

**AGRICULTURE**

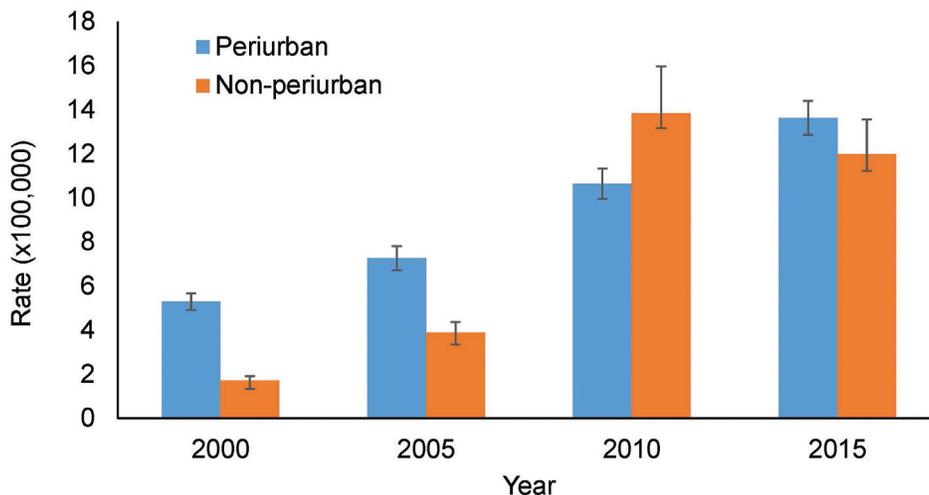
**Ticked Off: How Expansion of City Boundaries Affects Rates of Lyme Disease in the United States**

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The Centers for Disease Control and Prevention (CDC) estimates there could be between 300,000 and 400,000 cases of Lyme disease per year in the United States. Lyme disease is caused by *Borrelia burgdorferi*, a bacteria transmitted by blacklegged ticks. It is often associated with rural areas; however, urbanization and the presence of ecotones (a transition area between two ecosystems) have been deemed potential risk factors for Lyme disease. Thus, the objective of our study was to examine the expansion of city boundaries and its relation to rates of Lyme disease in the United States. We hypothesized that the areas on the edge of expanding city boundaries would have increased risk of Lyme disease. In order to test our hypothesis, we compared Lyme disease rates between the counties sharing boundaries with an urban county (i.e., periurban) and those that did not.

We compared annual case rates by county provided by the CDC, Department of Agriculture Rural Urban Commuting Area Codes (RUCA), and United States Census Population in order to gain insight into our research question. The results showed that the rate of Lyme disease in periurban counties was 3.1 (95% CI 2.4–4.0) and 1.9 (95% CI 1.4–2.5) times the rate in non-periurban counties in 2000 and 2005, respectively. The current findings partially support our hypothesis that expanding city boundaries are linked to higher rates of Lyme disease in those areas; however, the trends are not consistent throughout the years.

*Research advisor Hsin-Yi Weng writes: “Daphne came up with this intriguing ‘One Health’ research question, converted it into a testable hypothesis, and collected data from various sources to test the hypothesis. The findings of her project implicate the complexity of disease transmission amid rapid urbanization, which changes how humans and animals interact in the ecosystem.”*



Bar chart comparing the incidence rates of Lyme disease between periurban and non-periurban counties in the United States, 2000–2015. The rates were significantly higher in periurban counties compared to non-periurban counties in 2000 and 2005 (both  $P < 0.001$ ). The rates were not significantly different in 2010 and 2015 ( $P = 0.108$  and  $0.363$ , respectively).