



WEST VIRGINIA 2019 ZONOTIC DISEASE SURVEILLANCE REPORT

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Methods

Surveillance and Case Ascertainment Methods

During the 2019 study period (12/30/2018–12/28/2019), the Centers for Disease Control and Prevention (CDC) Morbidity and Mortality Weekly Report (MMWR) passive surveillance was conducted for mosquito-borne diseases (MBDs), tickborne diseases (TBDs) and zoonotic diseases in West Virginia. W. Va. Code §16-3-1 and W. Va. CSR §64-7, et seq. establish infectious disease reporting requirements for healthcare providers and laboratories. Local health departments (LHDs) conducted initial case investigations after receiving case reports or positive laboratory results for reportable MBDs, TBDs and zoonotic diseases. Cases were reported from LHDs to the West Virginia Department of Health and Human Resources (DHHR) using the West Virginia Electronic Disease Surveillance System (WVEDSS).

Cases were reviewed by the Zoonotic Disease Program in DHHR's Division of Infectious Disease Epidemiology before a final case classification status was assigned. All case classifications were determined using the most current Council for State and Territorial Epidemiologists (CSTE) case definition for each disease or condition. Once a final case status was determined, cases were reported by DHHR to the CDC via the National Electronic Disease Surveillance System (NEDSS).

Data Extraction and Analyses

Surveillance data for confirmed and probable cases of each MBD, TBD and zoonotic disease for MMWR Year 2019 were exported from WVEDSS to an Excel database for analyses. County- and state-level census estimates for 2019 were obtained from the 2010 U.S. Census Bureau.

2019 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 focuses on four endemic mosquito-transmitted diseases—La Crosse encephalitis virus (LAC), West Nile virus (WNV), St. Louis encephalitis virus (SLE), and eastern equine encephalitis virus (EEE)—and travel-associated, or imported 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.

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.

Mosquito surveillance is important to understanding the geographic and temporal distribution of these vectors, the diseases they might transmit to humans, and when and where human cases of mosquito-borne disease might occur. Mosquito surveillance is conducted in selected counties across West Virginia from late spring through fall. Environmental surveillance for MBDs monitors local disease activity in non-human species. 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. Additional information on ecological assessments of MBDs and tickborne diseases is available in the 2019 West Virginia Mosquito and Tick Surveillance Report. This surveillance summary describes human cases of MBDs in West Virginia during 2019.

Results

Human Surveillance

Table 1 provides a comparison of human cases of MBDs reported in West Virginia from 2013 to 2019. In 2019, 10 cases of MBDs were reported. Three probable cases of LAC were reported from three counties: Greenbrier, Logan, and Wyoming (Figure 1). All were neuroinvasive cases; the majority of these cases (n=2, 67%) were male. The median age was eight years (average=7.3 years; range=6-8 years). Illness onset for these LAC cases was August (n=2) and September (n=1). All cases were febrile and hospitalized as a result of illness. Two of these cases presented with headache, abnormal movements, stupor and fatigue. One case reported symptoms including encephalitis, meningitis, coma, arthralgia, conjunctivitis and convulsions. Four confirmed cases of dengue fever were reported in individuals who traveled to Thailand and one probable case of locally acquired dengue fever presented in Wood County. WNV was not ruled out as a diagnosis for the dengue case that appears to be locally acquired and there is the potential for cross-reactivity in the dengue test if a person has WNV. WNV is endemic to the area and may be a more likely reason for the positive dengue case. All past cases of dengue have been travel-associated, so while this case appears to be locally acquired, it may have been an unidentified case of WNV since dengue is not considered endemic to West Virginia. Two confirmed travel-associated malaria cases were reported in persons who traveled to Kenya and West Africa where malaria is endemic.

Table 1. Human cases of mosquito-borne disease in West Virginia from 2013 to 2019.

Disease	# (%) of Cases [†] (2013)	# (%) of Cases [†] (2014)	# (%) of Cases [†] (2015)	# (%) of Cases [†] (2016)	# (%) of Cases [†] (2017)	# (%) of Cases [†] (2018)	# (%) of Cases [†] (2019)
LAC	11 (69)	3 (33.3)	4 (57.1)	8 (38.1)	4(50)	6 (50)	3 (30)
WNV	1 (6)	0 (0)	0 (0)	1 (4.8)	1 (12.5)	2 (16.7)	0 (0)
Malaria	2 (12.5)	2 (28.6)	2 (28.6)	1 (4.8)	2 (25)	3 (25)	2 (20)
Dengue	2 (12.5)	1 (14.3)	1 (14.3)	0 (0)	0 (0)	1 (8.3)	5 (50)
EEE	0 (0)	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)	0 (0)
Chikungunya	0 (0)	3 (33.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Zika	-	-	-	11(52.4)	1* (12.5)	0 (0)	0 (0)
Total	16 (100)	9 (100)	7 (100)	21 (100)	8 (100)	12 (100)	10 (100)

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

Figure 1. Distribution of human La Crosse encephalitis virus cases (N = 3) reported in West Virginia in 2019.



Discussion

The incidence of local MBDs was lower for West Virginia in 2019 than in 2018. LAC cases followed the epidemiologic trends previously seen in West Virginia with cases in children under 15 years of age and reported from southern counties.

Six imported MBD cases occurred in 2019, accounting for 60% of all MBD cases reported in the State. It is important for West Virginia residents who travel internationally to be mindful of MBDs endemic in their destination country. CDC's Traveler's Health website is a good resource for this information: wwwnc.cdc.gov/travel. Links to CDC pages as well as to public health literature on MBDs can be found on DHHR's Office of Epidemiology and Prevention Services Mosquito-Borne Diseases webpage: oepe.wv.gov/arboviral/Pages/mbd.aspx.

2019 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 seven TBDs (Table 2). 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 with 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 2, are reportable to DHHR from healthcare providers and laboratories. The purpose of this summary is to describe the epidemiology of TBDs reported in West Virginia during 2019.

Table 2. Possible TBD by causative agent based on vectors found in West Virginia.

Tickborne Disease ^a	Agent	Tick Vector(s) in West Virginia
Anaplasmosis	<i>Anaplasma phagocytophilum</i>	Blacklegged tick (<i>Ixodes scapularis</i>) ^b
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>) ^c 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 ^d	<i>Francisella tularensis</i>	American dog tick (<i>Dermacentor variabilis</i>) Lone star tick (<i>Amblyomma americanum</i>)

^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.

Results

Human Surveillance

In 2019, 937 confirmed and probable TBD cases were reported from 53 counties in West Virginia. Diseases reported included anaplasmosis, ehrlichiosis, Lyme disease, and spotted fever group rickettsioses (SFGR) (Figure 2, Table 3). No cases of Powassan virus, tularemia or babesiosis were reported.

Figure 2. County-level distribution of Lyme disease, anaplasmosis, ehrlichiosis, and SFGR cases – West Virginia, 2019.

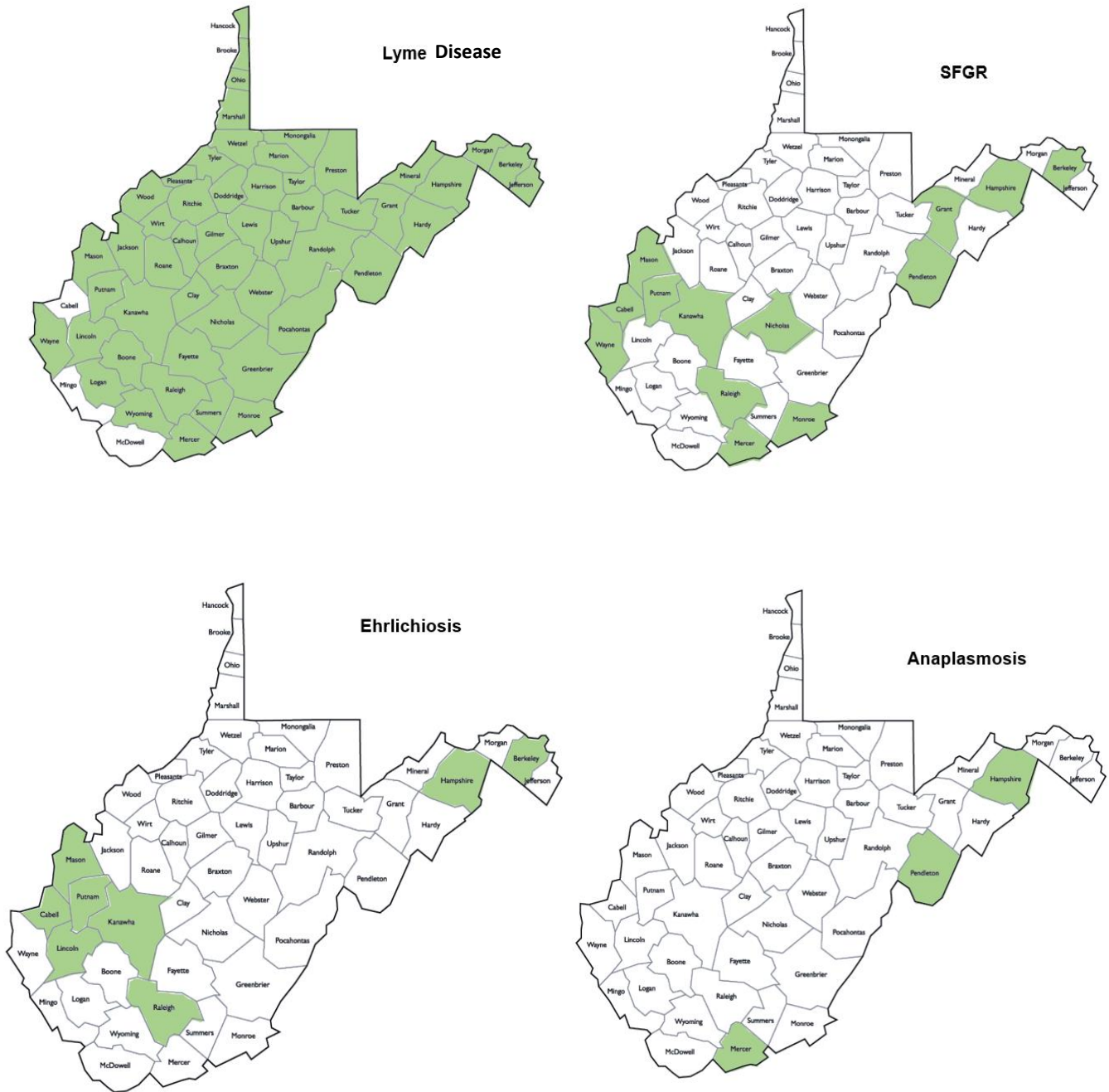


Table 3. Frequency of TBDs reported in West Virginia from 2014–2019.

Disease Name	# of 2014 cases	# of 2015 cases	# of 2016 cases	# of 2017 cases	# of 2018 cases	# of 2019 cases
Anaplasmosis	2	0	0	2	0	3
Babesiosis	0	0	0	1	1	0
Ehrlichiosis	3	5	6	6	4	10
Anaplasmosis/ Ehrlichiosis undetermined	0	1	0	1	1	0
RMSF/SFGR	5	9	14	17	20	26
Lyme disease	136	289	368	648	671	898
TOTAL CASES	146	304	388	675	697	937

Table 4. Frequency of counties reporting TBDs in West Virginia from 2014–2019.

Disease Name	Counties with cases (2014)	Counties with cases (2015)	Counties with cases (2016)	Counties with cases (2017)	Counties with cases (2018)	Counties with cases (2019)
Anaplasmosis	2	0	0	2	0	3
Babesiosis	0	0	0	1	1	0
Ehrlichiosis	3	4	5	6	4	8
Anaplasmosis/ Ehrlichiosis undetermined	0	1	0	1	1	0
RMSF/SFGR	5	7	10	14	12	13
Lyme disease	24	37	42	45	49	52
*TOTAL COUNTIES	24	38	43	47	55	53

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

Ten ehrlichiosis cases (five confirmed and five probable) were reported from Berkeley, Cabell, Hampshire, Kanawha, Lincoln, Mason, Putnam and Raleigh counties during MMWR Year 2019. Seven of the ten cases reported hospitalization. Their ages ranged from 22–78 years of age. The majority of cases presented with fever (n=10), malaise (n=8), headache (n=7), and myalgia (n=7). Out of ten cases, only two presented with rash.

Three anaplasmosis cases (one confirmed, two probable) were reported in MMWR Year 2019 from Hampshire, Mercer and Pendleton counties. All three were hospitalized and reported symptoms including fever, headache, malaise, and rash. Cases ranged in age from 45–64 years.

Twenty-six SFGR cases (26 probable) were reported during MMWR Year 2019 from 13 counties: Berkeley, Cabell, Grant, Hampshire, Kanawha, Mason, Mercer, Monroe, Nicholas, Pendleton, Putnam, Raleigh and Wayne counties. The majority of cases (n= 18, 60%) were male. Cases ranged in age from 8–81 years; five cases reported hospitalization. The symptoms that commonly presented were fever (n=26, 100%),

headache (n=20, 77%), malaise (n=20, 77%), myalgia (n=18, 69%), rash (n=6, 23%), nausea (n=13, 50%) and vomiting (n=7, 27%). Four cases (15%) reported underlying immunosuppressive conditions.

Lyme disease cases increased during MMWR Year 2019 with 898 cases reported in 2019 (713 confirmed and 185 probable) compared to 671 cases (554 confirmed and 117 probable) reported in the previous year. Lyme disease cases accounted for 96% of all TBD cases reported (898 of 937 cases) which is consistent with the past couple of years. The number of counties reporting at least one case increased slightly from MMWR year 2018, from 49 to 52 counties. Seventeen counties reported greater than 20 cases; Berkeley (n=52), Hampshire (n=46), Hancock (n=54), Harrison (n=69) and Upshur (n=59) reported the most cases.

Confirmed and probable Lyme disease cases ranged in age from 1–93 years; the highest proportion of cases were reported in the 1–10 age range (n=174) with the age range of 61–70 years old (n=168) following closely (Figure 3). 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 (35%) (Figure 4).

Figure 3. Frequency of Lyme disease cases (N = 898) by age and gender — West Virginia, MMWR Year 2019

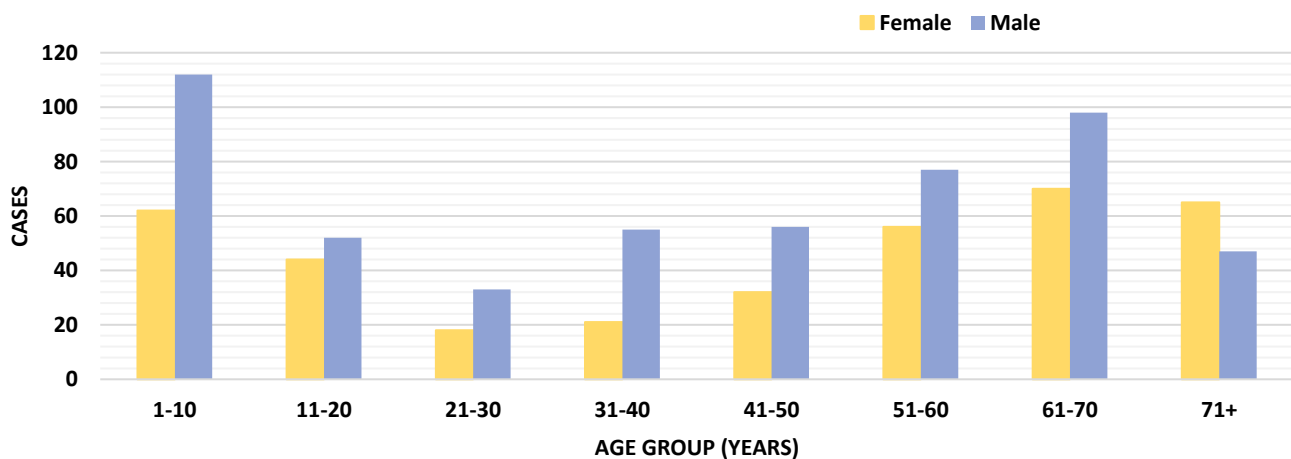
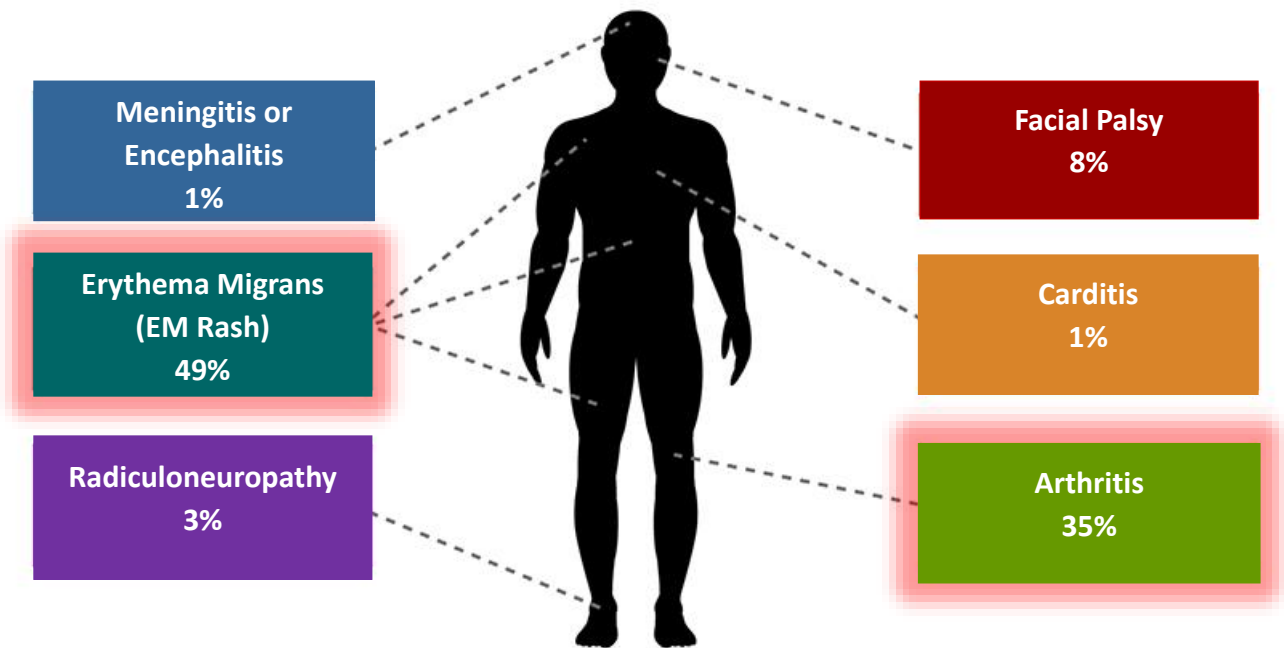


Figure 4. Frequency of clinical features of Lyme Disease among confirmed cases — West Virginia, MMWR Year 2019.



Discussion

Lyme disease accounted for the majority of TBD cases (Table 3) 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 MMWR Year 2019 or to date in West Virginia. The first human babesiosis case in West Virginia was reported in 2017, one case was reported in 2018 and no cases were reported in 2019.

The overall reported number of TBDs increased from 697 in 2018 to 937 in 2019 (Table 2); the number of counties that reported at least one TBD decreased slightly from 55 counties in 2018 to 53 counties in 2019. Reported Lyme disease cases have increased 211% during the past five MMWR years, from 289 in 2015 to 898 in 2019. 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. In 2019, West Virginia’s average incidence rate was 48.5 cases per 100,000 persons compared to 36.2 cases per 100,000 persons in 2018. West Virginia is seeing a steady increase in incidence of Lyme disease each year.

Tickborne rickettsial diseases (anaplasmosis, ehrlichiosis, and SFGR) often have high hospitalization rates among cases; 100% of anaplasmosis cases, 70% of ehrlichiosis cases and 19% of SFGR cases reported during MMWR Year 2019 were hospitalized.

West Virginia borders three states also 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, Virginia, 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 2019, there were 108 suspect cases of Lyme disease, 16 suspect SFGR cases, 1 suspect ehrlichiosis case and 1 suspect anaplasmosis case 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 diseases focuses primarily on avoiding tick bites. CDC’s recommendations for the prevention of TBDs are located on the CDC website: 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.

2019 Other Zoonotic Diseases Surveillance Summary

Introduction

While mosquito-borne and tick-borne diseases account for most zoonotic diseases reported in West Virginia, other diseases can be transmitted from animals to humans without arthropod vectors. Table 5 lists 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 5. Lists of diseases, the associated pathogen(s), and host species.

Disease	Pathogen	Host(s)
Anthrax	<i>Bacillus anthracis</i>	Cattle, sheep, and goats
Brucellosis	<i>Brucella</i> spp.	Sheep, goats, cattle, deer, elk, pigs, and dogs
Hantavirus pulmonary syndrome	Hantavirus	Wild rodents (deer mice)
Leptospirosis	<i>Leptospira interrogans</i>	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 rats, and rabbits
Plague	<i>Yersinia pestis</i>	Fleas and rodents
Psittacosis	<i>Chlamydia psittaci</i>	Parrots, parakeets, macaws, turkeys, and ducks
Q fever	<i>Coxiella burnetii</i>	Cattle, sheep, ticks and goats
Rabies ¹	Rabies lyssavirus	Mammals
SARS (Sudden Acute Respiratory Syndrome)	SARS coronavirus	Bats (likely)
Tularemia	<i>Francisella tularensis</i>	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

¹DHHR's Bureau for Public Health has an annual rabies report that can be accessed online (Data and Surveillance): <https://oeps.wv.gov/rabies/pages/default.aspx>.

Results

Two leptospirosis cases (1 probable and 1 confirmed) were reported during MMWR Year 2019. Both cases were hospitalized due to illness; one had reported exposure to mice and rats as well as their urine. No other zoonotic diseases were reported during MMWR Year 2019.

Discussion

Zoonotic diseases in West Virginia can be transmitted by a variety of animals and by a variety of different routes. 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 animal 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 5 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: oepps.wv.gov/zoonotic/pages/default.aspx.