Rhode Island Tick-Borne Disease Surveillance Summary 2012–2013

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The three common tick-borne illnesses in Rhode Island are Lyme disease, babesiosis, and anaplasmosis. All are transmitted to humans from animal hosts by the black-legged tick, *Ixodes scapularis*, commonly called the "deer tick."[1] The latter has a complex life cycle supported by the blood of various mammalian species, but none more important locally than the white-footed mouse and the white-tailed deer, whose numbers (and therefore the numbers of black-legged ticks hosted by them) have increased dramatically over the past several decades. This trend has been spurred by the expansion of supportive habitats such as second-growth woodlands and suburban developments, both of which provide abundant food and cover for both species.[2] The resultant increase in ticks, absent a vaccine to prevent any of the tick-borne illnesses common in Rhode Island, has led to an increase in the probability of contracting Lyme disease, babesiosis, or anaplasmosis in the state.

Surveillance of newly diagnosed cases of tick-borne diseases is essential to the development, testing, and evaluation of public health programs designed to prevent them. Nonetheless, the nature of these diseases and the tests available to confirm them result in high surveillance costs. For example, there is no definitive laboratory test for confirming *new cases* of Lyme disease.[3] Thus, although thousands of positive laboratory test results for Lyme disease stream electronically – and therefore cheaply – to the Rhode Island Department of Health ("HEALTH") each year, new cases cannot be discerned from old cases without obtaining further information on case history and clinical presentation, a costly affair. Lacking resources specifically earmarked for Lyme disease surveillance, HEALTH tracks Lyme disease with near-complete laboratory results and *some* information from health care providers, using the data from these two sources to construct judicious annual estimates of the number of newly diagnosed Lyme disease cases among residents of Rhode Island.

Fortunately, in 2013 HEALTH received additional resources to enhance surveillance of common tick-borne illnesses, permitting improved case counts, the subject of this report.

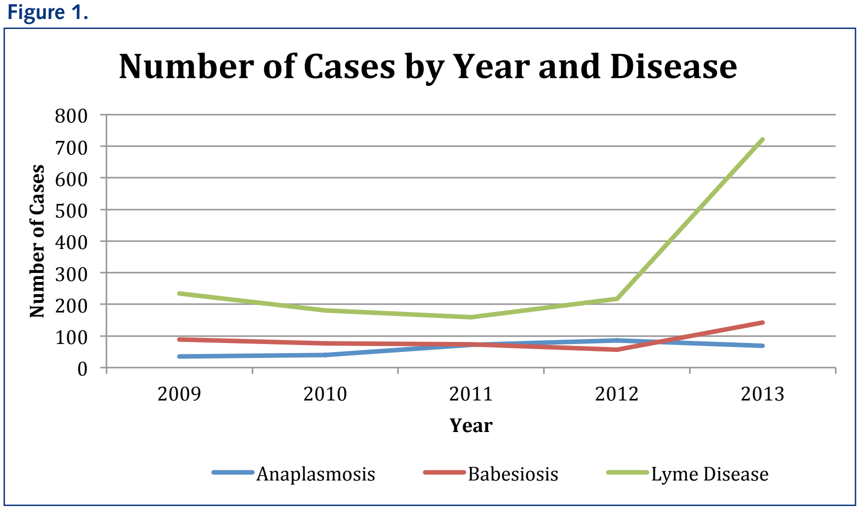
METHODOLOGY

HEALTH employs *passive* surveillance to track the burden of tick-borne diseases. Periodically, HEALTH reminds laboratories and health care providers to report possible cases of tick-borne illnesses, and processes the data thus received. (Were HEALTH to employ *active* surveillance, it would contact potential reporting sources regularly and frequently – for example, weekly during those months when people are likeliest to be bitten by ticks – requesting information on all potential cases identified since the last contact. HEALTH employs this method during periods of high risk for the transmission of very serious diseases.) Health care laboratories stream electronic positive test results to HEALTH. Health care providers report clinically-diagnosed cases using a variety of communication channels (primarily, fax).

Frequently, HEALTH receives a positive laboratory result for which no provider report is obtained. Such a case is initially classified "suspect." It may be *reclassified* "probable" or "confirmed" on the basis of additional information (date of illness onset, signs, and symptoms) from the health care provider who ordered the laboratory test. To obtain such additional information, HEALTH must query the provider. Based on all information received, a nurse investigator determines the final case classification. Individual queries and assessments are costly. When resources are exhausted for a year, reclassification stops.

The additional resources received for tick-borne disease surveillance in 2013 permitted exhaustive queries and

Figure 1.



optimal reclassification of cases initially classified as "suspect." The resulting counts of "probable" or "confirmed" cases are considerably higher than in previous years, when supplemental surveillance resources were unavailable.

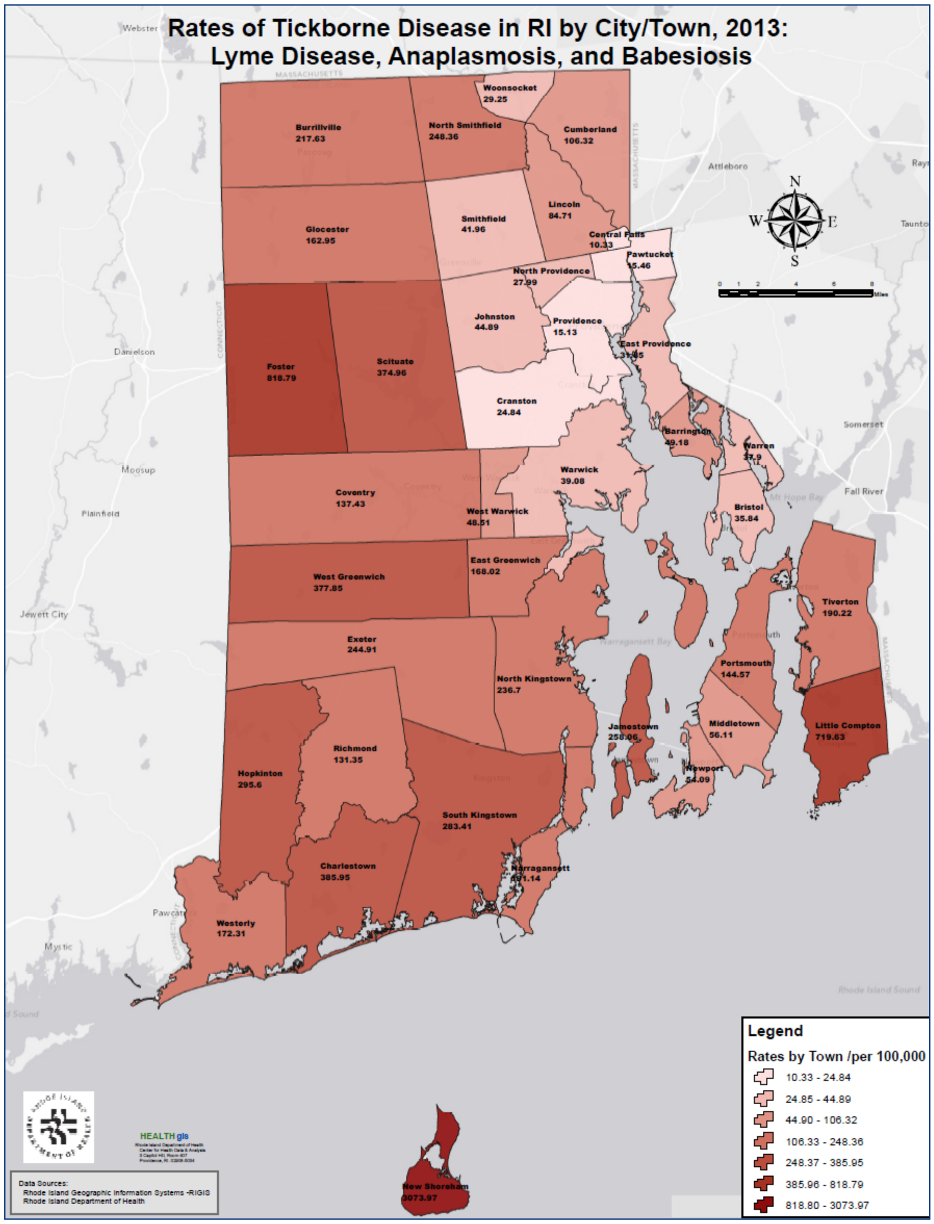
RESULTS

Lyme disease

Lyme disease incidence appears to have increased in Rhode Island from 2009 through 2013. Case counts in the first four years of the period underestimate true disease burden, for the reasons outlined above, but the 2013 case count, based on enhanced surveillance, is quite robust, providing a unique opportunity to examine the distribution of Lyme disease geographically and demographically.

Statewide, 723 new "confirmed" and "probable" cases of Lyme disease were diagnosed in 2013, yielding an incidence rate of 68.7 cases per 100,000 residents (**Figure 1**). Of the five Rhode Island counties, Washington and Newport Counties experienced the highest rates of newly diagnosed cases: 151 per 100,000 and 122 per 100,000, respectively, and of the 39 Rhode Island municipalities, New Shoreham had the highest incidence (2978 per 100,000 – almost 3 *percent*), followed by Foster (711 per 100,000) and Little Compton (576 per 100,000) (**Figure 2**). The majority of new Lyme disease cases in 2013 were diagnosed from June through October, but some new cases were reported each month (**Figure 3**). With regard to age, children 5–9 years old were at greatest risk of contracting Lyme disease (127/100,000), followed by people ages 70–79 (97/100,000). Male cases greatly outnumbered female cases (a count of 441 *vs.* a count of 281, respectively).

Figure 2.



Anaplasmosis

Anaplasmosis is far less common than Lyme disease in Rhode Island. In 2013, for example, the incidence of anaplasmosis, 6.6/100,000 residents, was only about one-tenth the incidence of Lyme disease, 69/100,000 residents. Like Lyme disease, anaplasmosis appears to be becoming more common in the state (6.6/100,000 in 2013, *vs.* 3.3/100,000 in 2009), and because case counts for this tick-borne illness have been more complete than case counts for Lyme disease in past years, the observed increase in anaplasmosis is unlikely to be artifactual (to have been caused solely or primarily by the enhanced surveillance program of 2013). Of the five Rhode Island counties, Washington County had the highest incidence of anaplasmosis in 2013 (30/100,000), and of the 39 Rhode Island municipalities, anaplasmosis incidence was highest in Charlestown (142/100,000), followed by Little Compton (115/100,000), and Exeter (107/100,000). In 2013, over 75 percent of all anaplasmosis cases occurred from May through August (**Figure 3**). People ages 50 and over accounted for more than 70 percent of anaplasmosis cases, with rates highest among people 60-69 years of age. Male cases outnumbered female cases in 2013 (a count of 42 *vs.* a count of 26), but previous years do not show such a large differential.

Babesiosis

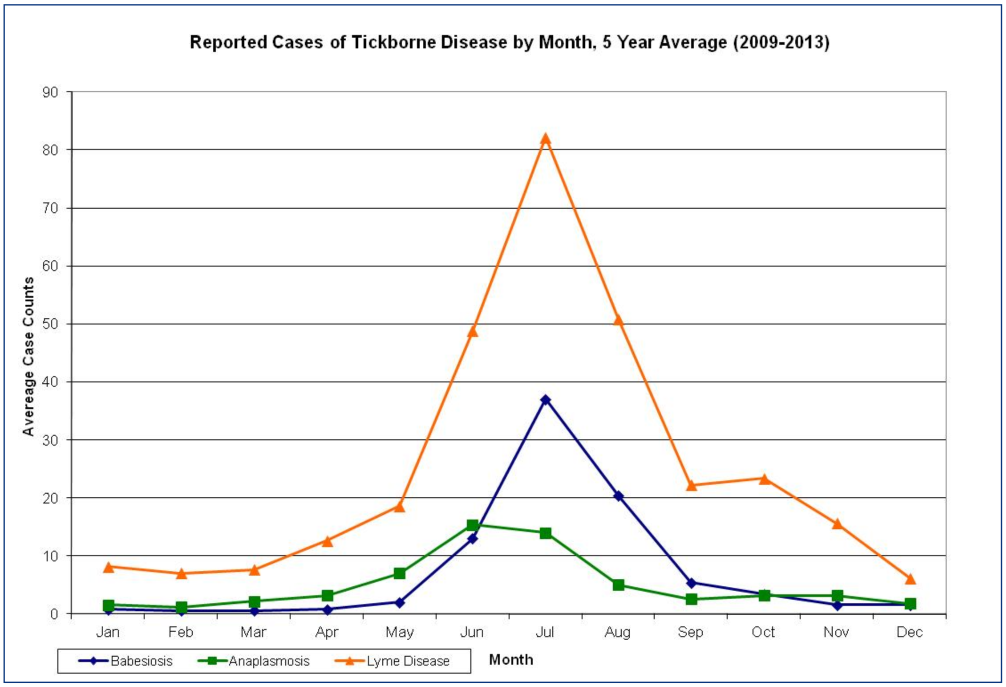
In Rhode Island the incidence rate of babesiosis is intermediate between the incidence rates of anaplasmosis, on the one hand, and Lyme disease, on the other. In 2013, the observed incidence of babesiosis was 13.5/100,000, double the incidence of anaplasmosis, but only one-fifth the incidence of Lyme disease (**Figure 1**). At least *some* of the increase observed in the incidence rate of babesiosis between 2012 and 2013 is artifactual, having been caused by the surveillance enhancements of 2013.

Among Rhode Island's five counties, the incidence rate of babesiosis is highest in Washington County, 78/100,000. In fact, over 60 percent of the babesiosis cases reported to HEALTH in 2013 resided in Washington County. Not surprisingly, therefore, the highest babesiosis incidence rates among cities and towns were found in Washington County, in South Kingstown (56/100,000), Hopkinton (37/100,000), and North Kingstown (34/100,000). Although the incidence rate in Rhode Island's other counties is substantially less than Washington's, it appears to be climbing faster in neighboring Newport County than anywhere else: from 2.4/100,000 in 2009 to 13.3/ 100,000 in 2013.

In 2013, nearly 90 percent of all babesiosis cases identified in Rhode Island were diagnosed in the months of June, July, and August (**Figure 3**). Persons 50 years of age and over accounted for over 80 percent of babesiosis cases in that year. Persons ages 70-79 had an incidence rate of 45/100,000, higher than any other age group. Similar to other tick-borne illnesses among Rhode Island residents, males outnumber females, with 89 *vs.* 53 cases, respectively, in 2013.

In Rhode Island in years past, babesia has been transmitted *directly* from one human to another via blood or organ donation.[4] In 2013, three new cases of babesiosis were found to have been transmitted via blood donation. In all three cases, the donor was diagnosed *after* donating blood.

Figure 3.



Co-infections

In Rhode Island in 2013, eight babesiosis-Lyme co-infections were identified, up from about two to three co-infections per year. Of late, smaller numbers of babesiosis-and-anaplasmosis and Lyme-and-anaplasmosis co-infections have been identified, as well.

DISCUSSION

The burden of tick-borne illness in Rhode Island is high, and presents several challenges of relevance to control and reduction, not the least of which is the cost of surveillance. Thus, it was very fortunate that resources became available to enhance statewide tick-borne disease surveillance in 2013.

The story told by the new, robust statistics of 2013 can go a long way in helping the state control and reduce the burden of tick-borne illnesses in Rhode Island, primarily by identifying population sub-groups at highest risk of infection. Doing so facilitates planning and policy development to reduce the burden of disease.

Clearly, residents of Washington County, Rhode Island are at considerably greater risk for contracting tick-borne illnesses than people who reside elsewhere in the state, as are children ages 5-9 and elders. Males are much more likely than females to be infected. This pattern of higher-than-average risk groups suggests several possible reasons for higher-than-average risks, which, if true, could be used to enhance the selection and targeting of disease control interventions. Nonetheless, additional questions must be asked and answered first.

Consider: Geographic differences in the risk of tick-borne illnesses suggest underlying differences in the density of black-legged ticks proximate to human habitation or activity. What, specifically, are these differences? In Washington County, for example, is the density of ticks greater than elsewhere in the state? The density of supportive mammalian species? Are the predators of these species less dense in Washington County than other counties? Are outdoor occupations like landscaping and farming and the raising of livestock more common in Washington County? Are outdoor leisure activities like hiking, camping, and golfing more common in this area of the state than other areas? Are settlement patterns different? Are homes more likely to be sited in ideal mouse habitat? Deer habitat? Is settlement density or landscaping more likely to attract and sustain deer? Similarly, gender and age differences suggest basic differences in work or leisure activities, or in personal protective behaviors, or both. Are men more likely to work outdoors than women? Are they more likely to pursue outdoor leisure activities like hunting, fishing, or golfing? Are children ages 5-9 more likely to play in tick-dense areas than children of other ages, or less likely to wear protective clothing, or less likely to recognize ticks, etc.? Are elders more likely to pursue outdoor leisure activities than younger adults? (Are they more likely to be retired?) Are elders less likely than younger individuals to be able to examine themselves for ticks after engaging in outdoor activities? These questions (and others) should be asked and answered before fielding potentially-costly risk-reduction strategies. We need to know *where* people are exposed to black-legged ticks, *what* they are doing, and *why* they could not (or did not) protect themselves from infection.

In the meantime, *all* Rhode Islanders should understand the risk of tick bites, *where* and *how* they are most likely to be exposed to ticks, *how* to protect themselves from infection, and *what to do* if they have been bitten. For example, when spending time in wooded or brushy areas, people should wear long sleeves and pants and perform routine tick checks, as well as shower as soon as possible. (Showering helps wash ticks off and helps in finding ticks on the legs and upper body.) Attached ticks should be removed promptly (and properly). Doing so within 24 hours greatly reduces one's chance of contracting a tick-borne illness. Appropriate repellents should be applied to skin and/or clothing before going outside. **Permethrin** – used to treat clothing – is practical for people who are repeatedly exposed to ticks in outdoor jobs or leisure activities, (e.g., landscapers, farmers, hunters, hikers, etc.), but **DEET**-based repellents – for use on skin and clothing – are *usually* more suitable for occasional use. Label instructions should be heeded, and adults should assist children when applying repellents. Closely-cropped lawns, reductions in leaf litter, and well-trimmed trees and shrubs (increased sunlight at ground level) discourage ticks which otherwise subsist in high-traffic recreational areas like back yards and school yards. Knowing all these things, and acting on the knowledge, will go a long way in protecting Rhode Islanders until such time as we are able to reduce the density of black-legged ticks in the state.

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