

# West Virginia Tickborne Disease Surveillance Summary, 2011

## Introduction

Tickborne diseases (TBDs) are diseases transmitted by the bite from an infected tick vector. In West Virginia, tick vectors responsible for disease transmission have been identified for at least six TBDs (Table 1). Diagnosing TBDs can be challenging as some of these infections can initially produce similar, non-specific clinical symptoms (as in rickettsial diseases), while other TBDs produce highly variable symptoms (as in Lyme disease)<sup>1,2</sup>. Early recognition and treatment of TBDs by healthcare providers are important to prevent complications from these diseases and decrease morbidity and mortality. Most TBDs, including those listed in Table 1, are reportable to public health authorities in West Virginia from healthcare providers and laboratories. The purpose of this summary is to describe the epidemiology of TBDs reported in West Virginia in 2011.

Table 1. Possible tickborne diseases by causative agent based on vectors found in West Virginia<sup>3</sup>.

Tickborne Disease <sup>a</sup>	Agent	Tick Vector(s) in West Virginia
Anaplasmosis	<i>Anaplasma phagocytophilum</i>	Black-legged tick ( <i>Ixodes scapularis</i> ) <sup>b</sup>
Babesiosis	<i>Babesia microti</i> and other <i>Babesia</i> spp.	Black-legged tick ( <i>Ixodes scapularis</i> )
Ehrlichiosis	<i>Ehrlichia chaffeensis</i> and <i>Ehrlichia ewingii</i>	Lone star tick ( <i>Amblyomma americanum</i> )
Lyme disease	<i>Borrelia burgdorferi</i>	Black-legged tick ( <i>Ixodes scapularis</i> )
Powassan encephalitis	Powassan virus	Groundhog tick ( <i>Ixodes cookei</i> ) <sup>c</sup> Black-legged tick ( <i>Ixodes scapularis</i> )
Rocky Mountain Spotted Fever and other spotted fever rickettsioses	<i>Rickettsia rickettsii</i> (and other spotted fever group <i>Rickettsia</i> spp.)	American dog tick ( <i>Dermacentor variabilis</i> ) Brown dog tick ( <i>Rhipicephalus sanguineus</i> )
Tularemia	<i>Francisella tularensis</i>	American Dog tick ( <i>Dermacentor variabilis</i> ) Lone star tick ( <i>Amblyomma americanum</i> )

<sup>a</sup> Other tickborne diseases, including but not limited to Colorado tick fever, tickborne encephalitis, and Crimean-Congo hemorrhagic fever, may result from travel to regions where these illnesses are endemic.

<sup>b</sup> *I. scapularis* is also commonly referred to as the deer tick.

<sup>c</sup> *I. cookei* does not have an official common name. Names that have been used include the groundhog tick, woodchuck tick, and the American castor bean tick.

## Methods

### Surveillance and Case Ascertainment Methods

During the study period (January 1<sup>st</sup>, 2011 to December 31<sup>st</sup>, 2011), passive surveillance was conducted for TBDs in West Virginia. West Virginia State Code 16-3-1 and 64CSR7 establishes infectious disease reporting requirements for healthcare providers and laboratories. Local health departments conducted initial case investigations after receiving a case report or positive laboratory

results for a reportable TBD. Cases were reported from local health departments to the state health department electronically using the West Virginia Electronic Disease Surveillance System (WVEDSS).

Cases reported by local health departments during the study period were reviewed by the state health department before a final case classification status was assigned. All case classifications were determined using the “2010 Nationally Notifiable Diseases and Conditions and Current Case Definitions<sup>4</sup>.” Once final case status was determined, cases were reported by the state health department to the Centers for Disease Control and Prevention (CDC) via the National Electronic Telecommunications System for Surveillance (NETSS).

#### *Data Extraction and Analyses*

Demographic and clinical information about suspect, probable, and confirmed cases of each TBD were exported from WVEDSS to an Excel database for each TBD listed in Table 1. For the purposes of this study, only probable and confirmed cases with report dates from January 1<sup>st</sup>, 2011 to December 31<sup>st</sup>, 2011 were included in analyses. County- and state-level census estimates were obtained through the U.S. Census Bureau for 2011 at <http://www.census.gov/popest/data/cities/totals/2011/index.html>. Charts were created using Microsoft Excel 2010.

#### *Active Tick Surveillance*

In cooperation with the National Park Service, regular biweekly tick surveys began on September 14<sup>th</sup>, 2011 and were conducted in two West Virginia national parks: Harper’s Ferry National Historic Park (Jefferson County) and New River Gorge River (Fayette, Raleigh, and Summers Counties). Tick drag surveys were also conducted in the following state forests: Greenbrier State Forest (Greenbrier County), Cabwaylingo State Forest (Wayne County), Kumbrabow State Forest (Randolph County), Seneca State Forest (Pocahontas County), and Cooper’s Rock State Forest (Monongalia and Preston Counties). Sporadic tick surveys were conducted in Kanawha County. Ticks from deer were provided by the West Virginia Division of Natural Resources.

Surveyors used the standard tick drag methods to collect specimens<sup>5</sup>. A tick drag cloth was dragged along the forest ground and examined every 20 meters for 100 meters. The route was then done in the reverse direction. Ticks found on the cloth were removed, preserved in 70% ethanol, and returned to the lab for species identification, sex determination, and pathogen screening. The Army Institute of Public Health (Aberdeen, MD) tested ticks collected from national parks for *Anaplasma phagocytophilum*, *Borrelia burgdorferi*, and *Babesia microti* using polymerase chain reaction (PCR).

## **Results**

In 2011, there were 126 probable and confirmed TBD cases reported. Conditions reported included anaplasmosis, ehrlichiosis, Rocky Mountain spotted fever (RMSF), and Lyme disease. Table 2 summarizes the data for 2011. No cases of Powassan virus or tularemia were reported during this period.

Table 2. Summary of reporting statistics for TBDs reported in West Virginia in 2011.

Disease Name	Total number of cases reported for 2011 (%)	Number of counties with confirmed or probable cases	Incidence per 100,000
Anaplasmosis	2 (1.6)	2	0.11
Ehrlichiosis	1 (0.8)	1	0.05
RMSF	4 (3.1)	3	0.22
Lyme disease	119 (94.5)	8	6.41

#### *Anaplasmosis*

Two probable cases of anaplasmosis were reported in 2011. Cases were reported from Kanawha and Berkeley counties with illness onsets in June and November, respectively. Age of cases ranged from 5 to 56 years of age; one (50%) case was female. Both patients were hospitalized; no deaths were reported.

#### *Ehrlichiosis*

One probable case of ehrlichiosis was reported from Mason County with an illness onset in July. The case was hospitalized and was reported to have survived.

#### *Rocky Mountain spotted fever*

Four probable cases of RMSF were reported in 2011; two in Greenbrier County and one each in Kanawha and Wayne Counties. The dates of onset for all cases occurred in late-spring to early summer (Figure 5). Cases ranged from 21 to 68 years of age; 2 (50%) cases were female. Two cases were hospitalized and no deaths were reported as a result of illness.

#### *Lyme disease*

There were 119 confirmed and probable Lyme disease cases reported in West Virginia during 2011 accounting for 94.4% (119/126) of all TBD cases reported during this period. Cases of Lyme disease were reported from eight counties across the state (Figure 1). Berkeley and Jefferson Counties, located in the Eastern Panhandle, had the highest proportion of cases with 62 (52.1%) and [39-36](#) (32.8%) cases, respectively. Berkeley, Hampshire, Jefferson, and Morgan Counties all had incidence rates greater than 30 per 100,000 people (based on population estimates for each county). All other counties with cases had incidence rates below 10 per 100,000 people.

The highest proportion of Lyme disease cases reported illness onset during the warm weather months (Figure 2); 85 (78.1%) cases had illness onset dates from May to September. Among females, [7](#) the highest incidence occurred in the 1-10 and 51-60 age groups; the highest incidence among males occurred in the 1-10 and 61-70 age groups. Males  $\leq$ 50 years of age had a higher incidence of Lyme disease as compared with females in the same age group (Figure 3). No deaths were reported as a result of illness.

Over half of the Lyme disease cases had EM (54.6%) (Figure 4). Arthritis (51.3%) was the second most reported finding followed by Bell's palsy (10.1%). Seven cases (5.9%) were hospitalized and no deaths were reported.

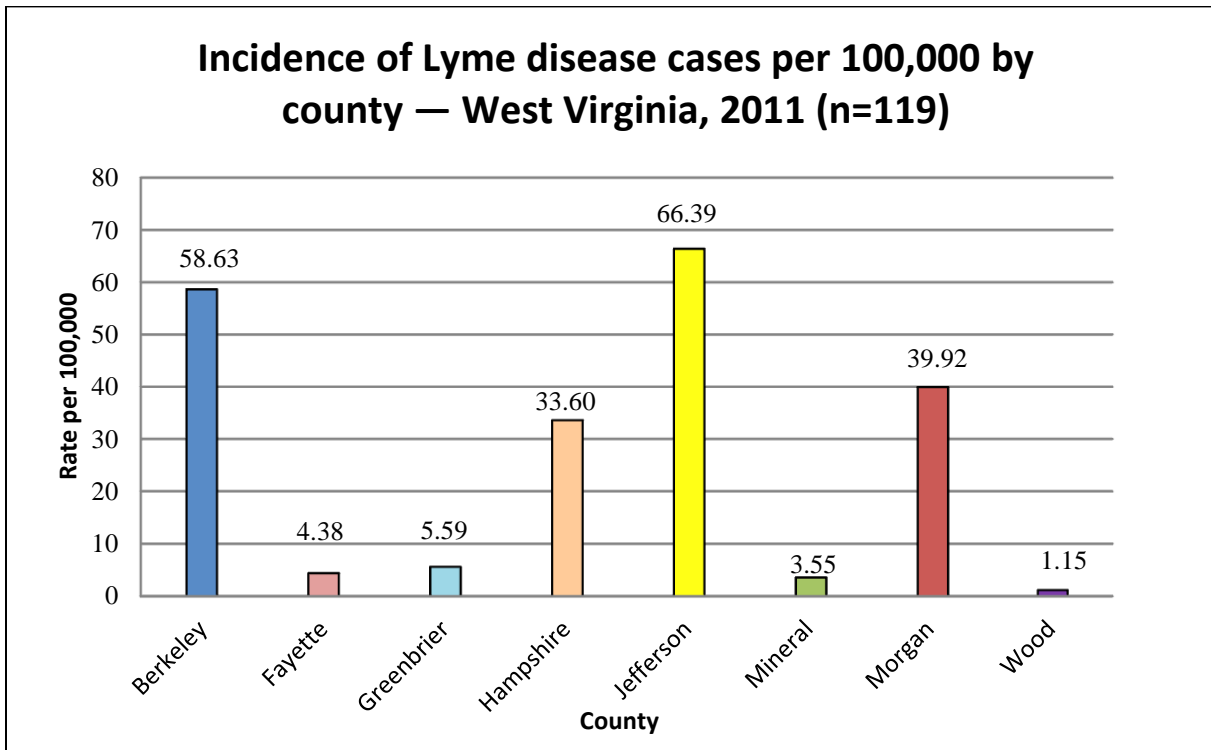


Figure 1. Incidence of Lyme disease cases by county. Estimates are based on 2011 census data for each county.

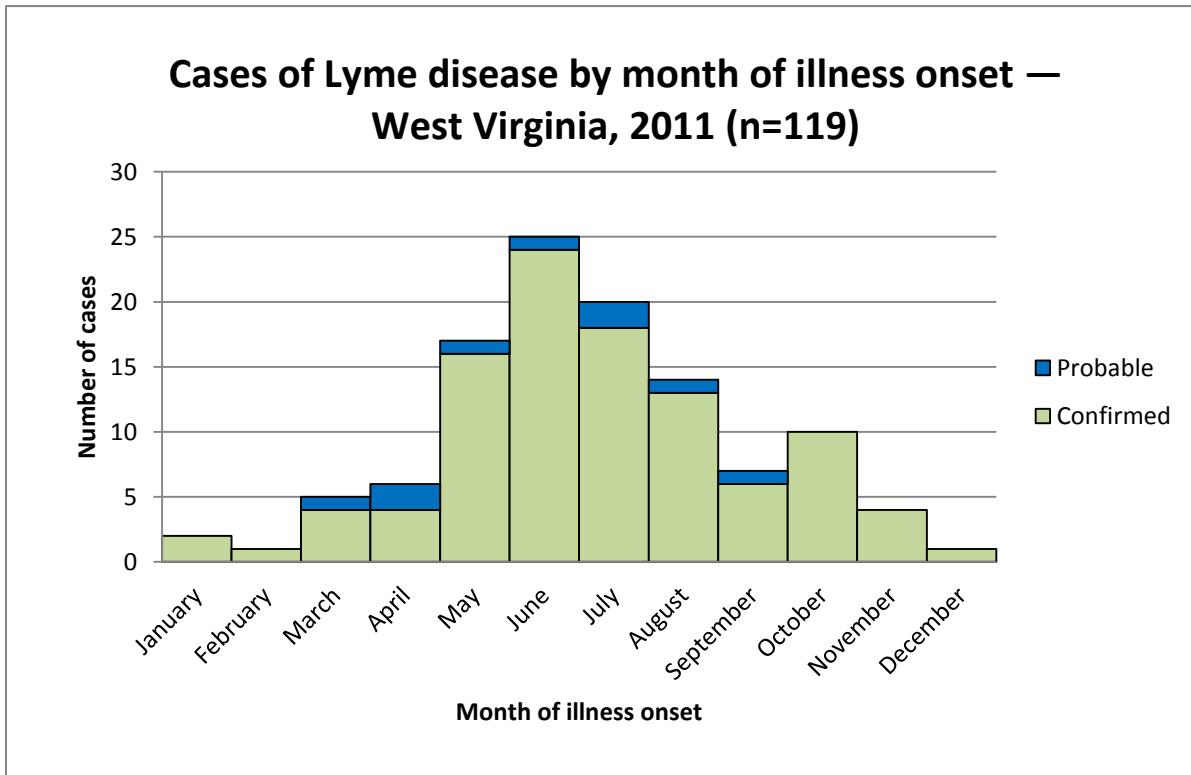


Figure 2. Month of illness onset for probable and confirmed cases of Lyme disease. Date of illness onset was missing for seven cases.

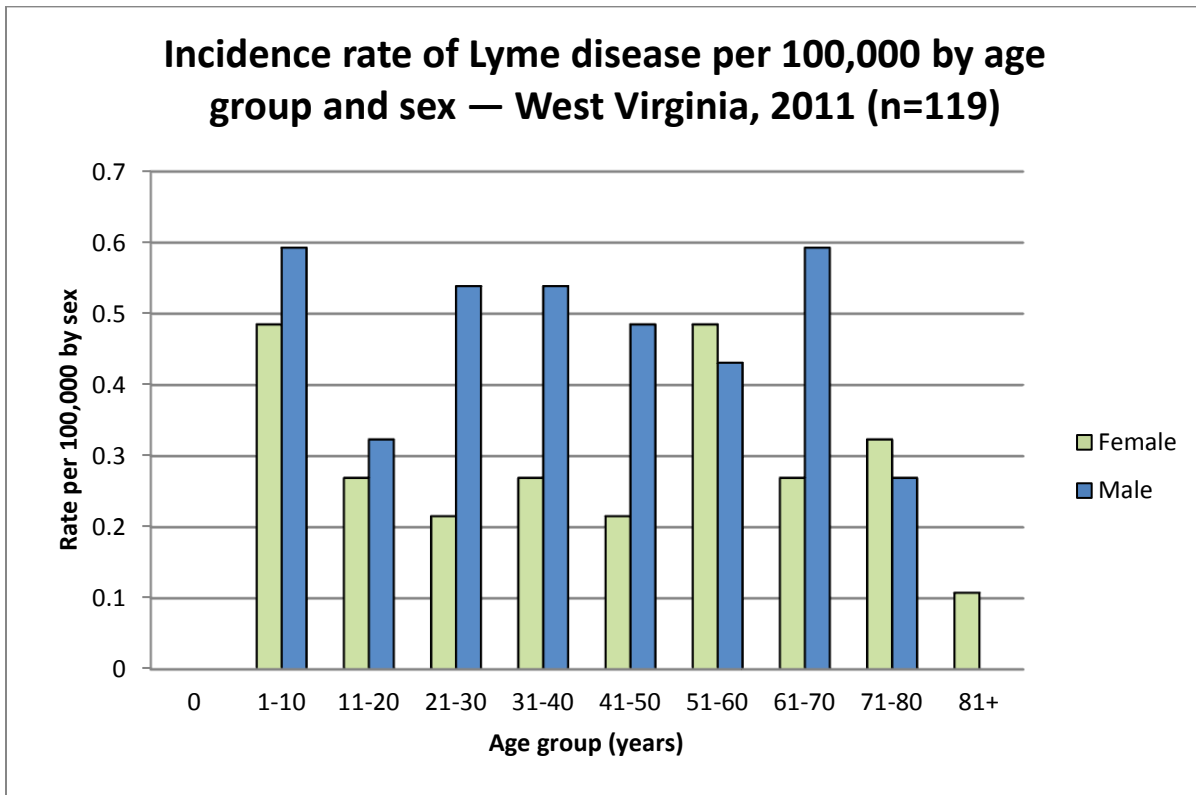


Figure 3. Incidence of Lyme disease by age group and sex.

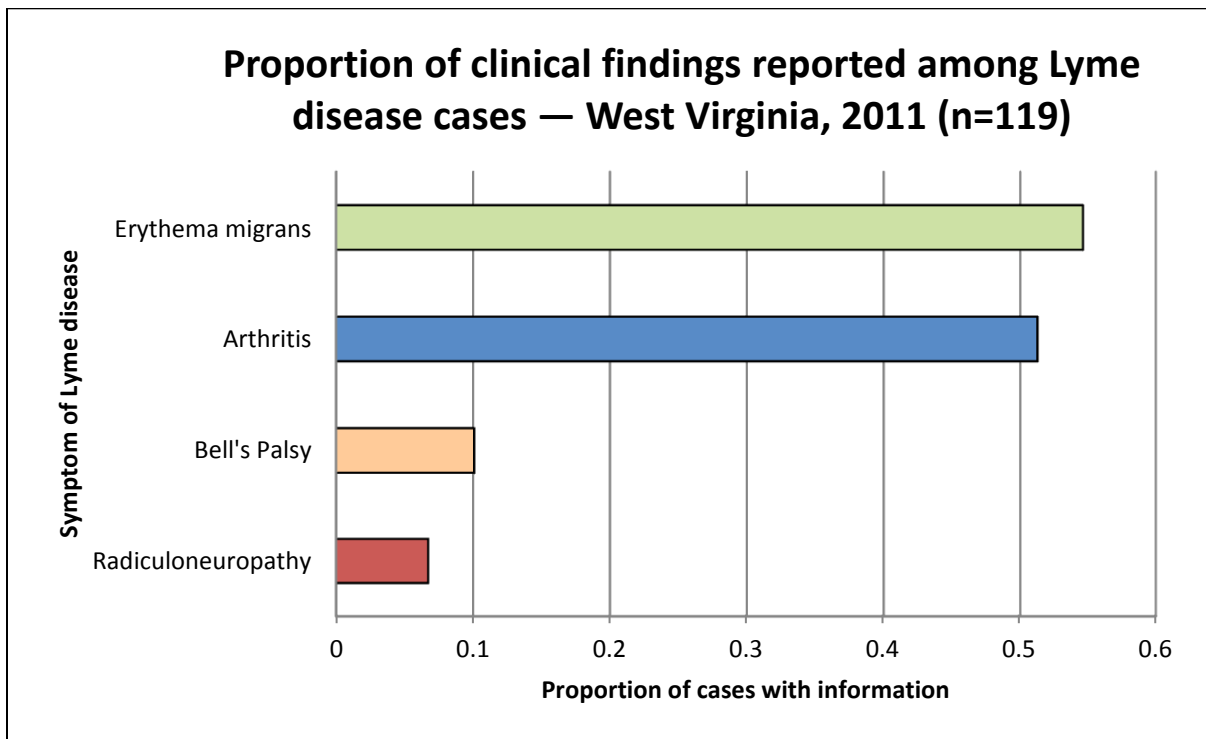


Figure 4. The four most common clinical manifestations reported for probable and confirmed Lyme disease cases.

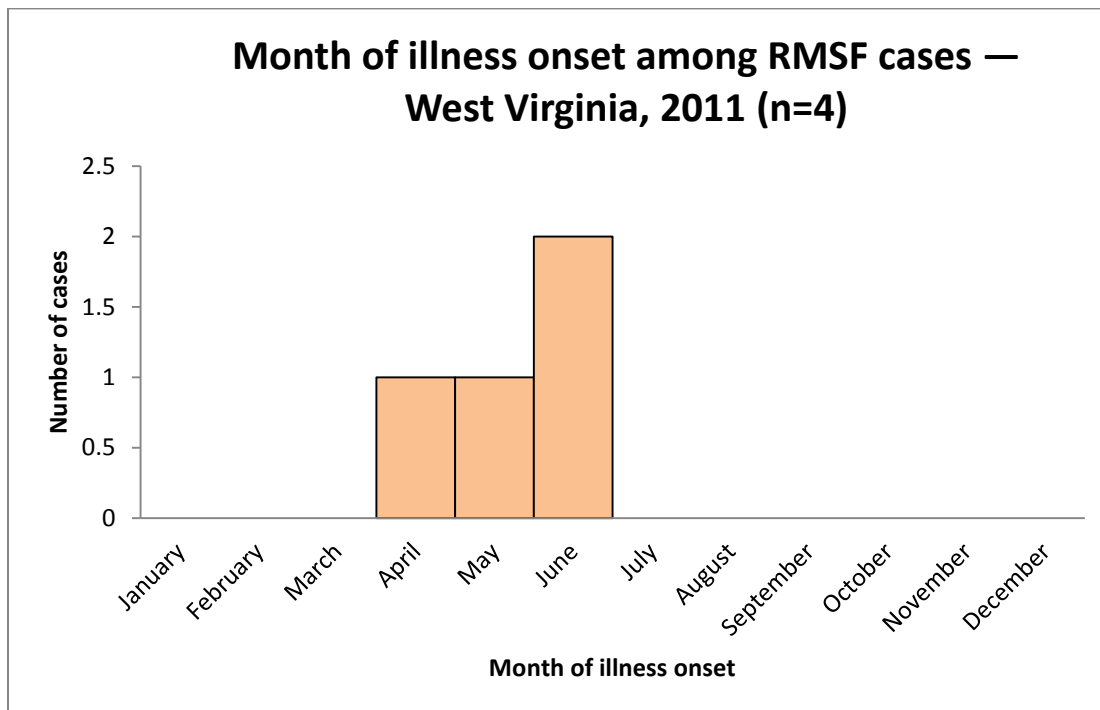


Figure 5. Month of illness onset for Rocky Mountain spotted fever cases. Four total cases were reported between late-spring and early summer.

### Tick Surveillance

Black-legged ticks were found in Harper’s Ferry National Park while no ticks were recovered from New River Gorge National River during the 2011 survey. Black-legged ticks from Harpers Ferry were negative for *Borrelia burgdorferi*, *Anaplasma phagocytophilum* and *Babesia microti*. Black-legged tick was also found on white-tailed deer captured at three separate localities in Hampshire County.

### Discussion

Four TBDs were reported in West Virginia during 2011: anaplasmosis, ehrlichiosis, Lyme disease, and Rocky Mountain spotted fever. Lyme disease accounted for the majority of cases, followed by Rocky Mountain spotted fever, anaplasmosis, and ehrlichiosis (Table 2). Though the vectors of tularemia (*D. variabilis* and *Amblyomma americanum*) and Powassan encephalitis (*I. cookei* and *I. scapularis*) have been identified in the state, there were no reports during the time period. Additionally, there have been no reports of either disease in the past five years (Powassan virus has never been identified in West Virginia).

Babesiosis, a TBD caused by *Babesia* spp. bacteria and transmitted by *Ixodes scapularis*, is on the rise in the United States. This emerging TBD primarily occurs in the northeast and Midwest; yet, there is cause for concern given that the tick vector for the disease is present in West Virginia. Eighteen states reported babesiosis in 2011, including Maryland with four cases<sup>6</sup>. Most babesiosis cases had symptom onset in June, July, and August, similar to what is seen for Lyme disease cases. Given that both babesiosis and Lyme disease are transmitted by the same tick vector, it would not be surprising to see cases of babesiosis in West Virginia in the recent future, either by itself or as coinfection with

Lyme disease. CDC provides additional information about babesiosis on its website:

<http://www.cdc.gov/parasites/babesiosis/>.

In 2010, an evaluation was done in West Virginia to determine which counties would be considered “endemic” for Lyme disease based on 2007-2009 surveillance data. An endemic county is “...one in which at least two confirmed cases have been acquired in the county or in which established populations of a known tick vector are infected with *B. burgdorferi*.” Results were based on confirmed cases who had documented EM, known exposure within West Virginia, and met laboratory criteria based on the national case definition of Lyme disease. Using these criteria, three counties were determined to be endemic counties: Berkeley, Jefferson, and Morgan Counties. From analysis of 2010 and 2011 Lyme disease case reports, Hampshire County meets the same criteria for being classified as an endemic county; two cases in 2010 and one case in 2011 met the clinical, exposure, and laboratory criteria for the county to be considered endemic (Appendix A).

There are limitations to the current report. First, underreporting of TBDs in West Virginia is likely. Cases may not seek medical attention unless symptoms or clinical manifestations of disease become severe and cannot be resolved without treatment. Misdiagnosis of disease is possible due to inaccurate laboratory test results and/or provider diagnostic error. Second, there is also the possibility of case misclassification. For example, case ascertainment for Lyme disease requires clinical, laboratory, and epidemiologic evidence. If information is missing, a true case may be classified as either “suspect,” or “not a case.” In 2011, there were 14 “suspect” cases of Lyme disease that were not included in the analyses of this summary. This highlights the importance of obtaining quality laboratory, clinical, and epidemiologic information to ensure that appropriate surveillance is being conducted. Lastly, there are limited resources for tick surveillance efforts. It would be difficult to survey all 55 counties in West Virginia for ticks.

As TBDs remain an important concern in West Virginia, surveillance is essential to understanding the distribution and incidence of these diseases. Although the incidence of some TBDs is currently low in West Virginia, human cases of TBDs are expected to increase in the near future due to climate change, increased human sprawl into forest habitat where tick vectors reside, and increased population of tick hosts (like the white-tailed deer)<sup>8</sup>. Quality surveillance allows for monitoring of changes in the occurrence of TBDs and identification of emerging TBDs at the local, state, and national level. Therefore, it is important to obtain timely and accurate data during TBD case investigations.

Due to the low number of cases for RMSF, ehrlichiosis, and anaplasmosis in West Virginia, targeted recommendations cannot be made for preventing these diseases. However, there were some trends noted among Lyme disease cases. The majority of Lyme disease cases (113/119) occurred in “endemic” counties from the Eastern Panhandle, accounting for 95% of confirmed and probable cases reported. Males were more likely overall to be infected with Lyme disease (70/119), particularly, between the ages of 21 to 50. Young children in the 1-10 years age group were also at higher risk for infection with an incidence rate of 1.1 cases per 100,000. Therefore, Lyme disease prevention efforts should be targeted towards residents of (and visitors to) the Eastern Panhandle, males, and young children.

Prevention of tickborne illnesses focuses primarily on avoiding tick bites. A tickborne illness prevention checklist can be found at <http://www.dhhr.wv.gov/oeps/disease/Zoonosis/Tick/Documents/Tick%20Bite%20Prevention%20Checklist.pdf>. In addition, CDC provides recommendation for the prevention of TBDs, adapted in Box 1. Because ticks are more active in warmer months, it is also important to make the public aware of the risk of becoming infected with any TBD from late-spring to early-fall. The Division of Infectious Disease Epidemiology (DIDE) sends out a yearly health advisory to provide important information about the start of TBD season. A link to the 2011 health advisory can be found at (<http://www.dhhr.wv.gov/oeps/disease/Documents/WV%20HAN%20Advisory%2044.pdf>).

Box 1. CDC recommended steps for tick bite prevention<sup>7</sup>.

- Be extra vigilant in warmer months (April-September) when ticks are most active.
- Avoid wooded and bushy areas with high grass and leaf litter.
- Walk in the center of trails.
- Repel ticks with DEET or permethrin. Use repellents that contain 20% or more DEET on exposed skin for protection that will last several hours. Use products that contain permethrin on clothing. Treat clothing and gear, such as boots, pants, socks, and tents.
- Find and remove ticks from your body. Bathe or shower as soon as possible after coming indoors to easily find ticks that may be crawling on you.
- Conduct a full-body tick check using a hand-held or full-length mirror to view all parts of your body upon returning from tick-infested areas.
- Parents should check their children for ticks under the arms, in and around the ears, inside the belly button, behind the knees, between their legs, around the waist, and especially in their hair.
- Examine gear and pets. Ticks can ride into the home on clothing and pets. Tumble clothes in a dryer on high heat for an hour to kill ticks that may be attached.

To assist with surveillance and diagnosis of TBDs, the West Virginia Department of Health and Human Resources provides laboratory support to healthcare providers for Lyme disease and RMSF. RMSF testing can be coordinated through the Division of Infectious Disease Epidemiology by calling 1-800-423-1271. The West Virginia Office of Laboratory Services provides Lyme disease testing free-of-charge. Information about this service can be obtained at <http://www.wvdhhr.org/labservices/labs/serology/index.cfm> or by calling 304-558-3530, ext. 2410.



## References

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**Appendix A: Counties in West Virginia considered endemic for Lyme disease.**

