

# DELAWARE VECTOR-BORNE DISEASE SURVEILLANCE ANNUAL REPORT 2023



DELAWARE HEALTH AND SOCIAL SERVICES  
Division of Public Health  
Office of Infectious Disease Epidemiology

April 2024

# **Delaware Vector-borne Disease Surveillance Annual Report**

**January 1, 2023 – December 31, 2023**

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# Delaware Vector-borne Disease Surveillance Annual Report

January 1, 2023 – December 31, 2023

## I. Executive Summary

Many people can recall a time when they were bitten by a mosquito or tick. Although mosquitoes and ticks are mostly a nuisance, some can become infected with pathogens like bacteria, viruses, and parasites. Vectors are living organisms that spread pathogens from one organism to another. Many of these vectors are bloodsucking insects, which ingest pathogens during a blood meal. Examples of vectors include mosquitoes, ticks, fleas, body lice, triatomine bugs, and many more. When a human is bitten by an infected vector and gets sick, they have a vector-borne disease. Examples of vector-borne diseases include malaria, Lyme disease, West Nile virus (WNV), and plague. According to the World Health Organization, vector-borne diseases account for more than 17% of all infectious diseases world-wide, causing more than 700,000 deaths annually.<sup>1</sup>

Everyone is vulnerable to vector-borne diseases. In the United States, the most commonly reported vector-borne disease is Lyme disease with approximately 300,000 infections reported each year.<sup>2</sup> Additionally, WNV is now endemic to the United States and outbreaks occur every summer. These diseases are on the rise due to increasing global travel and urbanization, and changes in the climate.

In Delaware, there are various types of vectors. The First State is home to mosquitoes, ticks, triatomine bugs, fleas, and more. The most common, endemic mosquito-borne disease in Delaware is WNV, while the most common tick-borne disease in Delaware is Lyme disease. These diseases can have serious consequences for Delaware residents. For instance, late disseminated Lyme disease occurs when the bacteria spreads to areas of the body like the joints and nerves. This can cause nerve pain, arthritis, dizziness, severe headaches, or inflammation of the brain and spinal cord.

To protect the health of all Delawareans, the Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology works closely with the Delaware Department of Agriculture and the Delaware Department of Natural Resources and Environmental Control, Mosquito Control Section.

The *inaugural Delaware Vector-borne Disease Surveillance Report 2023* provides the burden and epidemiology of human and animal vector-borne disease in Delaware. Aligning with the Center for Disease Control and Prevention's Vector-borne Disease Strategy to Protect People, the goals of this report are to summarize when and where people are exposed to vector-borne diseases in Delaware, evaluate trends in disease prevalence and compare historical data, and to disseminate this information to stakeholders and the public in a timely manner. The information in this report can be used to inform the general public, guide policy-making, and/or encourage preventive activities.

## II. Overview of Human Health Data

Human vector-borne disease data are summarized in the table below and some key findings are:

<sup>1</sup> <https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases#:~:text=Key%20facts,infection%20transmitted%20by%20Anopheline%20mosquitoes.>

<sup>2</sup> <https://www.cdc.gov/nceid/what-we-do/our-topics/vector-borne-diseases.html#:~:text=Lyme%20disease%20is%20the%20most,not%20treated%20promptly%20with%20antibiotics.>

- All mosquito-borne disease incidence rates increased in 2023 compared to 2022.
  - Travel-associated dengue virus and malaria cases increased in 2023 compared to 2022.
- Tick-borne disease incidence rates were higher in 2023 compared to 2022 except for anaplasmosis which had four less cases than the previous year.

**Table 1. Human Vector-borne Disease Case Count and Incident Rates by Disease and Year, Delaware, 2022-2023**

Mosquito-borne diseases					Tick-borne diseases and conditions				
	Case Counts		Incidence Rates <sup>x</sup>			Case Counts		Incidence Rates <sup>x</sup>	
	2023	2022	2023	2022		2023	2022	2023	2022
Malaria	13	11	1.3	1.1	Lyme disease	349	298	33.8	29.3
Dengue virus disease*	5	0	0.5	0.0	Ehrlichiosis	19	16	1.8	1.6
West Nile virus disease	4	1	0.4	0.1	Spotted fever rickettsiosis	6	4	0.6	0.4
Chikungunya virus disease	0	0	0.0	0.0	Babesiosis	3	1	0.3	0.1
Eastern equine encephalitis virus disease	0	0	0.0	0.0	Alpha-gal syndrome <sup>+</sup>	5	9	0.5	0.9
Jamestown Canyon virus disease	0	0	0.0	0.0	<i>Borrelia miyamotoi</i> disease <sup>+</sup>	0	0	0.0	0.0
LaCrosse encephalitis virus disease	0	0	0.0	0.0	Bourbon virus disease <sup>+</sup>	0	0	0.0	0.0
St. Louis encephalitis virus disease	0	0	0.0	0.0	Heartland virus disease <sup>+</sup>	0	0	0.0	0.0
Yellow fever virus disease	0	0	0.0	0.0	Powassan virus disease	0	0	0.0	0.0
Zika virus disease	0	0	0.0	0.0	Tularemia	0	0	0.0	0.0

<sup>x</sup> Incidence rates per 100,000 population. Rates based on small numbers (less than 20) result in a large relative standard error, indicating an imprecise estimate that is unstable and unreliable.  
<sup>\*</sup> See Table 2 for travel-associated case counts.  
<sup>+</sup> These diseases or conditions were not reportable in Delaware in 2022 and 2023.

Source: Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology, Delaware Electronic Reporting and Surveillance System, 2023

### III. Mosquito-borne Disease Human and Equine Activity

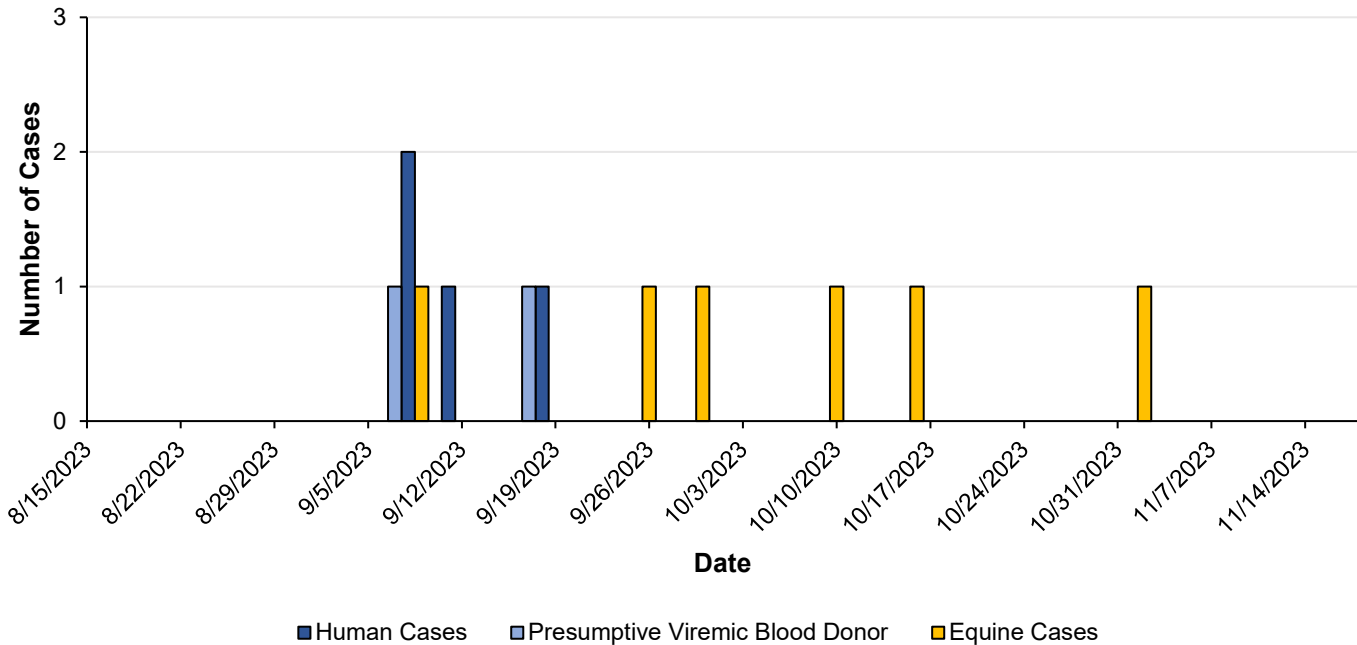
#### A. West Nile virus

- In Delaware, West Nile virus (WNV) activity was above the five-year average of 1.6 in 2023. This was similar to national WNV numbers, which were also above the five-year average.<sup>3</sup>
- There were four reported human WNV cases and two presumptive viremic blood donors (PVBD) (Table 2). Presumptive viremic blood donors are people who had no symptoms at the time of donating blood through a blood collection agency, but whose blood tested positive when screened for the presence of WNV.
- All human WNV cases were reported from New Castle County (four cases, zero deaths) (Table 4).

<sup>3</sup> <https://www.cdc.gov/westnile/statsmaps/current-season-data.html>

- In 2023, there were six confirmed equine WNV cases (one equine WNV case was reported in New Castle County, while the other five cases were reported in Kent County). This was a large increase from 2022, where there was only 1 confirmed equine WNV case.
- The first WNV equine case was reported on September 9, 2023, but most equine cases occurred weeks after the peak in WNV human cases (Figure 1).

**Figure 1. West Nile Virus Human Cases by Week, Delaware, 2023**



Source: Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology, Delaware Electronic Reporting and Surveillance System, 2023.

### B. Eastern Equine Encephalitis virus

- There were no reported human eastern equine encephalitis virus (EEEV) disease cases and zero reported equine EEEV disease cases in 2023.
- In 2023, no sentinel chickens tested positive for EEEV antibodies. The last sentinel chicken that tested positive for EEEV antibodies was in 2022.

### C. Other Mosquito-Borne Diseases

- In 2023, malaria and dengue virus disease were the only additional mosquito-borne diseases reported in Delaware. All cases were travel associated (Table 2).

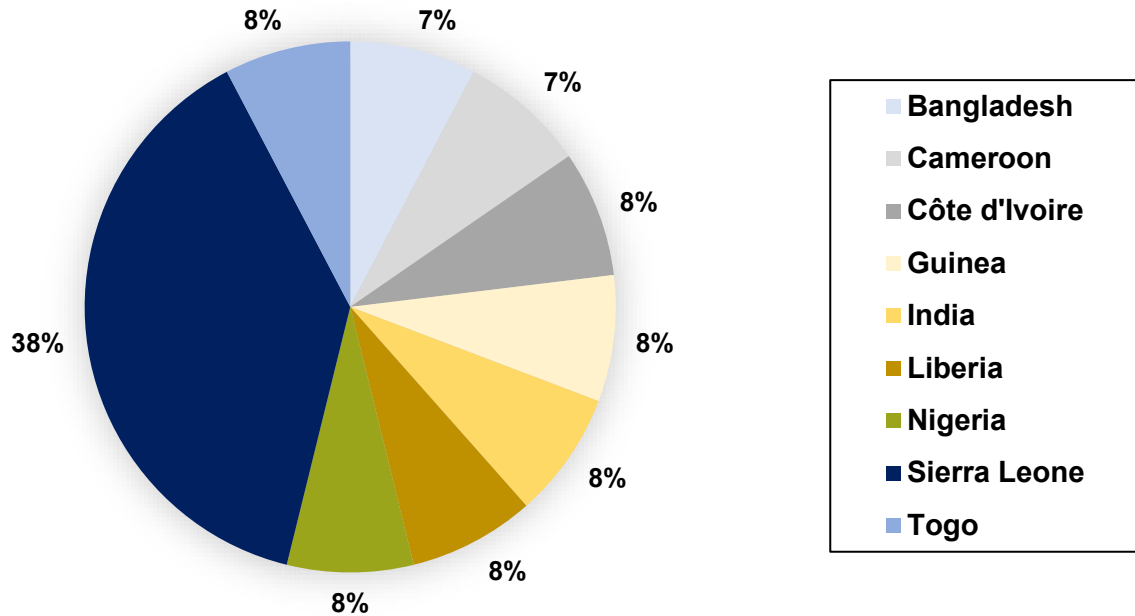
**Table 2. Mosquito-borne Disease Case Counts by Travel Status, Delaware 2023**

Disease	Travel-Associated Case Counts	Locally Acquired Case Counts
Dengue virus disease	5	0
Malaria	13	0

Source: Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology, Delaware Electronic Reporting and Surveillance System, 2023

- Knowing where patients acquire malaria provides key information on the likelihood of drug resistance and allows clinicians to choose appropriate drugs to treat the disease.
- Overall, Delaware malaria patients had travel linked to seven countries from Africa and two countries from Asia (Figure 2). More than 30% of malaria cases reported that they acquired the disease during travel to Sierra Leone. *Plasmodium* parasites from Sierra Leone have reported resistance to chloroquine and the CDC recommends atovaquone-proguanil, doxycycline, mefloquine, or tafenoquine for treatment.<sup>4</sup>

**Figure 2. Percentage of Malaria Cases by Country of Exposure, Delaware, 2023**



Source: Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology, Delaware Electronic Reporting and Surveillance System, 2023.

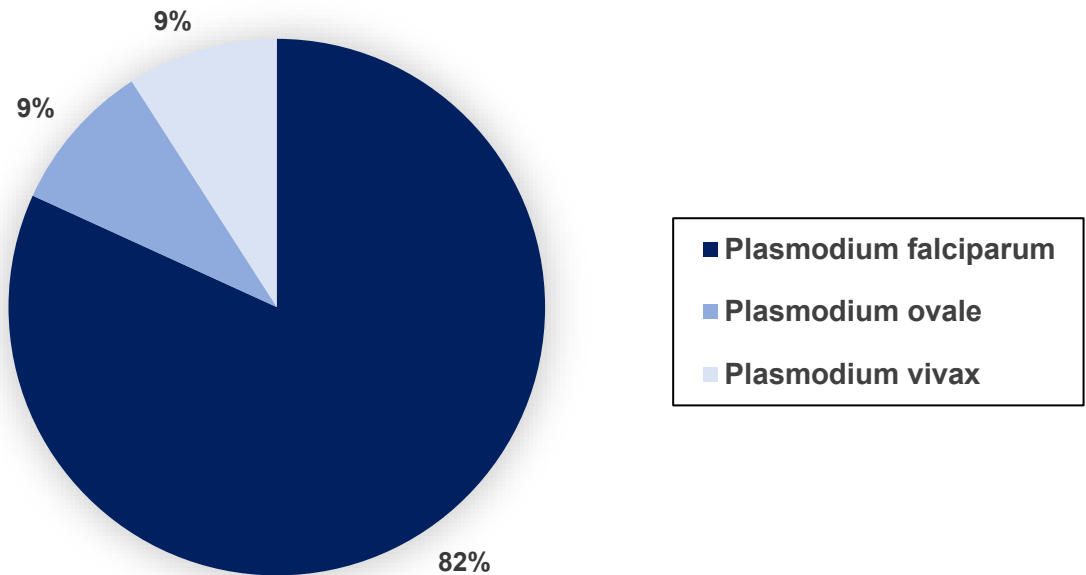
- The clinical presentation of malaria can vary substantially depending on the parasite species (*P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale*, and *P. knowlesi*), the level of parasitemia, and the immune status of the patient. According to the CDC, infections caused by *P. falciparum* are the most likely to progress to severe forms with central nervous system involvement (cerebral malaria), acute renal failure, severe anemia, or acute respiratory distress syndrome. Complications of *P. vivax* include splenomegaly (with, rarely, splenic rupture), and those of *P. malariae* include nephrotic syndrome.<sup>5</sup>
- In 2023, more than 80% of malaria cases in Delaware were caused by *Plasmodium falciparum* (Figure 3).

<sup>4</sup> [https://www.cdc.gov/malaria/travelers/country\\_table/a.html](https://www.cdc.gov/malaria/travelers/country_table/a.html)

<sup>5</sup> <https://www.cdc.gov/dpdx/malaria/index.html>



**Figure 3. Percentage of Malaria Cases by *Plasmodium* Species, Delaware, 2023**



Source: Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology, Delaware Electronic Reporting and Surveillance System, 2023.

#### D. Sentinel Chicken Surveillance Program

- The Delaware Department of Natural Resources and Environmental Control (DNREC), Mosquito Control Section monitors arbovirus transmission in Delaware using a statewide sentinel chicken surveillance program; their program sends chicken blood samples to the Delaware Public Health Laboratory to test for the presence of WNV and EEEv antibodies. The WNV seroconversion rate is the number of confirmed WNV antibody-positive chickens divided by the number of birds tested.
- Overall WNV activity was highest in New Castle County. Sixty-four sentinel chickens tested positive for antibodies to WNV across the three Delaware counties: New Castle (45 positive chickens), Kent (10 positive chickens), and Sussex (nine positive chickens). Zero sentinel chickens tested positive for antibodies to EEEv (Table 3).

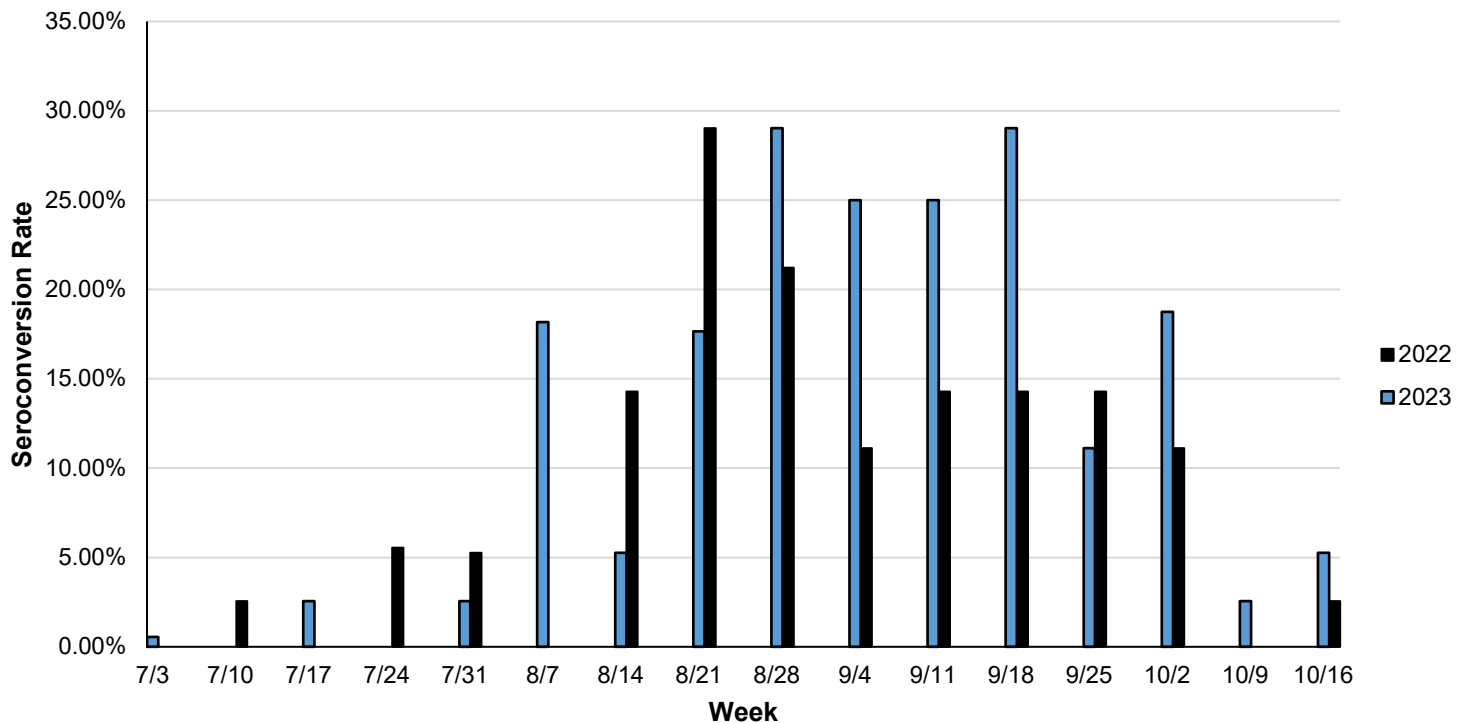
**Table 3. Summary of West Nile Virus Human and Equine Case Counts and Sentinel Chicken Seroconversion Rates by County, Delaware, 2023**

County	Total Sentinel Chicken Samples Tested for WNV	Total Sentinel Chicken Samples Positive for WNV	Sentinel Chicken WNV Seroconversion Rate	Total WNV Human Cases	Total WNV Equine Cases	Total PVBDs Cases
New Castle	266	45	16.9%	4	1	2
Kent	179	10	5.6%	0	5	0
Sussex	288	9	3.1%	0	0	0
<b>Total</b>	<b>733</b>	<b>64</b>	<b>8.7%</b>	<b>4</b>	<b>6</b>	<b>2</b>

Source: Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology, Delaware Electronic Reporting and Surveillance System and Public Health Laboratory Management System, 2023.

- The WNV seroconversion rate was above the five-year average for the 2023 mosquito season and remained at a higher rate for longer than it did in 2022 (Figure 4). The 2023 seroconversion rate peaked on August 28<sup>th</sup> and September 18<sup>th</sup> and began to slowly decrease after the 18<sup>th</sup>.
- Human WNV cases were detected after the sentinel chicken seroconversion rate was above 15% (Figures 1 and 4).

**Figure 4. Sentinel Chicken West Nile Virus Seroconversion Rates by Week, Delaware, 2022-2023**



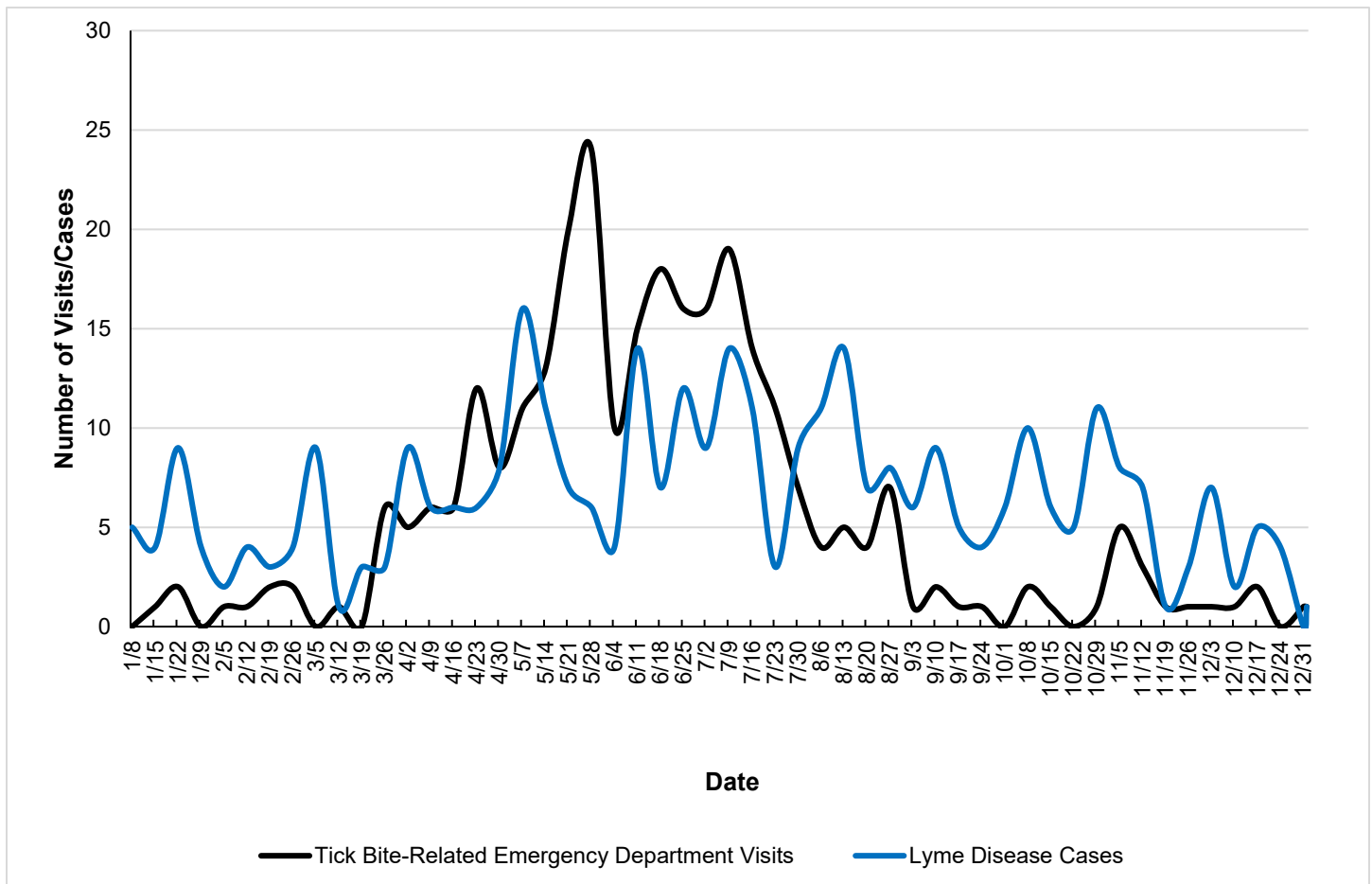
Source: Delaware Department of Health and Social Services, Division of Public Health, Public Health Laboratory Information Management System, 2023.

## IV. Tick-Borne Disease Activity

### A. Lyme Disease

- High-incidence Lyme disease jurisdictions is defined as states that had an average Lyme disease incidence of  $\geq 10$  cases/100,000 population for a period of three consecutive years.<sup>6</sup> Delaware is a high-incidence Lyme disease jurisdiction.
- In 2023, there were 349 Lyme disease cases reported in Delaware for an incidence rate of 33.8 cases per 100,000 persons. This was a 17% increase from 2022.
- Although most Lyme disease cases were reported in May and August, there was no clear peak throughout the year (Figure 5).
- Most Lyme disease cases were reported from New Castle County (213 cases) followed by Sussex (83 cases) and Kent (53 cases) counties.

**Figure 5. Lyme Disease Cases and Tick Bite-Related Emergency Department (ED) Visits by Date, Delaware, 2023**



Source: Delaware Department of Health and Social Services, Division of Public Health, ESSENCE-DE, 2023.

## B. Tick-Related Emergency Department Visits

- Delaware’s syndromic surveillance system, known as the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE–DE), collects near real-time electronic emergency department visit data from all 13 health care facilities in the state.
- The graph above represents all patients seen at emergency departments statewide with a tick bite complaint or signs and symptoms associated with a reported tick bite (Figure 5).<sup>7</sup>
- Tick-related emergency department visits occurred throughout the entire year (including during the fall and winter). The largest peak occurred at the end of May. Visits stayed consistently high until the middle of July; one small peak occurred in November.
- This is consistent with tick ecology and host-seeking behavior. Nymphal blacklegged tick activity is highest during spring and early summer. Adult blacklegged ticks are active during fall and winter months when the temperature is above freezing.

## C. Other Tick-Borne Diseases

- In 2023, ehrlichiosis was the second most common tick-borne disease in Delaware. All reported cases of ehrlichiosis were caused by *Ehrlichia chaffeensis* (Table 4). *Ehrlichia chaffeensis* is spread by the Lone Star tick (*Amblyomma americanum*), which is Delaware’s most abundant species of tick.
- Unlike Lyme disease cases, most cases of ehrlichiosis occurred in Sussex County.

**Table 4. Tick-Borne Disease Cases by County, Delaware, 2023**

Disease	Case Counts		
	New Castle County	Kent County	Sussex County
Anaplasmosis	2	1	2
Babesiosis	2	0	1
Ehrlichiosis	2	4	13
Spotted fever rickettsiosis	1	0	5

Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Electronic Reporting and Surveillance System, 2023.

## V. Program Summary and Adopting a One Health Approach to Combat Vector-Borne Diseases

Although vector-borne diseases are preventable, 2023 was an above average year for vector-borne disease activity in Delaware. A total of eight different vector-borne pathogens caused disease in more than 400 Delaware residents. The number of WNV cases greatly exceeded the five-year average and Lyme disease cases increased 17% from the previous year. Furthermore, travelers returned to Delaware infected with malaria and dengue virus, both of which Delaware has competent mosquito vectors to potentially sustain local

<sup>7</sup> The Centers for Disease Control and Prevention (CDC) report that the arthropod bite ICD-10 code is non-specific and created a tick bite query using the Chief Complaint Query Validation: Tick ^,or,^ tick ^,^ tick,or,ticks ^,or,^ ticks ^,or,^ ticks,or,(,^ti[ck]^,AND,^bit[e ]^). The CDC tick bite query was used to detect ED visits due to tick bites and filtered by region: Kent, Del, New Castle, Del, Sussex, Del. Lyme disease cases were classified according to national surveillance case definitions adopted by the Council of State and Territorial Epidemiologists (CSTE). The Lyme disease case definition, which was changed in 2022, may be found here.

transmission. In fact, our neighboring state Maryland, reported their first locally acquired malaria case in over 40 years in 2023.<sup>8</sup>

Controlling and preventing vector-borne diseases will require a One Health approach. One Health recognizes that the health of people is closely connected to the health of animals and our shared environment. In fact, this surveillance report shows that equines (horses) are affected by WNV, and birds are used to monitor WNV activity in the environment. Adopting a One Health approach, the Delaware Department of Health and Social Services (DHSS), Division of Public Health (DPH), Office of Infectious Disease Epidemiology (OIDE) developed the One Health Program (Figure 6) and works closely with animal (Delaware Department of Agriculture, veterinarians) and environmental (Delaware Department of Natural Resources and Environmental Control, Mosquito Control Section) partners to forge successful, holistic public health interventions and prevent the spread of vector-borne diseases in Delaware. For example, human and equine arboviral case reports are communicated to DNREC for mosquito abatement in a timely manner. These case reports allow DNREC to quickly focus their surveillance and control efforts on specific geographic locations. When local arboviral transmission is suspected or outbreaks occur in other countries, OIDE utilizes public facing media like press releases, Health Alert Network Notifications (HANS), and social media to alert the Delawareans. Additionally, in 2023, the vector-borne disease webpage was updated with new data, educational materials, and fact sheets, and redesigned for increased usability. The vector-borne disease webpage can be found at <https://www.dhss.delaware.gov/dhss/dph/epi/vectordisease.html>.

**Figure 6.** Delaware Department of Health and Social Services, Division of Public Health, Office of Infectious Disease Epidemiology One Health Program Logo



<sup>8</sup> <https://health.maryland.gov/newsroom/Pages/Maryland-Department-of-Health-announces-positive-case-of-locally-acquired-malaria.aspx>

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