

# Brucellosis

## Surveillance and Investigation Protocol

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**Office of Epidemiology and Prevention Services**

**Division of Communicable Disease Epidemiology**

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### I. ABOUT THE DISEASE

Brucellosis is an infectious disease caused by *Brucella* bacteria species not in the genus *Ochrobactrum*. People can get the disease when they are in contact with infected animals or animal products contaminated with the bacteria. The most common transmission route is by eating or drinking unpasteurized/raw dairy products. When sheep, goats, cows, or camels are infected, their milk becomes contaminated with the bacteria. Person-to-person spread of brucellosis is extremely rare. Infected mothers who are breast-feeding may transmit the infection to their infants. Sexual transmission has been rarely reported. While uncommon, transmission may also occur via tissue transplantation or blood transfusions.

#### A. Clinical Presentation

Brucellosis can cause a range of signs and symptoms. Fever is virtually always present. Other symptoms can include: sweats, malaise, anorexia, headache, fatigue, and/or muscle, joint, and back pain. Physical examination is generally non-specific, although patients may have lymphadenopathy, hepatomegaly, and splenomegaly.

*Brucella* is a systemic infection and any organ in the body may become involved. Complications include focal infections of the bones or joints; hepatitis; acute or chronic meningitis or brain abscess; endocarditis; kidney infections; skin and ocular infections; and epididymo-orchitis in men. Women in endemic areas experience higher rates of spontaneous abortion in association with *Brucella* infection. Prompt treatment can prevent fetal loss. *Brucella* is also associated with depression in patients with chronic infection.

#### B. Etiologic Agent

The etiological agent of brucellosis is any small gram-negative coccobacillus *Brucella* spp that does not belong to genus *Ochrobactrum*. However, *Brucella melitensis*, *Brucella suis*, *Brucella abortus*, and *Brucella canis* are most commonly associated with human infection.

#### C. Reservoir

Animal species associated with brucellosis are food-producing animals: cattle, sheep, goats, and pigs. Other animals including bison, buffalo, elk, camels, dogs, horses,

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reindeer, and yaks can become infected and may be significant local sources of infection in some regions of the world. Recently, the infection has also been identified in marine mammals, including dolphins, porpoises, and seals, and these may present an emerging hazard to persons occupationally exposed to infected marine mammals.

### **D. Incubation Period**

The incubation period for brucellosis is variable from less than one week to several months. Most people become ill within 3 to 4 weeks of exposure.

### **E. Mode of Transmission**

Humans can become infected with brucellosis by:

- Eating undercooked meat or consuming unpasteurized/raw dairy products
- Inhalation of *Brucella* bacteria, especially in lab settings
- Having skin/mucous membrane exposure to the bacteria
- Needlestick injury associated with brucellosis vaccination in cattle (rare)

Person-to-person spread of brucellosis is very rare; however, infected mothers who are breastfeeding may transmit infection to their infants. Transmission via tissue transplantation or blood transfusion may occur but is rare. Sexual transmission is also rare.

Persons at high occupation risk for infection include: farmers, veterinary personnel, slaughterhouse workers, meat-packing plant employees, and exposed laboratorians.

### **F. Period of Communicability**

Brucellosis very rarely spreads person-to-person, so there is no period of communicability.

## **II. DISEASE CONTROL AND PREVENTION**

### **A. Disease Control Objectives**

1. Reduce severe complications of disease by educating healthcare providers about the occurrence of brucellosis.

### **B. Disease Prevention Objectives**

1. Reduce exposures through public education regarding use of personal protective measures.

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### C. Disease Prevention and Control Intervention

#### *Agricultural Prevention and Control:*

1. Because of *Brucella* spp.'s pervasive environmental contamination, agricultural prevention and control is highly challenging. West Virginia Department of Agriculture should be consulted about management of animal disease to prevent new infections or reinfections in humans.
2. In some jurisdictions, contaminated bedding and other high risk materials, such as aborted fetuses, are buried in lime or incinerated. Areas in which an abortion of infected parturition has occurred should be washed down with approved disinfectants (hypochlorite, iodophor, or phenolic disinfectant)
3. Encouraging pasteurization of dairy products is important to prevent disease. As of this protocol's date, the direct sale of raw milk is legal in West Virginia.

#### *Occupational Prevention*

1. Workers in biomedical research facilities are at higher risk of infection and should be educated about proper precautions when handling suspected *Brucella* spp. specimens.
2. Healthcare workers should notify laboratory personnel that samples are suspected to contain *Brucella* spp. prior to testing to ensure proper containment.
3. Laboratorians should use bio-safety level 3 containment for cultures or handling products of conception/clinical specimens suspected to contain *Brucella* spp. Laboratory procedures that can potentially create aerosols or splashes include pipetting, centrifuging, and grinding specimens.
4. If a *Brucella* spp. is suspected in a specimen that was worked on under bio-safety level 2 or lower precautions, laboratorians should follow their lab safety guidelines for proper storage and notify their occupational health for next steps and possible prophylaxis or symptom watch.

### D. Treatment

Antimicrobial therapy is necessary to cure brucellosis and should be prolonged. Relapses can occur if therapy is stopped prematurely. Consult an infectious disease specialist for treatment recommendations. [The Brucellosis Reference Guide also has summaries of treatment recommendations for reference.](#) Regimens that have been used include: doxycycline and streptomycin or gentamicin; doxycycline and rifampin; and other combinations. Treatment of persons with bone infections; persons who are pregnant; children under age 8; and persons with endocarditis or meningitis may be

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especially challenging. Please note that the RB51 vaccine strain of brucellosis is resistant to rifampin and penicillin.

### III. DISEASE INVESTIGATION

#### A. Criteria for Case Ascertainment

Report any infection to public health authorities that meets any of the following criteria:

##### Clinical Criteria for Reporting

N/A

##### Laboratory/Imaging Criteria for Reporting

*Definitive laboratory evidence:*

- Culture and identification of *Brucella* spp. from clinical specimens
- Evidence of a fourfold or greater rise in *Brucella* antibody titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart

*Presumptive laboratory evidence:*

- *Brucella* total antibody titer of greater than or equal to 160 by standard tube agglutination test (SAT) or *Brucella* micro-agglutination test (BMAT) in one or more serum specimens obtained after onset of symptoms
- Detection of *Brucella* DNA in a clinical specimen by PCR assay

##### Epidemiologic Linkage Criteria for Reporting

N/A

##### Vital Records Criteria for Reporting

- A person whose death certificate lists brucellosis as a cause of death or significant condition contributing to death

##### Other Criteria for Reporting

- A person whose healthcare record contains a diagnosis of brucellosis

#### B. Case Definition and Case Classification

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### Clinical Criteria

An illness characterized by acute or insidious onset of fever and one or more of the following: night sweats, arthralgia, headache, fatigue, anorexia, myalgia, weight loss, arthritis/spondylitis, meningitis, or focal organ involvement (endocarditis, orchitis/epididymitis, hepatomegaly, splenomegaly).

### Laboratory/Imaging Criteria

*Definitive laboratory evidence:*

- Culture and identification of *Brucella* spp. from clinical specimens
- Evidence of a fourfold or greater rise in *Brucella* antibody titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart

*Presumptive laboratory evidence:*

- *Brucella* total antibody titer of greater than or equal to 160 by standard tube agglutination test (SAT) or *Brucella* micro-agglutination test (BMAT) in one or more serum specimens obtained after onset of symptoms
- Detection of *Brucella* DNA in a clinical specimen by PCR assay

### Epidemiologic Linkage

N/A

### Vital Records Criteria

N/A

### Other Classification Criteria

N/A

### Case Classifications

*Confirmed:* A clinically compatible illness with a definitive lab result.

*Probable:* Any clinically compatible illness with at least one of the following:

- Epidemiologically linked to a confirmed human or animal brucellosis case
- Presumptive laboratory evidence, but without definitive lab evidence, of *Brucella* infection

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### C. Reporting Timeframe to Public Health

All probable or confirmed cases of brucellosis should be reported to the local health department within 24 hours upon diagnosis.

### D. Outbreak Recognition

An outbreak is defined as two or more cases that are epi-linked, regardless of mode of transmission.

### E. Healthcare Provider Responsibilities

1. Report suspect and confirmed cases of brucellosis (including copies of lab results) to the local health department within 24 hours of diagnosis. Follow up with a faxed copy of the laboratory confirmation and complete demographic and clinical information on the patient as requested by the local health department.
2. Communicate with the laboratory if brucellosis is in the differential diagnosis so that laboratory personnel can take precautions. *Brucella* spp. can easily cause infections in laboratory personnel.

### F. Laboratory Responsibilities

1. Communicate with the Office of Laboratory Services and your worksite safety coordinator if *Brucella* testing is requested. *Brucella* can easily cause infections in laboratory personnel.
2. If positive laboratory results for brucellosis are identified and the laboratory is not a biosafety level 3 facility:
  - a. Move all specimens to a biosafety hood and do not allow additional staff to enter the room. Report the situation to your worksite safety coordinator. If feasible to do so without exposing additional staff, seal all specimens and move them to a biosafety level 3 environment.
  - b. Call the Office of Laboratory Services Bioterrorism Unit at (304) 558-3530 to arrange confirmatory testing. **The sending lab must call ahead to the Office of Laboratory Services Bioterrorism Unit before shipping specimens.**
  - c. Consult the Zoonotic Disease Program about evaluation and management of potentially exposed employees.
  - d. Follow the Department of Transportation guidelines for safe shipping of a Category A specimen, if shipping cultures.
3. Report suspect or confirmed brucellosis positive specimens to the local health department within 24 hours.

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### G. Local Health Responsibilities

1. Prior to the occurrence of a brucellosis case, protect employee health.
  - a. Educate staff who will investigate *Brucella* cases to use standard precautions. *Brucella* is not transmitted person-to-person under normal circumstances.
  - b. *Brucella spp.* can be transmitted from environmental and animal sources. In particular, aborted fetuses, products of conception, etc. can be highly infective. Environmental investigation such as collection of animal samples should only be undertaken after consultation with an expert on occupation health and safety.
    - i. In farm environments, follow West Virginia Department of Agriculture protocols.
    - ii. Seek expert consultation for field investigation of a laboratory or research facility exposure.
2. When a case of brucellosis is reported:
  - a. Contact the provider to collect clinical data using the [Brucellosis Case Report Form](#). Record data in the West Virginia Electronic Disease Surveillance System.
  - b. Contact the patient for risk factor information.
3. Contact the Division of Communicable Disease Epidemiology if:
  - a. There is evidence of occupational exposure
  - b. The patient knows other people with a similar illness
  - c. The patient appears to be part of an outbreak of brucellosis
4. For outbreaks of brucellosis, see [outbreak investigation protocol](#). Anticipate that the outbreak investigation will include:
  - a. Interviews of cases to identify risk factors, including:
    - i. Occupation
    - ii. Exposure to animals, especially parturient animals
    - iii. Exposure to birth products (placenta, amniotic fluid, fetuses)
    - iv. Exposure to environments that might be contaminated with *Brucella* species such as farms, laboratories, research facilities, slaughterhouses, etc.
    - v. Exposure to unpasteurized milk or cheese or other animal products
  - b. Hypothesis testing might include any of the following:
    - i. Evaluation of suspected source animals, including serological testing;
    - ii. Evaluation of suspected environmental sources of exposure (e.g., site visits, environmental sampling)
    - iii. Case-control or retrospective cohort studies
    - iv. Trace-back studies

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### H. State Health Responsibilities

1. Prior to the occurrence of a brucellosis case, protect employee health.
  - a. Educate staff who will investigate *Brucella* cases to use standard precautions. *Brucella* is not transmitted person-to-person under normal circumstances.
  - b. *Brucella* spp. can be transmitted from environmental and animal sources. In particular, aborted fetuses, products of conception, etc. can be highly infective. Environmental investigation such as collection of animal samples should only be undertaken after consultation with an expert on occupation health and safety.
2. Review reported cases and submit to the Centers for Disease Control (CDC) after assuring that case ascertainment is correct and an adequate risk factor investigation has been completed.
3. Assist with outbreak and complex investigations:
  - a. Assist or take lead on evaluation of laboratory exposures;
  - b. Liaison with the West Virginia Department of Agriculture, US Department of Agriculture, and the CDC to assure that animal investigations can be completed safely.
  - c. Serve as primary lead on design of epidemiological studies, if needed.
  - d. Development of questionnaires and line lists
  - e. Assist with site visits and laboratory testing to evaluate exposure hypotheses.
  - f. For suspected or confirmed deliberate exposure events, liaison with law enforcement and the CDC.

### I. Occupational Health

In the event of a laboratory exposure:

1. Determine the potential source of exposure.
2. Identify who was in the lab, their whereabouts in relation to the exposure, and whether surfaces, materials, or equipment have been contaminated.
3. Determine the level of risk for each lab worker as either [minimal, low, or high risk.](#)
4. Conduct follow-up monitoring as necessary.
5. Arrange for procurement of post-exposure prophylaxis, if indicated, in conjunction with a health provider.
  - a. If exposure was to the *B. abortus* RB51 vaccine strain, consideration should be taken that the strain may be resistant to rifampin.

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6. In lab workers whose risk was low or high risk, serological testing should be arranged at time of exposure, 6, 12, 18, and 24 weeks after exposure. Agglutination assays are recommended.
  - a. If exposure was to either *B. canis* or the *B. abortus* RB51 vaccine strain, serological tests cannot detect infection. Rely on symptom monitoring.
7. If a laboratory worker becomes positive, arrange for continuation of treatment.

### IV. DISEASE SURVEILLANCE

#### A. Public Health Significance

Four species of *Brucella* cause this zoonotic disease in humans: *Brucella abortus*, principally affecting cattle, bison, and cervids; *Brucella suis*, principally affecting swine and reindeer but also cattle and bison; *Brucella melitensis*, principally affecting goats; and *Brucella canis*, principally affecting dogs. Bacteria are shed in milk or via the aborted fetus, afterbirth, or other reproductive tract discharges.

In 1954, an eradication program was approved to eliminate brucellosis from the United States. The program depends on the support and participation of livestock producers. The approach is to vaccinate calves (with RB51), test cattle and domestic bison for infection, and send infected animals to slaughter. Depopulation of herds may be considered if herds are severely affected. At the beginning of the program, brucellosis was widespread through U.S. livestock, but eradication efforts have had dramatic results. In 1956, there were 124,000 affected herds found by testing in the United States. By 1992, 700 herds were affected and has declined to single digits since then.

From a contaminated animal source, *Brucella* can enter the body through ingestion, inhalation, or direct exposure to mucous membranes or open skin. *Brucella* can also be spread through the airborne route from animal bedding contaminated with birth products; or in laboratories through handling of *Brucella* isolates. This propensity for spread through the airborne route has been exploited by bioweapons manufacturers.

Each year, about 100 cases of brucellosis are reported in the US. In 2010, California, Texas, Arizona, and Florida accounted for over 50% of humans. *Brucella* is an occupational hazard for veterinarians, slaughterhouse workers, animal husbandry workers, and laboratory workers.

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### B. Disease Surveillance Objectives

1. To identify and monitor the epidemiologic characteristics of brucellosis in West Virginia, including the geographic distribution of cases.
2. In the event of an outbreak, identify the point source of infection and isolate or remove it. Example of possible point sources include: infected herd animals, laboratory contamination, or contaminated animal products (e.g. food products, products of conception).

### C. Surveillance Indicators

1. Proportion of cases with complete demographic information.
2. Proportion of cases with complete clinical information (i.e., presence of fever and other clinical signs meeting clinical criteria of case definition).
3. Proportion of cases with risk factor information.

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November 2024



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[https://usbiotechnologyregulation.mrp.usda.gov/wcm/connect/aphis\\_content\\_library/sa\\_our\\_focus/sa\\_animal\\_health/sa\\_animal\\_disease\\_information/cattle/national-brucellosis-eradication#:~:text=In%201954%20Congressional%20funds%20were,and%20participation%20of%20livestock%20producers.](https://usbiotechnologyregulation.mrp.usda.gov/wcm/connect/aphis_content_library/sa_our_focus/sa_animal_health/sa_animal_disease_information/cattle/national-brucellosis-eradication#:~:text=In%201954%20Congressional%20funds%20were,and%20participation%20of%20livestock%20producers.)

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