UTAH DEPARTMENT OF HEALTH

Q Fever

Disease Plan

Quick Links:

Last updated: March 14, 2018 by Dallin Peterson

Questions about this disease plan?

Contact the Utah Department of Health Bureau of Epidemiology: 801-538-6191.

✓ CRITICAL CLINICIAN INFORMATION

Clinical Evidence

Signs/Symptoms

- 60% Asymptomatic
- High fever (104-105˚F)
- Headache
- Malaise
- Pneumonia or hepatitis

Period of Communicability

- Direct person to person transmission of Q fever is rare

Incubation Period

- Acute Q fever is generally 2-3 weeks
- Chronic Q fever can develop as soon as 6 weeks or up to 20 years after exposure

Mode of Transmission

- Exposure to placental tissue and amniotic fluid
- Breathing in dust contaminated with placental materials, birth fluids, or excrement
- Direct contact with contaminated straw, fertilizer, or laundry

Laboratory Testing

Type of Lab Test/Timing of Specimen Collection

- Immunofluoresence Assay (IFA) (Phase I and Phase II IgM/IgG *gold standard
  - Specimen must be collected within 2 weeks after symptom onset and convalescent collected 3-6 weeks later
- Nucleic Acid Testing
  - Specimen must be obtained within the first 2 weeks of symptom onset and before or shortly after administration of antibiotics
- Isolation is not recommended

Type of Specimens

- Serum, red-top or serum separator tube
  - Ship cold if less than 24 hours or frozen over 24 hours
- Blood for nucleic acid testing is an EDTA tube shipped cold

Treatment Recommendations

Type of Treatment

- Adults
  - Doxycycline 100 mg every 12 hours for 14 days
- Children under 45 kg
  - Doxycycline kg 2.2 mg/kg twice daily for 14 days
- Children over 45 kg
  - Doxycycline 100 mg twice daily for 14 days
- Pregnant Women
  - 160 mg of trimethoprim and 800 mg of sulfamethoxazole twice daily throughout duration of pregnancy

Time Period to Treat

- Treatment is most effective when started in the early course of disease

Prophylaxis

- Not recommended

Contact Management

Isolation and Quarantine of Case

- None

Infection Control Procedures

- Standard Precautions

✓ WHY IS Q FEVER IMPORTANT TO PUBLIC HEALTH?

Q fever is a worldwide disease with acute and chronic stages. Cattle, sheep and goats are the primary reservoirs. There are many ways to contract Q fever, such as drinking raw milk, or exposure to animal birthing material. The organism is hardy and can be dried and spread through air. It doesn't take much of the bacteria to infect someone. Finding farms that are infected with Q fever requires partnerships between public health and agriculture agencies. These agencies can work together to eliminate the source and prevent future animal and human illness.

Q fever is also a class B bioterrorism agent.

✓ DISEASE AND EPIDEMIOLOGY

Clinical Description

While up to 60% of infections are asymptomatic, symptomatic infections present in two distinct forms: acute, which occurs just after initial exposure; and chronic, which can occur years after an initial infection. Many symptoms are commonly seen with acute Q fever, such as high fevers (up to 104-105° F), severe headache, myalgias, malaise, weakness, chills, severe sweating, nausea, vomiting, diarrhea, abdominal pain, chest pain and anorexia. Pneumonia or hepatitis occurs in up to 60% of acutely ill persons. The illness resolves gradually over 1-4 weeks, and life-threatening sequelae such as endocarditis and meningoencephalitis are rare.

The chronic form of the disease is characterized by infection that lasts for more than six months. This form is far less common—occurring in less than 5% of infected persons—but more serious. Chronic Q fever may develop any time between 1-20 years after the initial infection. The most serious complication of chronic disease is endocarditis: infection of the valves of the heart. Patients with pre-existing valvular disease, cancer, and chronic kidney disease are at greater risk for the development of the chronic form of Q fever.

Coxiella burnetii has the ability to persist for long periods of time in the body after infection. Although most people with acute Q fever recover completely, a post-Q fever fatigue syndrome has been reported to occur in 10-25% of some acute patients. This syndrome is characterized by constant or recurring fatigue, night sweats, severe headaches, photophobia (eye sensitivity to light), pain in muscles and joints, mood changes, and difficulty sleeping.

Causative Agent

Q fever is a bacterial disease caused by *Coxiella burnetii*. *C. burnetii* is classified as a rickettsiae and is an intracellular pathogen. The organism is very stable and is highly resistant to many disinfectants.

Differential Diagnosis

Symptoms are non-specific and diagnosis can be delayed. Both infectious and non-infectious etiologies should be considered. This disease can be mistaken for other chronic febrile illnesses such as plague and brucella. A careful history that assesses for exposures to animals, as well as certain geographic regions, may increase a provider's suspicion for diagnosing Q fever.

Laboratory Identification

Medical Providers

Medical providers should request both Phase I and Phase II IgG and IgM serologic titers for diagnostic confirmation of acute and chronic Q fever.

Testing at Utah Public Health Lab (UPHL)

The UPHL can provide diagnostic capabilities for this organism during threat events. UPHL performs PCR, but send serology tests to CDC. Reference laboratories, such as ARUP, can perform serology tests.

Specimens

Serum

Serum is collected in either a red-top or serum separator tube, collected within the first 2 weeks after symptom onset with a convalescent-phase specimen collected 3-6 weeks later. Serum should be shipped cold if less than 24 hours or frozen if over 24 hours.

Blood

Whole blood for Nucleic Acid Detection testing should be collected before antibiotic administration in an EDTA anticoagulant tube and shipped cold on gel packs if less than 24 hours.

Overview

When a person develops Q fever, their immune system produces antibodies to *C. burnetii,* with detectable antibody titers usually observed by 7-10 days after illness onset. It is important to note that a negative test during the first week of illness does not rule out Q fever as a cause of illness.

Antibodies to *C. burnetii* may remain elevated for months or longer after the disease has resolved, or may be detected in persons who were previously exposed to antigenically related organisms. Approximately 3% of currently healthy people in the U.S. general population and up to 20% of people in high-risk professions (veterinarians, ranchers, etc.) have elevated antibody titers due to past exposure to *C. burnetii.* Therefore, if only one sample is tested, it can be difficult to interpret the findings.

Serologic Testing

There are two distinct antigenic phases to which humans develop antibody responses. In acute infection, an antibody response Phase II antigen is predominant and is higher than Phase I antibody response; the reverse is true in chronic infection which is associated with a rising

Phase I IgG titer (according to current U.S. case definitions >1:800) that is often much higher than Phase II IgG.

For an acute illness, IgM antibodies rise at the same time as IgG near the end of the first week of illness and remain elevated for months or longer as shown in figure 1 and 2. Also, IgM antibodies are less specific than IgG antibodies and more likely to result in a false positive. For these reasons, physicians should request both Phase I and Phase II IgG and IgM serologic titers for diagnostic confirmation of acute and chronic Q fever.

Paired serum samples provide the best evidence for a correct diagnosis of acute Q fever. The first sample should be taken as early in the disease as possible, preferably in the first week of symptoms, and the second sample should be taken 3-6 weeks later demonstrating a significant (four-fold) rise in antibody titer levels. The first IgG titer is typically low, or “negative,” and the second typically shows a significant (four-fold) increase in IgG antibody levels.

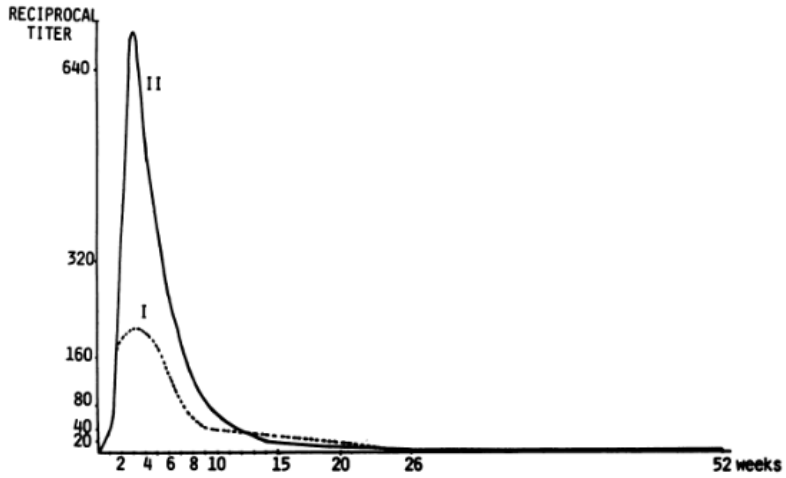

Figure 1: IgM antibodies to C. burnetti Phase l and II by IFA.

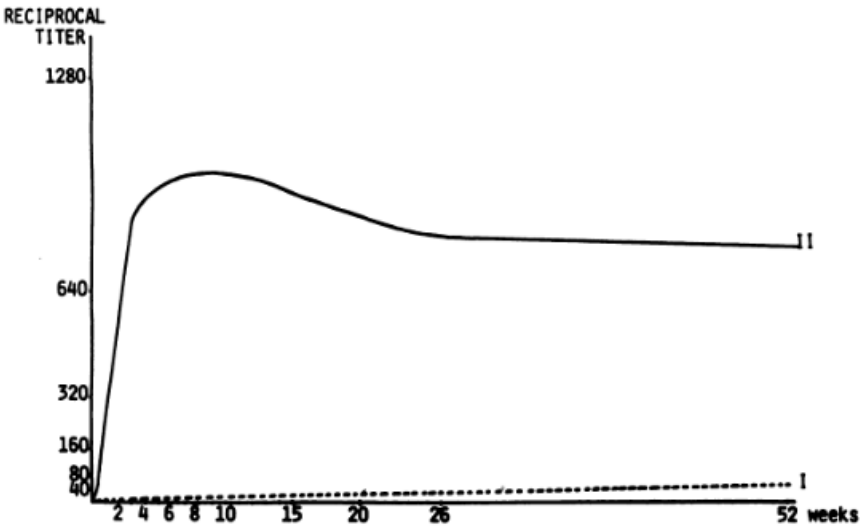

Figure 2: IgG antibodies to C. burnetti Phase l and II by IFA

Diagnosis of chronic Q fever is confirmed by elevated Phase I IgG antibody (according to current U.S. case definitions >1:800 and higher than Phase II IgG) and an identifiable persistent focus of infection (e.g. endocarditis). Elevated Phase I titers alone do not confirm a chronic Q fever diagnosis and would not warrant treatment in a clinically normal patient. Because chronic Q fever involves lengthy persistence of the organism in the body, the antibody levels are often quite high, and you will not see a rising titer between paired serum specimens.

Immunofluoresence Assay (IFA)
The gold standard serologic test for diagnosis of acute Q fever is the indirect immunofluorescence assay (IFA) using *C. burnetii* antigen, performed on paired serum samples to demonstrate a significant (four-fold) rise in antibody titers.

Nucleic Acid Detection
It is important for medical providers to be aware that the sensitivity and specificity can differ due to multiple PCR techniques that have been developed for Q fever testing.

Either whole blood or serum can be used for PCR testing. Whole blood might have a higher concentration of *C. burnetii* DNA than serum but is also likely to have more PCR inhibitors. For PCR results to be useful, the clinical sample must be obtained in the acute phase of infection (optimally during the first 2 weeks of symptom onset) and either before or shortly after (within 24-48 hours) antibiotic administration. When appropriate samples are drawn (i.e., during the acute phase and before or shortly after antibiotic administration), PCR results are positive in almost all patients with early acute Q fever before the antibody response develops. Patients with suspected chronic Q fever should have whole blood or serum PCR tests performed because they can experience a recurrent bacteremia similar to early acute infection.

Isolation
Cultivation of *C. burnetii* is not recommended for routine diagnosis because the process is difficult, time consuming, and dangerous; culture requires a biosafety level 3 (BSL-3) laboratory because bacteria are highly infective and can be hazardous for laboratory workers. Often, patients with chronic Q fever have already received antibiotics, which further complicates isolation attempts; a negative culture does not rule out a *C. burnetii* infection. If necessary, specimens can be referred to the Utah Public Health Lab and sent to CDC.

Treatment

Doxycycline is the most effective at preventing severe complications from developing, if it is started early in the course of the disease. Therefore, treatment must be based on clinical suspicion alone, and should always begin before laboratory results return.

If the patient is treated within the first three days of the disease, fever generally subsides within 72 hours. In fact, failure to respond to doxycycline suggests that the patient's condition might not be due to Q fever. Severely ill patients may require longer periods before their fever resolves. Resistance to doxycycline has not been documented.

There is no role for prophylactic antimicrobial agents in preventing Q fever after a known exposure and prior to symptom onset; attempts at prophylaxis will likely extend the incubation period by several days, but will not prevent infection from occurring.

Recommended Dosage for Acute Q Fever	
Adults	Doxycycline 100 mg twice daily for 14 days
Children under 45 kg	Doxycycline 2.2 mg/kg body weight given twice a day for 14 days
Children over 45 kg	Doxycylcine 100 mg twice daily for 14 days
Pregnant Women	Trimethoprim 160 mg twice daily
	or
	Sulfamethoxazole 800 mg twice daily
Patients should be treated for at least three days after the fever subsides and until there is evidence of clinical improvement. Standard duration of treatment is 2-3 weeks. Expert consultation with an infectious disease is recommended.	
Recommended Dosage for Chronic Q fever	
Adults	Doxycycline 100 mg every twice daily
	or
	Hydroxychloroquine 200 mg every 8 hours
Standard duration of treatment is 18-24 months.	

Treating Children

The use of doxycycline is recommended to treat Q fever in children of all ages who are hospitalized or are severely ill. Unlike older generations of tetracyclines, doxycycline has not been shown to cause staining of permanent teeth, and most experts consider the benefit of doxycycline in treating Q fever in children younger than eight years of age with severe illness, or who are hospitalized, greater than the potential risk of dental staining. Children with mild illness who are less than eight years of age may be treated with trimethoprim and sulfamethoxazole, but therapy should be switched to doxycycline if their course of illness worsens.

Other Treatments

In cases of life threatening allergies to doxycycline and in pregnant patients, physicians may need to consider alternate antibiotics. Treatment of pregnant women diagnosed with acute Q fever with twice daily with trimethoprim and sulfamethoxazle throughout pregnancy has been shown to significantly decrease the risk of adverse consequences for the fetus.

Case Fatality

Approximately 1-2% of hospitalized acute cases are fatal. The fatality rate for untreated chronic Q fever with endocarditis is 25-60%.

Reservoir

Goats, sheep, and cattle appear to be the most important animal reservoirs. Other potential reservoirs include: dogs, cats, feral rodents, and birds. Ticks appear to be important in maintaining the disease reservoir within animals and some birds. However, direct human infection from a tick bite is rare.

Transmission

Infected animals are usually asymptomatic, but they shed large numbers of organisms in placental tissue and amniotic fluid. The *C. burnetii* bacterium is most commonly transmitted through breathing in dust contaminated with dried placental material, birth fluids, or excrement from infected animals. Direct contact with infected animals or contaminated materials, such as straw, fertilizer, and laundry, is also a mode for transmission. *C. burnetii* has an extremely low infectious dose. A single inhaled organism may be enough to cause infection. *C. burnetii* is resistant to heat, drying, and many common disinfectants. The organism's ability to persist in the environment may result in a continued risk for infection weeks to months after an animal's birthing event. In rare cases, human infections have been reported to occur via intradermal injection, blood transfusion, and transplacentally. Transmission through ingestion of raw milk of infected cows or by tick bites is rare.

Susceptibility

All people are susceptible to Q fever; however, certain professions are at higher risk, for example, veterinarians, meat workers, sheep (occasionally dairy) workers, and farmers. Also, those who work in stockyards, meatpacking and rendering plants, laboratories, and in medical and veterinary centers that use sheep in research are at higher risk.

Incubation Period

The incubation period for acute Q fever varies, but it is generally 2-3 weeks. Signs and symptoms of chronic Q fever may develop soon (within six weeks) after an acute infection, or may manifest anytime from 1-20 years after exposure.

Period of Communicability

Direct person-to-person transmission of Q fever is rare.

Epidemiology

Q fever is a zoonotic disease that occurs worldwide. Human infection is presumably underreported. People with regular contact with sheep, goats, or cattle—such as veterinarians, meat processing plant workers, sheep and dairy workers, or livestock farmers—have the highest risk of exposure. In farming areas, seasonal disease trends occur with predictability, with the greatest increase in cases occurring around the lambing season during early spring. Around 3% of the healthy adult U.S. population and 10-20% of persons in high-risk occupations (veterinarians, farmers, etc.) have antibodies to *C. burnetii*, suggesting past infection.

Q fever was made a notifiable disease condition in the U.S. in 1999 in order to better understand the epidemiology and magnitude of the disease. The surveillance case definition for Q fever was modified in 2008 to revise laboratory criteria for diagnosis, and to allow for separate reporting of acute and chronic Q fever. During 2008-2014, the number of nationally reported cases decreased slightly relative to 2007, and the incidence rate has decreased to 0.4 cases per million persons/year. One hundred seventy-six (176) cases of Q fever were reported in the U.S. with onset in 2014; of these, 137 were acute Q fever and 39 were chronic Q fever.

Cases of Q fever are most frequently reported from western and plains states where ranching and rearing of cattle are common. In other states, areas where sheep, goat, and cattle ranching are locally practiced may demonstrate increased incidence. Four states (California, Colorado, Illinois, and Texas) have accounted for thirty five percent (35%) of all cases since human Q fever became notifiable. Cases of Q fever are reported less frequently in the eastern U.S. Sporadic reports of cases may result from patients involved in animal research work and from patient travel to other states.

Although cases of Q fever can occur during any month of the year, most cases report onset of illness during the spring and early summer months, peaking in April and May. These increases coincide with increases in human outdoor activity, and with the birthing season for a number of domestic animal species.

Since 2010, Utah has had 21 cases of Q fever (confirmed and probable) reported. Ten of these were acute, and eleven are chronic.

Bioterrorist Potential
C. burnetii is listed by the Centers for Disease Control and Prevention (CDC) as a Category B bioterrorist agent. If acquired and properly disseminated, *C. burnetii* could cause a serious public health challenge.

✓ PUBLIC HEALTH CONTROL MEASURES

Public Health Responsibility

- Identify the source of infection and prevent further transmission.
- Rule out the possibility of bioterrorism; Q fever is a category B agent.
- Check laboratory workers to assure that there was no exposure to the isolate, or that exposed laboratory personnel are appropriately treated.
- Notify the Utah Department of Agriculture and Food (UDAF) if case was acquired in Utah.
- Provide education.
- Ensure environmental health assessment is completed if warranted.
- Identify additional exposure and contacts.

Prevention

- Assure appropriate disposal of placenta, birth products, fetal membranes, and aborted fetuses at facilities housing sheep and goats in accordance with facility-specific guidelines for infectious waste.
- Restrict access to barns and laboratories used in housing potentially infected animals.
- Use only pasteurized milk and milk products.
- Use appropriate procedures for bagging, autoclaving, and washing of laboratory clothing. Soiled laundry should not be shaken or handled in a way that might aerosolize infectious particles. For more information visit the CDC website at https://www.cdc.gov/mmWr/preview/mmwrhtml/rr6203a1.htm.

- Quarantine imported animals.
- Ensure that holding facilities for sheep are located away from populated areas. Animals should be routinely tested for antibodies to *C. burnetii,* and measures should be implemented to prevent airflow to other occupied areas.

Chemoprophylaxis

Chemoprophylaxis following potential exposures is generally not recommended. Exposed populations may be monitored by public health or UDAF. If symptoms arise after exposure, immediate medical evaluation or treatment is recommended.

Vaccine

A vaccine for Q fever has been developed and has successfully protected humans in occupational settings in Australia. However, this vaccine is not commercially available in the U.S. Persons wishing to be vaccinated should first have a skin test to determine a history of previous exposure. Individuals who have previously been exposed to *C. burnetii* should not receive the vaccine because severe reactions, localized to the area of the injected vaccine, may occur. A vaccine for use in animals has also been developed, but it is not available in the U.S.

Isolation and Quarantine Requirements

Isolation: None.

Hospital: None.

Quarantine: None.

✓ CASE INVESTIGATION

Reporting

- Report all suspect and confirmed cases of Q fever.
- Q fever is a category B BT agent

Criterion	Acute Q fever		Chronic Q fever	
	Reporting			
Clinical Presentation				
Fever		N		
Rigors		O		
Severe retrobulbar headache		O		
Acute hepatitis		O		
Pneumonia		O		
Elevated liver enzyme levels		O		

Culture-negative endocarditis (particularly in a patient with previous valvulopathy or compromised immune system)				O
Suspected infection of a vascular aneurysm				O
Suspected infection of a vascular prosthesis				O
Chronic hepatitis				O
Chronic osteomyelitis				O
Chronic osteoarthritis				O
Chronic pneumonitis				O
Infection persists >6 months				N
Absence of other known etiology				N
Healthcare record contains a diagnosis of Q fever		S		
Death certificate lists Q fever as a cause of death or a significant condition contributing to death		S		
Laboratory findings†				
Serological evidence of a fourfold change in immunoglobulin G (IgG)-specific antibody titer to *C. burnetii* Phase II antigen by indirect immunofluorescence assay (IFA) between paired serum samples		O	O	
Detection of *C. burnetii* DNA in a clinical specimen via amplification of a specific target by polymerase chain reaction (PCR) assay		O	O	O
Demonstration of *C. burnetii* antigen in a clinical specimen by immunohistochemical methods (IHC)		O	O	O
Isolation of *C. burnetii* from a clinical specimen by culture		O	O	O
Single IFA IgG titer of ≥1:128 to Phase II antigen		O	O	
Serologic evidence of elevated IgG or IgM* antibody reactive with *C. burnetii* antigen by enzyme-linked immunosorbent assay (ELISA)		O	O	
Serologic evidence of elevated IgG or IgM* antibody reactive with *C. burnetii* antigen by dot-ELISA		O	O	

Serologic evidence of elevated IgG or IgM* antibody reactive with *C. burnetii* antigen by latex agglutination		O	O	
Serological evidence of IgG antibody to *C. burnetii* Phase I antigen ≥ 1:800 by IFA (laboratory confirmed)				
Antibody titer to *C. burnetii* Phase I IgG antigen ≥1:128 and < 1:800 by IFA (laboratory probable)				
Epidemiological risk factors				
Epidemiological link to a laboratory confirmed case of Q fever		N		

Notes:
S = This criterion alone is sufficient to report a case.
N = All "N" criteria in the same column—in conjunction with at least one of any "O" criteria in each category (e.g., clinical presentation and laboratory findings) in the same column—are required to report a case.
O = At least one of any "O" criteria in each category (e.g., clinical presentation and laboratory findings) in the same column—in conjunction with all other "N" criteria in the same column—is required to report a case.
C = This finding corroborates (e.g., supports) the diagnosis of—or is associated with—Q fever, but is not included in the case definition and is not required for reporting.
*For acute testing, CDC uses in-house IFA IgG testing (cutoff of ≥1:128), preferring simultaneous testing of paired specimens, and does not use IgM results for routine diagnostic testing.
†Samples from suspected chronic patients should be evaluated for IgG titers to both Phase I and Phase II antigens. Current commercially available ELISA tests (which test only for phase 2) are not quantitative, cannot be used to evaluate changes in antibody titer, and hence are not useful for serological confirmation. IgM tests are not strongly supported for use in serodiagnosis of acute disease, as the response may not be specific for the agent (resulting in false positives) and the IgM response may be persistent. Complement fixation (CF) tests and other older test methods are neither readily available nor commonly used. Serologic test results must be interpreted with caution, because baseline antibodies acquired as a result of historical exposure to Q fever may exist, especially in rural and farming areas.

Case Definition

Q fever *(Coxiella burnetii)* (2010):

Acute Q Fever

Clinical presentation

Acute fever usually accompanied by rigors, myalgia, malaise, and a severe retrobulbar headache. Fatigue, night-sweats, dyspnea, confusion, nausea, diarrhea, abdominal pain, vomiting, non-productive cough, and chest pain have also been reported. Severe disease can include acute hepatitis, atypical pneumonia with abnormal radiograph, and meningoencephalitis. Pregnant women are at risk for fetal death and abortion. Clinical laboratory findings may include elevated liver enzyme levels, leukocytosis, and thrombocytopenia. Asymptomatic infections may also occur.

Note: Serologic profiles of pregnant women infected with acute Q fever during gestation may progress frequently and rapidly to those characteristic of chronic infection.

Clinical evidence
Acute fever and one or more of the following: rigors, severe retrobulbar headache, acute hepatitis, pneumonia, or elevated liver enzyme levels.

Laboratory evidence

Laboratory confirmed

- Serological evidence of a fourfold change in immunoglobulin G (IgG)-specific antibody titer to *C. burnetii* Phase II antigen by indirect immunofluorescence assay (IFA) between paired serum samples, (CDC suggests one taken during the first week of illness and a second 3-6 weeks later, antibody titers to Phase I antigen may be elevated or rise as well), or
- Detection of *C. burnetii* DNA in a clinical specimen via amplification of a specific target by polymerase chain reaction (PCR) assay, or
- Demonstration of *C. burnetii* in a clinical specimen by immunohistochemical methods (IHC), or
- Isolation of *C. burnetii* from a clinical specimen by culture.

Laboratory supportive

- Has a single supportive IFA IgG titer of ≥1:128 to Phase II antigen (Phase I titers may be elevated as well).
- Has serologic evidence of elevated IgG or IgM antibody reactive with *C. burnetii* antigen by enzyme-linked immunosorbent assay (ELISA), dot-ELISA, or latex agglutination.

Note: For acute testing, CDC uses in-house IFA IgG testing (cutoff of ≥1:128), preferring simultaneous testing of paired specimens, and does not use IgM results for routine diagnostic testing.

Case Classification
Confirmed acute Q fever: A laboratory confirmed case that either meets clinical case criteria or is epidemiologically linked to a lab confirmed case.

Probable acute Q fever: A clinically compatible case of acute illness (meets clinical evidence criteria for acute Q fever illness) that has laboratory supportive results for past or present acute disease (antibody to Phase II antigen) but is not laboratory confirmed.

Chronic Q Fever

Clinical presentation
Infection that persists for more than six months. Potentially fatal endocarditis may evolve months to years after acute infection, particularly in persons with underlying valvular disease. Infections of aneurysms and vascular prostheses have been reported.

Immunocompromised individuals are particularly susceptible. Rare cases of chronic hepatitis without endocarditis, osteomyelitis, osteoarthritis, and pneumonitis have been described.

Clinical evidence

Newly recognized, culture-negative endocarditis, particularly in a patient with previous valvulopathy or compromised immune system, suspected infection of a vascular aneurysm or vascular prosthesis, or chronic hepatitis, osteomyelitis, osteoarthritis, or pneumonitis in the absence of other known etiology.

Laboratory evidence

Laboratory confirmed

- Serological evidence of IgG antibody to *C. burnetii* Phase I antigen ≥ 1:800 by IFA (while Phase II IgG titer will be elevated as well; Phase I titer is higher than the Phase II titer), or
- Detection of *C. burnetii* DNA in a clinical specimen via amplification of a specific target by PCR assay, or
- Demonstration of *C. burnetii* antigen in a clinical specimen by IHC, or
- Isolation of *C. burnetii* from a clinical specimen by culture.

Laboratory supportive
Has an antibody titer to *C. burnetii* Phase I IgG antigen ≥1:128 and < 1:800 by IFA.

Note: Samples from suspected chronic patients should be evaluated for IgG titers to both Phase I and Phase II antigens. Current commercially available ELISA tests (which test only for phase 2) are not quantitative, cannot be used to evaluate changes in antibody titer, and, hence, are not useful for serological confirmation. IgM tests are not strongly supported for use in serodiagnosis of acute disease, as the response may not be specific for the agent (resulting in false positives) and the IgM response may be persistent.

Complement fixation (CF) tests and other older test methods are neither readily available nor commonly used.

Serologic test results must be interpreted with caution because baseline antibodies acquired as a result of historical exposure to Q fever may exist, especially in rural and farming areas.

Case Classification

Confirmed chronic Q fever: A clinically compatible case of chronic illness (meets clinical evidence criteria for chronic Q fever) that is laboratory confirmed for chronic infection.

Probable chronic Q fever: A clinically compatible case of chronic illness (meets clinical evidence criteria for chronic Q fever) that has laboratory supportive results for past or present chronic infection (antibody to Phase I antigen).

Exposure

Exposure is usually via aerosol, is broadly interpreted, and may be unknown (especially for chronic infection), but often includes the presence of goats, sheep, or other livestock, especially during periods of parturition. Direct contact with animals is not required, and variable incubation periods may be dose dependent.

Classification Table

Criterion	Acute Q fever			Chronic Q fever	
	Case Definition			Case Definition	
	Confirmed		Probable	Confirmed	Probable
Clinical Presentation					
Fever	N		N		
Rigors	O		O		
Severe retrobulbar headache	O		O		
Acute hepatitis	O		O		
Pneumonia	O		O		
Elevated liver enzyme levels	O		O		
Culture-negative endocarditis (particularly in a patient with previous valvulopathy or compromised immune system)				O	O
Suspected infection of a vascular aneurysm				O	O
Suspected infection of a vascular prosthesis				O	O
Chronic hepatitis				O	O
Chronic osteomyelitis				O	O
Chronic osteoarthritis				O	O
Chronic pneumonitis				O	O
Absence of other known etiology				N	N
Laboratory findings†					
Serological evidence of a fourfold change in immunoglobulin G (IgG)-specific antibody titer to *C. burnetii* Phase II antigen by indirect immunofluorescence assay (IFA) between paired serum samples	O	O		O	
Detection of *C. burnetii* DNA in a clinical specimen via amplification of a specific target by polymerase chain reaction (PCR) assay	O	O		O	
Demonstration of *C. burnetii* antigen in a clinical specimen by immunohistochemical methods (IHC)	O	O			
Isolation of *C. burnetii* from a clinical specimen by culture	O	O		O	

Single IFA IgG titer of ≥1:128 to Phase II antigen			O		
Serologic evidence of elevated IgG or IgM* antibody reactive with *C. burnetii* antigen by enzyme-linked immunosorbent assay (ELISA)			O		
Serologic evidence of elevated IgG or IgM* antibody reactive with *C. burnetii* antigen by dot- ELISA			O		
Serologic evidence of elevated IgG or IgM* antibody reactive with *C. burnetii* antigen by latex agglutination			O		
Serological evidence of IgG antibody to *C. burnetii* Phase I antigen ≥1:800 by IFA				N	
C. burnetii Phase I titer > *C. burnetii* Phase II titer				N	
Antibody titer to *C. burnetii* Phase I IgG antigen ≥1:128 and <1:800 by IFA					N
Epidemiological risk factors					
Epidemiological link to a laboratory confirmed case of Q fever		N			

Notes:
N = All "N" criteria in the same column—in conjunction with at least one of any "O" criteria in each category (e.g., clinical presentation and laboratory findings) in the same column—are required to classify a case.
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Case Investigation Process

- Complete CMR in UT-NEDSS.
- Verify case status.
- Fill out disease investigation form.
- Determine whether patient had travel/exposure history consistent with acquisition of disease in Utah or elsewhere.
- If patient acquired disease in Utah, identify the source of transmission and eliminate it.

- Contact UDOH to coordinate investigation with UDAF if a farm is involved.
- The sample must be confirmed by UPHL or the CDC in order to confirm the case.

Outbreaks

An outbreak is defined as more than one related case in a 30-day period.

Identifying Case Contacts

This disease is rarely spread person-to-person. However, laboratory workers may become exposed during the culture and identification process. Public health should contact the testing laboratory(s) to see whether any personnel were exposed.

Case Contact Management

Any acute febrile illness in exposed persons occurring within six weeks of exposure warrants immediate treatment and medical evaluation.

✓ REFERENCES

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✓ VERSION CONTROL

Update Mar 2017: Added Figures 1 and 2 showing the IgG and IgM titer levels and serologic paragraph, updated CCI, and Rules for Entering in Laboratory Results

Update Dec 2016: Updated Laboratory Identification, Treatment, Epidemiology, Public Health Responsibility, Minimum Data Set, and Laboratory Evidence tabs.

Update Nov 2015: Included reporting table and updated the following sections: Epidemiology, Treatment, Laboratory Information and Why is Q Fever Important to Public Health. Also, added minimum/required fields by tab.

Update Aug 2015: Update to general document formatting.

✓ Rules for Entering Laboratory Results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

Test-Specific Rules

Test specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS.

Test Type	Test Result	Create a New Event	Update an Existing Event
IgG Antibody[1]	Positive	Yes	Yes
	Negative	No	Yes
IgM Antibody[1]	Positive	Yes	Yes
	Negative	No	Yes
PCR/amplification[2]	Positive	Yes	Yes
	Negative	No	Yes
Total Antibody[1]	Positive	Yes	Yes
	Negative	No	Yes

[1] Positive *Coxiella burnetii* Phase 2 should create a Q fever, **acute** case
[2] Positive PCR/amplification result for *Coxiella burnetii* should create a Q fever, **acute** case

Whitelist Rules

Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.

Q fever, chronic Morbidity Whitelist Rule: Never a new case.

Q fever, chronic Contact Whitelist Rule: Never added to contact.

Q fever, acute Morbidity Whitelist Rule: If the collection date of the laboratory result is 1 year or less after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Q fever, acute Contact Whitelist Rule: Never added to contact.

Graylist Rule

We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.

Q fever, chronic Graylist Rule: If the specimen collection date of the laboratory result is 30 days before to 7 days after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Q fever, acute Graylist Rule: Never added to contact.

Other Electronic Laboratory Processing Rules

- If an existing event has a state case status of “not a case,” ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.

✓ UT-NEDSS Minimum/Required Fields by Tab

Demographic

- ☑ County
- ☑ State
- ☑ City
- ☑ Street
- ☑ Unit Number
- ☑ Zip Code
- ☑ Date of Birth
- ☑ Birth Gender
- ☑ Ethnicity
- ☑ Race
- ☑ First Name
- ☑ Last Name
- ☑ Phone Number

Clinical

- ☑ Date Diagnosed
- ☑ Date of Death
- ☑ Died
- ☑ Disease
- ☑ Onset Date
- ☑ Hospitalized

Laboratory

- ☑ Organism
- ☑ Test Result
- ☑ Test Type
- ☑ Collection Date

Epidemiological

- ☑ Imported From
- ☑ Date of Exposure
- ☑ Contact with birthing animals?
- ☑ What kind of animal?
- ☑ Was there contact with birthing material (e.g., placenta, birth fluids, etc.?)
- ☑ Did patient drink raw milk?
- ☑ Did the patient have a tick bite?
- ☑ List 21 days prior to disease onset
- ☑ Did the patient travel overnight during the above time periods
- ☑ If yes, list locations and dates
- ☑ Acute: Fever
- ☑ Acute: Headache, retrobulbar
- ☑ Acute: Hepatitis acute
- ☑ Acute: Liver enzymes, elevated
- ☑ Acute: Pneumonia
- ☑ Acute: Rigors
- ☑ Acute: Epi-linkage to a laboratory-confirmed case
- ☑ Chronic: Aneurysm, suspected infection of vascular aneurysm
- ☑ Chronic: Endocarditis, culture negative
- ☑ Chronic: Hepatitis, chronic
- ☑ Chronic: Osteoarthritis, chronic
- ☑ Chronic: Osteomyelitis, chronic
- ☑ Chronic: Prothesis, Suspected infection of vascular prosthesis
- ☑ Chronic: Pneumonitis, chronic

Investigation

- ☑ Did this patient have an appropriate exposure history for this disease?
- ☑ Are the symptoms appropriate for the disease?
- ☑ Was the patient previously healthy?
- ☑ Is the patient responding to therapy?
- ☑ Does the patient work in or with: Healthcare? Government? Research laboratory? Animals?
- ☑ According to Agriculture – is there a concurrent outbreak in animals underway in Utah?
- ☑ If yes, please provide additional information

Reporting

- ☑ Date First Reported to Public Health

Administrative

- ☑ Outbreak Name
- ☑ Outbreak Associated
- ☑ State Case Status