SURVEILLANCE BRIEF
Wisconsin Environmental Public Health Tracking Program
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LYME DISEASE TRENDS IN WISCONSIN

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SUMMARY - Lyme disease is acquired through the bite of a blacklegged tick (commonly known as the deer tick) infected with the bacterium *Borrelia burgdorferi*. A rare, new emerging species, *Borrelia mayonii*, has been detected among Wisconsin residents.

Wisconsin is among the top 25% of states reporting high incidence of Lyme disease cases. Lyme disease has been reported in every county in Wisconsin, with the highest incidence in the northwestern region.

The risk of tick exposure occurs when it is warm enough for ticks to be active, usually from spring to autumn. Lyme disease surveillance in Wisconsin is conducted year round. The majority of reported Lyme disease cases occur between May and August.

Lyme disease can be prevented through personal behaviors such as using tick repellant, wearing long-sleeved shirts and pants, tucking pants into socks or boots, checking for ticks after being in wooded areas, and promptly showering to wash off any crawling ticks.

BACKGROUND

Scientists first recognized Lyme disease in the U.S. in 1975 after an outbreak in Lyme, Connecticut.[1] Most cases reported in the U.S. are caused by the bacterium *Borrelia burgdorferi*. A rare, emerging species, *Borrelia mayonii*, was identified in 2012 and is currently present only in the Midwest.[2] Lyme disease can be transmitted to humans by the bite of an infected *Ixodes scapularis* tick, commonly called the blacklegged or deer tick.[1]

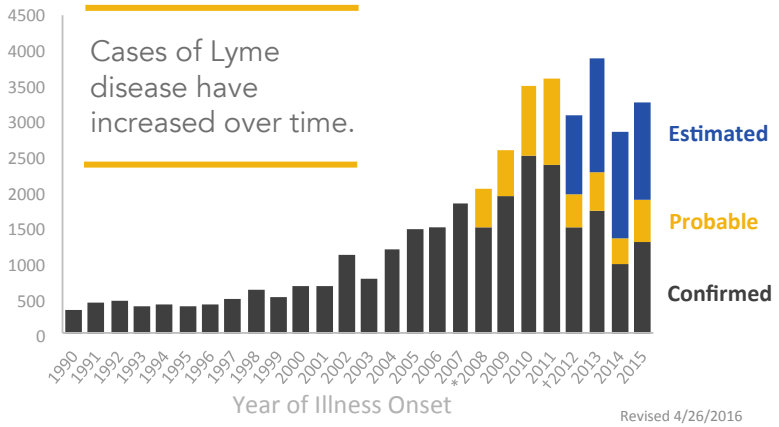
Lyme disease is increasing in Wisconsin and was the state's fourth highest reported notifiable communicable disease in 2015.[3] The highest number of cases has traditionally been reported in the northwestern region of Wisconsin, but in recent years cases have increased in the central and eastern regions (Figure 1). Between

1990 and 2015, 38,394 cases of Lyme disease were reported in Wisconsin (Figure 2).[1] Lyme disease is the most commonly reported vectorborne illness in the U.S., with 25,359 cases reported in 2014.[4] Nationally, 96% of cases in 2014 were observed in 14 states, including Wisconsin.[5]

Many factors contribute to the increase in Lyme disease infections, including the abundance and distribution of ticks, the prevalence of infection in ticks, and the frequency of ticks and human contact.[6] *B. burgdorferi* can infect a wide range of animal hosts, including deer, small mammals, lizards, and birds. Climate conditions can play a role in the tick life cycle, which impacts Lyme disease.[7]

Wisconsin has experienced a warmer and wetter climate in recent decades and this increased humidity and temperature creates a hospitable environment for ticks.[7,8] Climatic shifts allow for extended geographic distribution of ticks, as well as earlier seasonal activity. Increased temperatures with higher humidity can enhance tick survival, while colder temperatures may lead to a decrease in tick population.[6] Other factors such as host populations (e.g., deer and mice) and changes in land use can also influence Lyme disease incidence.[7]

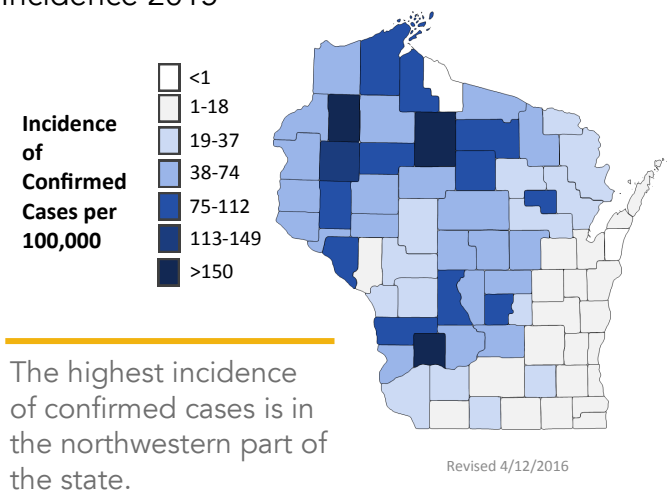
FIGURE 2. Lyme Disease Cases in Wisconsin, 1990-2015[1]



*Surveillance case definition changed to include probable cases.

†Criteria in Wisconsin for reporting Lyme disease were revised so that only cases with an erythema migrans (EM) rash required follow-up. A statistical method was implemented to estimate cases based on the number of total laboratory reports for each year since 2012.

FIGURE 1. Wisconsin Lyme Disease Annual Incidence 2015



Statewide incidence = 22.6/100,000

This map is based on the county of residence of confirmed cases. Some infections may have been acquired during travel to other areas.

Data source: Wisconsin Division of Public Health

LYME DISEASE IN WISCONSIN

Geographically, Lyme disease incidence varies within the state of Wisconsin. The incidence is highest in the northwestern region of the state (Figure 1).

Figure 2 displays statewide cases (confirmed, probable, and estimated) from 1990 to 2015. Case estimation began in 2012 due to the Wisconsin Department of Health Services' (WI DHS) change in Lyme disease reporting which modified follow-up requirements. WI DHS provided a method to calculate estimated Lyme disease cases based on the number of reported Lyme disease laboratory results.

Nationally, the Centers for Disease Control and Prevention estimates the total number of cases is approximately 10 times higher than what is reported through surveillance.[10] Similar to the national number, the actual number of Lyme disease cases in Wisconsin is likely much greater because of incomplete testing, misdiagnoses, and

underreporting. Lyme disease may not be recognized or diagnosed because the public or medical providers are not aware of the risk of infection and proper testing is not performed, especially in areas where Lyme disease is emerging. Surveillance capabilities, including investigation and follow-up of reports, are determined by budget and personnel constraints.[11]

WISCONSIN EFFORTS AND TICK SURVEILLANCE

In Wisconsin, several programs collaborate to monitor Lyme disease. The Vectorborne Disease Program (VDP) compiles and disseminates data and resources on a range of vectorborne diseases in Wisconsin (such as the data in Figures 1 and 2). In 2015, the Wisconsin Environmental Public Health Tracking (WI EPHT) Program partnered with the VDP to enhance accessibility and availability of Lyme disease data and highlight the role of environmental factors in Lyme disease. One outcome of this partnership is the inclusion of Lyme disease data on the WI EPHT program's public data portal by fall 2016.

The Wisconsin Building Resilience Against Climate Effects (BRACE) Program seeks to build statewide capacity to respond to health issues related to weather and climate. To better understand tick activity patterns, the WI BRACE program partnered with the Eau Claire City-County Health Department to conduct tick surveillance. The goal was to provide baseline trends of seasonal tick activity, tick population numbers, and *B. burgdorferi* infectivity rates. Staff conducted weekly tick drags in 2014 and 2015 at two popular county parks in the Eau Claire area (Big Falls and Lowes Creek), with drags conducted in alternating fashion between the two parks each week (Figure 3). Figure 4 shows the monthly number of blacklegged ticks collected by tick drags. In both years, tick collections were notably low in July through September but higher in the months of April, May, and October.

PREVENTING LYME DISEASE

Prevention of Lyme disease is possible, and vector and disease surveillance can direct and drive prevention activities. The collection and dissemination of these data provide public health partners with the means to understand the scope of this problem within their communities. This allows for the appropriate prioritization of resources and funds to improve the health of community members.

Prevention can also be taken at the individual level:

Avoid wooded areas with high grass and leaf litter. If venturing in these areas, avoid overgrown grass and brush.[14]

Wear light-colored clothing so ticks can be easily spotted. Long-sleeved shirts and pants should be

FIGURE 3. Maps of Tick Drag Locations in Eau Claire County

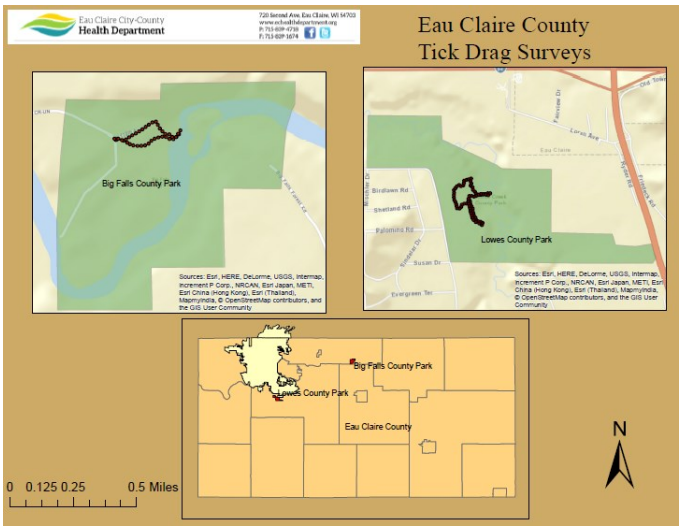
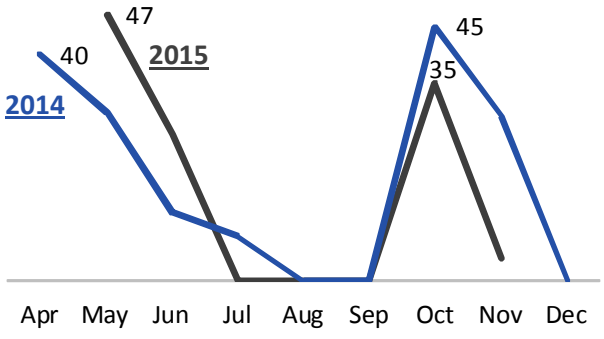


FIGURE 4. Number of Blacklegged Deer Ticks Collected at Lowes Creek Park and Big Falls Park in Eau Claire County, 2014 and 2015



tucked into waistbands and socks or shoes to minimize skin contact.[14]

Use repellants. Repellants with 20 to 30% DEET may be applied to skin and clothing to provide protection for several hours.[15]

Treat clothing with permethrin. Clothing may also be treated with 0.5% permethrin, an insecticide that kills ticks on contact. As such, it should not be applied directly on the skin. Clothing and gear treated with permethrin remain protective after several washings.[14] Clothing treated with permethrin should be removed soon after leaving grassy or wooded areas to reduce insecticide exposure.

Check for ticks soon after visiting wooded areas. Examine the body, clothing, gear, and pets. Shower to wash off any crawling ticks.[15] Inspect the armpits, scalp, and groin area, using a handheld or full-length mirror as necessary.[15]

Heat clothing and gear. Place dry items in the dryer on high heat for six minutes, or one hour for wet items, to kill any blacklegged ticks present.[15,16]

Remove attached ticks promptly with tweezers. Pull the tick up and out from the body then disinfect the site and wash hands.[13] If tick is attached for ≥24 hours, WI DHS recommends consulting a doctor for a single dose of doxycycline to prevent Lyme disease.

CONCLUSIONS

Lyme disease is passed to humans through the bite of the blacklegged tick, a common vector found in Wisconsin. It is the most frequently reported tickborne disease in the state. Infection is most likely in warmer months, but Wisconsin is experiencing expanded seasonal tick activity due to climate effects. People spending time outdoors can prevent Lyme disease with the following activities: avoidance of areas prone to tick activity, use of repellants, selection of light-colored clothing with long sleeves and full pant legs tucked into waistbands and socks, and completion of tick checks and shower after being in grassy or wooded areas.

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ABOUT TRACKING

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