Nebraska Department of Health and Human Services

Health Alert Network

UPDATE

May 13, 2026

Tickborne Diseases in Nebraska

Healthcare providers should remain vigilant for vector-borne diseases as seasonal risk shifts throughout the year. Greater than 70% of tick-borne disease cases in Nebraska occur during March through July, coinciding with peak tick activity in Nebraska. Due to similar presentation of signs and symptoms, clinicians should maintain a high index of suspicion for tickborne diseases during this timeframe and prioritize appropriate diagnostic testing for patients with compatible symptoms, while also considering West Nile virus as a secondary possibility. Beginning in August, as tick activity decreases, diagnostic priority should shift to mosquito-borne diseases (e.g., West Nile virus) with tickborne diseases considered second. Timely recognition and diagnostic testing are essential to ensure appropriate patient management and public health response.

Spotted Fever Rickettsia (SFR)/Rocky Mountain Spotted Fever (RMSF)

SFR is a group of related bacteria that can cause spotted fevers including RMSF. Several of these SFR have similar signs and symptoms, including fever, headache, and rash, but are often less severe than RMSF. Nebraska has reported an average of 6.6 cases with SFR annually over the last five years (2021–2025). SFR, particularly **RMSF, needs to be a diagnostic consideration in any person with a fever and a history of exposure to environments where ticks might be present and empiric therapy should begin while awaiting laboratory confirmation**. A skin rash is not always present when patients first present to a physician. **RMSF is frequently overlooked or misdiagnosed, with numerous reports of serious and sometimes fatal consequences.** Nebraska has experienced fatal cases of RMSF.

Laboratory Diagnosis:

Serology

- The standard serologic test for diagnosis of RMSF is the indirect immunofluorescence antibody (IFA) assay for immunoglobulin G (IgG) using *R. rickettsii* antigen.
- IgG IFA assays should be performed on paired acute and convalescent serum samples collected 2–4 weeks apart to demonstrate evidence of a 4-fold seroconversion.
- Antibody titers are frequently negative in the first week of illness. RMSF cannot be confirmed using single acute antibody results.
- Immunoglobulin M (IgM) IFA assays are available through some reference laboratories; however, results might be less specific than IgG IFA assays for diagnosing a recent infection.
- *R. rickettsii* is closely related to other pathogenic SFR species, including *R. akari, R. parkeri,* and *Rickettsia 364D.* Closely related species of SFR share similar antigens such that antibodies directed to one of these antigens can cross-react with other heterologous spotted fever group antigens.
- Most commercial labs are unable to differentiate one spotted fever infection from another using these serologic methods.

Persistent Antibodies

- Antibodies to *R. rickettsia* can remain elevated for many months after disease resolution.

- In certain people, high titers of antibodies against *R. rickettsia* have been observed up to four years after acute illness.
- Ten percent or more of healthy people in some areas might have elevated antibody titers due to past exposure to *R. rickettsii* or other SFR.
- Comparison of paired, and appropriately timed, serologic assays provide the best evidence of recent infection.
- Single or inappropriately timed serologic tests, in relation to clinical illness, can lead to misinterpretation of results.

PCR

- Polymerase chain reaction (PCR) amplification is performed on DNA extracted from whole blood and might also be used to amplify DNA from a skin biopsy of a rash lesion, or in post-mortem tissue specimens.
- *R. rickettsii* infect the endothelial cells lining blood vessels and may not circulate in large numbers in the blood until the disease has progressed to a severe phase of infection.
- Although a positive PCR result is helpful, a negative result does not rule out the diagnosis, and treatment should not be withheld based on a negative result.

IHC and Culture

- Culture and immunohistochemistry (IHC) assays can also be performed on skin biopsies of a rash lesion or post-mortem tissue specimens.
- Culture isolation and IHC assays of *R. rickettsii* are only available at specialized laboratories; routine hospital blood cultures cannot detect the organism.

Treatment requires the use of doxycycline. Doxycycline treatment is recommended for patients of all ages, including children. Beta lactam antibiotics and fluoroquinolones are contraindicated. Immediate empiric therapy is recommended and should not be delayed while awaiting diagnostic results. Additional information on treatment and clinical care is available on the CDC Rocky Mountain Spotted Fever page.

Tularemia

Tularemia is caused by the bacterium, *Francisella tularensis*, which is naturally found in rabbits, muskrats, prairie dogs, and other rodents. Human infection occurs through several routes, including tick or deer fly bites, skin contact with infected animals, bites from infected cats, ingestion of contaminated water, or inhalation of contaminated dusts or aerosols. Nebraska has reported an average of 17 cases annually over the last five years (2021–2025) with outbreaks of disease having been reported in 2015, 2024 (2024 DHHS Increase in Tularemia HAN), and 2025 (2025 Southwest NE Public Health Department Press Release)

Disease signs and symptoms vary depending on transmission route. Illness ranges from mild to life-threatening. All forms are accompanied by fever, which can be as high as 104°F. Forms of tularemia include:

- **Ulceroglandular** The most common form of tularemia, usually occurs following a tick or deer fly bite or after handling of an infected animal. A skin ulcer appears at the site where bacteria entered the body. The ulcer is accompanied by swelling of regional lymph glands, usually in the armpit or groin.
- **Glandular** Similar to ulceroglandular tularemia but without an ulcer. Also generally acquired through the bite of an infected tick or deer fly or from handling sick or dead infected animals.
- **Oculoglandular** Occurs when bacteria enter through the eye, often when a person is butchering an infected animal and touches their eyes. Symptoms include ocular irritation and inflammation and swelling of lymph glands in front of the ear.
- **Oropharyngeal** Results from eating/drinking contaminated food or water. Patients may have sore throat, mouth ulcers, tonsillitis, and swelling of lymph nodes in the neck.
- **Pneumonic** The most serious form of tularemia, resulting from breathing contaminated dust or aerosols; can also occur when other forms of tularemia (e.g., ulceroglandular) are left untreated and the bacteria

spread through the bloodstream to the lungs. Symptoms include cough, chest pain, and difficulty breathing
- **Typhoidal** Characterized by any combination of general symptoms (without localizing symptoms of other syndromes).

Laboratory Diagnosis:
- Growth of *F. tularensis* in culture is the definitive means of confirming the diagnosis of tularemia. Depending on the form of illness, appropriate specimens include swabs or scrapings of skin lesions, lymph node aspirates or biopsies, pharyngeal swabs, sputum specimens, or gastric aspirates. Paradoxically, blood cultures are often negative.
- A presumptive diagnosis of tularemia may be made through testing specimens using IFA, IHC staining, or PCR.
- Diagnosis of tularemia can also be established serologically by demonstrating a 4-fold increase in specific antibody titers between acute and convalescent sera. Convalescent sera are best drawn at least four weeks after illness onset; hence this method may be useful for confirming the diagnosis but not for clinical management.

In patients presenting with symptoms and/or history highly suggestive of tularemia, clinicians should consider culture, which will facilitate typing if an isolate is recovered. For surveillance purposes, typing of isolates is highly advantageous. If tularemia is suspected, laboratory staff should be alerted to ensure safety precautions are in place to prevent exposure and infection. ***Although tularemia can be life-threatening, most infections are successfully treated with antibiotics. In 2025, CDC updated best practices for treatment and prophylaxis of human tularemia*** (DHHS Update on Tularemia Treatment Best Practices HAN).

Ehrlichiosis

Ehrlichiosis is caused most commonly by *Ehrlichia chaffeensis* (less commonly *Ehrlichia ewingii*), an intracellular bacterium that grows within cytoplasmic phagosomes of white blood cells and can cause leukopenia. These bacteria are transmitted via the tick bite of *Amblyomma americanum* ("Lone star tick"). Symptoms may include severe malaise, fever, and headache. Although rare, severe outcomes, including death, are possible. Nebraska has reported an average of 15.4 cases annually over the last five years (2021-2025) an increase of 166% compared to the previous five years (2016–2020). With the expansion of the Lone star tick in Nebraska, this disease is likely underdiagnosed. **Providers suspecting SFR or RMSF should also consider ehrlichiosis as a differential diagnosis**.

Laboratory Diagnosis:

PCR
- PCR amplification is typically performed on whole blood specimens but might also be used to amplify DNA in solid tissue and bone marrow specimens.
- PCR is the preferred test assay and most sensitive in the first week of illness and decreases in sensitivity following the administration of appropriate antibiotics (within 48 hours).
- Although a positive PCR result is helpful, a negative result does not rule out the diagnosis, and treatment should not be withheld based on a negative result.

Serology
- The reference standard serologic test for diagnosis of ehrlichiosis is the IFA assay for IgG.
- IgG IFA assays should be performed on paired acute and convalescent serum samples collected 2–4 weeks apart to demonstrate evidence of a 4-fold seroconversion.
- Antibody titers are frequently negative in the first week of illness. Ehrlichiosis cannot be confirmed using single acute antibody results.

- IgM IFA assays offered by reference laboratories are not necessarily indicators of acute infection and might be less specific than IgG antibodies.
- Antibodies, particularly IgM antibodies, can remain elevated in patients for whom no other supportive evidence of a recent ehrlichiosis infection exists. For these reasons, IgM antibody titers alone should not be used for laboratory diagnosis.

Persistent Antibodies

- Antibodies against *Ehrlichia* species might remain elevated for many months after disease has resolved.
- Comparison of paired, and appropriately timed, serologic assays provide the best evidence of recent infection.
- Single or inappropriately timed serologic tests, in relation to clinical illness, can lead to misinterpretation of results.

Cross Reactivity

- Closely related organisms, including those in the *Ehrlichia* and *Anaplasma* genera, share similar antigens such that antibodies directed to one of these antigens can cross-react.
- Most commercial labs are unable to differentiate between *Ehrlichia* species.
- In areas endemic for Ehrlichiosis and Anaplasmosis, IFA using antigen from both Ehrlichia and Anaplasma species should be run side-by-side.

IHC and Culture

- Culture isolation and IHC assays of *Ehrlichia* species are only available at specialized laboratories; routine hospital blood cultures cannot detect the organism.
- PCR, culture, and IHC assays can also be applied to post-mortem specimens.
- If a bone marrow biopsy is performed as part of the investigation of cytopenias, immunostaining of the bone marrow biopsy specimen can diagnose ehrlichiosis.

Blood-smear Microscopy

- During the first week of illness, a microscopic examination of a peripheral blood smear might reveal morulae (microcolonies of *Ehrlichiae*) in the cytoplasm of white blood cells and is highly suggestive.
    - *E. chaffeensis* most commonly infects monocytes.
    - *E. ewingii* more commonly infects granulocytes.
- Blood smear examination is relatively insensitive and should not be relied upon as a sole diagnostic.
- The observance of morulae in a particular cell type cannot conclusively differentiate between *Ehrlichia* species or between *Ehrlichia* and *Anaplasma* infections.

Recommended therapy is with doxycycline. Immediate empiric therapy is recommended and should not be delayed while awaiting diagnostic results. Additional information on treatment and clinical care is available on the CDC Ehrlichiosis page.

Anaplasmosis

Anaplasmosis is caused by *Anaplasma phagocytophilum*, an intracellular bacterium that infect neutrophils, altering their function, and forms morulae within vacuoles. Symptoms are similar to ehrlichiosis and include malaise, fever, and headache. If left untreated, anaplasmosis can be fatal, even in previously healthy people. Severe clinical presentations may include difficulty breathing, hemorrhage, renal failure, or neurological deficits. Like Lyme disease, anaplasmosis is transmitted by the *Ixodes scapularis* tick. Established populations of this tick have been identified in Douglas, Sarpy, and Saunders counties in 2019, Thurston County in 2021, and Cuming County in 2025, **increasing suspicion that anaplasmosis could be locally acquired in eastern Nebraska. However, Nebraska is presently considered a low prevalence state for anaplasmosis, and currently local human health risk is unknown, but clearly of increased concern.** Nebraska has reported an average of <1 case annually over the last five years (2021–2025).

Laboratory diagnosis:

PCR

- PCR is typically performed on DNA extracted from whole blood specimens but might also be used to amplify DNA in solid tissue, bone marrow, and autopsy tissue specimens.
- PCR is the preferred test assay and most sensitive in the first week of illness and decreases in sensitivity following the administration of appropriate antibiotics (within 24–48 hours).
- Although a positive PCR result is helpful, a negative result does not rule out the diagnosis, and treatment should not be withheld on the basis of a negative result.

Serology

- The reference standard serologic test for diagnosis of ehrlichiosis is the IFA assay for IgG using *A. phagocytophilum* antigen.
- IgG IFA assays should be performed on paired acute and convalescent serum samples collected 2–4 weeks apart to demonstrate evidence of seroconversion (4-fold increase).
- Antibody titers are frequently negative in the first week of illness. Anaplasmosis cannot be confirmed using single acute antibody results.
- IgM IFA assays may also be offered by reference laboratories, however, are not necessarily indicators of acute infection and might be less specific than IgG antibodies.
- Antibodies, particularly IgM antibodies, might remain elevated in patients for whom no other supportive evidence of a recent anaplasmosis infection exists. For these reasons, IgM antibody titers alone should not be used for laboratory diagnosis.

Persistent Antibodies

- Antibodies to *A. phagocytophilum* might remain elevated for many months after the disease has resolved.
- In certain people, high titers of antibodies against *A. phagocytophilum* have been observed up to four years after the acute illness.
- Between 5–10% of healthy people in some areas might have elevated antibody titers due to past exposure to *A. phagocytophilum* or similar organisms.
- Comparison of paired, and appropriately timed, serologic assays provide the best evidence of recent infection.
- Single or inappropriately timed serologic tests, in relation to clinical illness, can lead to misinterpretation of results.

Blood-smear Microscopy

- During the first week of illness, a microscopic examination of a peripheral blood smear might reveal morulae (microcolonies of anaplasmae) in the cytoplasm of granulocytes and is highly suggestive of a diagnosis.
- However, blood smear examination is relatively insensitive and should not be relied upon solely to diagnose anaplasmosis.
- The observance of morulae in a particular cell type cannot conclusively differentiate between *Anaplasma* and *Ehrlichia* species.

IHC and Culture

- IHC assays of *A. phagocytophilum* are only available at specialized laboratories; routine hospital blood cultures cannot detect the organism.
- Culture and IHC assays can also be applied to autopsy tissue specimens.

Recommended therapy is with doxycycline. Immediate empiric therapy is recommended and should not be delayed while awaiting diagnostic results. Additional information on treatment and clinical care is available on the CDC Anaplasmosis page.

Lyme Disease

Lyme disease is caused by the bacterium *Borrelia burgdorferi*, and transmitted via the bite of *Ixodes scapularis* ("Blacklegged or deer tick"). Early-stage symptoms may include fever, chills, headache, fatigue, muscle and joint pain, swollen lymph nodes, and erythema migrans (EM) rash and typically begin within 3–30 days after a tick bite. The EM rash occurs in 70–80% of infections and will sometimes clear as it enlarges resulting in the "bull's-eye" appearance. However, most EM rashes due to Lyme disease do not appear as the classic bull's-eye rash. Late-stage symptoms of Lyme disease typically begin weeks to months after the initial infection and can include severe headache, neck stiffness, facial palsy, arthritis (particularly of large joints), heart palpitations or irregular heartbeat, and inflammation of the brain and spinal cord. Nebraska has reported an average of 6.8 cases annually over the last five years (2021–2025). In 2019, established populations of *I. scapularis* were identified in Douglas, Sarpy, and Saunders counties. In 2021, as part of an epidemiological investigation into a cluster of Lyme disease cases, an established population was detected for the first time in Thurston County. Ticks collected from Thurston County tested positive for *B. burgdorferi*, marking the first detection of the pathogen in Nebraska ticks. **Local identification of both the vector and pathogen, in association with documented Lyme disease cases, demonstrates that Lyme disease can be acquired in eastern Nebraska. However, Nebraska will likely remain a low prevalence state for Lyme disease. Providers suspecting Lyme disease must be vigilant and obtain thorough patient histories, including any travel 30 days prior to symptom onset, reported tick attachments/bites, reported exposure to tick habitat (e.g., tall grass or wooded areas), etc. Additionally, providers should take great care to order appropriate serologic tests in the correct order**.

Laboratory Diagnosis:

Serology

- The serologic tests for diagnosis of Lyme disease include:
    - Standard two-tier test (STTT)
        - The first tier is a serum antibody test and may be an enzyme immunoassay (EIA) or IFA for IgM and/or IgG.
        - If the EIA/IFA is positive or equivocal, this is reflexed to a Western immunoblot. If this is positive, the STTT is considered positive.
    - Modified two-tier test (MTTT)
        - Approved MTTTs will run two EIA tests concurrently or sequentially.
        - The first tier EIA tests for IgM/IgG and if positive or equivocal, second tier individual EIA is run to distinguish between IgM and IgG antibodies.
- Positive second tier IgM Western blot (STTT) and second tier IgM EIA (MTTT) results should be disregarded if the patient has been ill for more than 30 days.
- Association of Public Health Laboratories Suggested Reporting, Language and Interpretation For Lyme Disease Serological Test Results

PCR

- PCR testing is not generally recommended because of low sensitivity. This is due to low levels of the bacteria circulating in the blood.
- It may be useful in certain situations, such as testing synovial fluid to help differentiate Lyme arthritis from other types of arthritis.

Cross Reactivity

- False positive cross-reactions may occur in patients with other conditions including relapsing fever, syphilis, rheumatoid arthritis, and Epstein-Barr virus infection.

Recommended therapy is with proper antibiotic treatment regimens (CDC Lyme Disease Treatment Best Practices).

Heartland and Bourbon Viruses

Heartland and Bourbon viruses are both RNA viruses and believed to be transmitted by the Lone star tick. Heartland virus was first discovered in 2009 in Missouri. Initial symptoms are similar to ehrlichiosis, including fever, fatigue, anorexia, nausea, and diarrhea. Bourbon virus was discovered in Bourbon County, Kansas in 2014. Symptoms reported by patients include fever, fatigue, anorexia, nausea, vomiting, and maculopapular rash. Leukopenia, thrombocytopenia, and mild to moderate elevation of liver transaminases have also been seen in patients diagnosed with Heartland or Bourbon viruses. To date, no cases of Heartland or Bourbon viruses have been identified in Nebraska residents. **However, the first detection of Heartland virus in tick samples was identified in 2025 from ticks collected in southeast Nebraska indicating it is circulating in local Lone star ticks.** Infection with Heartland or Bourbon viruses should be considered in patients being treated for suspected tick-borne disease who do not respond to treatment (e.g., doxycycline). Presently, commercial testing is available for Heartland virus at Mayo Clinic Laboratories by PCR on serum (HRTV Serum PCR Mayo Clinic) and CSF (HRTV CSF PCR Mayo Clinic). Commercial testing for Bourbon virus is not currently available. Protocols are also in place to allow people to be tested for evidence of Heartland and Bourbon virus infections through the CDC. **Providers must contact their local health department to determine if suspected patients meet CDC criteria for testing.**

CDC specimen submission criteria for Heartland and Bourbon virus testing

Testing for Heartland or Bourbon virus should be considered for patients with an acute febrile illness within the past three months AND at least one epidemiologic criterion AND at least one clinical criterion:

- Epidemiologic criteria
    - Known tick bite, finding tick on body, or potential exposure to ticks through outdoor activities in the three weeks prior to illness onset during spring through fall (April–October); OR
    - Resides in or recently traveled to an area with previous evidence of Heartland or Bourbon virus. These areas can be found here: Data and Maps for Heartland virus.
- Clinical criteria
    - Leukopenia (white blood cells <4,500 cells/µL) or thrombocytopenia (platelets <150,000 cells/mL) not explained by another known condition (e.g., negative laboratory testing for other tick and mosquito-borne diseases common to the area); OR
    - Suspected tickborne disease (e.g., RMSF, ehrlichiosis) with no clinical response to appropriate treatment (e.g., doxycycline).

Samples collected >3 months after symptom onset will not be tested at this time based on limitations of current understanding of antibody kinetics.

As of May 2026, the following tests for Heartland and Bourbon virus are available at CDC:

Test	Heartland Virus	Bourbon Virus
RT-PCR	Yes	Yes
IgM MIA	Yes	Not available
IgG MIA	Not Available	Not available
PRNT	Yes	Yes

Alpha-gal Syndrome (Red meat allergy)
An updated alpha-gal syndrome specific HAN will be sent out in the near future. See prior HAN Alpha-Gal Syndrome in Nebraska.

For More Information, Please Visit

Nebraska DHHS Tickborne Disease Information for Health Professionals

Nebraska DHHS Tick Surveillance Maps

Tickborne Diseases of the US: A Reference Manual for Health Care Providers, Sixth Edition (2022)

Jeff Hamik, MS
Vector-Borne Disease Epidemiologist
402-471-2937

Timothy Tesmer, MD
CMO Public Health
402-471-8566

Sydney R. Stein, DVM, MPH
State Epidemiologist
402-471-8566