

New map pinpoints areas of highest human risk for lyme disease in eastern United States

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A new map pinpoints well-defined areas of the Eastern United States where humans have the highest risk of contracting Lyme disease, one of the most rapidly emerging infectious diseases in North America, according to the U.S. Centers for Disease Control and Prevention. As part of the most extensive Lyme-related field study ever undertaken, researchers found high infection risk confined mainly to the Northeast, Mid-Atlantic and Upper Midwest and low risk in the South. The results were published in the February issue of the [American Journal of Tropical Medicine and Hygiene](#). Given frequent over- and under-diagnosis of Lyme disease, the new map could arm the public and health officials with critical information on actual local risk.

"There has been a lot of discussion of whether [Lyme disease](#) exists outside of the Northeast and the upper Midwest, but our sampling of tick populations at hundreds of sites suggests that any diagnosis of Lyme disease in most of the South should be put in serious doubt, unless it involves someone who has traveled to an area where the disease is common," said Dr. Maria A. Diuk-Wasser, Assistant Professor at the Yale School of Public Health and the lead author of the study.

"We can't completely rule out the existence of Lyme disease in the South," she added, "but it appears highly unlikely."

The Lyme disease risk map was developed by researchers at the Yale School of Public Health in collaboration with Michigan State University, University of Illinois and University of California, Irvine, through a cooperative agreement with the CDC, which is seeking a better understanding of where Lyme disease poses a public health menace. Lyme disease is a tick-borne ailment with symptoms that range from a rash, headaches and

fever to arthritis and Bell's palsy.

Mobilizing Tick Hunters

The scientists involved in the study assembled a large field staff of more than 80 tick hunters. From 2004 to 2007, they combed through 304 individual sites from Maine to Florida and across the Midwest, dragging a one-meter by one-meter square of corduroy cloth in hopes of snagging the black legged tick *Ixodes scapularis* that is the main carrier of the Lyme disease pathogen, *Borrelia burgdorferi*. (The study did not examine risk in the West where Lyme disease is believed to be confined to areas along the Pacific Coast where a different tick species, known as *Ixodes pacificus* or the western blacklegged tick, carries Lyme.)

The goal of the field work was to provide doctors and public health officials with a better sense of where people are at risk of Lyme disease by using the presence of known Lyme-carrying ticks as the main indicator of danger.

Current geographical assessments of Lyme disease risk are heavily reliant on reports of human infections, which the study notes can be a poor predictor of risk. The researchers point out that using human cases to determine areas of risk can be misleading due to the high level of "underreporting and misdiagnosis" of Lyme disease. They also note that where someone is diagnosed with the disease is not necessarily where they contracted it.

In addition, the study found that infected *I. scapularis* ticks may colonize a region long before they actually infect a human with Lyme disease, which means risk can be significant even without a confirmed case.

"A better understanding of where Lyme disease is likely to be endemic is a significant factor in improving prevention, diagnosis and treatment," Diuk-Wasser said. "People need to know where to take precautions to avoid tick bites. Also, doctors may be less likely to suspect and test for Lyme disease if they are unaware a patient was in a risky area and, conversely, they may act too aggressively and prescribe unneeded and potentially dangerous treatments if they incorrectly believe their patient was exposed to the pathogen."

The study notes that "accurate and timely" diagnosis is crucial to initiating antibiotic treatments that can help patients avoid the more serious complications of Lyme disease. At the same time, the authors point out that incorrectly suspecting Lyme disease has its own consequences, including potentially life-threatening complications from the antibiotics typically used to treat infections. (While the laboratory test for Lyme disease can produce both false-positives and false-negatives, false-positives are far more likely in non-endemic areas.)

Establishing a Map for Lyme Disease Risk in the Eastern United States

The maps that emerged from the tick survey show a clear risk of Lyme disease in large parts of the Northeast (including eastern Pennsylvania) from Maine going as far south as Maryland and northern Virginia, which is in the Washington, DC, metropolitan area. But while conditions could be favorable for the disease to spread into the Tidewater region of Virginia - the data collected for the study indicates the bulk of the South is free of Lyme disease-carrying ticks.

The researchers also identify a separate and distinct Lyme disease risk region in the upper Midwest. It includes most of Wisconsin, a large area in northern Minnesota, and a sliver of northern Illinois.

However, the scientists confirm that Lyme disease remains on the move as its preference for forests and deer is aided by a century-long re-planting of trees inland once cleared for agriculture, along with a resurgence of deer populations. Diuk-Wasser and her colleagues found evidence to support an

"emerging risk" for Lyme disease along the Illinois/Indiana border, the New York/Vermont border, southwestern Michigan, and eastern North Dakota. Also, Diuk-Wasser said new, unpublished field work now underway indicates Lyme disease is probably moving into central Virginia.

Lyme Disease: the Southern Challenge

While the scientists involved in mapping the Lyme disease risk believe most of the South is relatively free of the disease, one challenge to delineating a southern risk frontier is the fact that there are *I. scapularis* ticks in the region. They were once thought to be a distinct species, Diuk-Wasser said, but scientists now consider them to be the same species, although there are biological differences.

Most notably, tick experts find the Southern *I. scapularis* exhibit a feeding behavior in the immature stages that is different than that of its northern cousins. The Southern ticks prefer, it appears, the blood of lizards and skinks to small mammals that are more likely to carry the bacteria and show no interest in feeding on humans, which scientists believe makes it unlikely they play an important role as Lyme disease carriers.

Diuk-Wasser noted that one reason some people in the South may believe Lyme disease is a risk in their region is that they may frequently encounter a species known as the lone star tick (*Amblyomma americanum*) that is "very aggressive, very abundant" and whose bite can cause a rash that looks similar to the "bull's eye" lesion caused by Lyme disease. However, this disease, known as Southern Tick-Associated Rash Illness or STARI, does not feature the neurological and arthritis problems associated with Lyme disease.

Nonetheless, Diuk-Wasser stresses that scientists cannot rule out completely that Lyme disease exists outside of the areas identified in the mapping project. And she pointed out there are limitations to the tick sampling techniques she and her colleagues employed to create the risk map. For example, the field teams conducted their tick collecting in late May, June, July, and August, which is considered peak feeding time. But she said some areas might experience a population

surge in early May or earlier. (The climate in April in parts of Tennessee is likely tick friendly, but Diuk-Wasser said other field studies conducted in Tennessee during the spring have not found any Lyme-infected ticks.)

"This is a useful tool that can help physicians, nurses and policymakers make realistic resource decisions," said James W. Kazura, MD, President of the American Society of Tropical Medicine and Hygiene, which publishes the journal, and director of the Center for Global Health and Diseases at Case Western Reserve University. "The scientific research done to create this new risk map for Lyme disease is an example of what is needed in the U.S. today for a variety of diseases given its immense value in making clinical decisions and allocating scarce resources."

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