WEST VIRGINIA
2018 ZOONOTIC DISEASE SURVEILLANCE REPORT

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Contents

2018 Mosquito-borne Disease Surveillance Summary

Introduction

Mosquito-borne diseases (MBDs), most of which are viruses, are transmitted through the bite of infected mosquitoes. Surveillance for these diseases in West Virginia (WV) focuses on four endemic arboviruses—La Crosse encephalitis virus (LAC), West Nile virus (WNV), St. Louis encephalitis virus (SLE), and eastern equine encephalitis virus (EEE)—and travel-associated diseases such as chikungunya, dengue fever, malaria, and Zika virus (ZIKV). Historically, LAC has been the mosquito-borne disease of most concern in West Virginia, with up to 40 human cases reported in previous years.

Most people who become infected with endemic MBDs have no clinical symptoms; however, encephalitis (inflammation of the brain) is a potentially life-threatening complication that is often reported among infected persons who develop symptoms. Symptoms generally begin one to two weeks after a mosquito bite and include fever, headache, myalgia, meningitis, and neurologic dysfunction. There is no specific treatment available for arboviral infections.

Environmental surveillance for MBDs monitors local activity in non-human species. Mosquito surveillance is important to understanding the distribution of these vectors and the diseases that they may transmit to humans. Mosquito surveillance is conducted in selected counties across the State from late spring through fall. Horses can become infected with arboviruses resulting in clinical illness. Mosquitoes, dead birds and horses have all been used to help identify WNV and other arboviral disease activity in West Virginia. This surveillance summary describes human cases of MBDs in West Virginia in 2018.

Methods

Surveillance and Case Ascertainment Methods

During the study period (2018 Morbidity and Mortality Weekly Report (MMWR) Year), passive surveillance was conducted for mosquito-borne diseases in West Virginia. West Virginia State Code 16-3-1 and 64CSR7 establish infectious disease reporting requirements for healthcare providers and laboratories. Local health departments (LHDs) conducted initial case investigations after receiving a case report or positive laboratory results for a reportable MBDs. Cases were reported from LHDs to the West Virginia Department of Health and Human Resources, Bureau for Public Health (State Health Department) using the West Virginia Electronic Disease Surveillance System (WVEDSS).

Cases were reviewed by the Zoonotic Disease Program in the State Health Department's Division of Infectious Disease Epidemiology 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 a final case status was determined, cases were reported by the State Health Department to the Centers for Disease Control and Prevention (CDC) via ArboNET.

Data Extraction and Analyses

Surveillance data for confirmed and probable cases of each MBD for MMWR Year 2018 was exported from WVEDSS to an Excel database for analyses. County and state-level census estimates for 2018 were obtained from the U.S. Census Bureau.

Results

Human Surveillance

Table 1 provides a comparison of human cases of MBDs reported in West Virginia from 2013 to 2018. In 2018, 12 cases of MBDs were reported. Two probable cases of WNV were reported, one in Hardy County in September and one in Wyoming County in November. These cases presented with symptoms of severe illness affecting the central nervous system including fever, meningitis, encephalitis, myelitis, stupor, coma, paresis, nerve palsies, abnormal reflexes and convulsions. Six probable cases of LAC were reported from four counties: Fayette, Kanawha, Mercer and Raleigh (Figure 1). Five were neuroinvasive cases and one was non-neuroinvasive. The majority of these cases (n=4, 66.7%) were male. The median age was seven years (average=6.7 years; range=2-13 years). Illness onset for LAC cases began in June (n=1, 16%), July (n=3, 50%) and September (n=2, 33%). All cases were hospitalized as a result of illness and all cases presented with fever and headache and the majority (n=5, 83.3%) presented with encephalitis and fatigue. Less frequently reported symptoms included myalgia and convulsions (n=3, 33.3%) and abnormal movements (n=1, 16.7%). One probable case of dengue fever was reported in an individual who traveled to Thailand. Three confirmed travel-associated malaria cases were reported in persons who traveled to Sub-Saharan Africa where malaria is endemic.

Table 1. Human cases of mosquito-borne disease in West Virginia from 2013 to 2018.

Disease	# (%) of Cases† (2013)	# (%) of Cases† (2014)	# (%) of Cases† (2015)	# (%) of Cases† (2016)	# (%) of Cases† (2017)	# (%) of Cases† (2018)
LAC	11 (69)	3 (33.3)	4 (57.1)	8 (38.1)	4(50)	6 (50)
WNV	1 (6)	0 (0)	0 (0)	1 (4.8)	1 (12.5)	2 (16.7)
Malaria	2 (12.5)	2 (28.6)	2 (28.6)	1 (4.8)	2 (25)	3 (25)
Dengue	2 (12.5)	1 (14.3)	1 (14.3)	0 (0)	0 (0)	1 (8.3)
EEE	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SLE	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Chikungunya	0 (0)	3 (33.3)	0 (0)	0 (0)	0 (0)	0 (0)
Zika	-	-	-	11(52.4)	1* (12.5)	0(0)
Total	16 (100)	9 (100)	7 (100)	21 (100)	8 (100)	12 (100)

*Positive viremic blood donor. †Includes only cases classified as confirmed or probable.

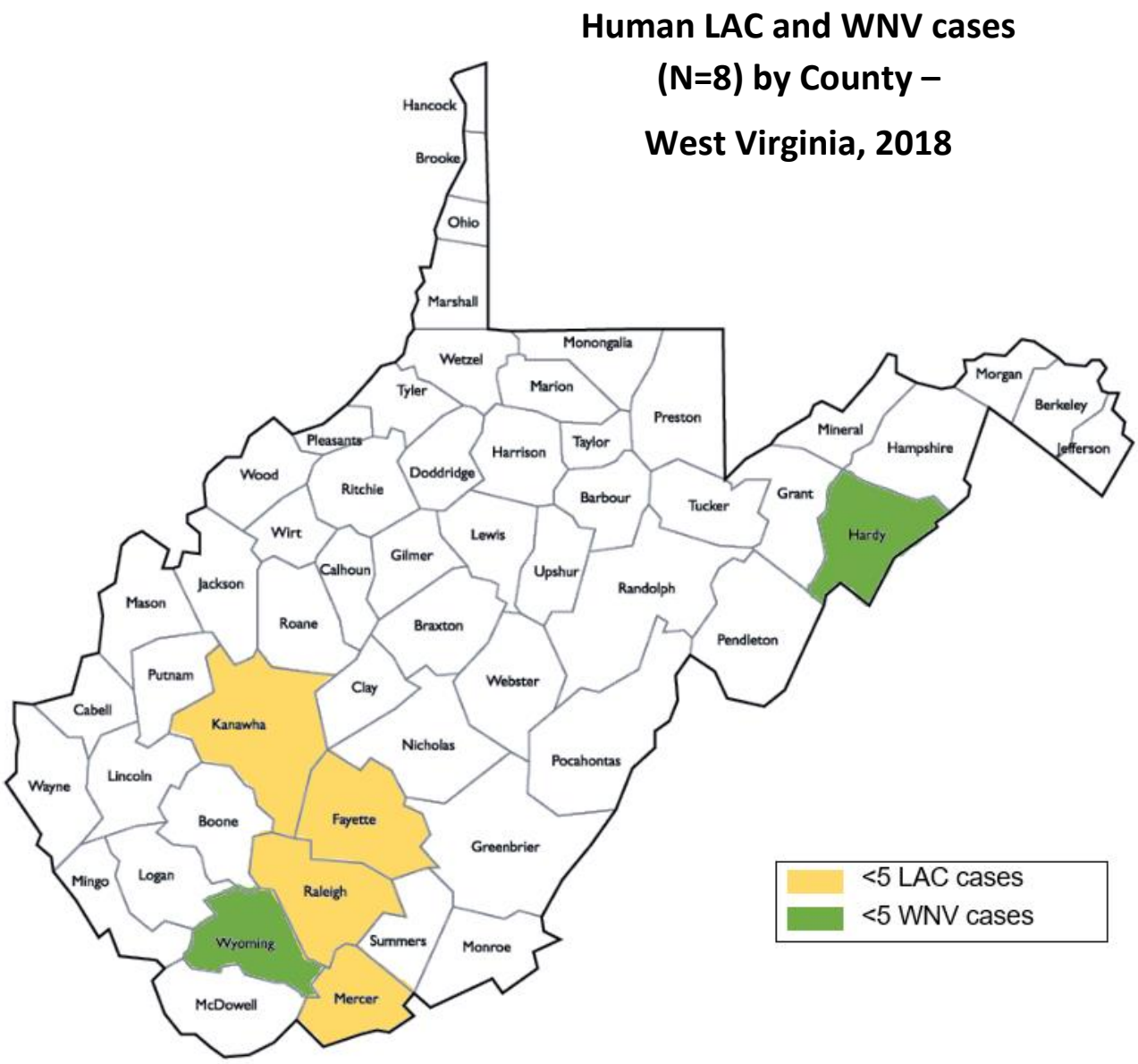

Figure 1. Distribution of human locally transmitted mosquito-borne cases reported in West Virginia in 2018.

Discussion

The incidence of local MBDs was slightly higher for West Virginia in 2018 than in 2017 with six LAC cases in 2018 compared to four reported in 2017, and two WNV cases in 2018 compared to one in 2017. LAC cases followed the epidemiologic trends previously seen in West Virginia: cases were in children under 15 years of age and the majority of cases (n=5, 83.3%) were reported from southern counties. Human WNV cases are commonly noted in areas that have high WNV infection in the mosquito population and are typically seen later in the year as was observed in the two cases in 2018.

Four imported MBD cases occurred in 2018, accounting for 33.3% of all MBD cases reported in the State. It is important that residents from West Virginia who travel internationally be mindful of MBDs endemic

in their destinations. CDC's Traveler's Health website is a good resource for this information available at wwwnc.cdc.gov/travel. Links to CDC pages as well as public health literature on MBDs can be found on the Office of Epidemiology and Prevention Services Mosquito-borne Diseases webpage: oeps.wv.gov/arboviral/Pages/mbd.aspx.

Reducing the risk of mosquito-borne disease means reducing the risk of being bitten by mosquitoes:

- Be aware of the times of day when mosquitoes are most active. For many mosquitoes, peak hours are dusk and dawn. The LAC-transmitting mosquitoes are active during the day.
- Wear protective clothing such as long sleeves, pants, and socks. Use insect repellant that contains DEET, Picaridin, IR3535, or oil of lemon eucalyptus on exposed skin and clothing when outdoors.
- Ensure that window and door screens are intact to keep mosquitoes outside of homes. Remove breeding sites around the home (e.g., any containers that can accumulate water).
- Check with your healthcare provider when traveling abroad to learn about MBDs found in that area of the world.

2018 Tickborne Disease Surveillance Summary

Introduction

Tickborne diseases (TBDs) are transmitted by the bite of 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). Early recognition and treatment of TBDs by healthcare providers can prevent complications from these diseases and decrease morbidity and mortality. Most TBDs, including those listed in Table 1, are reportable to the State Health Department 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 2018.

Table 1. Possible TBD by causative agent based on vectors found in West Virginia.

Tickborne Disease[a]	Agent	Tick Vector(s) in West Virginia
Anaplasmosis	*Anaplasma phagocytophilum*	Blacklegged tick (*Ixodes scapularis*)[b]
Babesiosis	*Babesia microti* and other *Babesia* spp.	Blacklegged tick (*Ixodes scapularis*)
Ehrlichiosis	*Ehrlichia chaffeensis* and *Ehrlichia ewingii*	Lone star tick (*Amblyomma americanum)*
Lyme disease	*Borrelia burgdorferi*	Blacklegged tick (*Ixodes scapularis*)
Powassan encephalitis	Powassan virus	Groundhog tick (*Ixodes cookei*)[c] Blacklegged tick (*Ixodes scapularis*)
Rocky Mountain Spotted Fever and other spotted fever rickettsioses	*Rickettsia rickettsii* (and other spotted fever group *Rickettsia* spp.)	American dog tick (*Dermacentor variabilis*) Brown dog tick (*Rhipicephalus sanguineus)* Lone star tick (*Amblyomma americanum*) Gulf Coast tick (*Amblyomma maculatum*)
Tularemia[d]	*Francisella tularensis*	American dog tick (*Dermacentor variabilis*) Lone star tick (*Amblyomma americanum*)

[a] Other TBD, 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.

[b] *I. scapularis* is also commonly referred to as the deer tick.

[c] *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.

[d] Tularemia cases are included in the "Other ZD Surveillance Summary" since other animal species more commonly transmit tularemia to humans.

Methods

Surveillance and Case Ascertainment Methods

During the study period (2018 MMWR Year), passive surveillance was conducted for TBDs in West Virginia. West Virginia State Code 16-3-1 and 64CSR7 establish infectious disease reporting requirements for healthcare providers and laboratories. LHDs conducted initial case investigations after receiving a case report or positive laboratory results for a reportable TBD. Cases were reported from LHDs to the State Health Department using the WVEDSS.

Cases were reviewed by the Zoonotic Disease Program in the State Health Department's Division of Infectious Disease Epidemiology 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 a final case status was determined, cases were reported by the State Health Department to the CDC via the National Electronic Disease Surveillance System (NEDSS).

Data Extraction and Analyses

Surveillance data for confirmed and probable cases of each TBD for MMWR Year 2018 was exported from WVEDSS to an Excel database for analyses. County- and state-level census estimates for 2018 were obtained from the U.S. Census Bureau.

Results

Human Surveillance

In 2018, 697 confirmed and probable TBD cases were reported from 55 counties in West Virginia. Conditions reported included anaplasmosis, babesiosis, ehrlichiosis, Lyme disease, and spotted fever group rickettsioses (SFGR) (Figure 2, Table 2). No Powassan virus cases were reported.

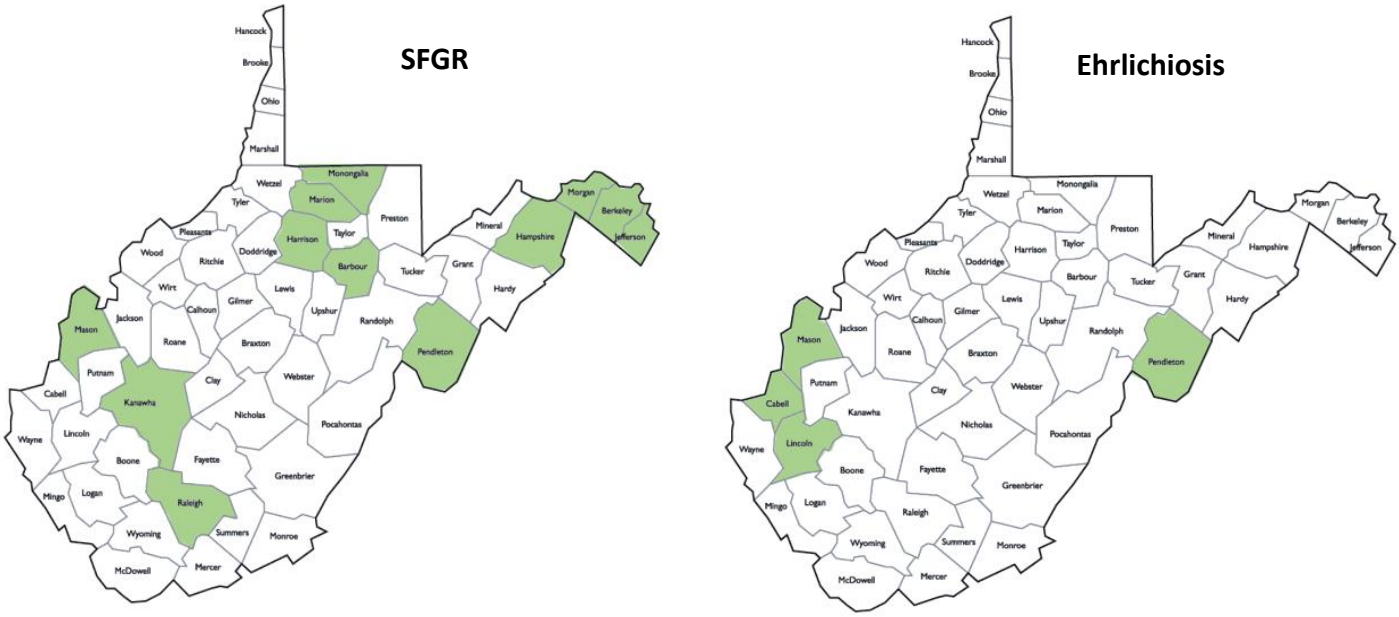

Figure 2. County-level distribution of ehrlichiosis and SFGR cases – West Virginia, 2018,

Table 2. Frequency of TBDs reported in West Virginia from 2014-2018.

Disease Name	# of 2014 cases	# of 2015 cases	# of 2016 cases	# of 2017 cases	# of 2018 cases
Anaplasmosis	2	0	0	2	0
Babesiosis	0	0	0	1	1
Ehrlichiosis	3	5	6	6	4
Anaplasmosis/ Ehrlichiosis undetermined	0	1	0	1	1
RMSF/SGFR	5	9	14	17	20
Lyme disease	136	289	368	648	671
TOTAL	**146**	**304**	**388**	**675**	**697**

Table 3. Frequency of counties reporting TBDs in West Virginia from 2014-2018.

Disease Name	Counties with cases (2014)	Counties with cases (2015)	Counties with cases (2016)	Counties with cases (2017)	Counties with cases (2018)
Anaplasmosis	2	0	0	2	0
Babesiosis	0	0	0	1	1
Ehrlichiosis	3	4	5	6	4
Anaplasmosis/ Ehrlichiosis undetermined	0	1	0	1	1
RMSF/SGFR	5	7	10	14	12
Lyme disease	24	37	42	45	49
***TOTAL**	**24**	**38**	**43**	**47**	**55**

*Note: Counties are mutually exclusive and are not double counted in the total.

Four ehrlichiosis cases (two confirmed and two probable) were reported from Cabell, Lincoln, Mason and Pendleton counties during MMWR Year 2018. Three of the four cases reported hospitalization. Their ages ranged from 47 to 77 years of age. The majority of cases presented with fever (n=4, 100%) and malaise (n=3, 75%). One case had an underlying immunosuppressive condition which reported the previously mentioned symptoms as well as a few more severe symptoms. These symptoms included rash, eschar, nausea and vomiting. An anaplasmosis/ehrlichiosis undetermined case was reported from Upshur County and presented with commonly seen early symptoms including headache, myalgia, malaise, and rash, and had an underlying immunosuppressive condition.

Twenty SFGR cases (one confirmed and 19 probable) were reported during MMWR Year 2018 from 12 counties: Barbour, Berkeley, Hampshire, Harrison Jefferson, Kanawha, Marion, Mason, Monongalia, Morgan, Raleigh, and Wood counties. The majority of cases (n= 12, 60%) were female. Their ages ranged from 28 to 74 years of age. Ten cases reported hospitalization, and there was one death. The symptoms that commonly presented were fever (n=20, 100%), headache (n=12, 60%), malaise (n=13, 65%), myalgia (n=9, 45%), rash (n=11, 55%), nausea (n=9, 45%) and vomiting (n=4, 20%). Four cases (20%) reported underlying immunosuppressive conditions. One babesiosis case was reported from Greenbrier County and was hospitalized.

Lyme disease cases increased during MMWR Year 2018 with 671 cases reported in 2018 (554 confirmed and 117 probable) as compared to 648 cases (503 confirmed and 145 probable) in the previous year. Lyme disease cases accounted for 96% of all TBD cases reported (671 of 697 cases) which is consistent with the past couple of years. The number of counties reporting at least one case increased slightly from MMWR year 2017, from 45 to 49 cases. Twelve counties reported greater than 20 cases. Berkeley (n=46), Hancock (n=83), Harrison (n=39), Monongalia (n=43), and Upshur (n=32) were the five counties that reported the most cases (Figure 3). Figure 4 shows risk of contracting Lyme disease based on incidence rates for individual counties (cases/100,000 population).

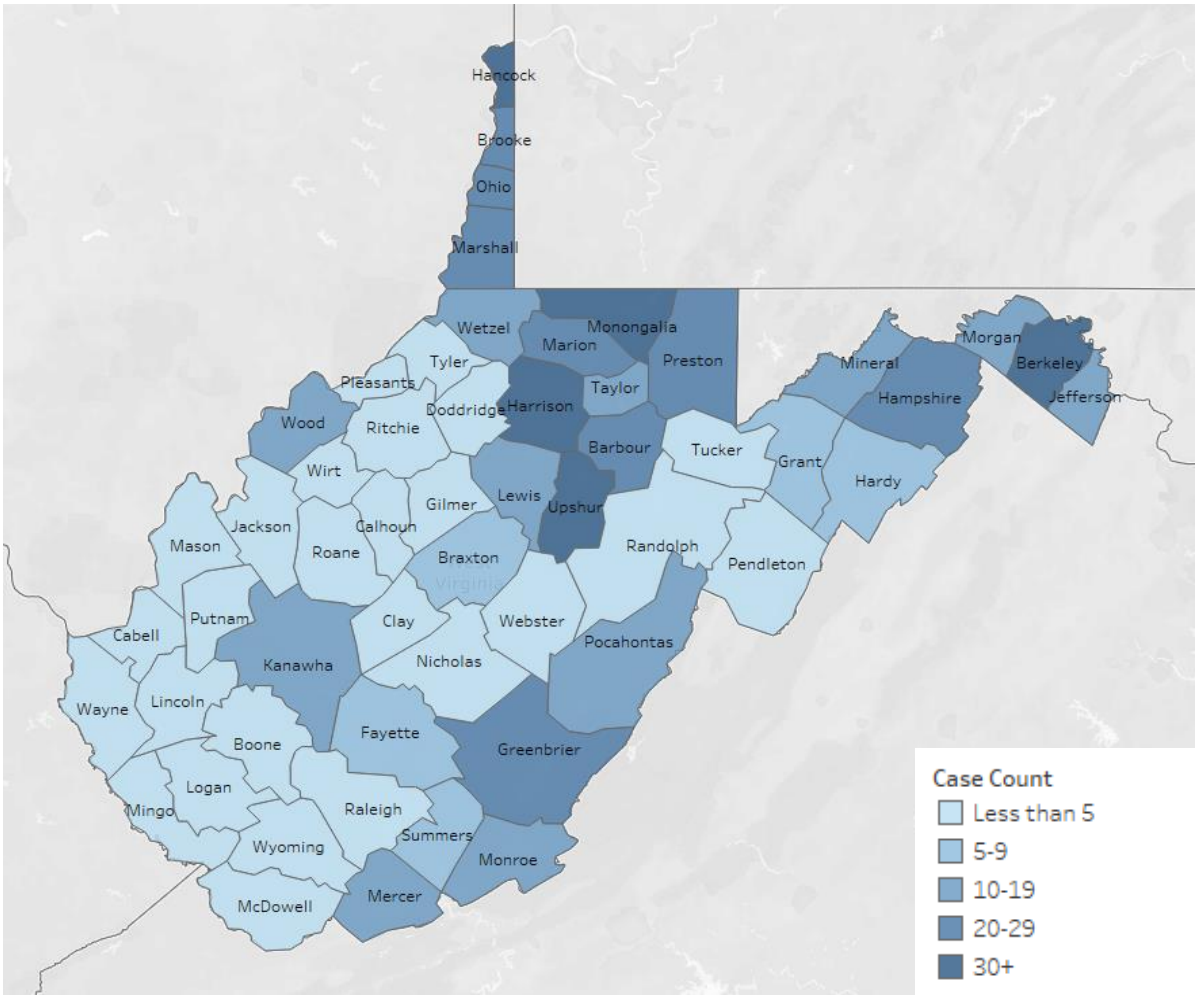

Figure 3. Human Lyme disease cases – West Virginia, MMWR Year 2018.

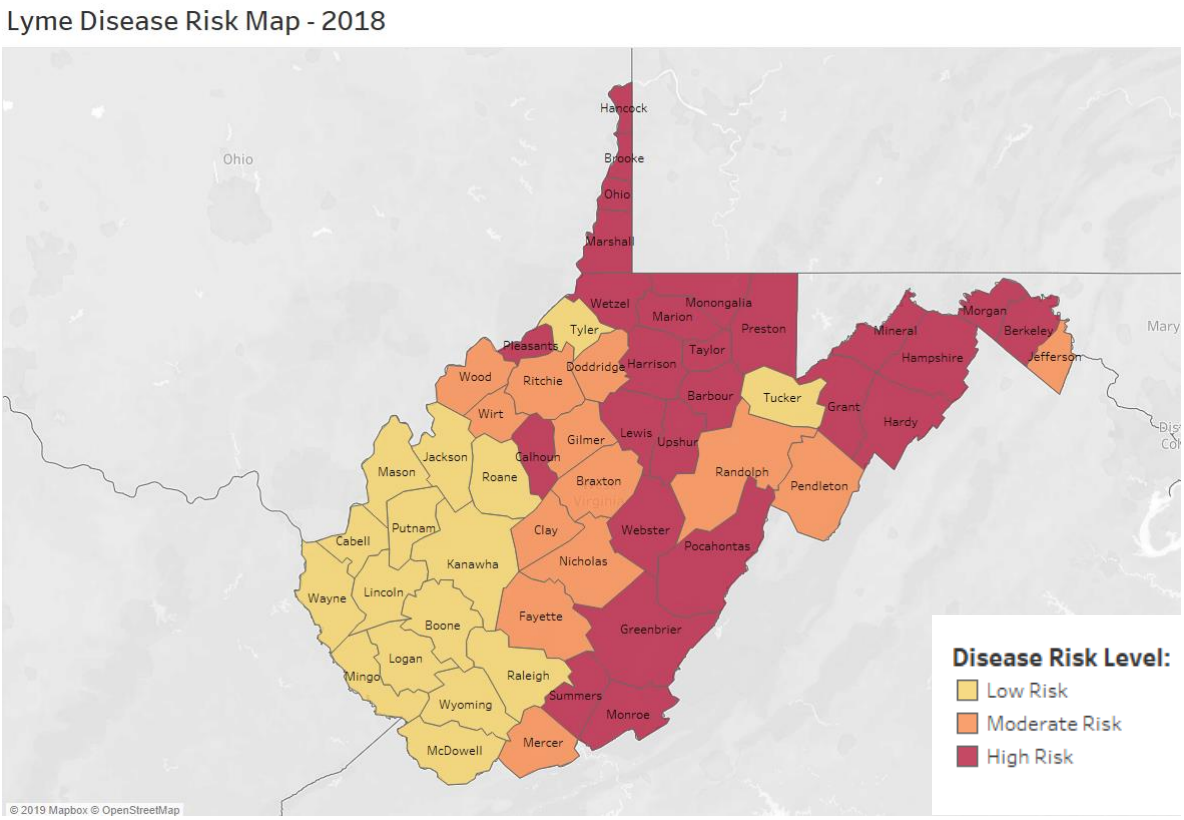

Figure 4. Lyme Disease risk map, MMWR year 2018. Risk is based on Lyme disease incidence per county (cases/100,000 population).

Confirmed and probable Lyme disease cases ranged in age from 1 to 91 years; the highest proportion of cases were reported in the 1-10 age range (Figure 5). When looking at the relative frequency of reported symptoms, Erythema Migrans was the most commonly reported (49%) and arthritis was the second most commonly reported symptom (38%) (Figure 6).

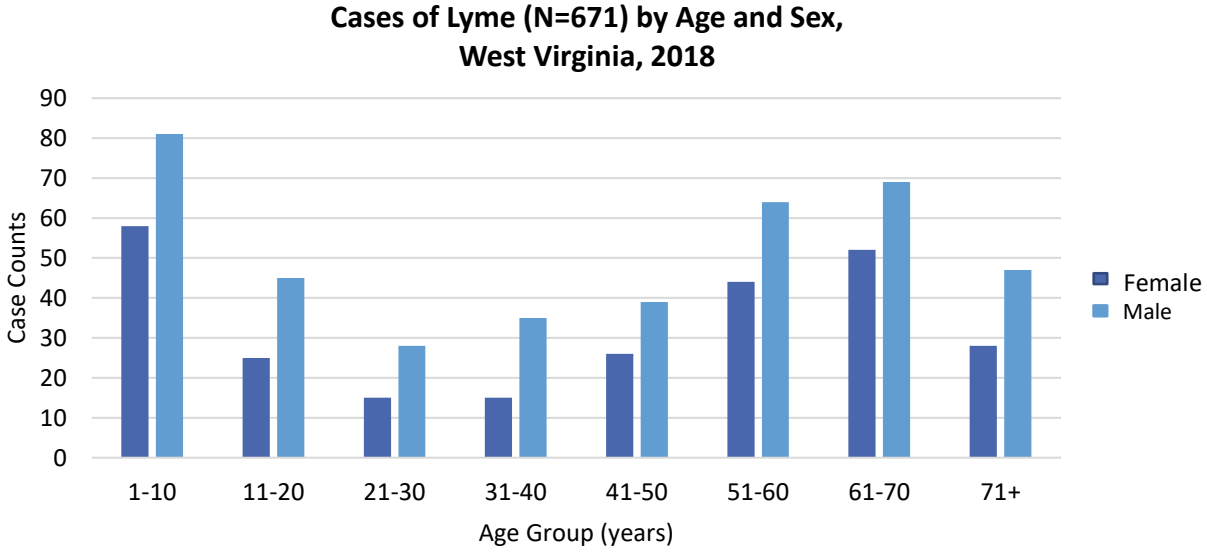

Figure 5. Frequency of Lyme disease cases by age and gender – West Virginia, MMWR Year 2018.

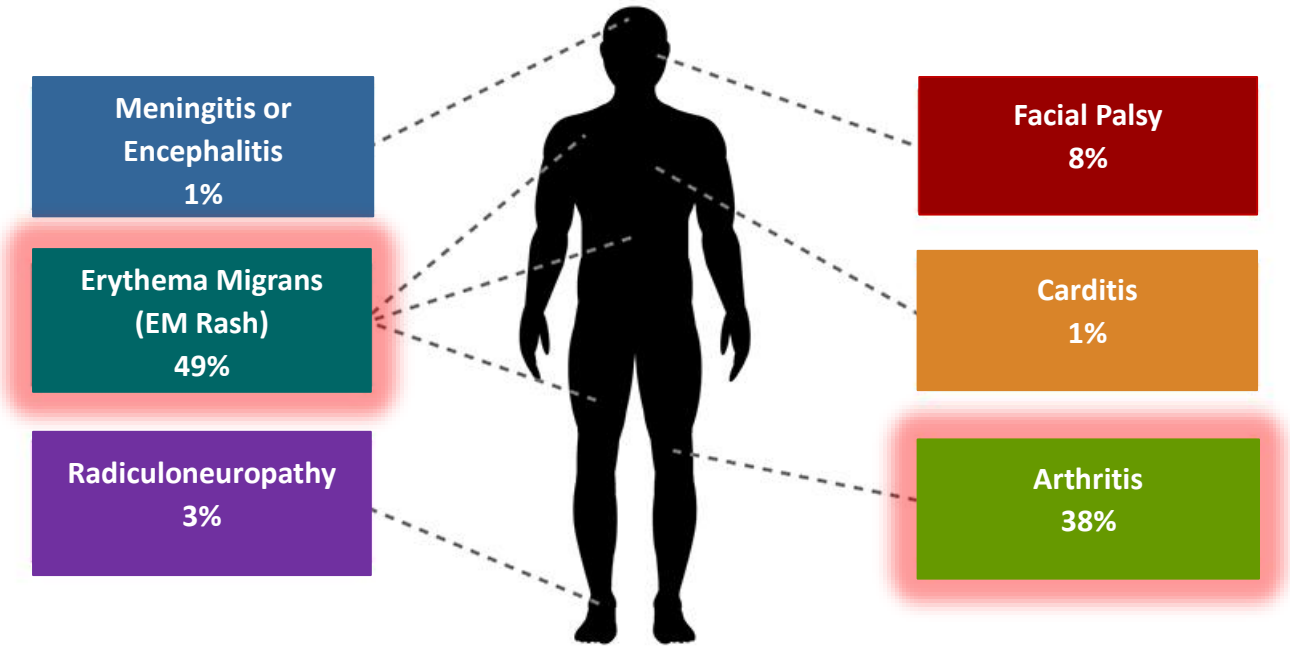

Figure 6. Frequency of clinical features of Lyme Disease among confirmed cases – West Virginia, MMWR Year 2018.

Discussion

Lyme disease accounted for the majority of TBD cases (Table 2) as seen in previous years. Though the vectors of Powassan encephalitis (*I. cookei* and *I. scapularis*) have been identified in the State, there were no reports of Powassan encephalitis during the period or to date in West Virginia. The first human babesiosis case in West Virginia was reported in 2017 and one case was reported in 2018.

The overall reported number of TBDs increased slightly from 675 in 2017 to 697 in 2018 (Table 2); the number of counties that reported at least one TBD increased from 47 counties in 2017 to 55 counties in 2018. Reported Lyme disease cases have increased 132% during the past three years, from 289 in 2015 to 671 in 2018. West Virginia became a high incidence state in 2017 based on having a three-year average incidence of greater than 10 cases per 100,000 persons.

Tickborne rickettsial diseases (anaplasmosis, ehrlichiosis, and SFGR) often have high hospitalization rates among cases; 75% of ehrlichiosis cases and 50% of SFGR cases reported during MMWR Year 2018 were hospitalized.

West Virginia borders three states classified as high incidence states for Lyme disease; Maryland, Pennsylvania, and Virginia rank in the top 14 states that account for about 95% of Lyme disease cases reported annually. West Virginia also borders Tennessee and North Carolina which contain hotspots for SFGR. Quality surveillance allows for monitoring of changes in TBD incidence 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.

There are limitations to TBD surveillance. 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 2018, there were 103 suspect cases of Lyme disease, 12 suspect SFGR cases, 1 suspect ehrlichiosis case, 2 suspect anaplasmosis cases, and 3 suspect anaplasmosis/ehrlichiosis cases 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.

Prevention of tickborne illnesses focuses primarily on avoiding tick bites. CDC recommendations for the prevention of TBDs are located on the CDC website at www.cdc.gov/ticks/avoid/on_people.html. 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.

Below are CDC recommended steps for tick bite prevention:

- Be extra vigilant in warmer months (April-September) when ticks and people are most active.
- Avoid wooded and bushy areas with high grass and leaf litter.
- Walk in the center of trails.
- Use repellents that contain 20 to 30% DEET on exposed skin and clothing for protection that lasts up to several hours. Always follow product instructions. Parents should apply this product to their children, avoiding hands, eyes, and mouth.
- Use products that contain permethrin on clothing. Treat clothing and gear, such as boots, pants, socks and tents with products containing 0.5% permethrin. It remains protective through several washings. Pre-treated clothing is available and may be protective longer.
- Bathe or shower as soon as possible after coming indoors (preferably within two hours) to wash off and more easily find ticks that are 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 return 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 the legs, around the waist, and especially in their hair.
- Examine gear and pets. Ticks can ride into the home on clothing and pets, then attach to a person later, so carefully examine pets, coats, and day packs. Ensure pets also have tick personal protection.
- Tumble clothes in a dryer on high heat for an hour to kill remaining ticks. (Some research suggests that shorter drying times may also be effective, particularly if the clothing is not wet.)

2018 Other Zoonotic Diseases Surveillance Summary

Introduction

While mosquito and tickborne diseases account for most zoonotic diseases reported in West Virginia, other diseases can be transmitted from animals to humans without arthropod vectors. Table 1 shows a list of diseases and conditions transmitted by animals that are under surveillance in West Virginia. While Q fever and tularemia can be transmitted by ticks, they are more commonly transmitted by other animals.

Table 4. Lists of diseases, the associated pathogen(s), and host species.

Disease	Pathogen	Host(s)
Anthrax	*Bacillus anthracis*	Cattle, sheep, and goats
Brucellosis	*Brucella* spp.	Sheep, goats, cattle, deer, elk, pigs, and dogs
Hantavirus pulmonary syndrome	Hantavirus	Wild rodents (deer mice)
Leptospirosis	*Leptospira interrogans*	Cattle, pigs, horses, dogs, rodents, and wild animals
MERS (Middle East Respiratory Syndrome)	MERS coronavirus	Camels and bats
Monkeypox	Monkeypox virus	Rodents, prairie dogs, Gambian giant rat, and rabbits
Plague	*Yersinia pestis*	Fleas and rodents
Psittacosis	*Chlamydophila psittaci*	Parrots, parakeets, macaws, turkeys, and ducks
Q fever	*Coxiella burnetii*	Cattle, sheep, ticks and goats
Rabies[1]	Rabies lyssavirus	Mammals
SARS (Sudden Acute Respiratory Syndrome)	SARS coronavirus	Bats (likely)
Tularemia	*Francisella tularenis*	Hard ticks, rabbits, hares, and rodents
Viral hemorrhagic fever	Marburg virus, Lassa virus, Ebola virus, Crimean-Congo virus, Rift Valley Fever, and Yellow Fever	Bats, primates, ticks, mosquitoes, and rodents

[1]The Bureau for Public Health has an annual rabies report that can be accessed at: oeps.wv.gov/rabies/documents/data/2018_animal_rabies.pdf

Methods

Human Surveillance

During the study period (MMWR Year 2018), passive surveillance was conducted for reportable zoonotic diseases in West Virginia. West Virginia State Code 16-3-1 and 64CSR7 establish infectious disease reporting requirements for healthcare providers and laboratories. LHDs conducted initial case investigations after receiving a case report or positive laboratory results for a reportable zoonotic disease. Cases were reported by LHDs to the State Health Department electronically using the West Virginia Electronic Disease Surveillance System (WVEDSS). Program leads reviewed each investigation before a final case classification status was assigned. All case classifications were determined using the most current case definition for each disease or condition.

Results

Two probable Q fever cases were reported during MMWR year 2018. Both were hospitalized due to illness; both had reported exposure to livestock. One tularemia case was reported during MMWR year 2018. The case had exposure to animal hides and wild game blood.

Discussion

Zoonotic diseases in West Virginia can be transmitted by a variety of animals and by a variety of different methods. Some zoonotic diseases require travel to specific areas of the world for a person to become infected, while others may require exposure to bodily fluids or a bite from a specific animal host.

In West Virginia, most zoonotic diseases not arthropod-transmitted result from contact with domestic animals such as livestock and dogs. High risk groups for both diseases include farm workers, veterinarians, and meat processing workers since their professions put them in close contact with animal products (e.g., unpasteurized milk) and body fluids (e.g., birth products, feces). Inhalation of the bacteria that cause brucellosis and Q fever may also lead to infection.

Most of the “other” zoonotic diseases listed on Table 4 are reportable within 24 hours or immediately since these diseases can result in severe morbidity and even mortality (e.g., rabies, hantavirus) and are considered bioterrorism agents (e.g., anthrax, Q fever). Some “other” reportable zoonotic diseases are considered travel associated. These zoonotic diseases are not endemic to West Virginia but occur when a person is infected during travel to an area where the disease is transmitted (e.g., viral hemorrhagic fever, MERS-CoV). For information about “other” zoonotic diseases reportable in West Virginia, visit: oeps.wv.gov/zoonotic/pages/default.aspx.