New Lyme disease forecast map targets rising tide of ticks

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As the rate of Lyme disease grows rapidly across the United States, new research offers veterinarians a forecasting map that tells them which parts of the country are most at risk of Lyme disease infections in dogs, which could also help track and predict Lyme disease in people.

The forecast map, created by Michael Yabsley, a parasitologist at the University of Georgia, and Christopher McMahan, an assistant professor of mathematical sciences at Clemson University, shows the predicted Lyme disease prevalence-the percentage of dogs who are likely to test positive-by county in each of the 48 contiguous states. It draws on monthly test data from veterinarians, providing the most timely picture of Lyme disease cases available.

"Our research into modeling disease in space and time shows us how dynamic canine Lyme disease is on an annual basis. It's our hope that these maps can be used to optimize patient care by veterinarians and public health officials or physicians," McMahan said.

Ticks that carry the disease-causing bacterium, Borrelia burgdorferi, were once thought to be limited to northern parts of the United States, but recent research shows they are now in half of the counties across the country, including Southern states.

Yabsley and McMahan combined factors associated with Lyme disease-forestation, surface water area, temperature, population density and median household income-with nearly 12 million Lyme disease test

results collected between 2011 and 2015 in dogs, by county, in the contiguous United States, provided by the veterinary diagnostic company IDEXX Laboratories Inc.

The research is "a call to action for people to protect their dogs and for veterinarians to engage in conversations with their clients about risks to their pets and options for prevention, including vaccination and tick preventatives," said I. Craig Prior of the VCA Murphy Road Animal Hospital in Nashville, Tennessee, and president of the Companion Animal Parasite Council board of directors.

Ticks feed throughout the year, Prior said. As mice and other animals that ticks feed on move into new habitats, the ticks, and Lyme disease, move with them. "Awareness is the key, and forecasting helps people and veterinarians know the potential risk in their county," he said.

The research also has implications for Lyme disease in people.

"Dogs really are the canary in the coal mine for human infection. Our research team has evidence that the relationship between canine disease and human disease is strong," Yabsley said. "Because dogs are being tested for exposure during annual exams, these data are available on a national scale, something that is difficult to get when studying the ticks and environment directly."

McMahan and Yabsley are expanding this analysis and plan to release additional data on the relationship between human and canine disease later this year.

The research was originally conceptualized by the CAPC, which assembled a team of scientists from a variety of disciplines and institutions to address a major gap in the understanding of parasitic disease prevalence. CAPC is a nonprofit that works closely with

academia and the animal health industry to provide veterinarians with up-to-date information on parasitic infections in pets.

Veterinarians have typically relied on a preconceived understanding that Lyme disease was endemic in the Northeastern and Mid-Central United States.

"Integrating data on a national level allows for a more advanced view of the variables impacting Lyme disease prevalence, and expands our understanding of the true prevalence of disease across the U.S.," said Chris Carpenter, chief executive director of CAPC. "The scientists observed an apparent convergence of Lyme disease infection of dogs from the Northeastern and Mid-Central United States in the Great Lakes region, encompassing Indiana, Ohio, Illinois, Kentucky and Michigan, all of which is supported by recent studies and CDC reports of expansion of the ticks that carry the pathogen into this region."

Initial symptoms of Lyme disease, which appear between five and 30 days in humans and two to five months in dogs, are flu-like: fatigue, low fever, achy muscles and joints. But if left undiagnosed or untreated, Lyme disease can cause long-term complications of the heart, nervous system and muscles.

"The research conducted by doctors Yabsley, McMahan and their interdisciplinary team has been instrumental in helping CAPC fulfill our mission to protect pets against vector-borne diseases, such as Lyme disease, and in helping us create the 2017 Lyme disease forecast," Carpenter said. "We are pleased to have funded this research effort and we look forward to expanding this research in support of human health as well."

  More information: Stella C. Watson et al. A Bayesian spatio-temporal model for forecasting the prevalence of antibodies to Borrelia

burgdorferi, causative agent of Lyme disease, in domestic dogs within the contiguous United States, *PLOS ONE* (2017). [DOI: 10.1371/journal.pone.0174428](#)

Provided by University of Georgia

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