

2023 West Virginia Zoonotic Disease Report

Division of Infectious Disease Prevention and Response

West Virginia Department of HEALTH

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2023 West Virginia Zoonotic Disease Report
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West Virginia Zoonotic Disease
2023 Surveillance Report
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Methods

Surveillance and Case Ascertainment Methods

During the 2023 study period (1/1/2023-12/31/2023), passive surveillance was conducted for mosquito-borne diseases (MBDs), tickborne diseases (TBDs) and zoonotic diseases (ZDs) in West Virginia. W. Va. Code §16-3-1 and W. Va. CSR §64-7 establishes infectious disease reporting requirements for healthcare providers and laboratories. Case investigations were handled by the local health department (LHD) covering the area where the patient resides after receiving positive laboratory results for reportable MBDs, TBDs, and ZDs. The only exceptions were Lyme cases, which were managed entirely by the Office of Epidemiology and Prevention Services (OEPS) ZD Program. Diseases were identified based upon Council of State and Territorial Epidemiologists (CSTE) case definitions following clinical, laboratory, and epidemiological criteria. Cases were then reported from the LHDs to the West Virginia Department of Health (WVDH) using the West Virginia Electronic Disease Surveillance System (WVEDSS).

Cases were reviewed by the Zoonotic Disease program in WVDH's Division of Communicable Disease Epidemiology (DCDE) before a final case classification status was assigned. All case statuses were determined using the latest Council for State and Territorial Epidemiologists (CSTE) case definition for each disease. Once the final case status was determined, cases were reported by the WVDH to the Centers for Disease Control and Prevention (CDC) via the National Electronic Disease Surveillance System (NEDSS).

Data Extraction and Analysis

Surveillance data for confirmed and probable cases of each condition for MMWR Year 2023 were exported from WVEDSS to an Excel database for analysis. County- and state-level census estimates for 2020 were obtained from the 2020 U.S. Census Bureau.

2023 Mosquito-Borne Disease Surveillance Summary

Introduction

Mosquito-borne diseases, most of which are caused by viruses, are transmitted through the bite of an infected mosquito. Surveillance for these diseases focuses on three endemic mosquito-transmitted diseases: La Crosse Encephalitis (LAC), West Nile Virus Disease (WNV), and Eastern Equine Encephalitis (EEE). It also includes travel-associated diseases such as Chikungunya, Dengue, Malaria, and Zika Virus Disease (ZIKV). LAC has historically been the mosquito-borne disease of most concern in West Virginia.

Most people who are infected with endemic MBDs have no clinical symptoms; however, encephalitis (swelling of the brain) is a potentially life-threatening complication that arises with many of these conditions. Symptoms normally start one to two weeks after the patient is bitten by a mosquito and include fever, headache, myalgia, meningitis, and neurologic dysfunction. Treatment for most of these conditions, excluding malaria, is supportive in nature.

Results

Table 1 provides a comparison of human cases of MBDs in West Virginia from 2018 to 2023. In 2023, 13 cases of MBDs were reported. Six cases of LAC, one confirmed and five probable, were reported from five separate counties: Fayette, Kanawha, Mercer, Nicholas and Webster (Figure 1). All six of these cases were neuroinvasive and all patients were male. The median age was three years (average=15.7 years; range=1-78 years). Illness onset for these LAC cases was July (n=2), August (n=3) and October (n=1). All cases were febrile and were hospitalized because of illness. The most common symptom was fatigue (n=5) followed closely by diagnosis of encephalitis (n=4).

There were two cases of WNV in 2023, one confirmed case and one probable case, in two separate counties: Hardy and Monongalia. Both cases were male, in their 70s (75 and 77), and hospitalized. Illness onset months for these cases were May (n=1) and October (n=1). Both cases exhibited neuroinvasive disease symptoms. The Hardy County patient had a previous WNV infection in 2018. The significance of the prior infection is uncertain; possible persistence or recurrence should be interpreted cautiously.

There were also travel-related cases of malaria and dengue in West Virginia in 2023. There were four confirmed malaria cases in three counties: Berkeley (2), Cabell, and Harrison. All cases were determined to be caused by *Plasmodium falciparum* and all patients were male. Median age was 41 years (average=41, range=17-65) and the patients reported travel to Guinea, Sierra Leone, South Korea (patient's home country), and Zambia. There was one travel-associated case of Dengue in Kanawha County in a patient who traveled to India on a missionary trip.

Table 1. Human cases of mosquito-borne disease in West Virginia from 2018 to 2023.

Disease	# (%) of cases 2018	# (%) of cases 2019	# (%) of cases 2020	# (%) of cases 2021	# (%) of cases 2022	# (%) of cases 2023
LAC	6 (50)	3 (30)	7 (100)	1 (100)	2 (33.3)	6 (46.1)
WNV	2 (16.7)	0 (0)	0 (0)	0 (0)	0 (0)	2 (15.4)
Malaria	3 (25)	2 (20)	0 (0)	0 (0)	4 (66.7)	4 (30.8)
Dengue	1 (8.3)	5 (50)	0 (0)	0 (0)	0 (0)	1 (7.7)
EEE	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Chikungunya	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Zika	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	12 (100)	10 (100)	7 (100)	1 (100)	6 (100)	13 (100)

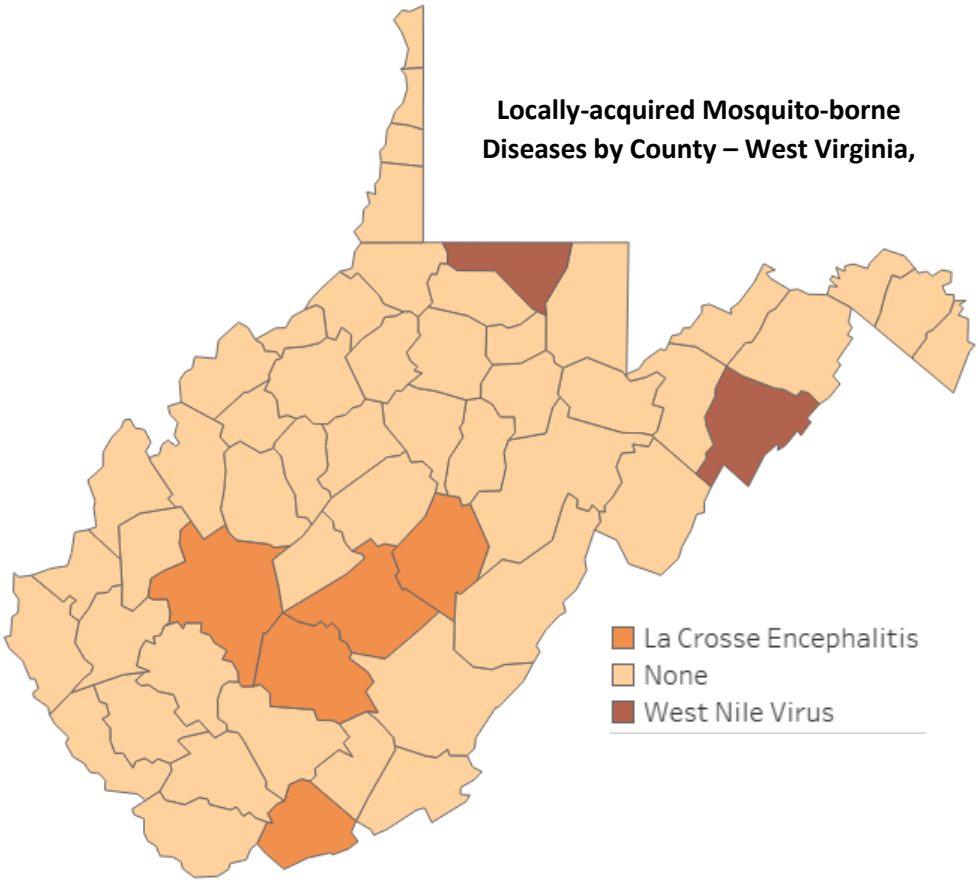

Figure 1. Distribution of human locally-acquired mosquito-borne disease cases (n = 8) reported in West Virginia in 2023.

Discussion

The incidence of local MBDs was higher for West Virginia in 2023 than in 2022. LAC, except for one 78-year-old patient, continues to show primarily in children under 15 and in the southern counties in West Virginia. According to the CDC, only about 11% of LAC cases have been in patients over the age of 17 between 2003 and 2025 (1).

As in other states, WNV case numbers remain low in West Virginia. Most patients infected with WNV do not develop symptoms. Based upon serological surveys and blood screen analysis, for every WNV neuroinvasive disease case there are an estimated additional 140-353 WNV infections that are not detected (2, 3, 4).

The WNV case in Hardy County, with prior WNV infection in 2018, highlights the need for continued monitoring of former patients, especially those with weakened immune systems. According to the CDC, it is possible for WNV to persist in the kidneys of some patients long after the virus should have been eliminated by the immune system (1). Some of these patients report long-term symptoms such as feeling weak or tired, and memory problems (1).

Imported MBDs accounted for 38.5% of all MBDs reported in the state. It's important for residents who travel internationally to know what MBDs they could encounter in the areas where they are traveling. CDC's Travelers' Health page is a good resource for finding diseases that are endemic to those areas ahead of time. Tips for preventing MBDs include wearing insect repellent, wearing loose-fitting long-sleeved shirts and pants when outdoors, treating clothing and gear with permethrin, using screens on windows and doors, and emptying any containers with standing water around your house. Links to CDC pages, as well as to public health literature on MBDs, can be found on the West Virginia Department of Health's Office of Epidemiology and Prevention Services Mosquito-Borne Diseases webpage.

2023 Tickborne Disease Surveillance Summary

Introduction

Tickborne diseases (TBDs) are transmitted by the bite of an infected tick vector. In West Virginia, tick vectors have been identified for at least seven TBDs (Table 2). Diagnosing TBDs can be challenging since all of these conditions 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 WVDH from healthcare providers and laboratories. The purpose of this summary is to describe the epidemiology of TBDs reported in West Virginia during 2023.

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

Tickborne Disease	Agent	Tick Vector(s) in West Virginia
Anaplasmosis	*Anaplasma phagocytophilum*	Blacklegged tick (*Ixodes scapularis*) and Groundhog tick (*Ixodes cookei*)
Babesiosis	*Babesia microti* and other *Babesia* spp.	Blacklegged tick (*Ixodes scapularis*) and Groundhog tick (*Ixodes cookei*)
Bourbon Virus Disease	Bourbon Virus	Lone Star Tick (*Amblyomma americanum*)
Ehrlichiosis	*Ehrlichia chaffensis* and *Ehrlichia ewingii*	Lone Star Tick (*Amblyomma americanum*)
Heartland Virus Disease	Heartland Virus	Lone Star Tick (*Amblyomma americanum*)
Lyme Disease	*Borellia burgdorferi*	Blacklegged tick (Ixodes scapularis) and Groundhog tick (*Ixodes cookei*)
Powassan Hemorrhagic Fever	Powassan Virus	Blacklegged tick (*Ixodes scapularis*) and Groundhog tick (*Ixodes cookei*)
Spotted Fever Rickettsiosis, including Rocky Mountain Spotted Fever	*Rickettsia rickettsii* and other Spotted Fever Group Rickettsia spp.	American dog tick (*Dermacentor variabilis*), Brown dog tick (*Rhipicephalus sanguineus*), Lone star tick (*Amblyomma americanum*), and Gulf Coast tick (*Amblyomma maculatum*)

Results

In 2023, there were 3286 confirmed and probable TBD cases reported from 55 counties in West Virginia. Diseases reported included anaplasmosis, babesiosis, ehrlichiosis, Lyme disease and spotted fever group rickettsiosis (SFGR) (Figure 2, Figure 3).

Sixteen anaplasmosis cases (15 confirmed and 1 probable) were reported from Barbour (2), Cabell, Hampshire, Hancock (2), Harrison, Jefferson, Marion, Mercer, Randolph, Tucker, Upshur (3), and Webster counties during MMWR year 2023. Eleven cases (68.8%) reported hospitalization. Their ages ranged from 34 to 88 years, with a median age of 62. Symptoms included fever (n=15), headache (n=11), malaise (n=13), nausea (n=12), rash (n=5), and vomiting (n=7). Severe complications included acute respiratory distress syndrome (ARDS) (n=1), anemia (n=4), elevated hepatic transaminases (n=7), leukopenia (n=4), renal failure (n=2), and thrombocytopenia (n=7).

Two babesiosis cases (both probable) were reported from Randolph and Monongalia counties in MMWR year 2023. One of the cases was hospitalized. Symptoms and complications reported included anemia, fever and headache.

Nineteen ehrlichiosis cases (16 confirmed, three probable) were reported from Cabell (6), Kanawha (5), Lincoln (2), Logan, Mason (2), Putnam (2), and Wood counties during MMWR year 2023 in West Virginia. Sixteen cases (84.2%) reported hospitalization. Their ages ranged from34 to 87 years. Symptoms reported included fever (n=18), headache (n=12), malaise (n=12), myalgia (n=6), nausea (n=7), rash (n=1), and vomiting (n=4). Severe complications reported with ehrlichiosis include ARDS (n=3), anemia (n=9), elevated hepatic transaminase (n=10), leukopenia (n=10), meningitis/encephalitis (n=3), renal failure (n=2), and thrombocytopenia (n=11).

Seven spotted fever group rickettsiosis (SFGR) cases (all probable) were reported from Cabell (3), Jackson, Kanawha, Preston, and Putnam counties in MMWR year 2023. One (14.3%) case reported hospitalization. The ages of patients ranged from 43 to 71 years. Symptoms included fever (n=7), headache (n=7), malaise (n=6), myalgia (n=5), nausea (n=4), and rash (n=5). The only severe complication in any of these cases was elevated hepatic transaminase (n=1).

Lyme disease continued the trend of increasing year over year. Case counts jumped from 2470 in MMWR year 2022 to 3242 in MMWR year 2023. As with last year, all 55 counties in West Virginia reported at least one case of Lyme disease. The highest Lyme disease incidence counties all occur in the northern and eastern portions of the state, with lower incidence counties in the southwest. Ages ranged from 1 to 96 years. Due to a case definition change in 2022, symptom information was not collected for Lyme disease cases.

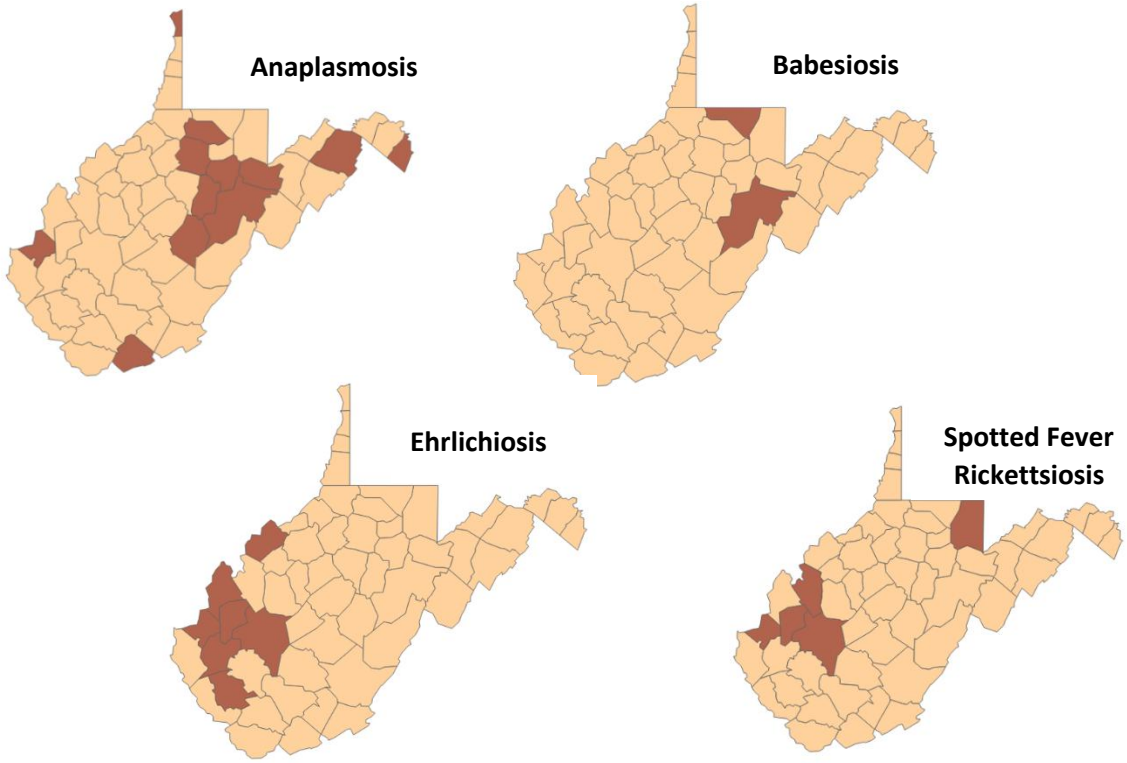

Figure 2. County-level distribution of anaplasmosis, babesiosis, ehrlichiosis, and SFGR cases, West Virginia, 2023. Cases were found in red counties.

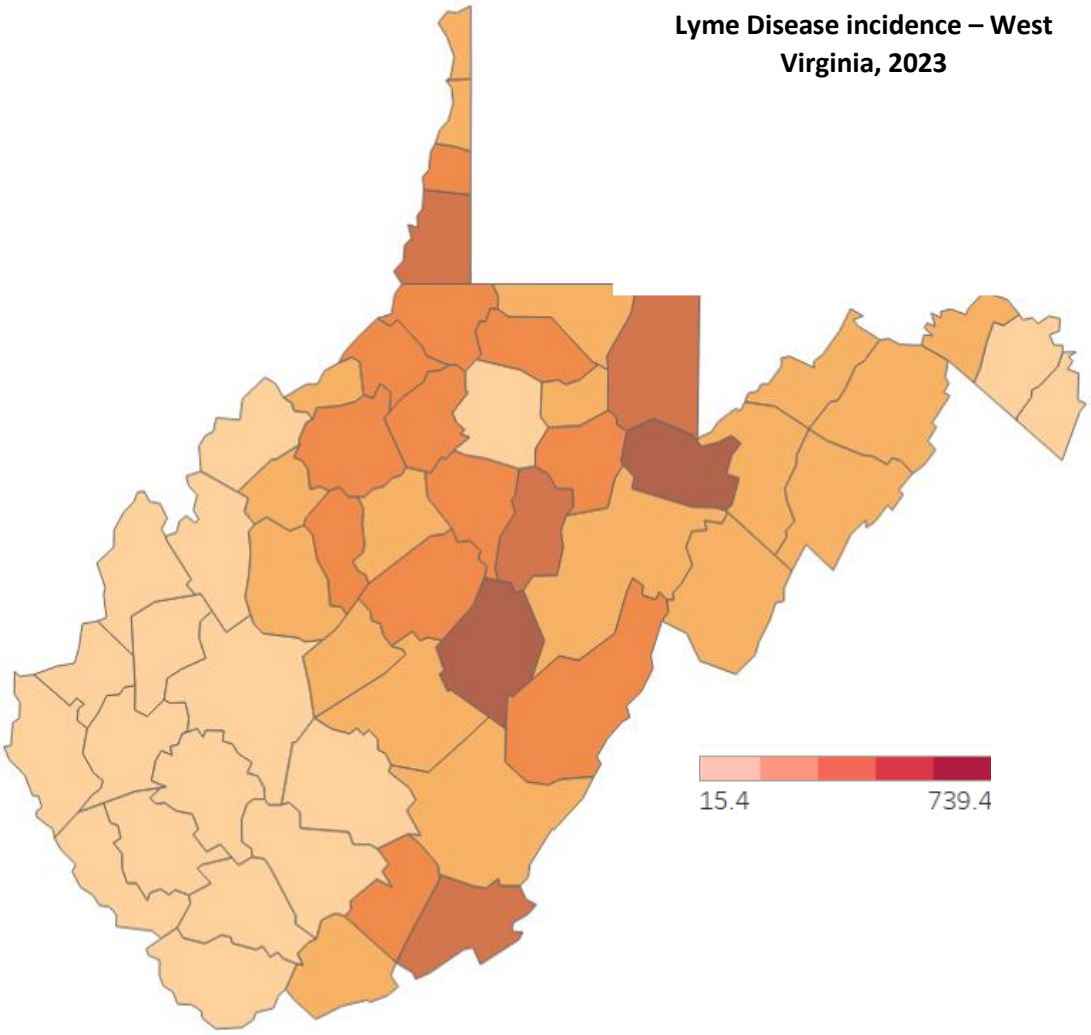

Figure 3. Lyme disease incidence, West Virginia, 2023. All counties had at least one case. Darker color indicates higher incidence.

Discussion

Lyme disease accounted for the majority of TBD cases as seen in previous years. Though the vectors of Powassan encephalitis (*I. cookei* and *I. scapularis*), Heartland Virus, and Bourbon Virus have been identified in the state, there continued to be no reported cases of these arboviruses during MMWR year 2023 in West Virginia.

The overall reported number of TBDs increased from 2501 in 2022 to 3286 in 2023; the number of counties that reported at least one TBD remained at 55 in 2023. Reported Lyme disease cases increased from 2022 to 2023 and increased in reported cases 261% during the past five MMWR years, from 898 in 2019 to 3242 in 2023. West Virginia became a high Lyme disease incidence state in 2017 based on having a three-year average incidence of greater than 10 cases per 100,000 people. In 2023, West Virginia's average incidence rate was 177.8 cases per 100,000 persons compared to 135.4 cases per

100,000 persons in 2022. 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; 68.8% of anaplasmosis cases, 84.2% of ehrlichiosis cases and 14.3% of SFGR cases reported during MMWR year 2023 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. High-incidence jurisdictions are those that have had an average Lyme disease incidence of $\geq$10 confirmed cases / 100,000 population for a period of three consecutive years (5). Nearby Tennessee, Virginia, and North Carolina contain hotspots for SFGR. The Asian longhorned tick (*Haemaphysalis longicornis*) was first collected in West Virginia in 2010 and originally misidentified as the rabbit tick, *Haemaphysalis leporispalustris*. It is a new tick to the US overall (2017) and is still being researched by scientists. While it has not been known to cause disease in humans in the US, studies have shown that it carries the potential to transmit Rickettsia *rickettsii*, the pathogen responsible for Rocky Mountain spotted fever (6). 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. Patients 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. If information is missing, a true case may be classified as either “suspect” or “not a case.” In 2023, there were 100 suspect cases of Lyme disease, 18 suspect SFGR cases, 1 suspect ehrlichiosis case and 3 suspect anaplasmosis 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 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.

2023 Other Zoonotic Diseases Surveillance Summary

Introduction

While mosquito-borne and tickborne diseases account for most of the zoonotic diseases reported in West Virginia, other diseases can be transmitted to humans from animals without arthropod vectors. Below is a list of other zoonotic diseases and their hosts.

Table 3. List of diseases, associated pathogen(s), and host species of other zoonotic Diseases. Rabies has a separate report that can be accessed online.

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
M-Pox	Monkeypox Virus	Rodents, prarie dogs, Gambian giant rats, and rabbits
Plague	*Yersina pestis*	Fleas and rodents
Psittacosis	*Chamydia psittaci*	Parrots, parakeets, macaws, turkeys, and ducks
Q-fever	*Coxiella burnetii*	Cattle, sheep, ticks and goats
Rabies	Rabies Lyssavirus	All mammals
SARS (Sudden Acute Respiratory Syndrome)	SARS coronavirus	Bats (likely)
Tularemia	*Francisella tularensis*	Hard ticks, rabbits, hares, and rodents
Viral Hemorrhagic Fever	Marburg Virus, Lassa Virus, Ebola Virus, Crimean-Congo virus, Rift Valley Fever virus, and Yellow Fever virus	Bats, primates, ticks, mosquitos and rodents

There was one case of tularemia in West Virginia in MMWR year 2023. The patient was not hospitalized. Symptoms included fever, headache, arthralgia, malaise, and myalgia.

There were three cases of Q fever in West Virginia in MMWR year 2023 in Jefferson (2) and Berkeley counties. One patient (33%) was hospitalized for their illness. Symptoms included fever (n=3), headache (n=3), malaise (n=3), and cough (n=2). Complications included pneumonitis (n=1), and elevated hepatic transaminase (n=2).

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.

Zoonotic disease surveillance information may be limited because zoonotic diseases, such as Q fever and tularemia, are considered underreported disease conditions. Public health experts and researchers attribute underreporting of Q Fever and Tularemia to nonspecific early clinical presentation, mild or self-limiting cases with no associated medical examination, laboratory diagnostic challenges requiring advanced laboratory techniques and biosafety precautions, and lack of healthcare provider familiarity with these rare disease conditions (7,8).

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 in Table 3 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). Visit “other” zoonotic diseases reportable in West Virginia for more information.

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