

Tick-Borne Diseases in Arkansas

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Arkansas is well known for its abundance of ticks and its fair share of tick-borne diseases. Rocky Mountain spotted fever, ehrlichiosis, tularemia and anaplasmosis are reported nearly every year in Arkansas. Of these illnesses, Rocky Mountain spotted fever and ehrlichiosis are the most frequently reported tick-borne diseases in the state.

Tick-borne diseases can be difficult to diagnose and symptoms may be mistaken for other illnesses. For these reasons, it is important to notify your healthcare providers of exposure to ticks if you have symptoms of tick-borne illnesses. Knowledge of tick-borne diseases and personal protective measures can help reduce disease risks associated with tick bites.

Rocky Mountain Spotted Fever

Rocky Mountain spotted fever (RMSF) is the most prevalent and severe tick-borne disease in Arkansas. The causal agent of RMSF is the rickettsial bacterium, *Rickettsia rickettsia*, which is primarily transmitted in Arkansas through the bite of an infected American dog tick, *Dermacentor variabilis*. The American dog tick is prevalent in Arkansas and is widely distributed east of the Rocky Mountains. RMSF is transmitted in the west by the Rocky Mountain wood tick, *Dermacentor andersoni*, and in the southwest primarily by the brown dog tick, *Rhipicaphalus sanguineus*. RMSF can be difficult to diagnose in the early stages and can be fatal without prompt treatment.



American dog tick female (left) and male (right). The American dog tick is the primary vector of RMSF and one of the vectors of tularemia. (Gary Alpert, Harvard University, Bugwood.org)



Brown dog tick female (left) and male (right). Vector of RMSF in the Southwest U.S. (Mat Pound, USDA Agricultural Research Service, Bugwood.org)

Early clinical symptoms of RMSF are nonspecific and may resemble a variety of other infectious and non-infectious diseases. Early symptoms may include fever, nausea, vomiting, severe headache, muscle pain and lack of appetite. A rash of small, flat, pink, non-itchy spots on the wrists, forearms and ankles may (or may not) first appear two to five days after the onset of fever. Often the rash varies from this description, and people who fail to develop a rash or who develop an atypical rash are at increased risk of being misdiagnosed.

The red to purple, spotted (petechial) rash of RMSF is usually not seen until the sixth day or later

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after onset of symptoms and occurs in 35 to 60 percent of patients with the infection. This is a sign of progression to severe disease, and every attempt should be made to begin treatment before petechiae develop. Appropriate antibiotic treatment should be initiated immediately upon clinical or epidemiological suspicion of RMSF. Many people with RMSF do not remember being bitten by a tick.

Other Spotted Fever Rickettsial Diseases

In addition to Rocky Mountain spotted fever (caused by *Rickettsia rickettsia*), other tick-borne species of *Rickettsia* are found in the U.S. and may cause human diseases. These diseases are often grouped together and called Spotted Fever Group *Rickettsia* (SFGR). Signs and symptoms of people infected with SFGR are similar to the signs and symptoms of RMSF. *Rickettsia parkeri* is a member of this group and is transmitted through infected *Amblyomma maculatum*, the Gulf Coast tick. Historically, the range of the Gulf Coast tick was up to 100 to 150 miles inland along the Gulf of Mexico and southern Atlantic coast. This tick is now established in Arkansas, Oklahoma and Kansas. In addition to potential transmission of human diseases, this tick can transmit pathogens of veterinary importance.



Gulf coast tick is a relatively new pest in many areas (male, left, and female, right) and the vector of *Rickettsia parkeri* (a member of the SFGR). (Mat Pound, USDA Agricultural Research Service, Bugwood.org)

Ehrlichiosis

Ehrlichiosis refers to several human and animal diseases caused by infection with bacteria in the genus *Ehrlichia*. Human ehrlichiosis (also called human monocytic ehrlichiosis) is caused by either *Ehrlichia chaffeensis* or *Ehrlichia ewingii*. *Ehrlichia chaffeensis* was first described in 1986 (from soldiers training at Fort Chaffee, Arkansas). Human ehrlichiosis occurs primarily in the southeastern and south-central regions of the country and is transmitted by the lone star tick, *Amblyomma americanum*, one of the most abundant ticks found in Arkansas.

Human ehrlichiosis symptoms vary from mild to severe and may include fever, headache, malaise and

muscle ache. Rashes are uncommon with adult ehrlichiosis patients; however, about 60 percent of pediatric patients may develop a rash. Ehrlichiosis is a serious illness that can be fatal if not treated correctly, even in previously healthy people. Severe clinical presentation may include difficulty breathing or bleeding disorders. Patients who are treated early may recover quickly on medication in outpatient settings, while those who experience a more severe course may require intravenous antibiotics, prolonged hospitalization or intensive care. Nearly one-half of untreated ehrlichiosis patients may require hospitalization. Prompt antibiotic treatment is advised for patients suspected of having ehrlichiosis.



Lone star tick (male, left, and female, right) is the primary vector of human ehrlichiosis, STARI and one of the vectors of tularemia. (Mat Pound, USDA Agricultural Research Service, Bugwood.org)

Anaplasmosis

Anaplasmosis refers to a disease in humans and animals infected with bacteria in the genus *Anaplasma*. Anaplasmosis in humans is a tick-borne disease caused by the bacterium *Anaplasma phagocytophilum* (formerly *Ehrlichia phagocytophilum*). Before the causal bacterium was reclassified as an *Anaplasma*, the illness was known as human granulocytic ehrlichiosis (HGE). Infected black-legged ticks (*Ixodes scapularis*) spread anaplasmosis in humans. Although most human anaplasmosis cases are reported from the upper midwestern and northeastern states, cases are reported in Arkansas.



Nymphs and adult stages of black-legged tick. Male (top left), female (top right) black-legged ticks are vectors of anaplasmosis and Lyme disease. (Jim Occi, BugPics, Bugwood)

Anaplasmosis is a serious illness that can be fatal if not treated correctly, even in previously healthy people. Typical symptoms of anaplasmosis, which occur within one to two weeks following a bite from an infected tick, include fever, headache, muscle aches and chills. Rashes are rare with anaplasmosis. Several aspects of anaplasmosis make it a challenge for healthcare providers to diagnose and treat. Symptoms vary from patient to patient and can be difficult to distinguish from other diseases. Treatment is more likely to be effective when started early in onset of symptoms.

Tularemia

Tularemia is another tick-borne disease occurring in Arkansas. Unlike other common tick-borne diseases, tularemia is also potentially spread through other means, such as deer fly (*Chrysops* spp.) bites, handling infected animal carcasses (rabbits, hares and rodents), eating or drinking contaminated food or water and breathing in the causal bacterium, *Francisella tularensis*. Over 40 percent of all cases of tularemia in the U.S. occur in Arkansas, Oklahoma and Missouri.

Arkansas ticks most capable of tularemia transmission include the lone star tick and American dog tick. Signs and symptoms of tularemia vary depending upon how the bacterium entered the body. All forms of tularemia include a fever (as high as 104°F). Severity of the disease varies from mild to life-threatening. Symptoms from infections due to infected tick or deer fly bites usually take the ulceroglandular or glandular form. In **ulceroglandular** tularemia (most common form), a skin ulcer forms at the site where the bacterium entered the body and regional lymph nodes swell (in armpit or groin). The **glandular** form is similar to the ulceroglandular except the skin ulcer is absent. The other forms of tularemia are oculoglandular, oropharyngeal and pneumonic. **Oculoglandular** tularemia occurs when the bacterium enters through the eye, resulting in inflammation of the eye and swelling of lymph glands in front of the eye. **Oropharyngeal** tularemia results from eating contaminated food or drinking contaminated water, resulting in mouth sores, sore throat, tonsillitis and swelling of lymph glands in the neck. **Pneumonic** tularemia is the worst type and results from breathing contaminated dusts of aerosols containing the bacterium. The pneumonic form can also occur when other forms of tularemia go untreated and the organism spreads through the bloodstream to the lungs.

Lyme Disease

Lyme disease is spread through the bite of the black-legged tick (*Ixodes scapularis*) infected with the

spirochete bacterium, *Borrelia burgdorferi*. The tick bite is painless, so most victims do not know they have been bitten. Ticks have three life stages: larva, nymph and adult. Each stage takes a single blood meal that can come from a variety of hosts, including humans, dogs, cats, horses, cows, deer, birds and small mammals. In the Northeast, Mid-Atlantic and upper Midwest, small larval ticks usually acquire the causal agent for Lyme disease when they feed on infected hosts (commonly small rodents). The nymphal stage appears to be responsible for most Lyme disease cases transmitted to humans in this region.

Although the spirochete bacterium responsible for Lyme disease has been found in deer, canines and ticks in Arkansas, the risk of acquiring this disease in Arkansas is currently considered low. Arkansas Department of Health authorities indicate that Lyme disease is not native to Arkansas, but individuals traveling to midwestern and northeastern states could become infected. However, University of Arkansas researchers (Trout et al., 2012) identified (in low frequency) the pathogen that causes Lyme disease (*Borrelia burgdorferi*) in deer, canines and ticks (including adult black-legged ticks, *Ixodes scapularis*). In northern areas of the U.S., where Lyme disease is common, the spirochete is transmitted by nymphal black-legged ticks, which commonly bite humans. However, in southern states, adult black-legged ticks bite larger animals (including humans). A recent study of patients in Florida and Georgia suspected of having Lyme disease identified *Borrelia burgdorferi* DNA from blood, skin and ticks removed from the patients (Clark et al., 2013). Occurrence of Lyme disease in the southern U.S. is controversial and will continue to be so until additional research is completed.

Lyme disease was first diagnosed in the U.S. in 1975 in Old Lyme, Connecticut. The disease was reported worldwide and throughout the U.S., but most U.S. cases occur in the northeastern, mid-Atlantic and north central states. The total number of nationally reported cases by the Centers for Disease Control and Prevention (CDC) in 2012 was over 22,000. The latest confirmed case in Arkansas occurred in 2007.

Lyme disease symptoms often imitate the symptoms of many other diseases. Lyme disease symptoms also appear in stages. The classic sign of the early stage, which begins a few days to a few weeks after the bite of an infected tick, is a slowly expanding red rash (erythema migrans) that may fade in the center as it spreads away from the tick bite location. It is often described as looking like a bull's-eye with alternating light and dark rings. However, it can vary from a reddish blotchy appearance to red throughout.

Only 70 to 80 percent of infected individuals develop the bull's-eye-shaped rash. Other early symptoms may include flu-like symptoms, such as mild headaches, sore throat, swollen lymph nodes, stiff and painful muscles and joints, fatigue and low fever. If left untreated, the rash usually fades spontaneously over a period of a few days to months, although the spirochetes remain. If any of these symptoms appear, seek prompt medical attention. Since the rash may fade before medical attention is sought, a photograph of the rash can aid proper diagnosis.

If ignored, the early symptoms may disappear, but more serious problems can develop months to years later. The later stages of Lyme disease can be severe and chronic. Muscle pain and arthritis, usually of the large joints, is common. Neurological symptoms include meningitis, numbness, tingling and burning sensations in the extremities, Bell's palsy (loss of control of one or both sides of the face), severe pain and fatigue (often extreme and incapacitating) and depression. Eye, heart, gastrointestinal and respiratory problems can develop. Symptoms are often intermittent, lasting from a few days to several months and sometimes years. Chronic Lyme disease, because of its diverse symptoms, mimics many other diseases and can be difficult to diagnose.

Early diagnosis of Lyme disease is based on finding a tick and the rash or, if there is no rash, the severe flu-like symptoms. Lyme disease is usually confirmed by a series of two blood tests. The first test is an enzyme immunoassay (EIA) to detect antibodies to the Lyme disease spirochete. If the EIA is positive, a second blood test, the immunoblot test, is conducted. Only if the EIA and immunoblot tests are positive is the patient considered positive. Patients treated with appropriate antibiotics in the early stages of Lyme disease usually recover rapidly and completely. People in areas with Lyme disease must be alert to ticks that are found on their body and to a rash or severe flu-like symptoms in the summer. Prompt medical attention can prevent or lessen the long-term effects of Lyme disease.

Southern Tick-Associated Rash Illness (STARI)

Southern tick-associated rash illness (STARI), also known as Masters disease, is a newly recognized tick-borne illness that produces a rash very similar to the one caused by Lyme disease. Symptoms include an expanding, red ring-like rash with a clearing central area at the site of the tick bite. This occurs in patients who have been recently bitten by the lone star tick, *Amblyomma americanum*. The rash may be accompanied by fatigue, fever, headache and muscle and joint pains. Symptoms of STARI are generally less severe than with symptoms of Lyme disease.

Most cases of STARI occur in the southern and south central U.S., where lone star ticks are most prevalent. The causal agent of STARI is unknown at this time. However, some evidence suggests that a recently discovered spirochete, *Borrelia lonestari*, could be responsible. Although polymerase chain reaction assays (PCR) have detected *Borrelia lonestari* DNA in lone star ticks removed from humans and in one case from a skin lesion of a patient, subsequent studies were unable to confirm this.

Because of the lack of a known causal agent for STARI, it is not known whether antibiotic treatment is necessary or beneficial to patients. However, because STARI's skin lesion is similar to Lyme disease, many physicians treat STARI with antibiotics, similar to early Lyme disease treatment. It appears that most cases of STARI clearly respond with timely antibiotic treatment.

Heartland Virus

The first case of Heartland virus occurred in northwestern Missouri in 2009. From 2009 through May 2014, nine cases were reported in three states (Missouri, Tennessee and Oklahoma), including two deaths. As of the publication of this fact sheet, no cases have been reported for Arkansas. However, the Oklahoma case was reported in a county that borders northwestern Arkansas.

The Heartland virus was isolated from lone star ticks, which are presumed to be the vector. The virus is a single-stranded RNA virus in the same genus (*Phlebovirus*) as Rift Valley fever. Signs and symptoms include fever, fatigue, headache, muscle ache, diarrhea, low platelet and white cell counts and loss of appetite. There is no vaccine or drug to prevent or treat the disease. Avoidance of tick bites is the best method to prevent Heartland virus infection.

Alpha-gal

Alpha-gal is the name often given to delayed anaphylaxis to red meat. This condition is related to serum IgE antibodies to alpha-gal (or oligosaccharide galactose-alpha-1,3-galactose, a sugar found in red meat). Studies have shown a marked increase in serum IgE antibodies to alpha-gal in a few individuals following tick bites. Research indicates that lone star tick bites are a cause of the IgE specific antibodies for alpha-gal in the southeastern U.S. (Commins et al., 2011). Evidence to support this conclusion includes a correlation between a history of tick bites and IgE antibodies to alpha-gal; evidence that the alpha-gal IgE antibodies are more common in areas where the lone star tick is common; and a correlation between IgE antibodies alpha-gal and IgE antibodies to proteins from the lone star tick. The first reported

case of alpha-gal occurred in 2008, and since that time, other cases in the U.S. have been reported, primarily from regions where the lone star tick occurs (Arkansas, Tennessee, Kentucky, Virginia and southern Missouri). We can expect more information about alpha-gal as additional research is completed.

Pets and Livestock

Tick-borne diseases can also cause serious illness in domestic animals. Pets that are allowed to come into contact with ticks can become infected with tick-borne illnesses, so frequently inspect pets and remove any attached or unattached ticks. Examples of tick-borne diseases in pets include cytauxzoonosis (bobcat fever) in domestic cats and canine ehrlichiosis in dogs. Anaplasmosis in ruminants (spread by ticks, some bloodsucking flies and contaminated needles, etc.) is also a concern. With pets and livestock, consider use of tick-control products recommended by veterinarians.

Precautions and Prevention

1. Avoid tick-infested areas when possible. Tick-infested areas may include dense vegetation or tall grass and the “edge” between open and forested areas.
2. Use tick repellents and apply according to label instructions. Insect repellents containing DEET or **clothing-only** repellents containing permethrin are most commonly used. Other repellents such as Bio UD (2-undecanone) have been effective in repelling ticks.
3. Find and remove ticks.
 - a. Check yourself, your children and pets frequently for ticks.
 - b. Wear light-colored clothing when in tick-infested areas, as dark ticks are more easily spotted against a light background.
 - c. After returning home, thoroughly inspect yourself with the aid of a mirror.
 - d. 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.
 - e. Bathe or shower as soon as possible after returning from tick-infested area to wash off crawling ticks and locate attached ticks.
4. Promptly remove ticks when found. If a tick is removed within a few hours after attachment, the chance of a tick transmitting a pathogen is greatly reduced.
 - a. Use clean, fine-tipped tweezers to grasp the tick as close to the skin’s surface as possible.
 - b. Pull upward with steady, even pressure. Don’t twist or jerk the tick; this can cause the mouthparts to break off and remain in the skin. If this happens, remove the mouthparts with tweezers. If you are unable to remove the mouth easily with clean tweezers, leave it alone and let the skin heal.
 - c. After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol, an iodine scrub or soap and water.
 - d. Examine gear. Ticks can ride into the home on clothing and pets, then attach to a person later, so carefully examine pets, coats and day packs.
 - e. 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.)
5. Create a tick-safe zone in your yard (from Connecticut Agricultural Experiment Station’s *Tick Management Handbook*).
 - a. Clear tall grasses and brush around homes and at the edge of lawns.
 - b. Place a 3-foot wide barrier of wood chips or gravel between lawns and wooded areas and around patios and play equipment. This will restrict tick migration into recreational areas.
 - c. Mow the lawn frequently and keep leaves raked.
 - d. Stack wood neatly and in a dry area (discourages rodents that ticks feed on).
 - e. Keep playground equipment, decks and patios away from yard edges and trees and place them in a sunny location, if possible.
 - f. Remove any old furniture, mattresses or trash from the yard that may give ticks a place to hide.
6. Know the symptoms of tick-borne disease. If you become sick and see a healthcare provider, alert them to any tick exposure.
7. Insecticide application and habitat modification are methods used to reduce tick populations around the home. Follow all label requirements when applying insecticides. Consult MP144, *Insecticide Recommendations for Arkansas* (<http://www.uaex.uada.edu/publications/mp-144.aspx>) for products labeled to use against ticks in residential and recreational areas. Consult your local Cooperative Extension Office for more information.

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