

# 2013 West Virginia Tickborne Disease Surveillance Summary



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## 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 with 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 is 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 2013.

**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>	Blacklegged tick ( <i>Ixodes scapularis</i> ) <sup>b</sup>
Babesiosis	<i>Babesia microti</i> and other <i>Babesia</i> spp.	Blacklegged 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>	Blacklegged tick ( <i>Ixodes scapularis</i> )
Powassan encephalitis	Powassan virus	Groundhog tick ( <i>Ixodes cookei</i> ) <sup>c</sup> Blacklegged 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> ) Lone star tick ( <i>Amblyomma americanum</i> ) Gulf Coast tick ( <i>Amblyomma maculatum</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 (2013 MMWR week 1 to MMWR 52), 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 most current case definition for each disease or condition. 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 MMWR week 1 to MMWR week 52 were included in analyses. County- and state-level census estimates were obtained through the U.S. Census Bureau for 2013 at

<http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>.

#### *Active Tick Surveillance*

Most active tick surveillance activities were directed to northern West Virginia due to the recent *I. scapularis* activity in surrounding counties in Pennsylvania and Ohio and the large number of *I. scapularis* submissions from veterinary clinics in the northern part of the state. In northern West Virginia, tick drag surveys were conducted in Cooper's Rock State Forest (Monongalia and Preston counties), Westvaco Natural Resources Center (Preston County), Tomlinson Run State Park (Hancock County), Blackwater Falls State Park (Tucker County), Grand Vue Park (Marshall County), and Brook Hills Farm (Brook County). Sporadic tick surveys were conducted throughout Kanawha County including Kanawha State Forest. Active tick surveillance was done at the Summit Bechtel Reserve prior to the 2013 National Scout Jamboree.

Surveyors used the standard tick drag method to collect specimens<sup>4</sup>. A tick drag cloth was dragged along the forest ground. Ticks found on the cloth were removed, preserved in 70% ethanol, and returned to the laboratory for species identification, sex determination, and human pathogen screening. Using polymerase chain reaction (PCR), the Army Institute of Public Health Command (Aberdeen, MD) tested *I. scapularis* for *Borrelia burgdorferi* and *Anaplasma phagocytophilum* and American dog ticks for *Rickettsia* spp.

Participants of the 2013 National Boy Scout Jamboree were encouraged to submit ticks to the West Virginia Department of Health and Human Resources Tick Surveillance Program. Ticks were stored in individual microcentrifuge vials along with information about collection locality, collection date, medical facility submission site, and submitter/patient identification. Specimens were submitted to the public health entomologist for species identification and the Army Institute of Public Health screened the tick specimens for human pathogens. Due to the extended time between tick collection and human pathogen testing, these studies were meant for surveillance purposes and not for individual, medical diagnostic purposes.

#### *Veterinary Tick Submission Project*

In 2013, veterinarians across West Virginia were invited to participate in tick surveillance through a project called the West Virginia Veterinary Tick Submission Project (WVVTSP). Ticks found on

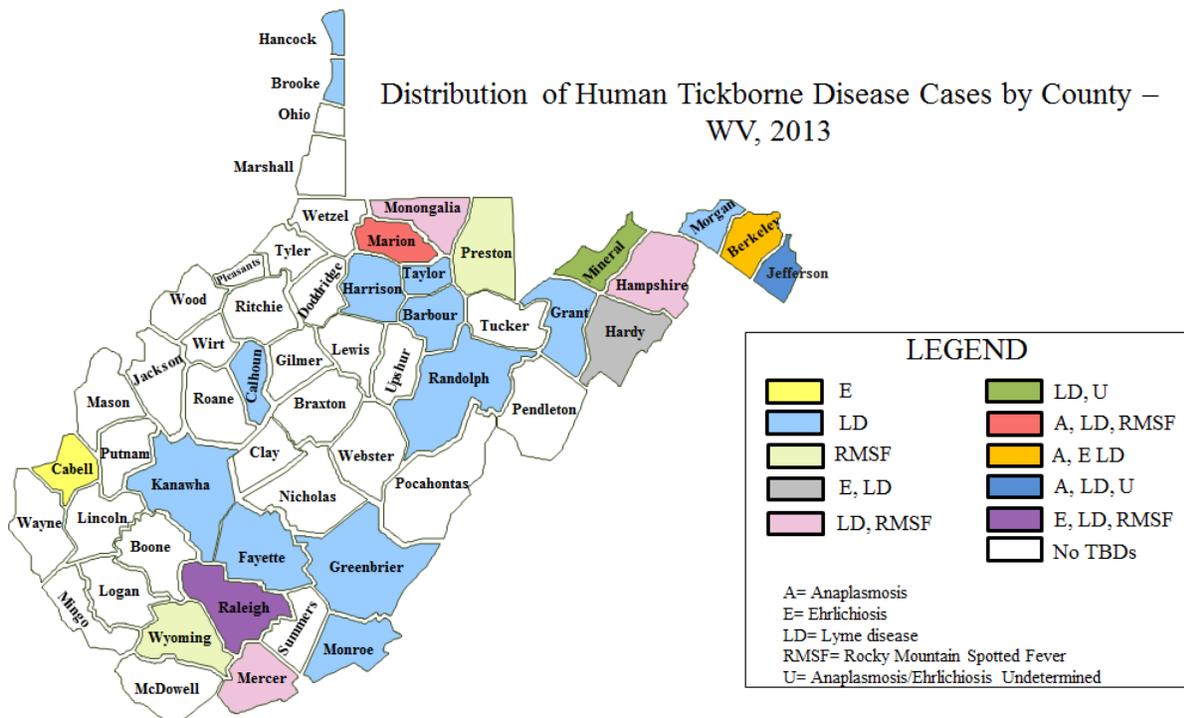
animal clients were mailed to the public health entomologist for identification along with a submission form. Animal species, date of tick collection, home county of animal, and other important data were collected for each submission.

## Results

In 2013, there were 159 probable and confirmed TBD cases reported from 24 counties in WV (Figure 1). Conditions reported included anaplasmosis, ehrlichiosis, anaplasmosis/ehrlichiosis undetermined, Rocky Mountain spotted fever (RMSF), and Lyme disease. Table 2 summarizes the data for 2013. No cases of babesiosis, Powassan virus, or tularemia were reported during this period.

**Table 2.** Summary of reporting statistics for TBDs reported in West Virginia in 2013.

Disease Name	Total number of cases reported in 2012	Total number of cases reported in 2013	Number of counties with cases (2013)	Incidence per 100,000 (2013)
Anaplasmosis	0	3	3	0.2
Ehrlichiosis	0	4	4	0.3
Anaplasmosis/ Ehrlichiosis Undetermined	2	2	2	0.1
RMSF	2	7	7	0.4
Lyme disease	97	143	22	7.7
<b>TOTAL</b>	<b>101</b>	<b>159</b>		



**Figure 1.** Counties in West Virginia that reported at least tickborne disease. Twenty-four of the state’s 55 (43.6%) counties reported in at least one TBD in 2013.

### *Anaplasmosis*

Two probable and one confirmed case of anaplasmosis were reported during the MWWR year 2013. Cases were reported from Berkeley, Jefferson, and Marion Counties. The cases were all females, ages 51, 59, and 68. One was hospitalized, and no deaths were reported.

### *Ehrlichiosis*

Three probable and one confirmed case of ehrlichiosis were reported during the MWWR year 2013. Cases were reported from Berkeley, Cabell, Hardy, and Raleigh Counties. Two cases were male and two were female. Their ages were 19, 47, 57, and 64. Three cases were hospitalized, and no deaths were reported.

### *Anaplasmosis/Ehrlichiosis, Undetermined*

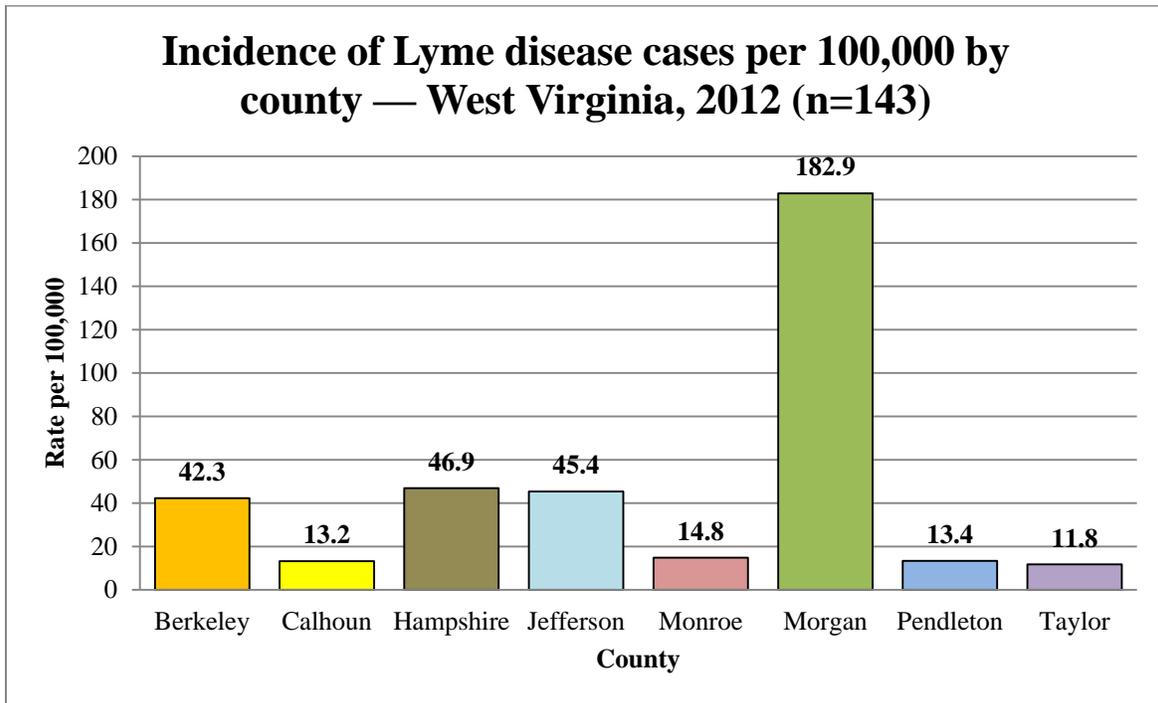
Two probable anaplasmosis/ehrlichiosis cases were reported in 2013; one in Jefferson County and one in Mineral County. The cases were both male, 50 and 52 years of age. Both were hospitalized, and no deaths were reported.

### *Rocky Mountain spotted fever*

Six probable cases and one confirmed case of RMSF were reported in 2013. Cases were reported in Hampshire, Marion, Mercer, Monongalia, Preston, Raleigh, and Wyoming Counties. Five cases were male and two were female. Their ages were 30, 31, 35, 45, 53, 55, and 85 years of age. Six cases were hospitalized, and no deaths were reported.

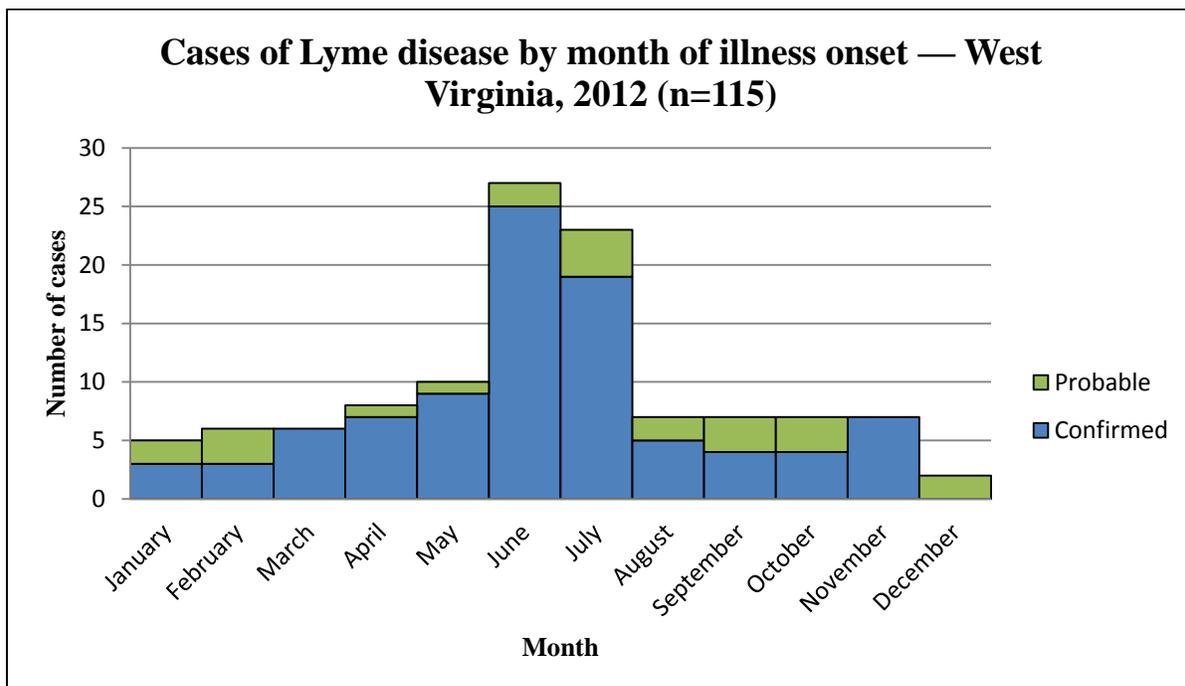
### *Lyme disease*

There were 143 confirmed and probable Lyme disease cases reported in West Virginia during MMWR year 2013 accounting for 89.9% (143/159) of all TBD cases reported during this period. Cases of Lyme disease were reported from 23 counties across the state (Figure 2). Berkeley and Morgan Counties, located in the Eastern Panhandle, had the highest proportion of cases with 46 (32.2%) and 32 (54.5%) cases, respectively. Berkeley, Hampshire, Jefferson, and Morgan Counties all had incidence rates greater than 20 per 100,000 people (based on population estimates for each county). All other counties with cases had incidence rates below 20.0 per 100,000 people.

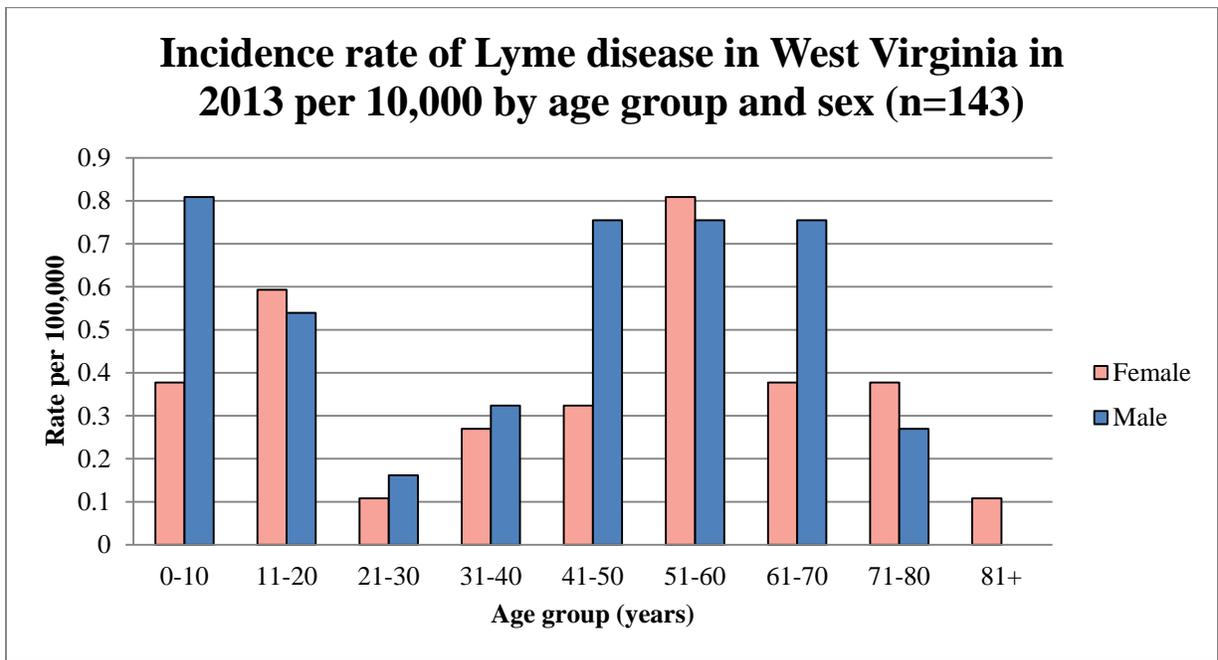


**Figure 2.** Incidence of Lyme disease cases by county. Estimates are based on 2012 census data for each county. Only counties with incidence rates above 10.0 per 100,000 are shown.

The highest proportion of Lyme disease cases reported illness onset during the warm weather months (Figure 3); 81 (70.4%) cases reported illness onset dates from May to August. Among females, the highest incidence occurred in the 51-60 age group; the highest incidence among males occurred in the 0-10 age group (Figure 4). No deaths were reported as a result of illness.



**Figure 3.** Month of illness onset for probable and confirmed cases of Lyme disease. Date of illness onset was missing for twenty-eight cases.



**Figure 4.** Incidence of Lyme disease by age group and sex.

#### Active Tick Surveillance

*I. scapularis* has been identified in counties previously unrecorded for the species. A single specimen of this species was found in Brooke County, the first on record in this county. On July 13, five *I. scapularis* nymphs were collected in Westvaco Natural Resources Center (Preston County). Thirteen adult *I. scapularis* females and six adult males were also collected in Hancock County on October 25. Three (16%) ticks were positive for *Borrelia burgdorferi* and one (5%) of the ticks was infected with *Anaplasma phagocytophilum* from the Hancock County sample. None were coinfecting with both pathogens. *I. scapularis* populations have become established in Preston and Hancock counties as defined in Dennis et al. (1998)<sup>5</sup>, and the blacklegged tick population in Kanawha County discovered in 2012 was active again in 2013. Ticks from Preston County and Kanawha County were not infected with either *Borrelia burgdorferi* or *Anaplasma phagocytophilum*.

In January 2013, *I. scapularis* ticks were found on a person in Tucker County and one found attached to a person in Hampshire County. One *I. scapularis* tick was found on a person in Greenbrier in May 2013 and another was collected on a human patient one month later in neighboring Summers County.

Nineteen adult *Dermacentor variabilis* were submitted by participants of the 2013 National Boy Scout Jamboree at Summit Bechtel Reserve on July 15-24, 2013. None were infected with *Rickettsia* spp.

#### Veterinary Tick Surveillance

Veterinarians from 27 veterinary clinics in West Virginia submitted 604 ticks from animal clients representing 30 counties. Animals included cats, dogs, humans, rabbits, and raccoons. Five tick species were identified: *Amblyomma americanum*, *Dermacentor variabilis*, *Ixodes cookei*, *Ixodes scapularis*, and *Haemaphysalis leporispalustris*. Ticks came from 31 counties (based on home county of the animal on which the tick was found), including one county in Maryland (Figure 5).



There was an increase in all reported TBDs from the previous year (Table 2). Additionally, the number of counties reporting TBDs more than doubled from 2012; 10 counties reported TBDs in 2012 while 24 reported TBDs in 2013. While the majority of cases reported illness onset in warm months, there was at least one case that reported illness onset in each of the year. *I. scapularis* ticks were collected by physicians from human patients in January 2013, and *I. scapularis* and *I. cookei* ticks were collected by veterinarians in December 2013 from animal clients, indicating that ticks were active even in cold weather.

The majority of cases with tickborne rickettsial diseases (anaplasmosis, ehrlichiosis, and RMSF) were hospitalized (62.5%). These diseases can lead to serious illness (such as bleeding disorders) or death if left untreated. Patients who are treated early may recover quickly making early diagnosis of these diseases very important.

West Virginia borders three states with high incidence of TBDs. Maryland, Pennsylvania, and Virginia rank in the top 13 states that account for about 95% of Lyme disease cases. 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, including travel history, during TBD case investigations.

Two counties have been added as Lyme disease endemic counties as of January 1<sup>st</sup>, 2014: Hancock and Mineral Counties. *B. burgdorferi* infected ticks were found in Hancock County, and Mineral County had at least two human cases with erythema migrans (EM) with the disease acquired within the jurisdiction. West Virginia now has six Lyme disease endemic counties, including Berkeley, Hampshire, Jefferson, and Morgan Counties that were previously classified as endemic (Appendix A).

*I. scapularis* activity in Preston and Hancock Counties is not surprising given that this species has been found in the northern panhandle and neighboring counties in western Pennsylvania and northeastern Ohio<sup>6,7</sup>. Unlike single specimen records (which could represent a tick being accidentally transported to a locality by a visiting vertebrate host), a population record implies tick vectors remaining in the locality each year independent of external tick introductions.

Due to the small sample size and general poor quality of information collected from tick submissions, we can derive few conclusions from tick surveillance done at the National Scout Jamboree. *D. variabilis* was found at all camp sites; however, most ticks were active near Base Camp C (assuming most people submitted ticks to the closest medical facility).

WVVTSP has greatly expanded knowledge of the distribution of tick vectors across the state. Interestingly, the distribution of ticks also seems to coincide with human TBD cases. For example, Marion County reported anaplasmosis, Lyme disease and RMSF, and veterinarians submitted ticks from animal clients that transmit these diseases (*D. variabilis* and *I. scapularis*). For 2014, animal zip code will be collected on the WVVTSP submission form to gather more specific information about the location of potential tick populations. This information will guide on-the-ground tick surveillance efforts across the state.

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. There is also the possibility of case

misclassification. For example, case ascertainment for Lyme disease requires clinical, laboratory, and, sometimes, epidemiologic evidence. If information is missing, a true case may be classified as either “suspect,” or “not a case.” In 2013, there were 15 “suspected” cases of Lyme disease and one “suspected” case of anaplasmosis/ehrlichiosis 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 is limited manpower and laboratory capacity for tick surveillance efforts. It would be difficult to survey all 55 counties in West Virginia for ticks, and testing ticks for pathogens has been done sporadically throughout the years. A major goal for 2014 is to enhance tick surveillance efforts and partner with a laboratory to perform routine pathogen testing on ticks specimens identified and collected.

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.

Box 1. CDC recommended steps for tick bite prevention<sup>3</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 RMSF, testing can be coordinated through the Division of Infectious Disease Epidemiology by calling 1-800-423-1271.

The Zoonotic Disease Group sincerely thanks the many public health partners who contributed to tickborne disease surveillance across the state. Your efforts have provided us with important information presented in this report.

## References

1. CDC. Rocky Mountain spotted fever. Available at: <http://www.cdc.gov/rmsf/> Accessed at 23 August 2013.
2. CDC. Lyme disease. Available at: <http://www.cdc.gov/lyme/> Accessed at 23 August 2013.
3. CDC. Tickborne diseases of the US. Available at <http://www.cdc.gov/ticks/diseases/> Accessed 12 October 2013.
4. Daniels, T. J., R. C. Falco & D. Fish. 2000. Estimating population size and drag sampling efficiency for the blacklegged tick (Acari: Ixodidae). *Journal of Medical Entomology* **37** (3): 357-363.
5. Dennis, D. T., T. S. Nekomoto, J. C. Victor, W. S. Paul & J. Piesman. 1998. Reported distribution of *Ixodes scapularis* and *Ixodes pacificus* (Acari: Ixodidae) in the United States. *Journal of Medical Entomology* **35** (5): 629-635.
6. Amrine, J. 2014. Professor Emeritus, Division of Plant & Soil Sciences, West Virginia University, Morgantown, WV.
7. McKinnon, J. M. 2012. Number of deer ticks surging across Ohio: Insect is only carrier of Lyme disease. Toledo Blade. January 24, 2012.

**Appendix A: Counties in West Virginia considered endemic for Lyme disease 2014.**

