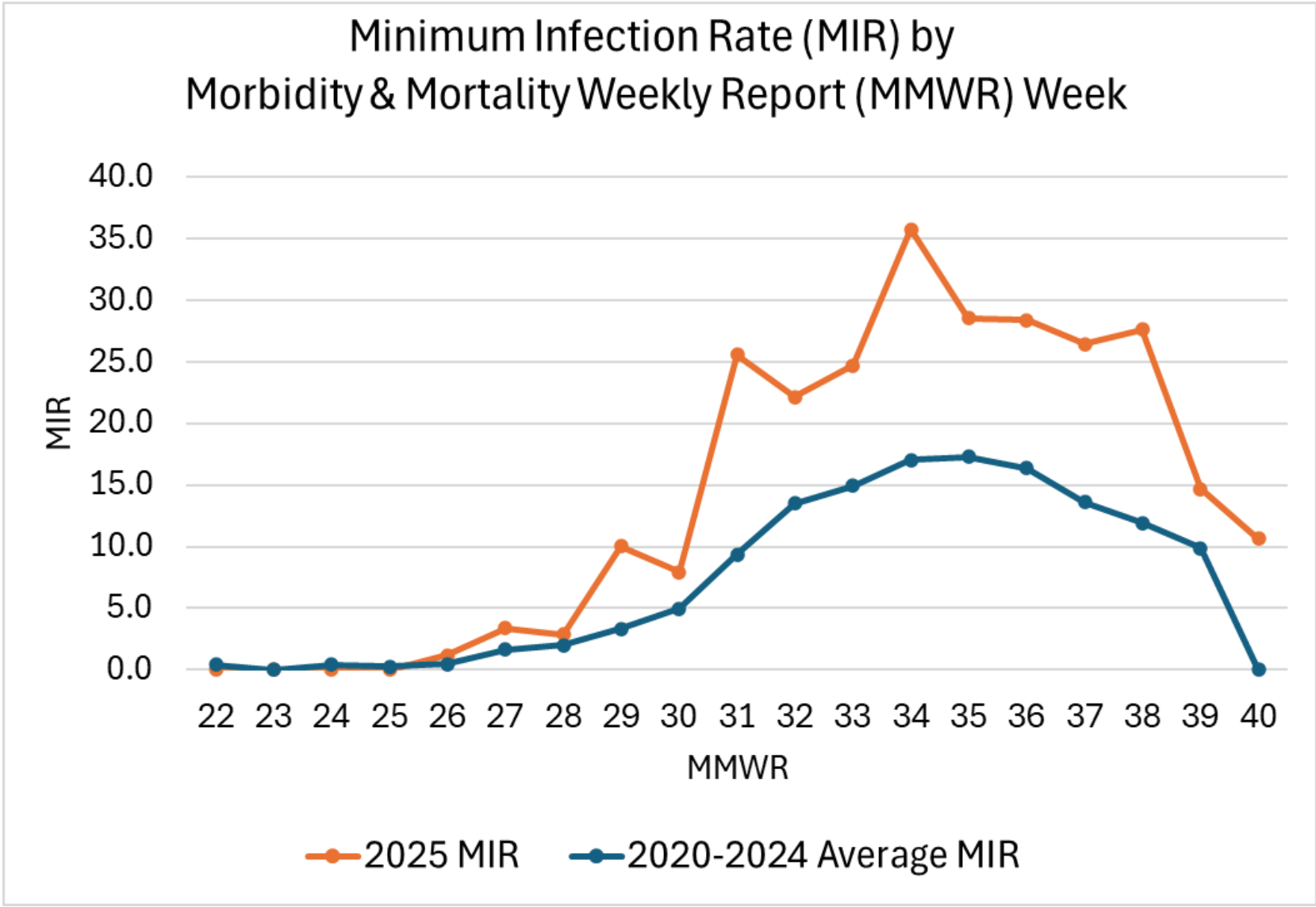
Mosquito Surveillance & West Nile Virus

Data Metrics

- **Percent Positive Pools:** The percentage of mosquito batches that test positive for WNV
- **Minimum Infection Rate (MIR)**: The estimated number of infected mosquitoes per 1,000 in the population
- **Human Cases:** Presence of confirmed human infections
- **Consecutive positive traps:** The number of consecutive weeks that WNV-positive mosquitoes are found in a surveillance trap or location.



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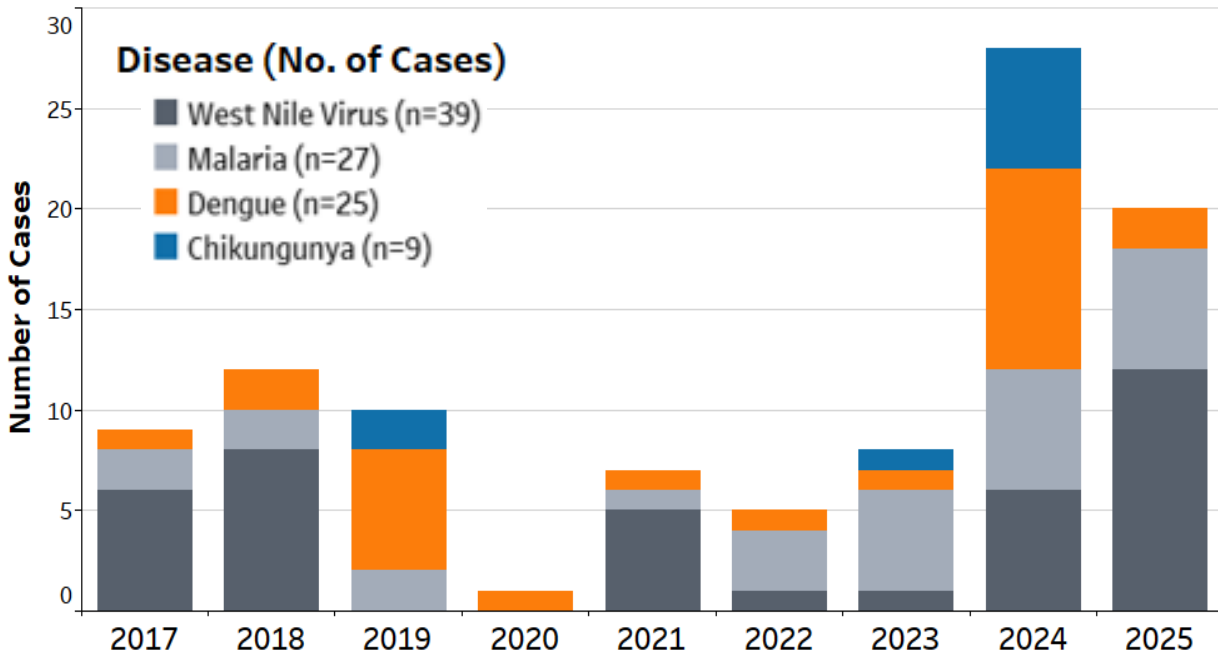
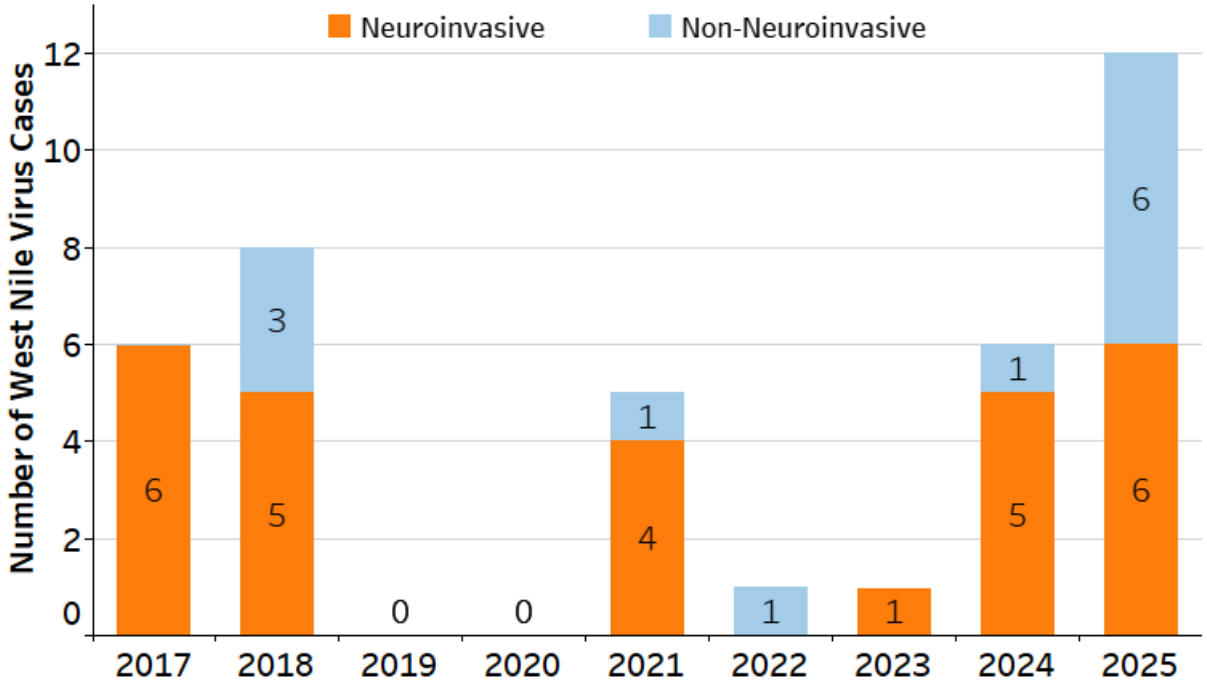
Mosquito-borne Human Disease Cases* in Lake County, Illinois

Total Mosquito-borne Disease Cases* in Lake County, 2017–2025 (N=100)



Reported West Nile Virus (WVN) Cases* in Lake County, 2017–2025 (N=39)



*Includes confirmed and probable cases.

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

Note: West Nile virus and Chikungunya case counts include both neuroinvasive and non-neuroinvasive disease.

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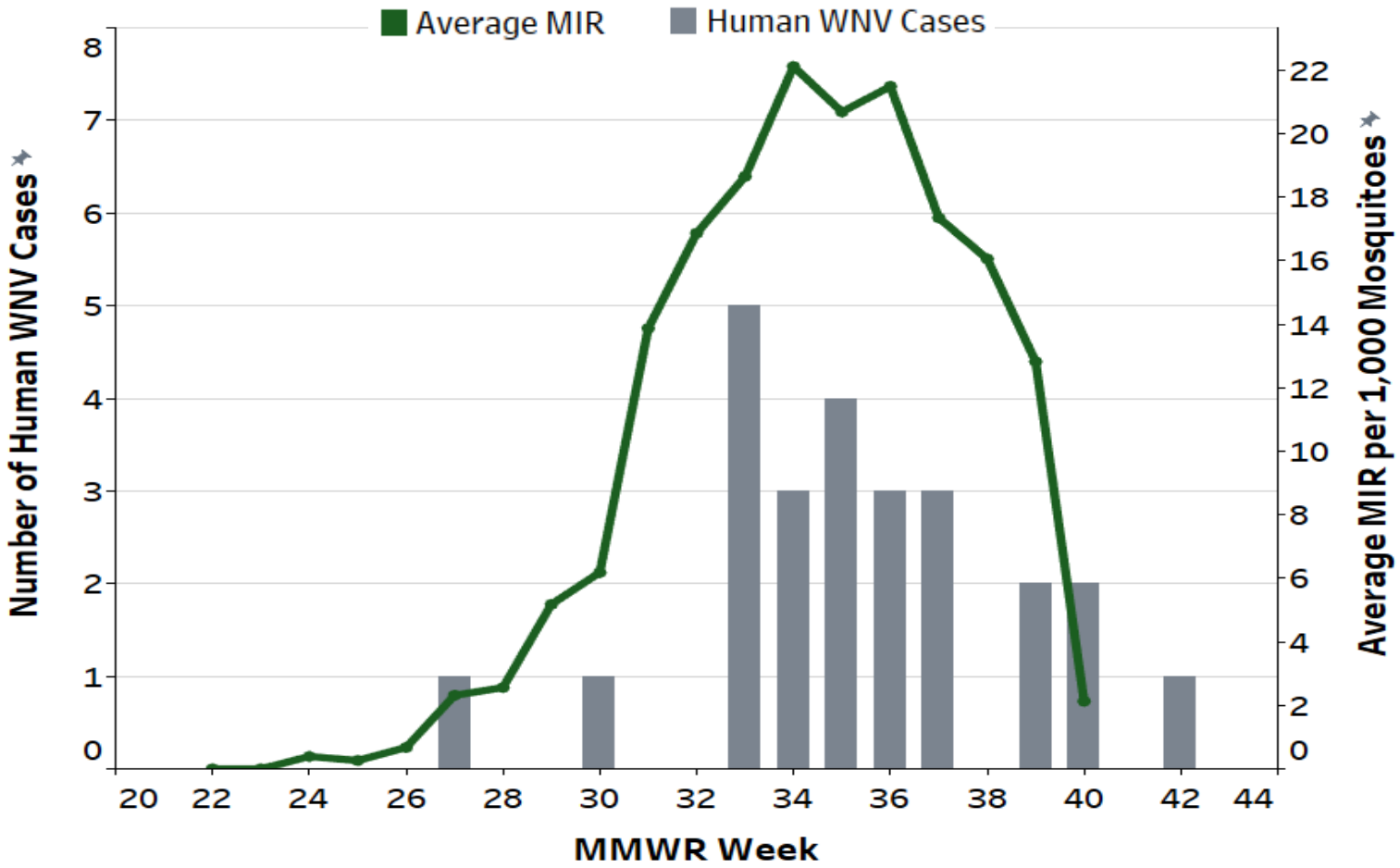
Five-Year Average Mosquito Minimum Infection Rate (MIR) and Aggregate Human WNV Cases* (2021–2025) by MMWR Week, Lake County



- **MIR:** Expressed as the number of infected mosquitoes per 1,000 tested
- Mosquito infection rate can serve as an **early indicator of increasing WNV activity in the community**
- Human cases follow MIR increases (1–2-week lag)

*Includes confirmed and probable cases (2021-2025).
Note: Average is a 5-year historical average (2021-2025).
Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

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West Nile Virus: Signs/Symptoms, Diagnosis, & Treatment

- **Symptoms typically develop 2–14 days after being bitten by an infected mosquito**
- **Neuroinvasive disease:**
  - < 1% of infected patients develop neuroinvasive disease
  - Manifests as meningitis, encephalitis, or acute flaccid myelitis
  - Risk of neuroinvasive disease is higher among older individuals and those with immunocompromising conditions
- **Non-neuroinvasive disease:**
  - An estimated 80% of human WNV infections in the US are subclinical or asymptomatic
  - If symptomatic, most people develop acute febrile illness (West Nile fever)
  - Fever, fatigue, headache, myalgia, arthralgia, transient maculopapular rash, GI symptoms
- **Testing and treatment:**
  - Laboratory diagnosis: test for WNV-specific IgM antibodies in serum (and in CSF if neurologic symptoms are present)
  - No medications available to treat WNV disease; clinical management is supportive

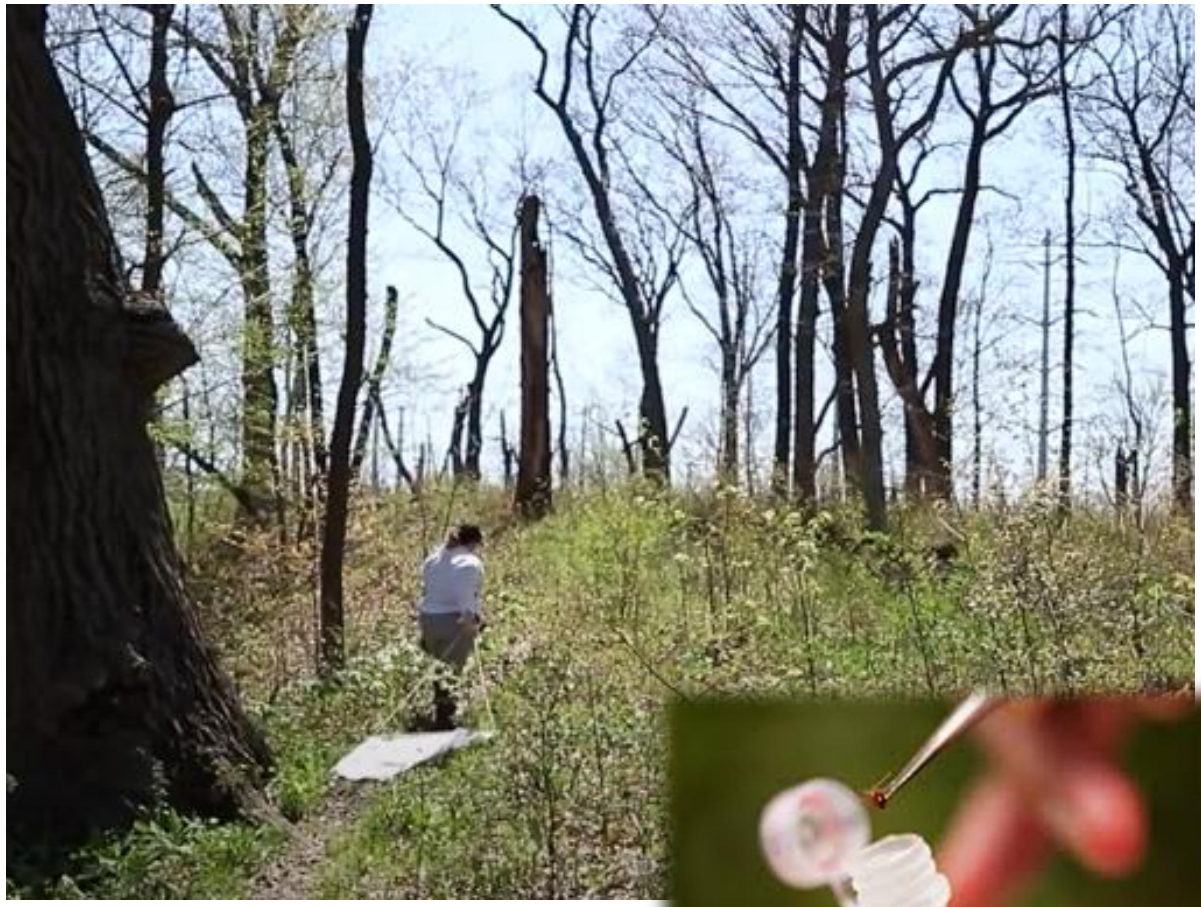
Lake County Health Department
Tick Surveillance Program

Goals of Tick Surveillance:

- Identify tick species
- Test tick species for tick-borne diseases
- Monitor for emerging tick species and pathogens.

Methods:

- Tick Drags
- CO2 Traps
- 2019 – Active surveillance for Illinois, ticks sent to IDPH/CDC
- Follow CDC and IDPH protocol



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Tick Surveillance: Primary Tick Species & Pathogens

BLACKLEGGED TICK (deer tick)
Ixodes scapularis

Transmits: Lyme disease, anaplasmosis,babesiosis, Powas san disease and *Ehrlichia Muris Eauclairensis*

LONE STAR TICK
Amblyomma americanum

Transmits: *Ehrlichia chaffeensis* and *Ehrlichia ewingii* (which cause human ehrlichiosis, tularemia, and STARI), Alpha Gal Syndrome

AMERICAN DOG TICK
Dermacentor variabilis

Transmits: Tularemia and Rocky Mountain spotted fever.

Tick Surveillance

- Lake County's location is optimal for a variety of tick species due to migration of tick species from Northern and Southern regions

- Year-round concern
  - Spring and Fall are peak tick activity
  - Summer increased risk for human-tick interaction.

- 2013-2024 Lake County Tick Pathogen Results
  - Borrelia Burgdorferi (Deer Tick) – 33% positive
  - Borrelia Miyamotoi (Deer Tick)– 1.2% positive
  - Anaplasma phagocytophilum (Deer Tick) – 6.1%
  - Babesia microti (Deer Tick) – 0.3%
  - Ehrlichia Muris Eauclairensis (Deer Tick) – 2024 (1 tick)

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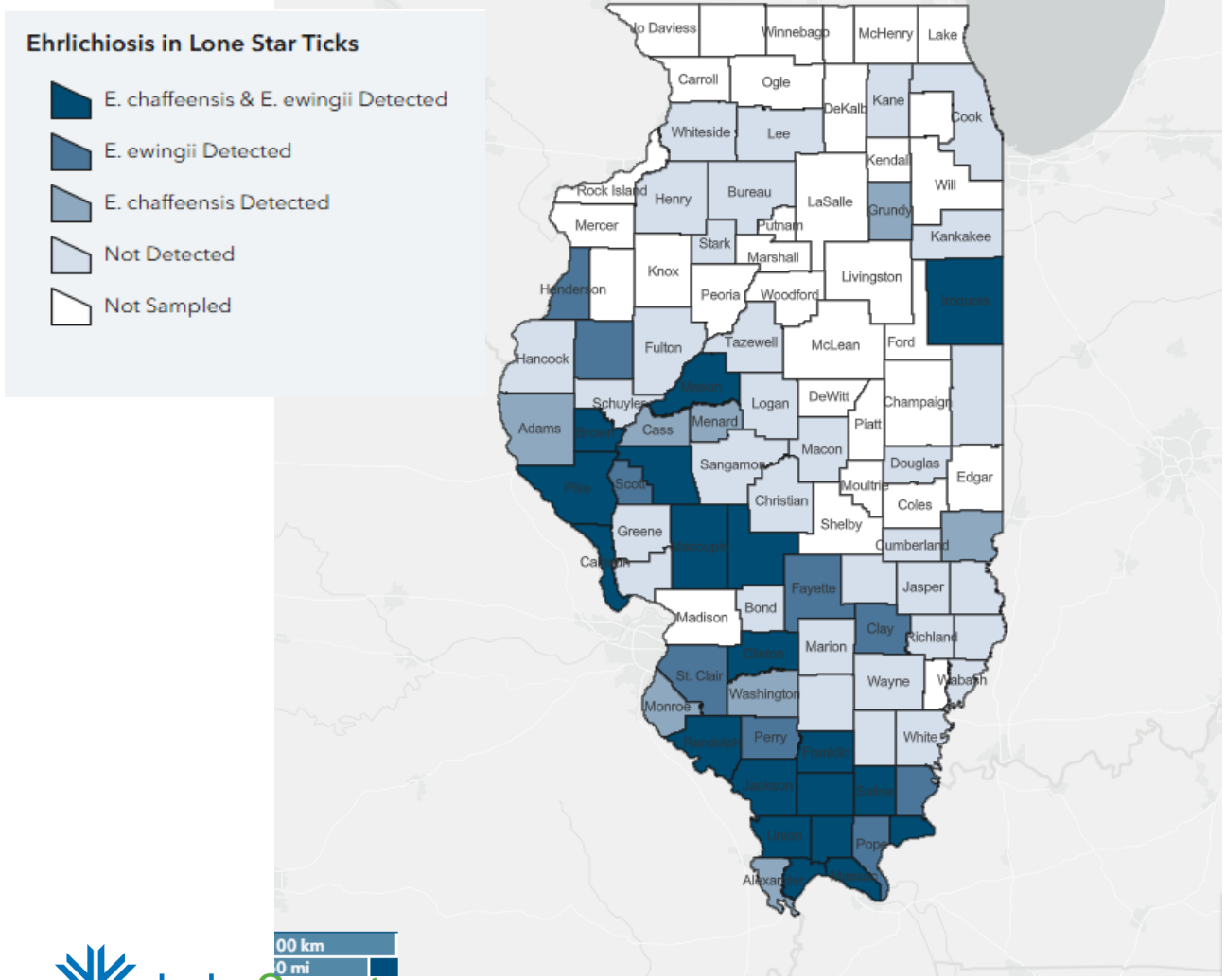
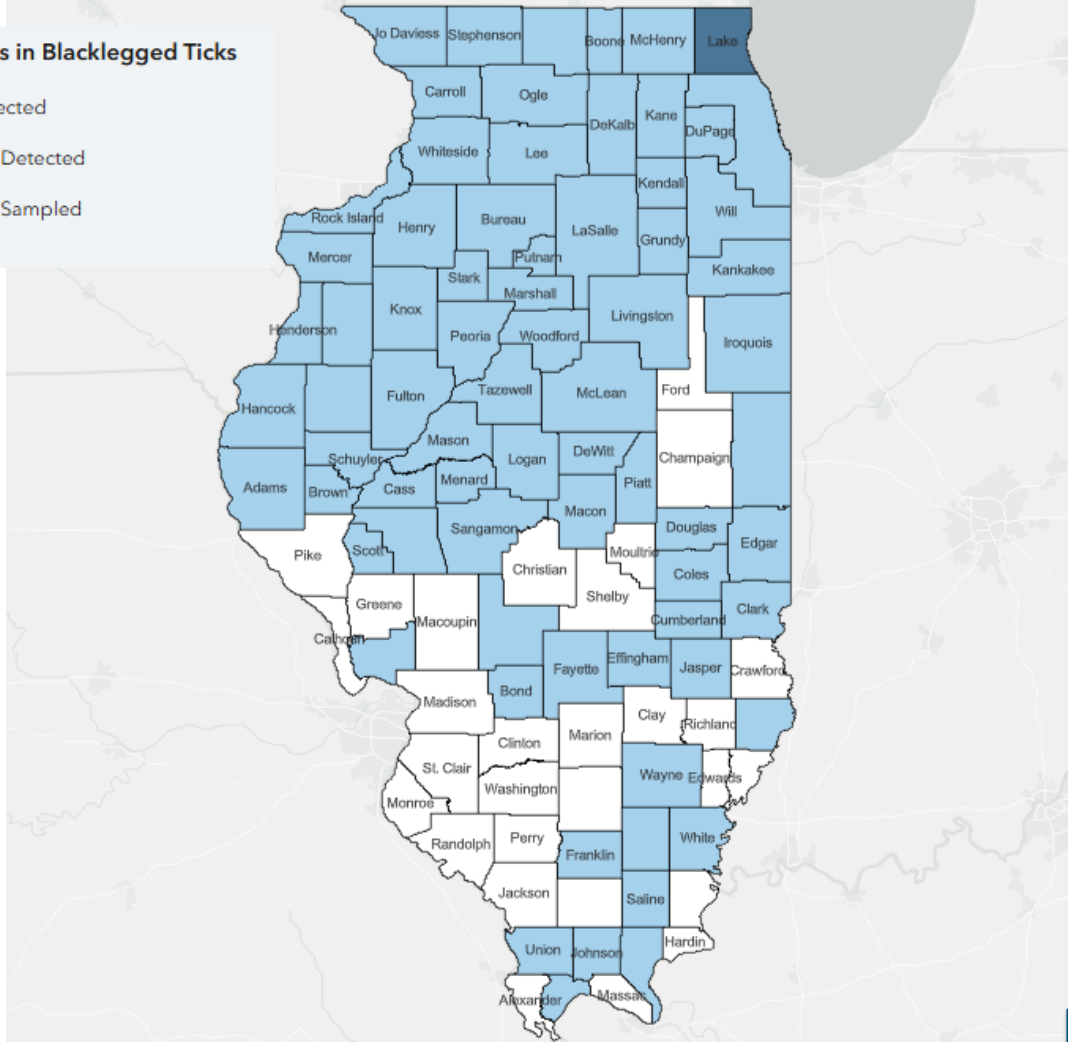
Emerging Tick Species & Diseases
Deer Tick: Erhlichiosis

Ehrlichiosis in Lone Star Ticks



Ehrlichiosis in Deer Ticks



https://dph.illinois.gov/topics-services/environmental-health-protection/vector-control-surveillance.html

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Emerging Tick Species & Diseases
Deer Tick: *Borrelia miyamotoi* & *Babesiosis*

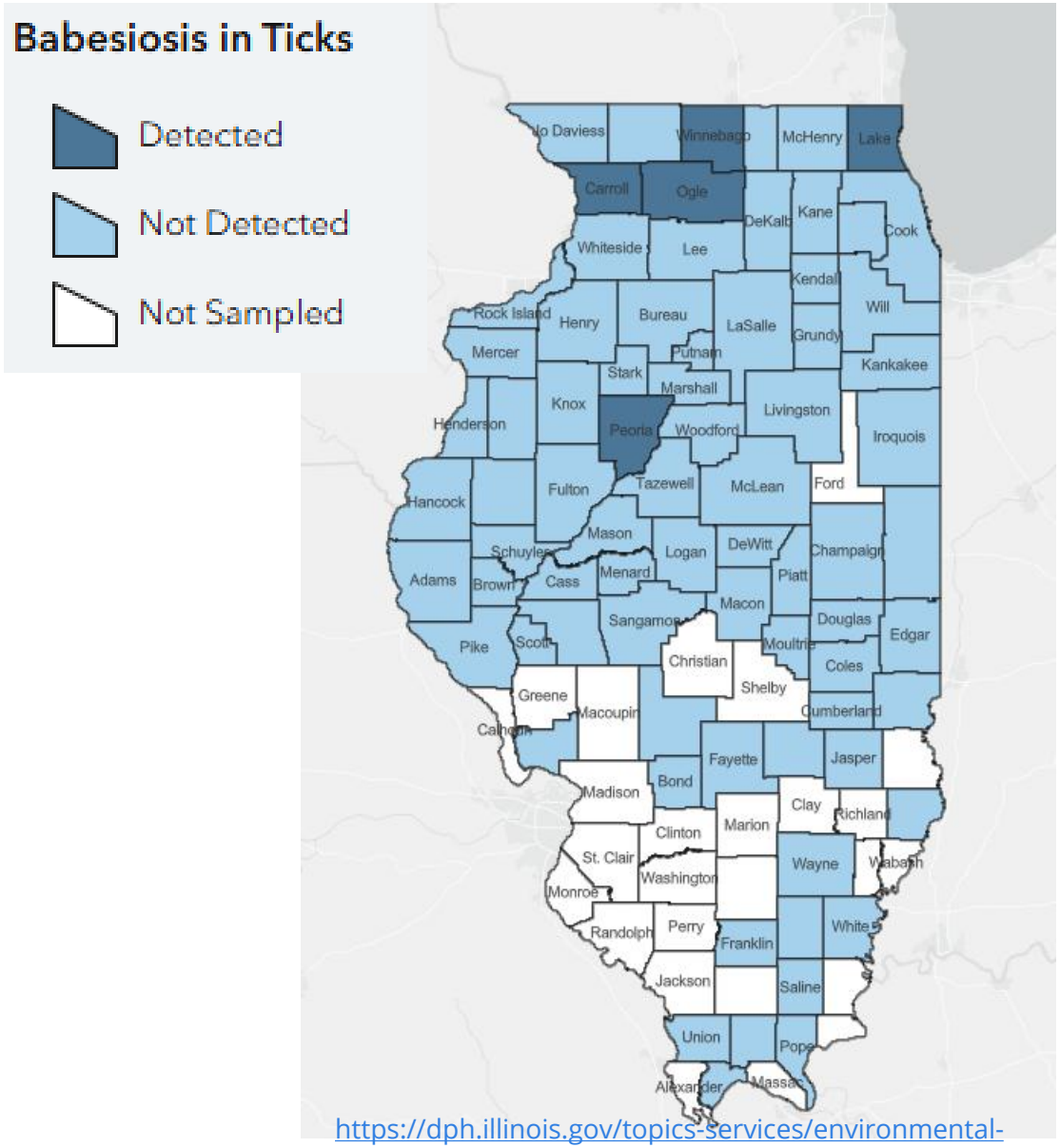
Borrelia miyamotoi

- No reported human cases yet in Illinois
- Causes symptoms similar to Lyme but not associated with bulls-eye rash
- Won't be detected by Lyme tests, human test does exist
- **Was found in ticks in Lake County**

Babesiosis

- 5 IL counties with positive ticks – including Lake Co.
- **Human cases in Lake Co.**

https://www.cdc.gov/lyme/about/index.html



https://dph.illinois.gov/topics-services/environmental-health-protection/vector-control-surveillance.html

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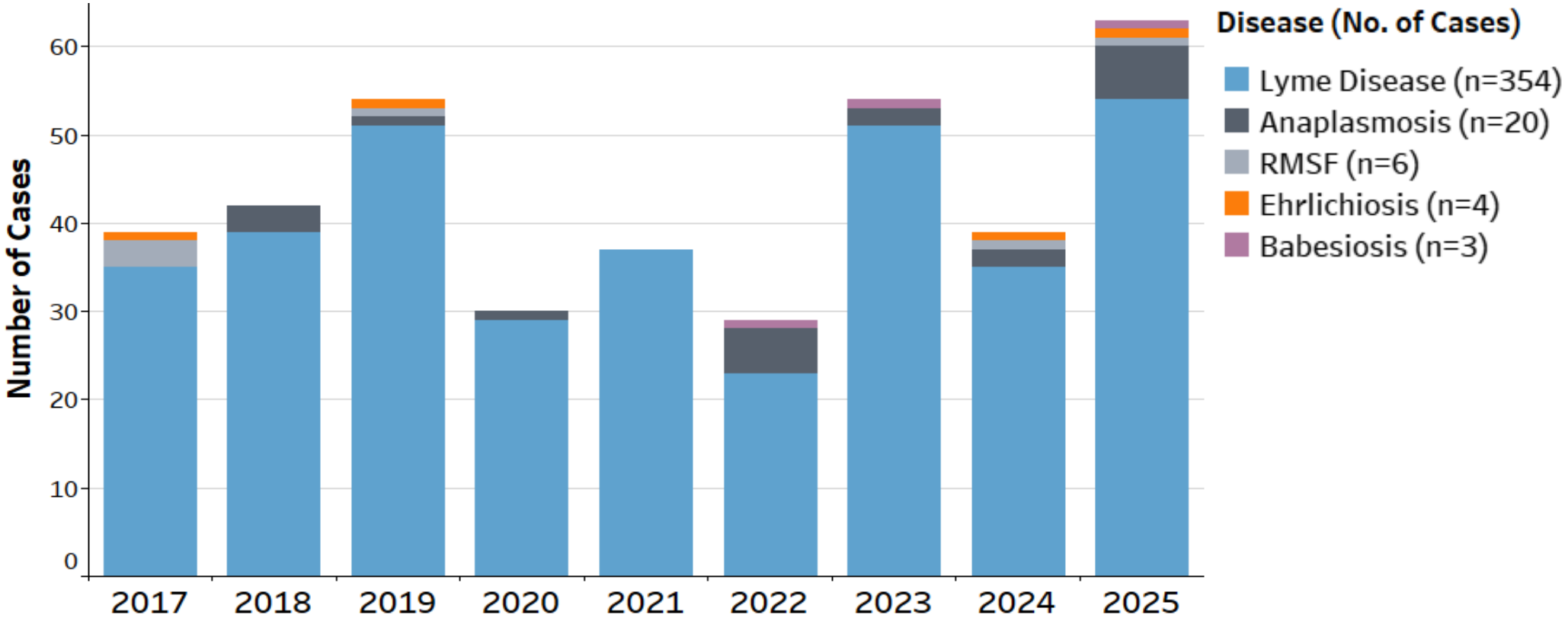
Tick-borne Diseases* in Lake County, 2017–2025

Lyme disease was the most frequently reported tick-borne illness among Lake County residents from 2017–2025



*Includes confirmed and probable cases.

Abbreviations: *RMSF* Rocky Mountain Spotted Fever

Note: Anaplasmosis was formerly HGA (Human Granulocytic Anaplasmosis); Ehrlichiosis was formerly HME (Human Monocytic Ehrlichiosis)

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

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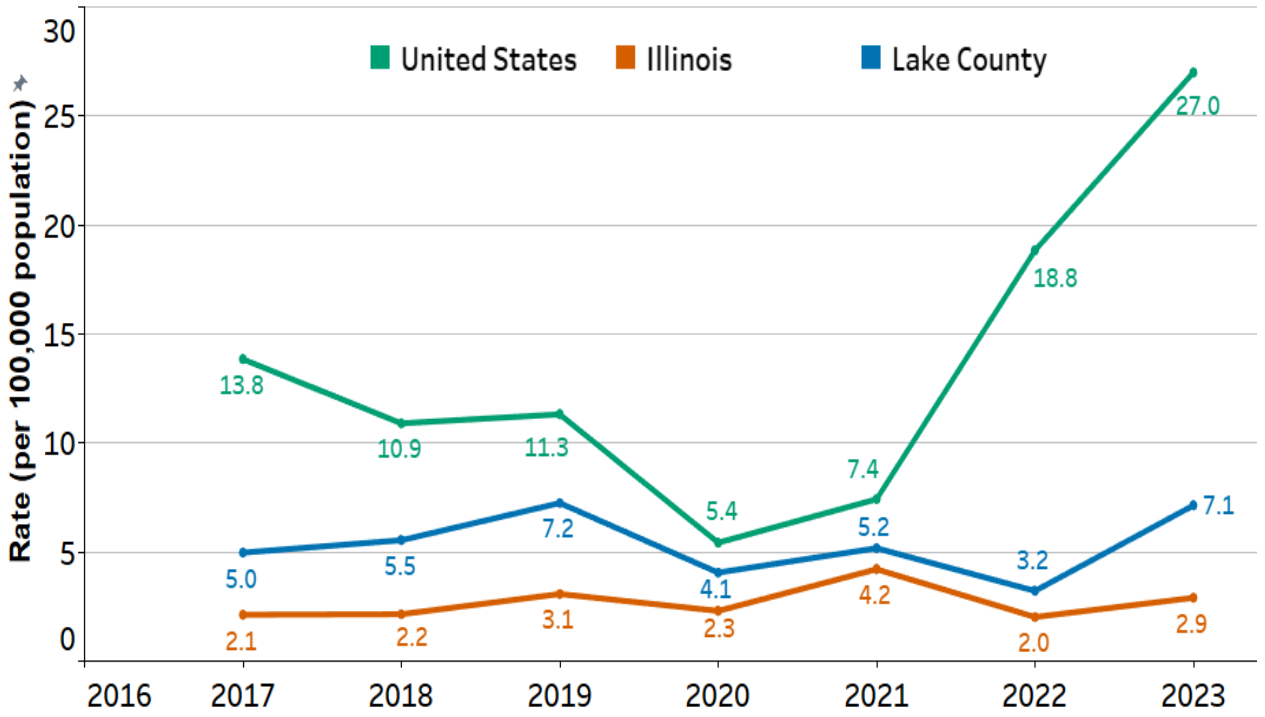
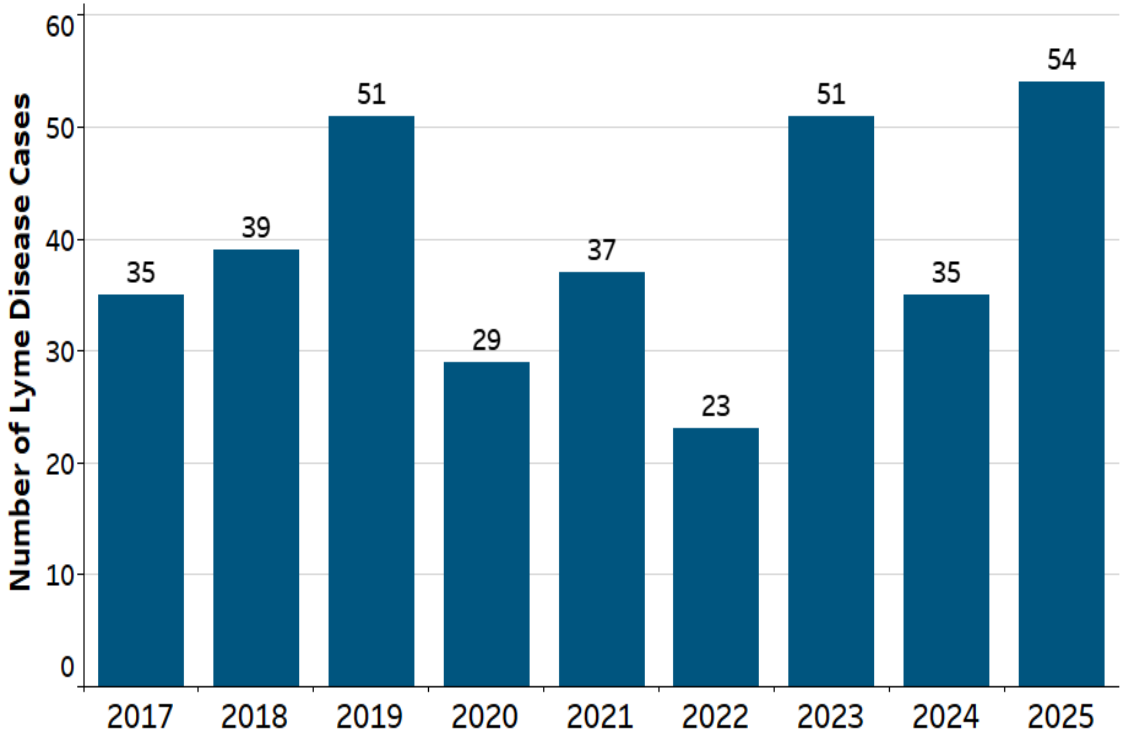
Lyme Disease in Lake County, Illinois, & the U.S.

Comparison of Lyme Disease Incidence Rates in the U.S., Illinois, and Lake County



Reported Lyme Disease Cases* in Lake County, 2017–2025 (N=354)



Note: Rates per 100,000 population, based on 2010 and 2020 U.S. Census Bureau decennial population estimates.
Note: 2023 is the most recent year with data available for all three regions.
Data Sources: CDC Lyme Disease Surveillance Data:https://www.cdc.gov/lyme/data-research/facts-stats/surveillance-data-1.html
Illinois National Electronic Disease Surveillance System (I-NEDSS)

*Includes confirmed and probable cases.
Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

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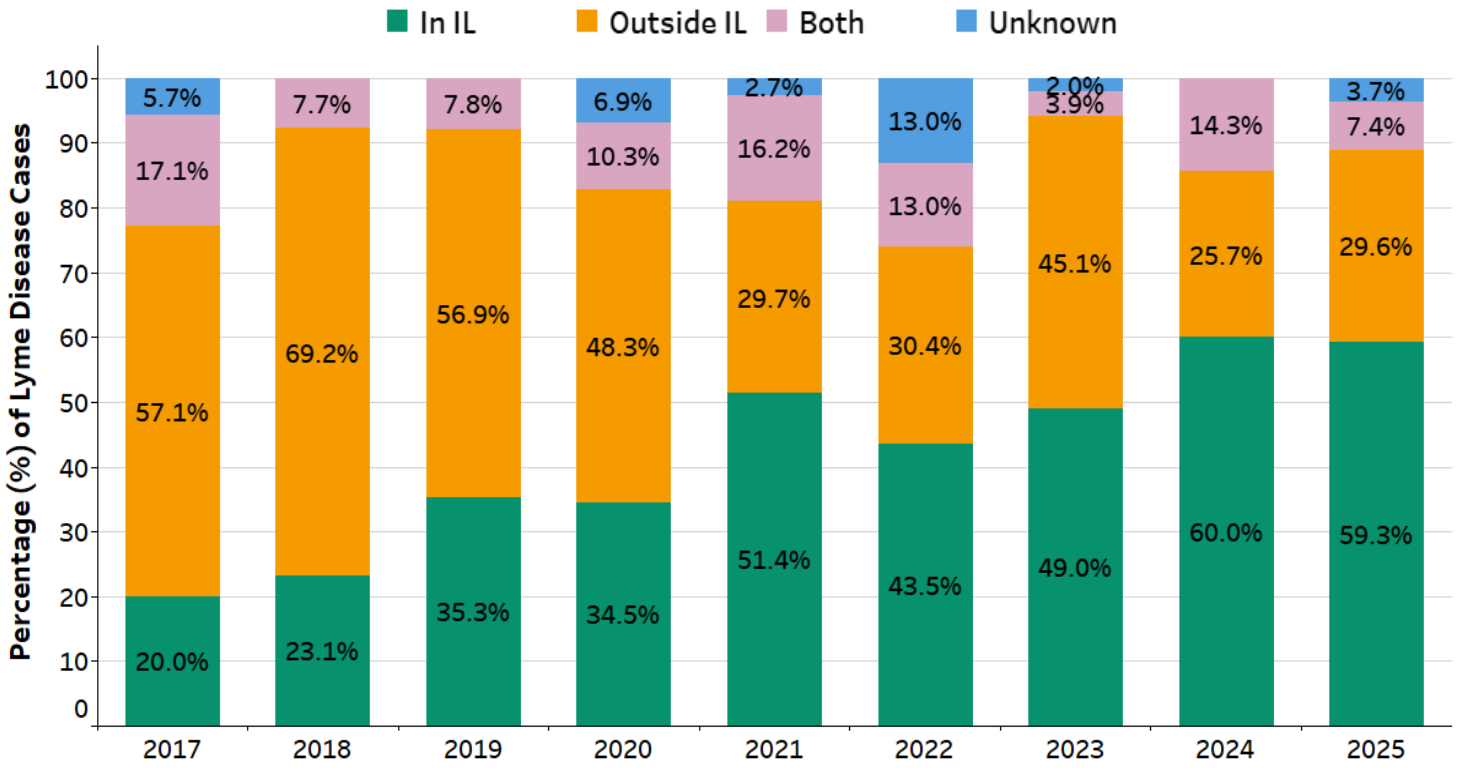
Increasing Local Lyme Disease Transmission in Illinois, 2017–2025



*Includes confirmed and probable cases.

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

- Shift from **travel-associated to locally acquired** Lyme disease over time
- **20%** (2017) → **60%** (2025) of cases acquired in Illinois
- Reflects **expanding tick populations** and **changing environmental conditions**

Hussain A et al. *Ticks Tick Borne Dis*. 2025;16(5):102533. doi:10.1016/j.ttbdis.2025.102533

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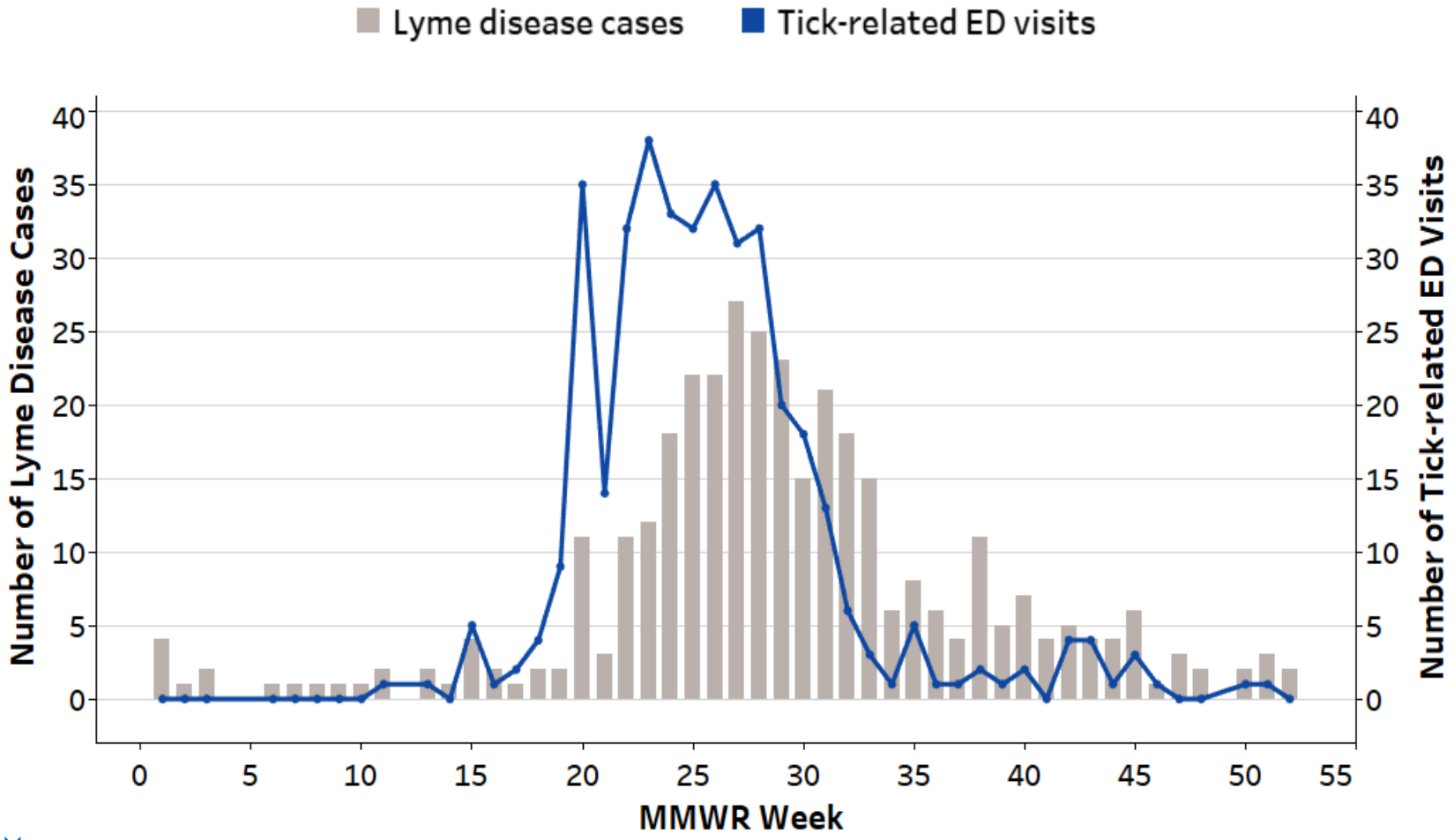
Aggregated Tick-related Emergency Department (ED) Visits (2017–2025) and Lyme Disease Cases* (2017–2025) by MMWR Week, Lake County



- **ED data can serve as an early warning signal for Lyme disease risk**
- **Syndromic surveillance** tracks near-real-time tick-related ED visits
- **ED visits tend to increase before reported Lyme disease cases peak** (MMWR weeks 24–30; June–July)

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*Includes confirmed and probable cases.

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

CDC syndrome definition for tick exposure: https://knowledgerepository.syndromicsurveillance.org/tick-bites-centers-disease-control-and-prevention

Lyme Disease: Signs/Symptoms, Diagnosis, & Treatment

- **Early signs and symptoms (3–30 days after tick bite):**
  - Fever, chills, headache, fatigue, muscle and joint aches, swollen lymph nodes
  - *Erythema migrans* (EM) rash (appears around site of tick bite on average 7 days post-bite)
- **Later signs and symptoms (days to years after tick bite):**
  - Temporary paralysis of the facial muscles, meningitis or encephalitis, Lyme carditis, arthritis, additional EM rashes on other areas of the body
- **Risk of developing more severe symptoms is higher among:**
  - Adults 50 + and children 5–14 years old
  - Immunocompromised individuals
  - Those who experience delayed diagnosis and treatment
- **Testing and treatment:**
  - CDC recommends a standard two–tier serologic testing approach: enzyme immunoassay followed by western blotting
  - Recommended treatment is doxycycline or an oral equivalent
  - *If patient has EM rash with tick exposure, they should be treated without waiting for serology test results*

Prevention & Outreach

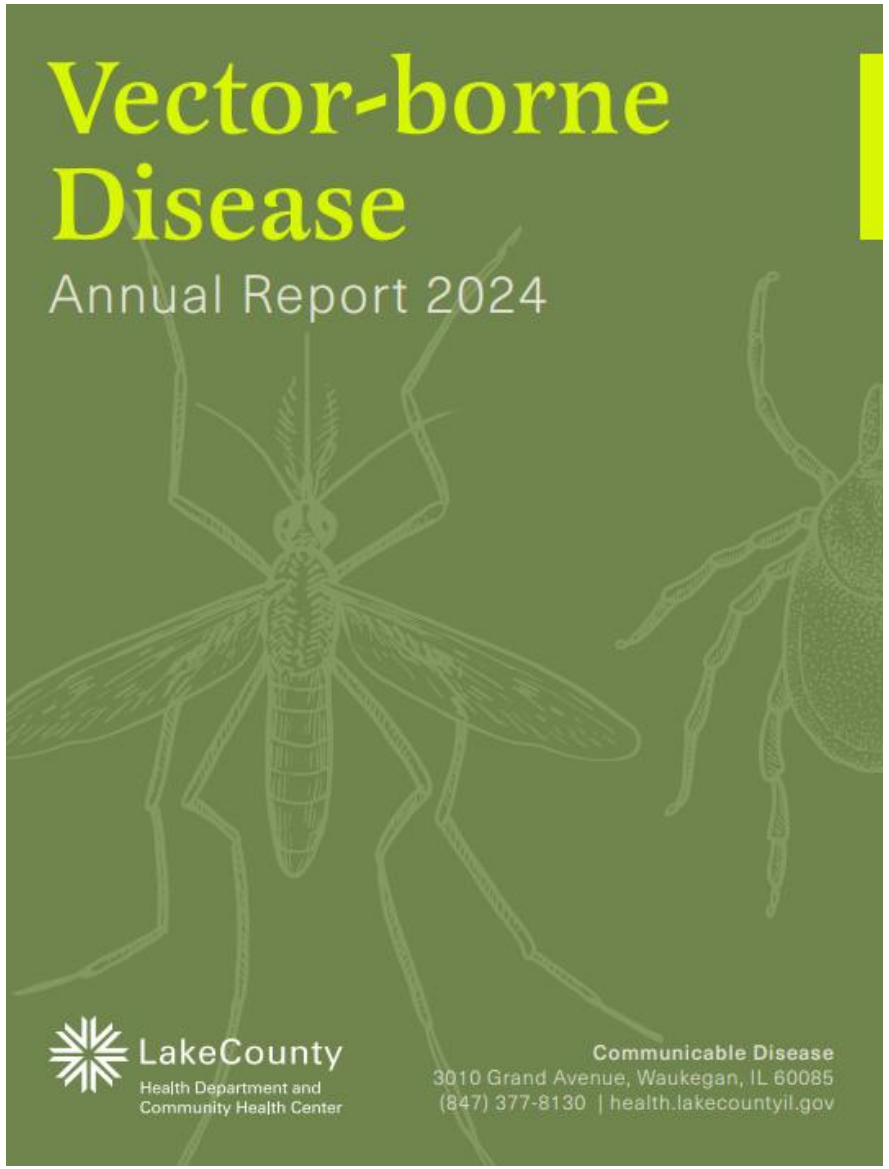
Outreach

- Social Media campaigns
- Provider Memos
- Press Releases
- Trainings (Larvicide)
- Tick Identification
- Presentations

West Nile Virus Hotline: 847-377-8300

- **Enforceable Environmental Health Violations: AA**
- 94.05 (D) – Drainage/Standing Water Complaint

- **General Environmental Health Complaint**
- Mosquito Surveillance/Control Complaint



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Recommendations

Residents

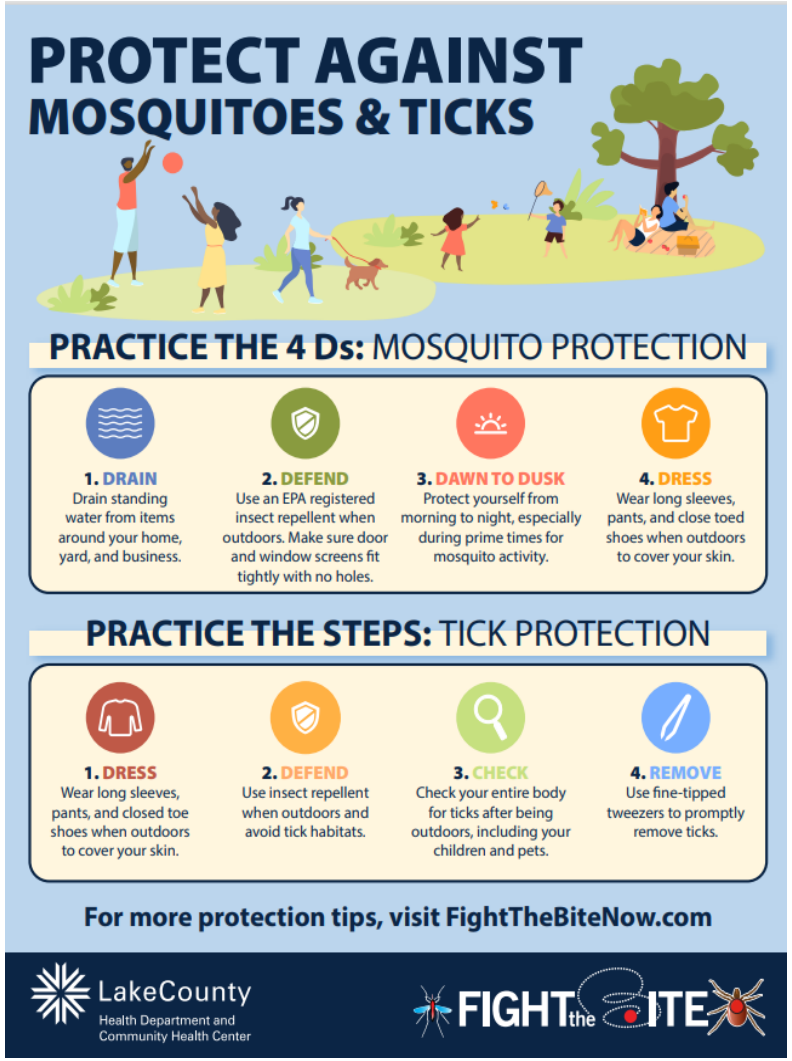
- 4 D's of Defense Against Mosquitoes (Drain, Defend, Dawn to Dusk, Dress)
- 4 Steps of Protection Against Ticks (Dress, Defend, Check, Remove)

Local Government

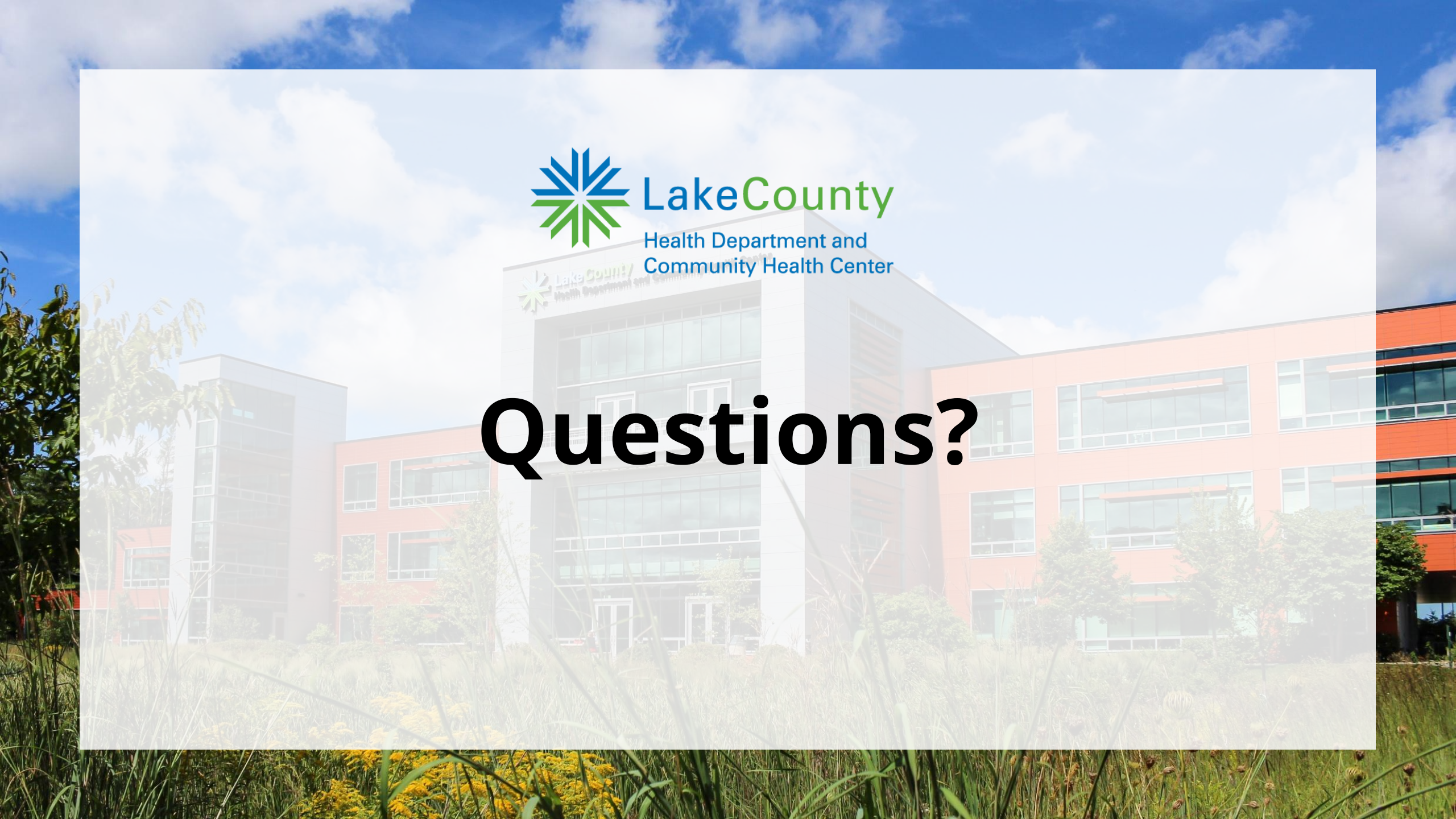
- Establish an active larvicide and mosquito abatement program
- Respond to stagnant water complaints
- Education on protection and prevention

Health Care Providers

- Order VBD diagnostic test based on current clinical guidelines, symptoms, and exposure risk.
- Treat early when clinical suspicion is high, which may include presumptive therapy to prevent severe illness and long-term complications.



Centers for Disease Control and Prevention. Guidelines for West Nile virus surveillance and control. Published May 17, 2024. Accessed July 9, 2025. https://www.cdc.gov/west-nile-virus/ php/surveillance-and-control-guidelines/index.html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Questions?

Extra Slides

Outline

- Vector-borne diseases (VBDs) and Public Health importance
- Mosquito surveillance
- Mosquito-borne disease in humans
- Tick surveillance
- Tick-borne disease in humans
- Prevention

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Vector-borne Disease Surveillance and Response in Lake County, Illinois

- **The Lake County Health Department (LCHD) Communicable Disease (CD) and Environmental Health (EH) programs work together to:**
  - conduct mosquito and tick surveillance
  - investigate human cases, and
  - educate the public to prevent bites and reduce exposure
- **LCHD also partners with state and local agencies to monitor vector activity and implement control measures to reduce vector-borne disease transmission.**

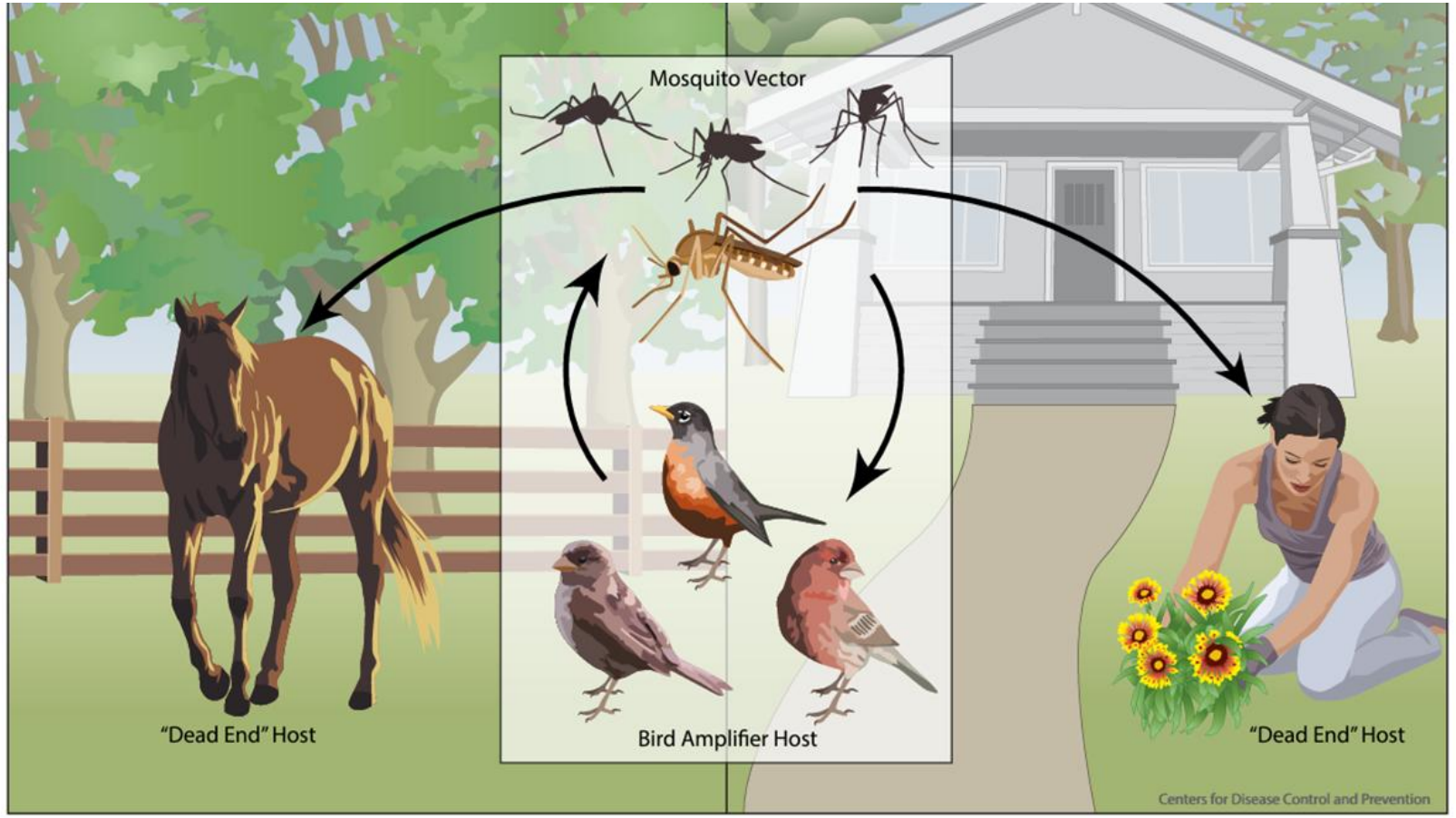
Mosquito Surveillance & West Nile Virus

West Nile Virus (WNV) monitored in:

- Birds
- Mosquitoes
- Horses
- Humans

WNV in birds & mosquitoes can give insight into human WNV risk.

Most environmental surveillance typically focuses on mosquito surveillance.



https://www.cdc.gov/west-nile-virus/php/transmission/index.html

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West Nile Virus: Signs and Symptoms

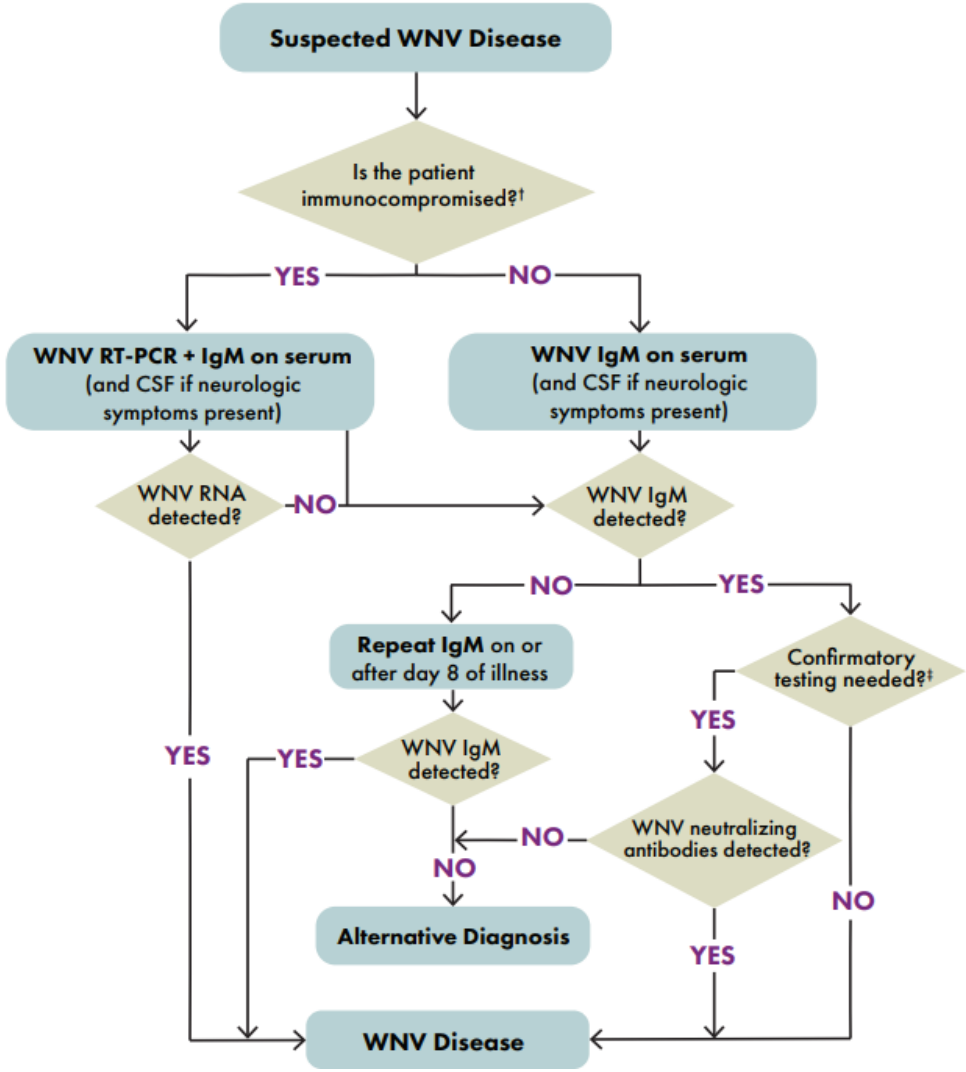
- **Transmitted to humans through the bite of an infected *Culex* mosquito**
- **Incubation period:** 2–14 days
  - Can be longer in immunocompromised individuals
- Approximately **80% of human WNV infections are asymptomatic**
- **Non-neuroinvasive disease:**
  - **Symptoms:** fever, headache, myalgia, arthralgia, transient maculopapular rash, or gastrointestinal symptoms like vomiting and fever
- **Neuroinvasive disease:**
  - < 1% develop neuroinvasive disease
  - **Manifests as**: meningitis, encephalitis, acute flaccid myelitis
  - **Rare complications**: cardiac dysrhythmias, myocarditis, rhabdomyolysis, pancreatitis
- **High-risk:**
  - Adults ≥ 50 years
  - Immunocompromised individuals (e.g., transplant patients, cancer patients)

https://www.cdc.gov/west-nile-virus/hcp/clinical-signs/index.html

West Nile Virus: Testing and Diagnosis

- **If WNV is suspected:**
  - Test for **WNV-specific IgM antibodies** (serum ± CSF*)
- **Timing matters:**
  - IgM detectable ~ **3–8 days after symptom onset**
  - Early negative→ repeat testing ≥ day 8 of illness
- **Interpretation:**
  - **IgM positive → recent infection** (may reflect cross-reactivity with other flaviviruses → confirm with PRNT if needed)
  - **IgM negative (early) → repeat testing**
  - **IgG alone → past infection** (not acute disease)
- **Special situations:**
  - Immunocompromised → use RT-PCR†

Abbreviations: IgM = immunoglobulin M; CSF = cerebrospinal fluid; PRNT = plaque reduction neutralization test; RT-PCR = reverse transcription polymerase chain reaction
*CSF if neurologic symptoms are present
† May have absent/delayed IgM response



WNV Diagnostic Testing Algorithm: https://www.cdc.gov/west-nile-virus/media/pdfs/West_Nile_Virus_Diagnostic_Algorithm_Print-Only.pdf

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West Nile Virus: Treatment

Clinical Presentation	Management
Mild illness	Patients can take over-the-counter medication for fever, pain, and headaches; stay hydrated; and rest.
Severe meningeal symptoms	Patients often require pain control for headaches and antiemetic therapy and rehydration for associated nausea and vomiting.
Encephalitis	Patients require close monitoring for the development of elevated intracranial pressure, seizures, or inability to protect their airway.
Acute flaccid myelitis	Patients should be monitored closely for acute neuromuscular respiratory failure that can develop rapidly and require prolonged ventilatory support.
Note on treating immunosuppressed patients: Decreasing or stopping immunosuppressive medications, if possible, when the patient is acutely unwell might help them to develop an immune response to control the virus	

https://www.cdc.gov/west-nile-virus/hcp/treatment-prevention/index.html

Mosquito Surveillance & West Nile Virus

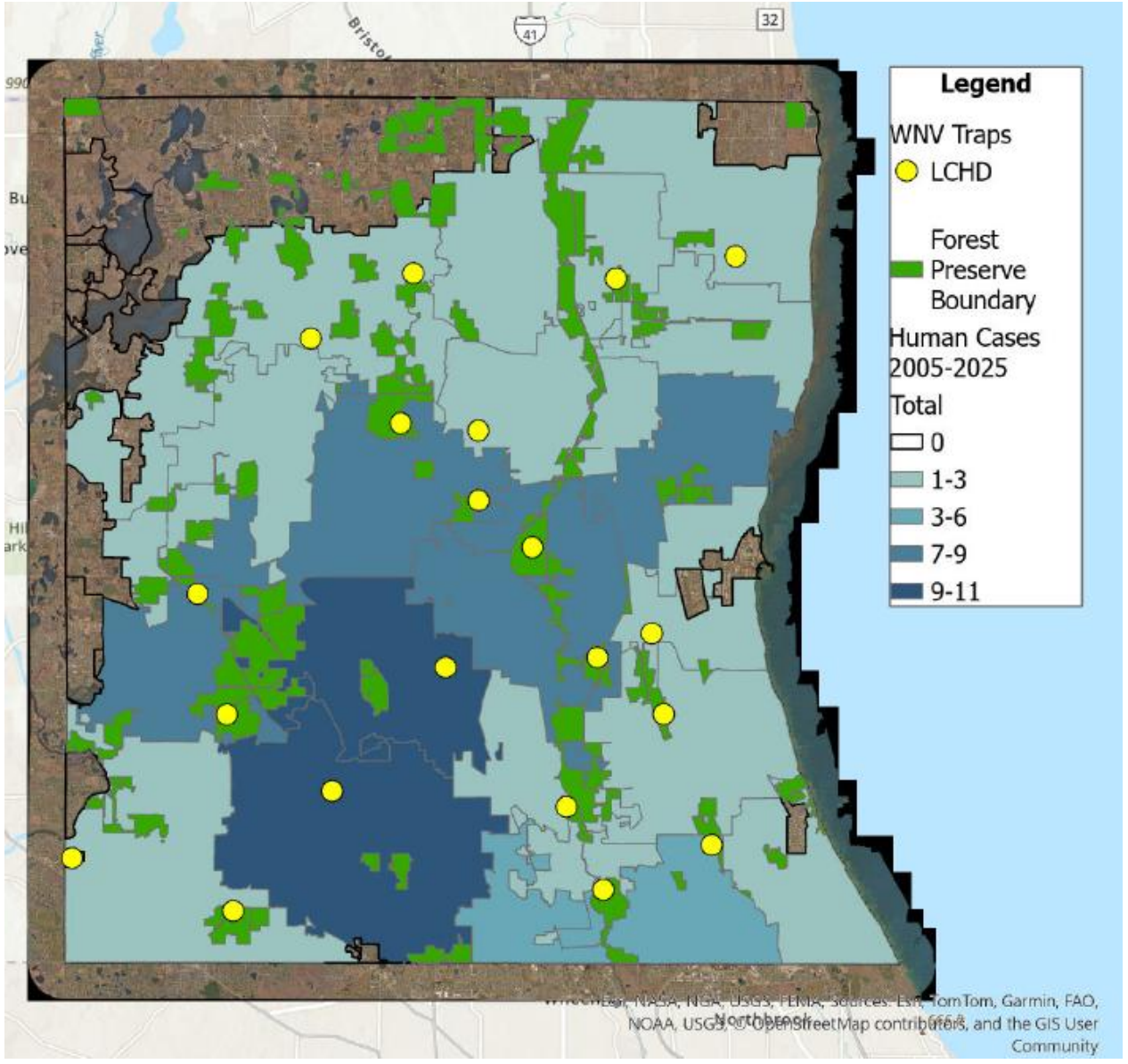
Trap Locations

- Spread throughout County
- Emphasis on areas with human cases
- Surveillance data can impact trap locations

Non-LCHD Traps

- Municipalities and Mosquito Abatement Districts also have some traps

2025 LCHD WNV Trap Locations and 2005-2025 Human Case Data by Zip Code, Lake County, IL



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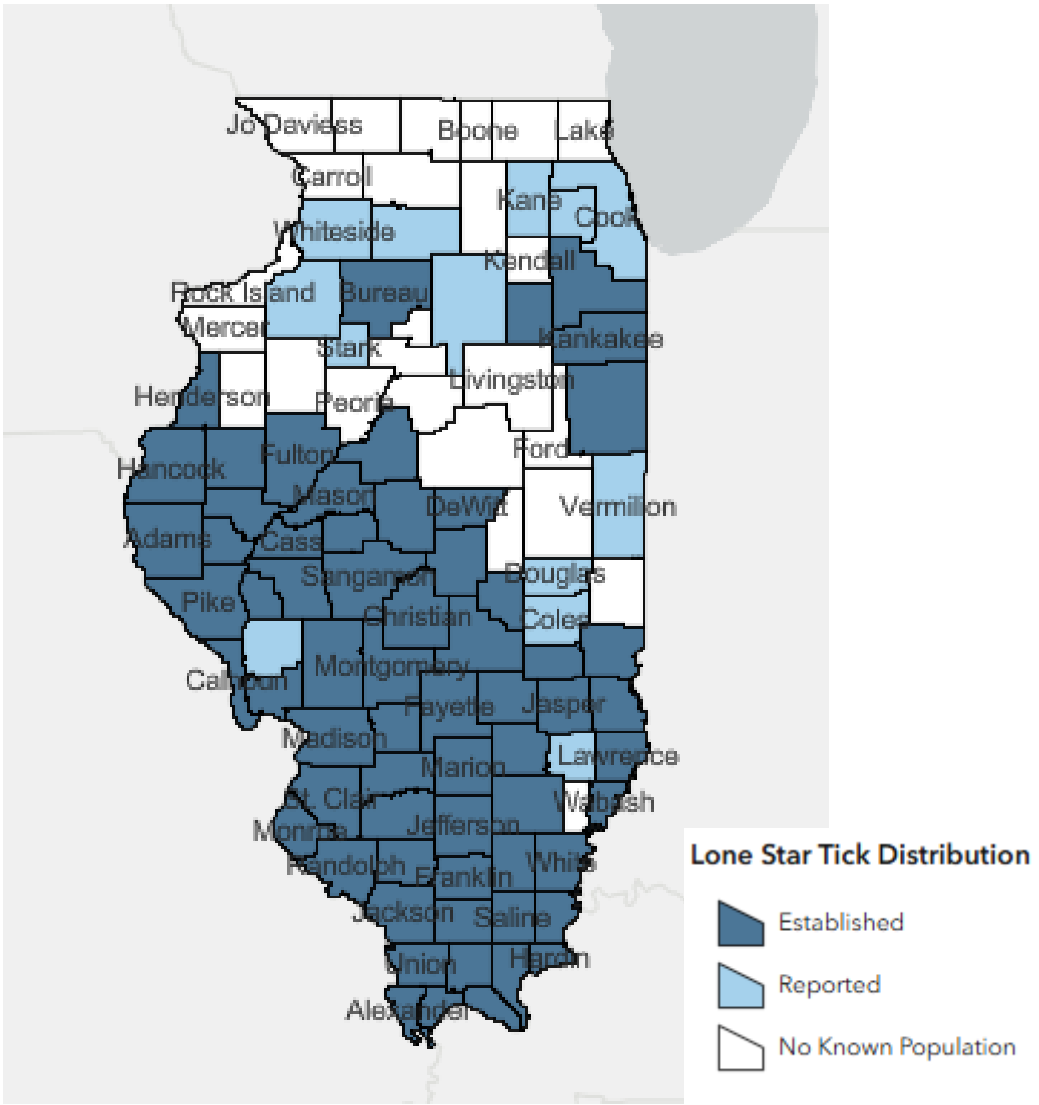
Emerging Tick Species & Diseases
Lone Star Tick

- Highest density in southern Illinois but can be found throughout State
- Eventually will be common throughout the state
- Aggressive biters – all life stages will bite humans
- Heartland Virus
- Alpha-gal allergy (an allergy to mammal meat and mammal by products - a lot unknown)
  - Definitive test



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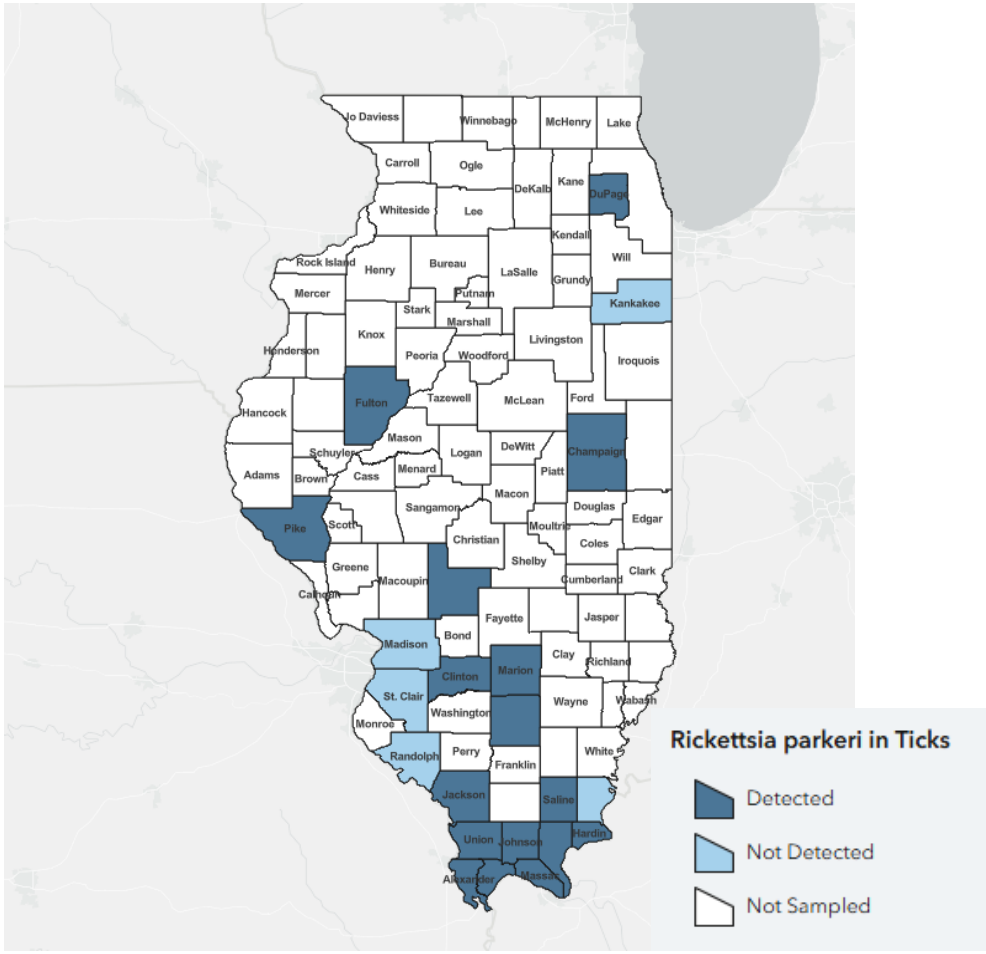
https://dph.illinois.gov/topics-services/environmental-health-protection/vector-control-surveillance.html

Emerging Tick Species & Diseases
Gulf Coast Tick & *Rickettsia parkeri*

- Not tied to forests habitats
- Likes Sunny, dry prairies/roadsides
- Looks like american dog tick (common in Lake Co.)
- *Rickettsia parkeri* – emerging tick born pathogen
  - Symptoms similar to RMSF with scab at bite site
  - No specific test for this disease agent exists
  - Roughly 1 in 5 ticks infected in Southern Illinois



https://dph.illinois.gov/topics-services/environmental-health-protection/vector-control-surveillance.html

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Lyme Disease: Early Signs & Symptoms

- **Caused by bacterium *Borellia burgdorferi***
- Transmitted to humans through the **bite of an infected deer tick**
  - Tick must be attached for 36–48 hours or more
- **Incubation period:** 3–30 days
- **Early signs and symptoms:**
  - Fever, chills, headache, fatigue, muscle and joint aches, and swollen lymph nodes
  - *Erythema Migrans* (EM) rash around the site of the bite (average onset 7 days post-bite [range 3-30 days])
    - Seen in approximately 70–80% of those bitten

Erythema Migrans (EM) rash: https://www.cdc.gov/lyme/signs-symptoms/lyme-disease-rashes.html

https://www.cdc.gov/lyme/signs-symptoms/?CDC_AAref_Val=https://www.cdc.gov/lyme/signs_symptoms/index.html

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Lyme Disease: Later Signs & Symptoms

- **Later symptoms (days to months after the bite):**
  - **Neurological:** facial palsy, meningitis or encephalitis, neuropathy
  - **Cardiac:** irregular heartbeat/heart palpitations (Lyme Carditis), 2nd or 3rd degree heart block
  - **Articular:** Arthritis with joint pain and swelling
  - **Dermatological:** additional EM rashes on other areas of the body
- **High-risk:**
  - Adults ≥ 50 years; children 5–14 years
  - Immunocompromised individuals
  - Delayed diagnosis

https://www.cdc.gov/lyme/signs-symptoms/index.html
https://www.cdc.gov/lyme/hcp/clinical-care/lyme-carditis.html

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Lyme Disease: Post-Treatment Lyme Disease Syndrome

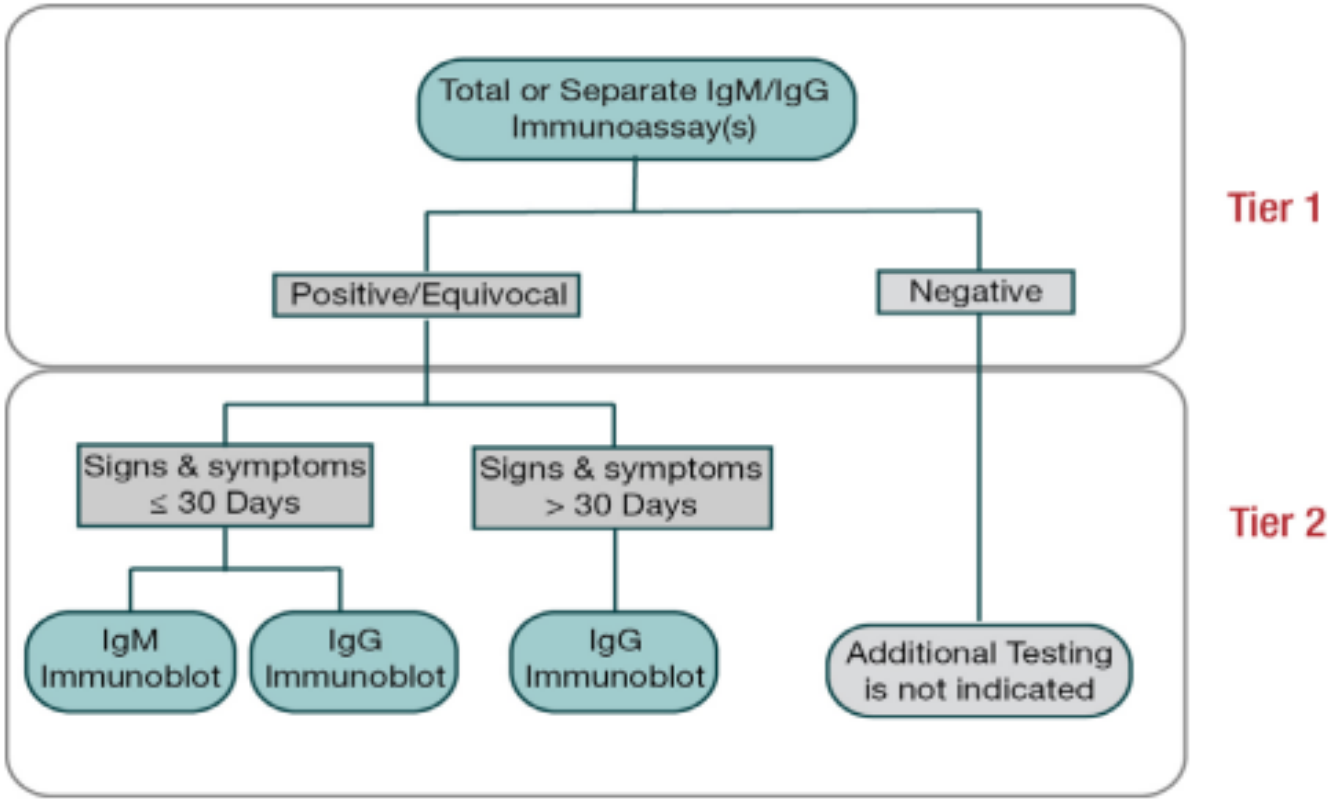
- **Most patients recover with a 2-to-4-week course of oral antibiotics**
- **Post-Treatment Lyme Disease Syndrome (PTLDS):**
  - Persistent fatigue, pain, or cognitive difficulty after treatment (>6 months)
- **Key points:**
  - No well-accepted definition
  - Cause is unknown
  - Similar symptoms occur after other infections
  - **No biologic evidence for the existence of symptomatic, chronic B. burgdorferi infection among patients after recommended therapy**
- **Management:**
  - **Prolonged antibiotics are <u>not</u> recommended**
  - Focus on symptom management and evaluation for other causes

https://www.cdc.gov/lyme/signs-symptoms/chronic-symptoms-and-lyme-disease.html

Lyme Disease: Testing and Diagnosis

Standard* Two-Tier Testing (STTT)

- **CDC recommends a two-step serologic testing**
- **Step 1: Enzyme immunoassay (EIA)**
  - **Negative** → no further testing
  - **Positive or equivocal** → Step 2
- **Step 2: Confirmatory test**
  - **Western blot (WB)**
  - Diagnosis supported **only if both steps are positive**
- **Timing matters:**
  - Antibodies take weeks to develop → serologic assays may be falsely negative during the first 4–6 weeks after infection
- ***Note: Patients with likely EM and possible tick exposure in a Lyme disease endemic area should be treated promptly, regardless of whether acute serologic testing is ordered***



*STTT uses EIA as first step and WB for the second step. However, increasingly, laboratories are using modified two-tier testing (MTTT) in which both assays are EIAs.

Suggested Reporting Language, Interpretation and Guidance for Lyme Disease Serologic Test Results: https://www.cdc.gov/lyme/media/pdfs/2024/05/Suggested-Reporting-Language-Interpretation-and-Guidance-Regarding-Lyme-Disease-Serologic-Test-Results.pdf

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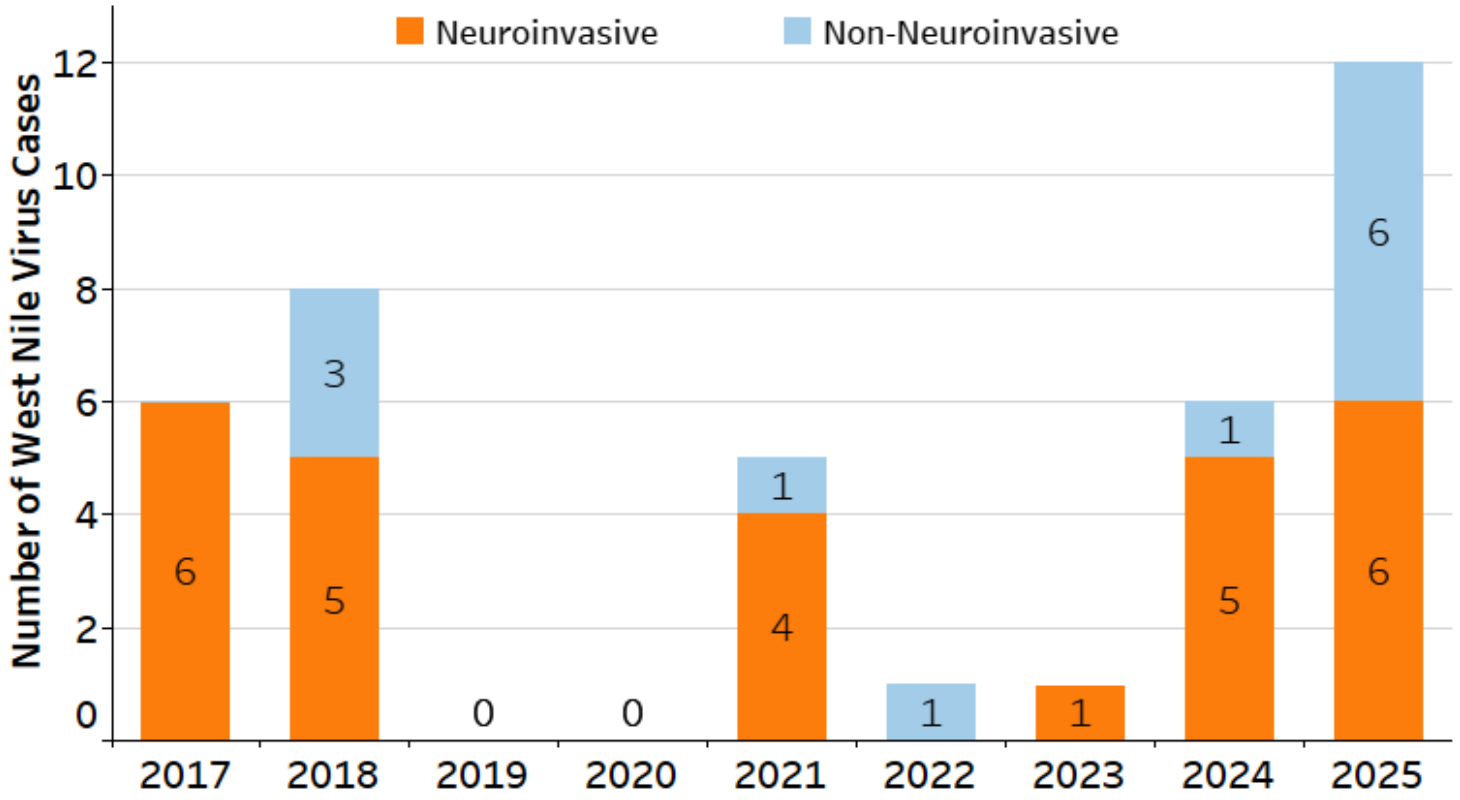
Lyme Disease: Treatment

Stage	Indication	Treatment	Duration (days)
Early	**Tick bite in US**	Doxycycline single-dose (within 72 hrs of high-risk tick bite) and/or observation	---
Early	**Erythema migrans**	Doxycycline, amoxicillin, or cefuroxime axetil (oral)	10–14
Late	**Facial palsy**	Doxycycline (oral)	14–21
	Meningitis (with or without radiculoneuropathy or encephalitis)	Doxycycline (oral) Ceftriaxone (IV)	14–21
	Lyme arthritis	Doxycycline, amoxicillin, cefuroxime (oral) Ceftriaxone (IV)	28 14–28
	Lyme carditis	Doxycycline, amoxicillin, cefuroxime (oral) Ceftriaxone (IV)	14–21 14–21
	Post-treatment Lyme disease syndrome	Repeated courses of antibiotics not recommended	---

Note: For patients unable to take both doxycycline and beta-lactam antibiotics, the preferred second-line agent is azithromycin.

AAN/ACR/IDSA 2020 Guidelines for the Prevention, Diagnosis, and Treatment of Lyme Disease: https://www.idsociety.org/practice-guideline/lyme-disease/

Reported West Nile Virus (WNV) Cases* in Lake County, 2017–2025



*Includes confirmed and probable cases.

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

Case characteristics (2017–2025):

- **Total cases:** 39 (100%)
- **Males:** 25 (64.1%)
- **Median age in years (range):** 65 (40–87)
- **Neuroinvasive cases:** 27 (69.2%)
- **Deaths:** 4 (10.3%)

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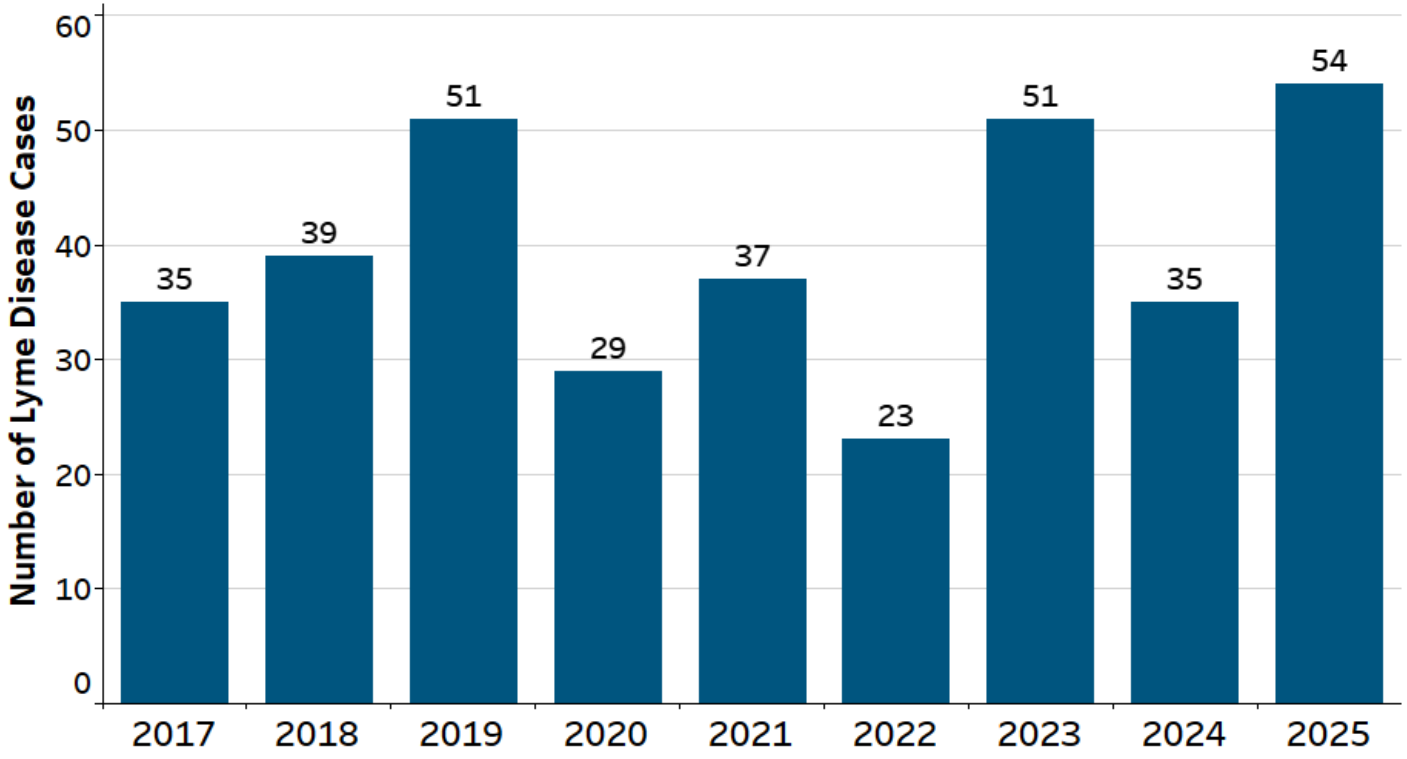
Reported Lyme Disease Cases* in Lake County, 2017–2025



*Includes confirmed and probable cases.

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

Case characteristics (2017–2025):

- **Total cases:** 354 (100%)
  - Case definition change resulted in higher case counts after 2022
- **Median age in years (range):** 47 (2–86)
- **Males:** 205 (57.9%)
- **Cases with *erythema migrans* (EM) rash:** 213 (60.2%)

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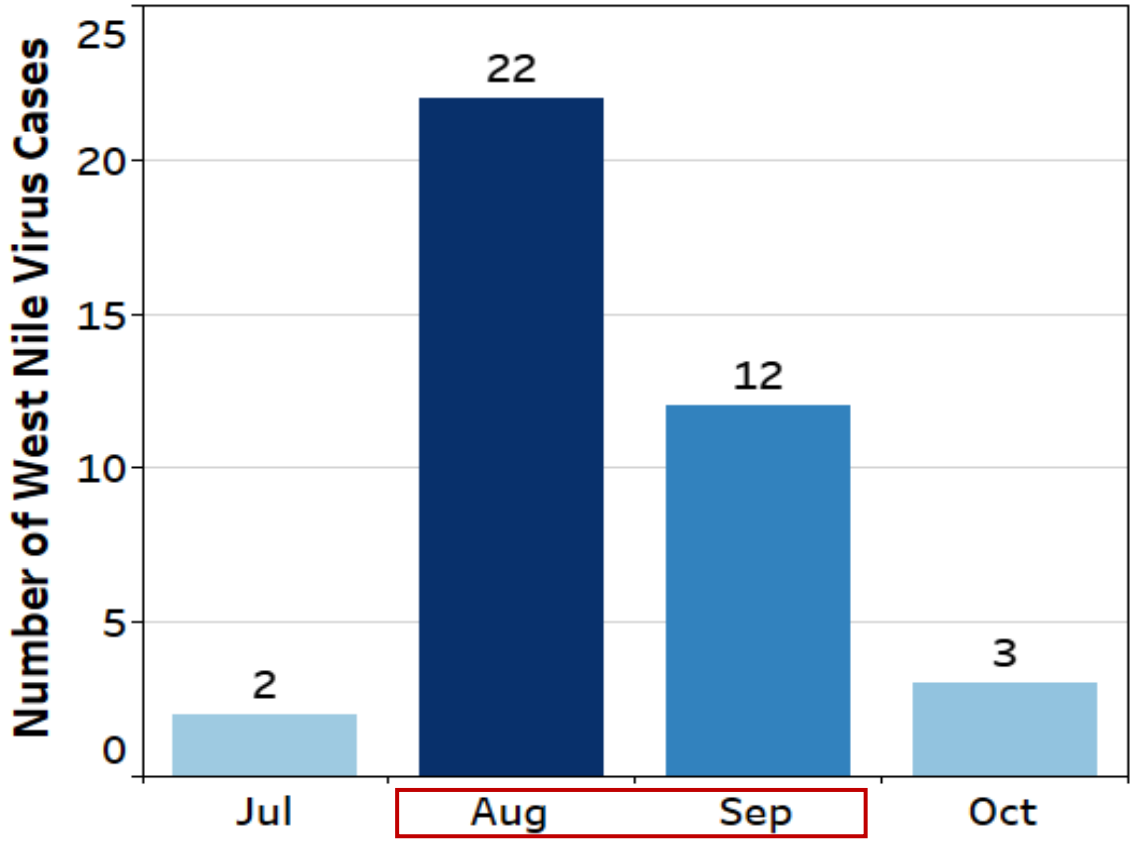
West Nile Virus Cases (WNV) Seasonality in Lake County, 2017–2025



*Includes confirmed and probable cases.

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

- **Most human cases* (87.2%, 34) occur in late summer (August–September)**
- **Outdoor activity** increases mosquito exposure during this time
- **Earlier onset observed** → suggests a possible shift in season timing
- **Warmer and drier conditions** can increase and prolong WNV transmission

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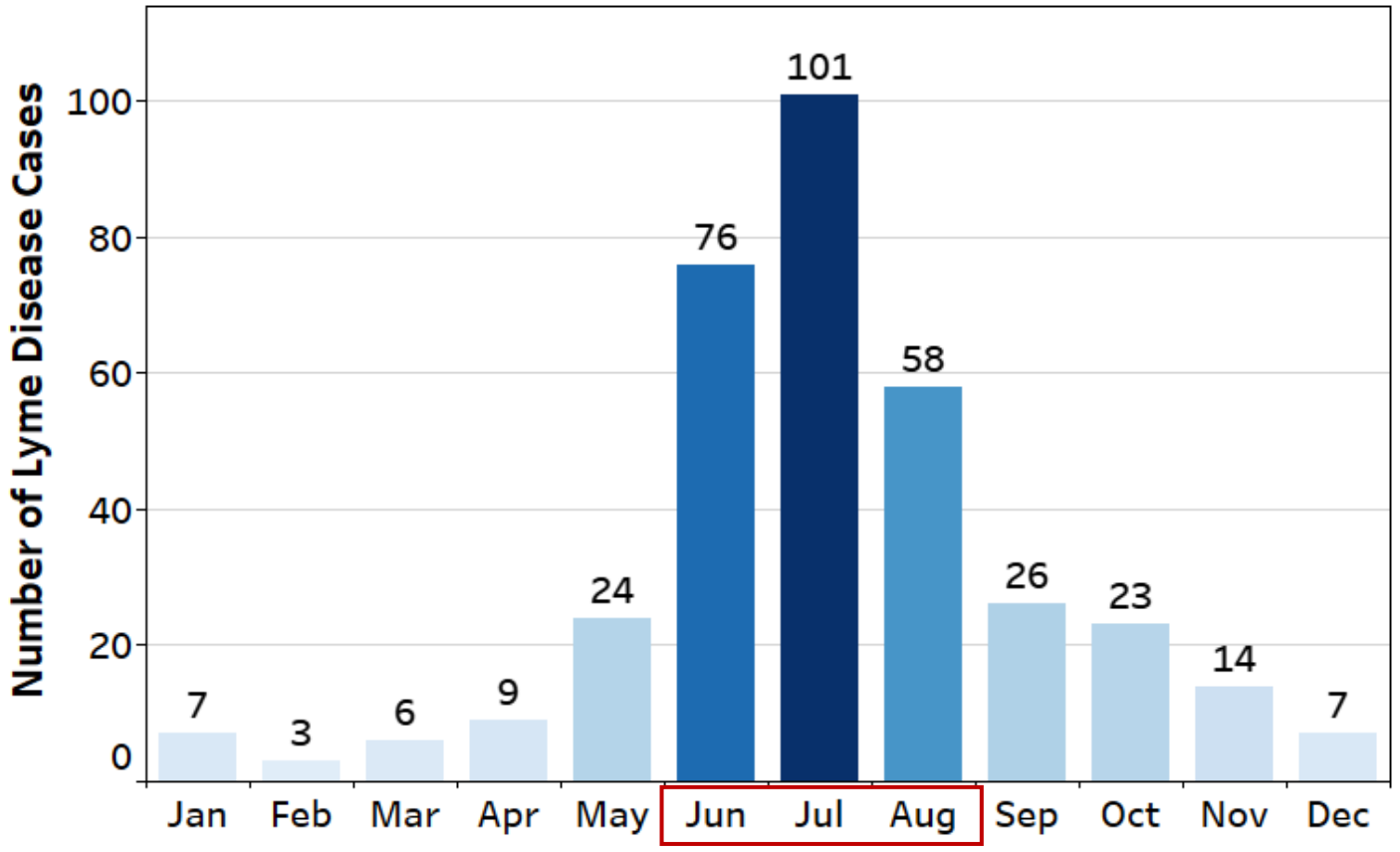
Russell M C et al. *Microorganisms*. 2025;13(12):2851. doi:10.3390/microorganisms13122851
Wang H R et al. *Infect Dis Poverty*. 2024;13(1):38. doi:10.1186/s40249-024-01207-2

Lyme Disease Seasonality in Lake County, 2017–2025



*Includes confirmed and probable cases.

Data source: Illinois National Electronic Disease Surveillance System (I-NEDSS)

- **Most human cases* (66.4%, 235) occur in warm summer months (June–August)**
  - Often see an increase in early fall as well
- **Outdoor activity** increases exposure to ticks during this time
- Cases occur **year-round/outside of peak season**
- **Warmer, more humid conditions** may extend tick activity and prolong Lyme disease transmission

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Ogden N H et al. *J Med Entomol*. 2021;58(4):1536-1545. doi:10.1093/jme/tjaa220