

WYOMING DEPARTMENT OF HEALTH

Brucellosis Guidelines

Section 1. Disease Reporting: Brucellosis

Human brucellosis is a reportable disease that must be reported immediately. Laboratories, health care providers and county health departments are required to immediately report any suspected or confirmed cases of human brucellosis to the Wyoming Department of Health (WDH) at (307)777-3593 or 1-877- 996-9000 (during business hours) or at 1-888-996-9104 (24 hours a day).

Section 2. Case Definition: Brucellosis

CDC/MMWR, May2, 1997/Vol. 46/No. RR-10, “Case Definitions for Public Health Surveillance”

2.1 Clinical description

An illness characterized by acute or insidious onset of fever, night sweats, undue fatigue, anorexia, weight loss, headache, and arthralgia

2.2 Laboratory criteria for diagnosis

- Isolation of *Brucella sp.* from a clinical specimen, or
- Fourfold or greater rise in *Brucella* agglutination titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart and studied at the same laboratory, or
- Demonstration by immunofluorescence of *Brucella sp.* in a clinical specimen

2.3 Case classification

Probable: a clinically compatible case that is epidemiologically linked to a confirmed case or that has supportive serology (i.e., *Brucella* agglutination titer of greater than or equal to 160 in one or more serum specimens obtained after onset of symptoms)

Confirmed: a clinically compatible case that is laboratory confirmed

Section 3. Epidemiology: Brucellosis

3.1 Etiologic Agent

Brucellosis is caused by several different species of *Brucella*, including *B. abortus* (cattle), *B. melitensis*, *B. ovis* (sheep, and goats), *B. suis* (pigs), and rarely *B. canis* (dogs). This document will primarily deal with issues concerning infection with *B. abortus*.

3.2 Species and Reservoirs

Species	Biovar/Serovar	Natural Host	Human Pathogen
<i>B. abortus</i>	1-6, 9	cattle	yes
<i>B. melitensis</i>	1-3	goats, sheep	yes
<i>B. suis</i>	1, 3	swine	yes
	2	hares	yes
	4	reindeer, caribou	yes
	5	rodents	yes
<i>B. canis</i>	none	dogs, other canids	yes
<i>B. ovis</i>	none	sheep	no
<i>B. neotomae</i>	none	Desert wood rat	no
<i>B. ?</i>		marine mammals	?

3.3 Mode of Transmission

Zoonotic. Commonly transmitted through abrasions of the skin from handling infected mammals. In the United States, occurs more frequently by ingesting unpasteurized milk or dairy products. Highly infectious in the laboratory via aerosolization; handling cultures warrants biosafety level-3 precautions.

3.4 Human Clinical Features

In the acute form (<8 weeks from illness onset), nonspecific and "flu-like" symptoms including fever, sweats, malaise, anorexia, headache, myalgia, and back pain. In the undulant form (<1 year from illness onset), symptoms include undulant fevers, arthritis, and epididymo-orchitis in males. Neurologic symptoms may occur acutely in up to 5% of cases. In the chronic form (>1 year from onset), symptoms may include chronic fatigue syndrome, depression, and arthritis.

Section 4. Specific Case Protocols: Brucellosis

4.1 Routes of Exposure

4.1.1 Exposure to Infected Tissues or Infected Herd

WDH recommends an individual exposed to a known or suspect brucellosis infected elk, bison or cattle, through one of the following mechanisms should seek medical attention from a health care provider

- Ingestion of unpasteurized milk or milk products including soft cheeses
- Direct contact of infectious or potentially infectious material (such as, fetal/aborted tissues or blood) with eyes, other mucous membranes, or open wounds
- Inhalation of potentially infectious material

4.1.2 Exposure to Known Infected Individual

WDH recommends an individual that has had contact with a known infected individual through one of the following mechanisms should seek medical attention

- Breast milk
- Sexual contact
- Tissue transplantation

4.1.3 Exposure to Brucellosis Vaccine

- All vaccine exposures should be reported to the State Veterinarian (307)777-7515
- WDH recommends an individual who is exposed to a brucellosis vaccine either by inoculation, splashing of vaccine into the eyes, other mucous membranes or open wounds seek medical attention immediately

4.1.4 Laboratory Exposure to *Brucella sp*

- WDH recommends that all individuals working with known isolates of *Brucella sp* follow the BSL specifications as described in the CDC Biosafety in Microbiological and Biomedical Laboratories (BMBL) guidelines. These guidelines are available at <http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm>.
- WDH recommends a laboratorian who suspects they have been exposed to *Brucella sp*, through aerosolization or direct contact of the organism with eyes, other mucous membranes or open wounds, should seek medical attention immediately
- **Clinical/Sentinel Laboratorians**
 - Clinical/Sentinel laboratorians are advised to work with all culture materials suspected of containing *Brucella sp*. within a Class II Biological Safety Cabinet
- **Confirmatory Laboratorians Operating under Select Agent Program (SAP)**
 - According to federal regulations (42 CFR 73.17, 9 CFR 121 and 7 CFR 331) accidental exposures or release of any select agent (which includes *B. abortus*) in a Confirmatory Laboratory operating under the SAP must be immediately reported to CDC or APHIS by either phone, FAX or e-mail as described in the

Guidance Document for Report of Theft, Loss, or Release of Select Biological Agents and Toxins (CDC Form 0.1316 or APHIS Form 2043)

- Sections 3 and 4 must be completed for an accidental release or exposure.
- A copy of the notification report should be kept on file at the reporting facility
- Notify WDH of exposure

4.2 Recommendations to Health Care Providers of Exposed Patient

- Communicate regularly with the WDH regarding the patient's status
- Discuss recent and past exposure history with the patient
- Determine if the exposure was a one-time event or is ongoing
- Complete a physical examination to determine if signs of chronic or current infection are present (see section 3.4 Human Clinical Features)
- Coordinate specimen testing with Wyoming Public Health Laboratory (WPHL). See Protocol for Submission of Human Specimens (section 5.1) for specifics on specimen collection and shipping.
 - For laboratory exposures, baseline titers are indicated regardless of clinical presentation. Additional intermediate titers after the exposure should be collected at 4-6 weeks, 3 months, and 6 months as the longest seroconversion after a lab exposure is documented at 5 months
- Start antibiotic therapy
 - For known infected individual
 - Minimum of 6 weeks if clinical signs are present
 - For an individual exposed to a known infected individual as in section 4.1.2
 - Minimum of 3 weeks
 - Exposure to vaccine
 - Minimum of 6 weeks if exposure is due to splashing of vaccine into eyes
 - Minimum of 3 weeks if exposure is due to inoculation, splashing of vaccine into open wounds or other mucous membranes
 - Laboratory Exposure
 - If the exposure is by inhalation **recommend** antibiotic therapy doxycycline and rifampin for 3-6 weeks.
 - If the exposure is less direct **offer** antibiotic therapy as indicated above
- If the patient owns an infected cattle or bison herd WDH recommends the health care provider counsel the owner about mental health well being and be aware of the signs of depression

4.2.1 Health Insurance Considerations

If the patient has no health insurance, or is unable to afford a health care provider visit, the WDH will direct the patient to a county public health office for appropriate follow up (as directed under the advice of the State Health Officer).(See section 4.10 for details on testing and treatment costs)

4.3 Special Considerations for Pregnant and Breast Feeding Women

- WDH recommends pregnant or breast feeding women that have been exposed to a known or suspected source of brucellosis should seek medical care immediately
- Additional Considerations for Pregnant Women
 - Brucellosis in the third trimester of pregnancy is potentially serious.
 - Pregnant women should avoid direct contact with the *Brucella* agent, animals or animal products known or suspected to be infected with brucellosis. Direct contact is described as
 - Ingestion of unpasteurized milk products or soft cheeses
 - Direct contact of infective tissues (fetal or aborted tissues, or blood)
 - Inhalation of infectious materials
 - Inoculation with a vaccination, splashing the vaccine into the eyes, other mucous membranes or open wounds
- Additional Considerations for Breastfeeding Women
 - *Brucella sp* can be transmitted via breast milk from an infected mother to an infant
 - Post Exposure Prophylaxis (PEP) for a breastfeeding infant may be indicated if the mother is infected

4.3.1 Recommendations to Health Care Provider of Exposed Pregnant and Breastfeeding Women

- These are in addition to recommendations in Section 4.2 above
- Baseline titers are indicated regardless of clinical presentation. A titer should be drawn at 6-month for follow-up serologic test, with consideration to additional tests in between based on patient history and status
- If consistent clinical signs exist consult Wyoming Public Health Laboratory (WPHL) to coordinate appropriate testing (See section 5.1 for specific protocol for submission)
 - Discuss pros and cons of antibiotic therapy with the patient including risk of antibiotic treatment vs. risk of spontaneous abortion due to infection with brucellosis.
 - If indicated start antibiotic therapy (for 3-6 weeks) with Bactrim and rifampin
 - If clinical signs are absent but the suspicion of infection is high (high suspicion would include vaccine exposures, lab exposures and exposures to aborted fetuses/products of conception from an infected animal) PEP with Bactrim and rifampin for 3-6 weeks should be considered after a discussion with the patient as indicated above.
 - *Brucella sp* can be transmitted via breast milk from an infected mother to an infant
 - If the mother is infected PEP should be considered for the infant for 3 weeks to eliminate the risk of infection to the infant

4.4 Recommendations for Immunocompromised Individuals

- There are no specific recommendations for immunocompromised people
- WDH recommends any immunocompromised individual at risk for infection with brucellosis seek consultation from a health care provider

4.4.1 Recommendations to Health Care Provider of Immunocompromised Patients

- Immunocompromised individuals should avoid direct contact with the *Brucella* agent, animals or animal products known or suspected to be infected with brucellosis. Direct contact is described as
 - Ingestion of unpasteurized milk products or soft cheeses
 - Direct contact of infective tissues (fetal or aborted tissues, or blood)
 - Inhalation of infectious materials
 - Inoculation with a vaccination, splashing the vaccine into the eyes, other mucous membranes or open wounds

4.5 Contact Precautions for Draining Wounds

Rarely draining lesions can develop in humans infected with brucellosis. WDH recommends an individual with a draining wound that suspects brucellosis infection contact their health care provider.

4.5.1 Recommendations to the Health Care Provider of a Patient with a Draining Wound

The health care provider should recommend the patient

- Isolate the lesions (cover with a sterile dressing)
- Keep the area clean
- The patient should wash his or her hands thoroughly after changing the bandage
- Dispose of the bandage materials in an appropriate sealed closed container (i.e. sealed zip lock bag)

4.6 Special considerations for Slaughter House Workers

- The State Veterinarian will notify the slaughter house director/owners that infected animals will be processed at their facility before the animals are processed
- The State Veterinarian will notify the WDH which slaughter facility will process the infected carcasses. They will also provide WDH with contact information for the operator/owner.
- WDH will contact the operator/owner about the possible public health implications to the workers of the facility and recommend the workers take certain precautions

4.6.1 WDH Precautionary Recommendations for Slaughter House Workers

- Wear protective clothing while handling infected carcasses
 - Impermeable gloves, protective eye wear, mask, long pants and sleeves, protective apron or other clothing deemed fit by the facility
- Wash hands thoroughly after handling carcasses especially before eating and drinking
- Minimize procedures that may generate aerosols

- If a worker is exposed to aerosols he/she should contact a health care provider to discuss PEP with doxycycline and rifampin as directed based on suspicion and level of exposure.
- WDH will notify the operators/owners of the facility that additional information on human brucellosis may be obtained for the workers from WDH and that those with additional questions or concerns about the disease should contact his/her health care provider

4.7 Special considerations during a human or animal outbreak

4.7.1 Information for health care providers during a human or animal outbreak

- Information on outbreaks will be sent to all Wyoming health care providers by blast fax or alternate health alert network mechanisms depending on availability and level of concern.
 - Alerts will be issued at the direction of the State Health Officer
 - Information will be designed to help promote an index of suspicion in persons presenting with a compatible illness and consistent epidemiological history
 - All health care providers will be encouraged to coordinate testing through the WPHL

4.7.2 Information for veterinarians during a human or animal outbreak

- Information will initially be provided to the Wyoming Regional Veterinary Coordinators (WRVC) who will then distribute the information to all veterinarians in their regions as directed by the State Public Health Veterinarian and the State Veterinarian.
- Animal brucellosis (as provided by the State Veterinary office and human brucellosis (Appendix one) fact sheets will be provided
- All veterinary workers will be encouraged to keep brucellosis high on their list of rule outs for diagnosis during an outbreak

4.7.3 Mental health considerations during a human or animal outbreak

- WDH will provide timely and accurate information about the event or threat involving brucellosis to the public as directed by the State Health Officer and Public Information Officer.
- WDH will provide a public forum to the residents in effected areas to address concerns and answer questions. Such a forum will be under the direction of the State Health Officer and the Public Information Officer
- WDH will provide the following information to the public
 - Appropriate coping behaviors to deal with the stress of an event or a threat
 - Contact information for professional mental health resources available to the public
 - Mailings to Wyoming health care providers/mental health care providers to remind them to alert for signs of depression or suicide
- This information will also be made available in targeted community areas
 - Churches, chiropractic clinics, beauty shops, extension offices etc.

4.8 Special Considerations for a Suspected Bioterrorist Event

- Suspected bioterrorist events should be reported 24/7 through the 1-888-996-9104 line and the appropriate chain of command will be implemented.
- The Strategic National Stockpile (SNS) can be utilized if an event (natural or otherwise) overwhelms state resources for antibiotic treatment of human cases.
 - Use of the SNS will be determined by following the official SNS Protocol (**Appendix Four**) and directed by the Governor, the Director of the Department of Health, the State Health Officer or the State Epidemiologist.
- Wyoming County Health Officers and Wyoming Regional Veterinary Coordinators will be notified as directed by the State Health Officer and the State Public Health Veterinarian respectively
- Bioterrorism related handouts will be mailed to health care practitioners, veterinarians and related individuals following such an event as directed by the State Health Officer and the State Public Health Veterinarian. (**Appendix Five**)
- Testing of specimens from an event will be coordinated by the WPHL Bioterrorism Response Laboratory using the Wyoming Laboratory Response Network as indicated.
- Note: Although brucellosis is on CDC's list for potential bioterrorism agents, human infection with *Brucella abortus* is thought to be much less severe than human infection with *B. melitensis* or *B. suis*.

4.9 WDH protocol after a cattle herd has tested positive

- The State Veterinarian will contact the State Public Health Veterinarian within 3 working days of notification of the positive herd.
- The owner(s) of the infected herd will be contacted by the State Public Health Veterinarian.
- Information about the zoonotic potential of brucellosis will be given to the owners and family of the infected herd.
 - Clinical signs of human disease and how the disease can be transmitted from animals to humans and from person to person.
- Other person(s) exposed to the herd will also be identified and contacted as directed by the State Public Health Veterinarian.

4.10 Testing and Treatment Costs

Testing and antibiotic treatment that cannot be covered by individuals will be paid for out of an emergency fund set aside by the WDH. These funds will be expected to be recovered by the individual(s) or insurance company(s) at a later time if possible.

4.11 WDH Follow Up Actions

- Educational Measures

The following information will be sent to all individuals that meet the case definition in Section 2 and those suspected of having a case of human brucellosis

 - Fact sheet on human brucellosis (**Appendix One**)
 - Resource guide for additional information on animal brucellosis and human brucellosis (**Appendix Two**)
 - Mental health/infectious disease pamphlet (**In progress**)
 - Exposed individuals showing signs of infection and those who are concerned about infection will be encouraged to seek medical attention from a health care provider.

- Epidemiological Measures
 - WDH Follow-Up Report form for Brucellosis – Draft Form will be completed by appropriate WDH employee as directed by the State Public Health Veterinarian within 24 hours of notification. (**Appendix Three**)
 - If warranted, an epidemiological investigation to determine the source of infection will be initiated within 48 hours at the direction of the State Public Health Veterinarian.

- Public Health Interventions

If evidence exists that there is an ongoing source of infection, appropriate public health interventions will be conducted as directed by State Public Health Veterinarian within 2 weeks of receiving the incident report. Such interventions may include one or more of the following:

 - Public education about risks of infection and modes of transmission of human brucellosis
 - Removal or quarantine of infected animals from the premises as directed by the State Veterinarian (307)777-7515
 - Change of procedures may be recommended after an investigation is completed by WDH as directed by the State Public Health Veterinarian
 - In conjunction with the State Veterinarian if the case involves animal quarantine or livestock issues
 - In conjunction with the director of Wyoming Game and Fish (WGF) (307)777-4600 if the case involves wildlife

- Communications

The State Public Health Veterinarian, or their designees will communicate with the appropriate state agency as indicated by transmission source.

 - State Veterinarian or their designee (307)777-7515 if infection is thought to have been transmitted from infected live stock, a domestic animal
 - State Veterinary Laboratory Director or their designee (307)742-6638 if the exposure occurred in an animal or local veterinary laboratory
 - Director of Wyoming Game and Fish or their designee if infection is thought to have been transmitted from infected wildlife

- Game and Fish Laboratory Director or their designee (307)766-5618 if exposure occurred in the Game and Fish laboratory
- WPHL Director or his designee (307) 777-7431 if the exposure occurred in a clinical laboratory or the Public Health Laboratory
- A Confidential Disease Report will be submitted to the epidemiology section of WDH for reporting to CDC
- For exposures in a laboratory operating under the Select Agent Program the appropriate federal notifications will be made by the Responsible Official at the facility according to the Guidance Document for Report of Theft, Loss, or Release of Select Biological Agents and Toxins (CDC Form 0.1316 or APHIS Form 2043)

Section 5. WPHL Issues: Brucellosis

5.1 WPHL Protocol for Submission of Human Specimens

Due to fastidious nature of *Brucella sp.* it may be necessary for cultures to be inoculated and incubated at local laboratories prior to transport to WPHL. Prior to collecting and shipping human specimens for laboratory testing contact the WPHL for consultation. During business hours (8am – 5pm), call 307-777-7431, after hours, use the 24/7 emergency number 888-996-9104.

5.1.1 Specimen Requirements

- Serum
 - Collect 5-10 ml of whole blood in a serum separator tube. Allow blood to clot, centrifuge briefly and collect resulting sera in vial with external caps.
 - Plan to collect both acute and convalescent sera.
 - Acute specimen, collect as soon as possible after onset of disease.
 - Convalescent specimen, collect >14 days after acute specimen.
- Specimens for Culture
 - Blood and/or Bone Marrow (Preferred Specimens)
 - Collect blood in appropriate vacutainer tube for inoculation into blood culture bottle system. WPHL will work with local laboratories to facilitate this culture.
 - Collect Bone Marrow specimen in syringe and inoculate into both blood culture bottles and plated media. WPHL will coordinate with local laboratories to facilitate bone marrow specimen inoculation.
 - Additional Specimens
 - Spleen, liver, or abscess fluid
 - *Brucella sp.* are only occasionally isolated from these sources.
 - Specimens should be inoculated into appropriate culture media within 2 hours of collection. If this is not possible, specimens should be refrigerated (2-8 C) until inoculation. Tissue must be kept moist; add several drops of sterile saline if necessary.

3.1.2 Shipping Requirements

- Serum
 - Specimen volume = 1ml minimum.
 - Ship on cool pack to keep sample at 4°C
 - Package and transport according to regulations for diagnostic specimens.
- Specimens for Culture
 - Culture media may be incubated until an isolate is observed and culture media with actively growing isolate forwarded to the WPHL.
 - Package and ship according to regulations for infectious substances.
 - Contact the WPHL to discuss logistics prior to transport of culture materials or isolates.

3.1.3 Notification of Test Results

The WPHL will notify the State Public Health Veterinarian (or their designee) of any tests that are positive for brucellosis so appropriate follow-up can be implemented.

Appendix One Brucellosis Fact Sheets

Facts about Brucellosis

1. What is brucellosis?

It is a contagious, costly disease of ruminant animals that also affects humans. Although brucellosis can attack other animals, its main threat is to cattle, bison, and swine. The disease is also known as contagious abortion or Bang's disease. In humans, it's known as undulant fever because of the severe intermittent fever accompanying human infection or Malta fever because it was first recognized as a human disease on the island of Malta.

2. How serious is brucellosis?

Considering the damage done by the infection in animals—decreased milk production, weight loss in animals, loss of young, infertility, and lameness, it is one of the most serious diseases of livestock. The rapidity with which it spreads and the fact that it is transmissible to humans makes it all the more serious.

3. What disease agents cause brucellosis?

The disease is caused by a group of bacteria known scientifically as the genus *Brucella*. Three species of *Brucella* cause the most concern: *B. abortus*, principally affecting cattle and bison; *B. suis*, principally affecting swine and reindeer but also cattle and bison; and *B. melitensis*, principally affecting goats but not present in the United States. In cattle and bison, the disease currently localizes in the reproductive organs and/or the udder. Bacteria are shed in milk or via the aborted fetus, afterbirth, or other reproductive tract discharges.

4. What are the signs of brucellosis?

There is no effective way to detect infected animals by their appearance. The most obvious signs in pregnant animals are abortion or birth of weak calves. Milk production may be reduced from changes in the normal lactation period caused by abortions and delayed conceptions. Not all infected cows abort, but those that do usually abort between the fifth and seventh month of pregnancy. Infected cows usually abort once, but a percentage will abort during additional pregnancies, and calves born from later pregnancies may be weak and unhealthy. Even though their calves may appear healthy, infected cows continue to harbor and discharge infectious organisms and should be regarded as dangerous sources of the disease. Other signs of brucellosis include an apparent lowering of fertility with poor conception rates, retained afterbirths with resulting uterine infections, and (occasionally) enlarged, arthritic joints.

5. How is brucellosis spread?

Brucellosis is commonly transmitted to susceptible animals by direct contact with infected animals or with an environment that has been contaminated with discharges from infected animals. Aborted fetuses, placental membranes or fluids, and other vaginal discharges present after an infected animal has aborted or calved are all highly contaminated with infectious *Brucella* organisms. Cows may lick those materials or the genital area of other cows or ingest the disease-causing organisms with contaminated food or water. Despite occasional exceptions, the general rule is that brucellosis is carried from one herd to another by an infected or exposed animal. This mode of transmission occurs when a herd owner buys replacement cattle or bison

that are infected or have been exposed to infection prior to purchase. The disease may also be spread when wild animals or animals from an affected herd mingle with brucellosis-free herds.

6. What is being done to fight brucellosis?

Before 1934, control of brucellosis was limited mainly to individual herds. Today, there is a Cooperative State Federal Brucellosis Eradication Program to eliminate the disease from the country. Like other animal disease-eradication efforts, success of the program depends on the support and participation of livestock producers. The program's Uniform Methods and Rules set forth the minimum standards for States to achieve eradication. States are designated brucellosis free when none of their cattle or bison are found to be infected for 12 consecutive months under an active surveillance program. As of June 30, 2000, 44 States, plus Puerto Rico and the U.S. Virgin Islands, were free of brucellosis. Six States currently have a herd infection rate of less than 0.25 percent and are considered to be in Class A status. There are no States in Class B (herd infection rate between 0.26 percent and 1.5 percent) or Class C status (herd infection rate greater than 1.5 percent).

7. What about free-ranging bison herds?

The presence of [brucellosis in free-ranging bison](#) in Yellowstone National Park and Grand Teton National Park threatens the brucellosis status of the surrounding States and the health of their livestock herds, which are free of the disease. Reintroduction of the disease into a brucellosis-free State could have a serious economic impact on domestic livestock markets and potentially threaten export markets. The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) is working cooperatively with other State and Federal agencies toward containing the spread of brucellosis from bison to domestic livestock and eliminating the disease from the Yellowstone and Teton herds while maintaining viable free-roaming bison herds in the Parks.

8. How do epidemiologists help fight brucellosis?

Epidemiologists are specially trained veterinarians who investigate disease sources and the means of eliminating infection in affected herds and areas. Epidemiologists are concerned with disease in a group or population of animals and evaluate circumstances connected with the occurrence of disease. These veterinarians help eliminate brucellosis by identifying factors essential to its control and prevention.

9. How costly is brucellosis to the livestock industry?

The livestock and dairy industries and the American consumer have realized great financial savings from the success of the Cooperative State Federal Brucellosis Eradication Program. Annual losses from lowered milk production, aborted calves and pigs, and reduced breeding efficiency have decreased from more than \$400 million in 1952 to less than \$1 million today. Studies have shown that, if brucellosis eradication program efforts were stopped, the costs of producing beef and milk would increase by an estimated \$80 million annually in less than 10 years.

10. How effective is the Brucellosis Eradication Program?

At the beginning of the program, brucellosis was widespread throughout 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, this number had dropped to 700 herds, and as of June 30, 2000, there were only 6 known affected herds remaining in the entire United States. USDA,

APHIS expects the Cooperative State Federal Program to achieve the goal of nationwide eradication of brucellosis from domestic cattle and bison in the very near future.

11. What is the basic approach to eradication?

The basic approach has always been to test cattle for infection and send infected animals to slaughter. Identification of market animals for tracing, surveillance to find infected animals, investigation of affected herds, and vaccination of replacement calves in high-risk areas are important features of the current program.

12. How is infection found in cattle?

Two primary surveillance procedures are used to locate infection without having to test each animal in every herd. Milk from dairy herds is checked two to four times a year by testing a small sample obtained from creameries or farm milk tank for evidence of brucellosis. Bison herds and cattle herds that do not produce milk for sale are routinely checked for brucellosis by blood-testing animals sold from these herds at livestock markets or at slaughter. In addition, some States require adult cattle and bison to be subjected to blood tests for brucellosis upon change of ownership even if sold directly from one farm to another. The cattle and bison remaining in the herds from which such animals originated are not tested unless evidence of brucellosis is disclosed among the market animals.

13. What happens when evidence of disease is found by surveillance testing?

Once an infected herd is located, the infection is contained by quarantining all infected and exposed cattle and bison and limiting their movement to slaughter only, until the disease can be eliminated from the herd. Diagnostic tests are used to find all infected cattle and bison. Also, Federal and State animal health officials check neighboring herds and others that may have received animals from the infected herd. All possible leads to additional infection are traced.

14. How does the brucellosis ring test (BRT) surveillance work?

The BRT procedure makes it possible to do surveillance on whole dairy herds quickly and economically. Milk or cream from each cow in the herd is pooled, and a sample is taken for testing. A suspension of stained, killed *Brucella* organisms is added to a small quantity of milk. If the milk from one or more infected animals is present in the sample, a bluish ring forms at the cream line as the cream rises.

15. How does market cattle identification (MCI) work?

Numbered tags, called backtags, are placed on the shoulders of adult breeding animals being marketed from beef, dairy, and bison herds. Blood samples are collected from the animals at livestock markets or slaughtering plants and tested for brucellosis. If a sample reacts to a diagnostic test, it is traced by the backtag number to the herd of origin. The herd owner is contacted by a State or Federal animal health official to arrange for testing of his or her herd. Once the animals have been gathered, all of the eligible animals in the herd are tested at no cost to the owner.

16. Which animals are eligible for MCI testing?

At slaughter, all cattle and bison 2 years of age or older are tested, except steers and spayed heifers. At market, all beef cattle and bison over 24 months of age and all dairy cattle over 20 months of age are tested except steers and spayed heifers. Pregnant or postparturient heifers are

also eligible for testing regardless of their age. Herd tests must include all cattle and bison over 6 months of age except steers and spayed heifers.

17. Why is identification of market cattle important?

The key to the MCI program is proper identification of all animals so they can be traced to their herds of origin. Most livestock markets identify cattle and bison with numbered USDA-approved backtags. Backtags, as well as eartags and other identification devices, are collected and sent to the diagnostic laboratory along with the matching blood samples to aid in identifying ownership of test-positive animals.

18. What are the advantages of MCI?

MCI provides a means of determining the brucellosis status of animals marketed from a large area and eliminates the need to round up cattle and bison in all herds for routine testing. MCI, along with other preliminary testing procedures, is effective in locating infection so control measures can be taken to contain the disease and eliminate it.

19. What is a blood agglutination test?

It is an effective method of diagnosing brucellosis. To pinpoint infection within a herd, a blood sample is taken from each animal and tested in the field or at a laboratory. The blood serum is mixed with a test fluid or antigen containing dead *Brucella* organisms. When the organisms in the test fluid clump together in a reaction known as agglutination, the test is positive.

20. What is the brucellosis card test?

It is a rapid, sensitive, and reliable procedure for diagnosing brucellosis infection. It is similar to the blood agglutination test but employs disposable materials contained in compact kits. Brucella antigen is added to the blood serum on a white card. Results of the test are read 4 minutes after the blood serum and antigen are mixed.

21. Are there any other tests for brucellosis?

There are a number of supplemental tests based on various characteristics of antibodies found in the blood and milk of infected animals. These tests are especially useful in identifying infected animals in problem herds in which chronic brucellosis infection exists and from which infection is difficult to eliminate. Another diagnostic method involves culturing *Brucella* organisms from infected tissues, milk, or other body fluids, from aborted calves or fetal fluids and membranes.

22. What animals are eligible for testing?

With certain exceptions, herd tests must include all cattle and bison over 6 months of age except steers and spayed heifers.

23. What is the incubation period of brucellosis?

An incubation period is the interval of time between exposure to an infectious dose of organism and the first appearance of disease signs. The incubation period of brucellosis in cattle, bison, and other animals is quite variable ranging from about 2 weeks to 1 year and even longer in certain instances. When abortion is the first sign observed, the minimum incubation period is about 30 days. Some animals abort before developing a positive reaction to the diagnostic test.

Other infected animals may never abort. Generally, infected animals that do not abort develop a positive reaction to the diagnostic test within 30 to 60 days after infection, although some may not develop a positive reaction for several months to over a year.

24. Can brucellosis in animals be cured?

No. Repeated attempts to develop a cure for brucellosis in animals have failed. Occasionally, animals may recover after a period of time. More commonly, however, only the signs disappear and the animals remain diseased. Such animals are dangerous sources of infection for other animals with which they associate.

25. Can brucellosis be prevented?

The disease may be avoided by employing good sanitation and management practices. Replacement animals should be tested when purchased and retested after a 30- to 60-day isolation period during which they are kept separate from the remainder of the herd. These practices will allow detection of animals that were in the incubation period of the disease when acquired.

26. What about vaccination?

For cattle and bison in heavily infected areas or replacement animals added to such herds, officials recommend vaccinating heifers with an approved *Brucella* vaccine. The vaccine is a live product and must be administered only by an accredited veterinarian or State or Federal animal health official. For best results, female calves should be vaccinated when they are 4 to 6 months old. At the time of vaccination, a tattoo is applied in the ear; that tattoo identifies the animal as an "official vaccinate." The tattoo identifies the year in which vaccination took place.

27. How does the vaccine work?

Brucella abortus vaccine produces a bodily response that increases the animal's resistance to the disease. However, vaccination is not 100-percent effective in preventing brucellosis; it typically protects about 65 percent of the vaccinated cattle from becoming infected by an average exposure to *Brucella*.

28. Is Strain 19 the only approved *Brucella* vaccine?

No. USDA recently licensed a new *Brucella* vaccine, called [Strain RB51](#), for use in cattle. Strain RB51 is as efficacious as Strain 19 vaccine but virtually eliminates adverse postvaccination reactions in cattle, such as abortions and localized inflammation at the vaccine injection site. Most importantly, unlike Strain 19, Strain RB51 does not stimulate the same type of antibodies that can be confused on standard diagnostic tests with those antibodies produced by actual infection.

29. Is Strain RB51 vaccine approved for use in bison?

As of June 2000, *B. abortus* Strain RB51 had not yet been approved for use in bison. Preliminary studies indicate that RB51 is safe and efficacious in bison calves. However, in order for RB51 to be conditionally licensed in bison, additional safety and efficacy trials must be completed.

30. Where or when is calfhood vaccination most important?

Owners whose herds are located in areas of relatively heavy infection or who ship replacement cattle or bison to, or receive animals from, such areas should carry out a vigorous calfhood vaccination program. Every cattle or bison owner, regardless of location, should discuss the advantages and disadvantages of vaccination with his or her veterinarian. Some States do not allow cattle and bison to be imported for breeding if they are not official vaccinates and they are beyond the age at which they should have been vaccinated.

31. Where is vaccination less important?

In many areas of the country, low herd infection rates coupled with improvement in the detection of early infection through BRT, MCI, and other surveillance systems have lessened the need to continue calfhood vaccination. Vaccination should be reduced in such areas, provided that adequate regulatory measures are in effect to prevent reintroduction of the disease.

32. How does brucellosis affect humans?

People infected with the brucellosis organism usually develop symptoms similar to a severe influenza, but this disease, called undulant fever, persists for several weeks or months and may get progressively worse. Farmers, ranchers, veterinarians, and packing plant workers are infected most frequently because they come into direct contact with infected animals. The initial symptoms are fatigue and headaches, followed by high fever, chills, drenching sweats, joint pains, backache, and loss of weight and appetite. Undulant fever does not often kill its victims, but the disease is too serious to be dealt with lightly.

33. What are the main sources of human infection?

In years past, prior to pasteurization, raw milk was considered the prime source of brucellosis in humans. Today, most humans contract the disease by coming in direct contact with aborted fetuses, afterbirth, and uterine discharges of diseased animals or with infected carcasses at slaughter. However, one 1994 study suggests that human brucellosis in California is most likely to be a food-borne illness (unpasteurized milk or cheese products) acquired in Mexico or from Mexican products consumed in California. Rarely, if ever, does a human contract the disease from another human.

34. How common is human brucellosis in this country?

Fortunately, the combination of pasteurization of milk and progress in the eradication of the disease in livestock has resulted in substantially fewer human cases than in the past. Ninety eight cases of human brucellosis were reported in 1997, a fraction of the 6,400 cases reported in 1947. Sixty two (62) cases of brucellosis in humans have been reported to the Centers for Disease Control and Prevention for 1998 (provisional data).

35. Can people get brucellosis by eating meat?

There is no danger from eating cooked meat products because the disease-causing bacteria are not normally found in muscle tissue and they are killed by normal cooking temperatures. The disease may be transmitted to humans when slaughtering infected animals or when processing contaminated organs from freshly killed animals.

36. How can people be protected from brucellosis?

Ranchers, farmers, or animal managers should clean and disinfect calving areas and other places likely to become contaminated with infective material. All individuals should wear sturdy rubber or plastic gloves when assisting calving or aborting animals, and scrub well with soap and water afterward. Precautions against drinking raw milk or eating unpasteurized milk byproducts are also important. Ultimately, the best prevention is to eliminate brucellosis from all animals in the area.

For additional information, contact:

USDA, APHIS, Veterinary Services
National Animal Health Programs
4700 River Road, Unit 43
Riverdale, MD 20737-1231
Telephone (301) 734-7708

BEATING BRUCELLOSIS



**WYOMING
GAME & FISH
DEPARTMENT**

Conserving Wildlife –
Serving People

CONSERVATIONISTS, SCIENTISTS, AND POLITICIANS JOIN FORCES TO BEAT A DISEASE THAT INFECTS WYOMING'S ELK, BISON, AND THREATENS CATTLE.



BEATING BRUCELLOSIS

ARTICLE BY CHRIS COLLIGAN
PHOTOGRAPY BY MARK GOCKE

Introduction

Managing brucellosis in elk and bison of the Greater Yellowstone Area (GYA) is one of the most complicated and contentious wildlife management issues in North America. Often called a “political disease,” brucellosis affects livestock, wildlife, and humans, resulting in social, economic, biological, and political complications that are a constant challenge for wildlife managers.

Many interest groups— state and federal wildlife and agricultural officials, hunters, ranchers, outfitters, conservationists, landowners, and the general public— have a stake in management of this disease.

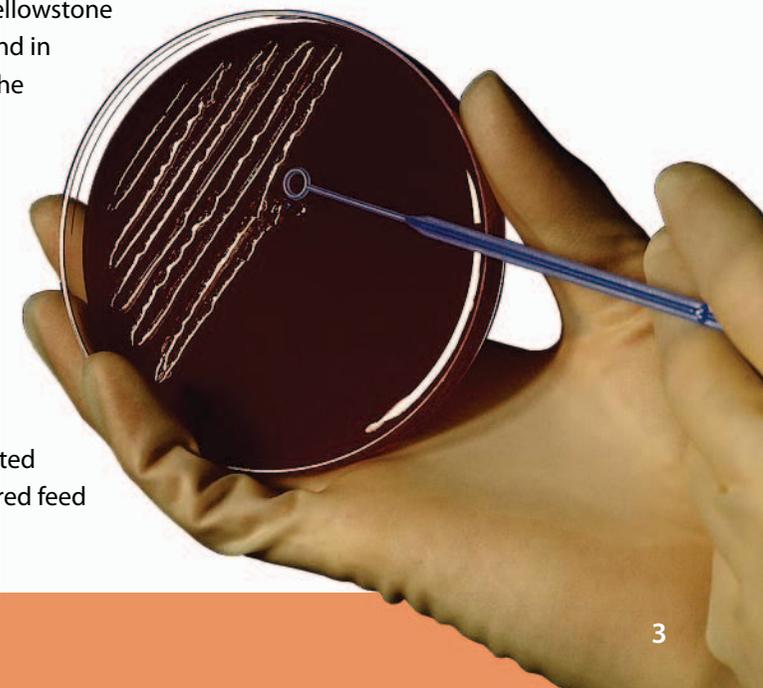
The Wyoming Game and Fish Department, along with other government agencies, private-sector organizations, and individuals, has increased its effort to solve the brucellosis problem. Together, these groups are making progress on a disease that the United States has sought to eliminate since 1934. Through vaccination, testing and slaughtering infected animals, research on new vaccines and the biology of the disease, and managing habitat to provide better forage outside the state’s feedgrounds, the disease is being managed but still remains a reoccurring encumbrance for many.

Some of the views that shape the debate over brucellosis have been with us for a century, and it is likely that eliminating brucellosis will require cooperation between all of the entities with a vested interest in the disease.

Biology of the Disease

Brucellosis is a highly contagious bacterial disease of both animals and humans that has been recognized since the nineteenth century. A cooperative state-federal brucellosis eradication program has existed for more than seventy years. This program has nearly eliminated brucellosis in domestic livestock, but the disease still exists in elk and bison in the greater Yellowstone area. Brucellosis is not found in wildlife anywhere else in the state.

Brucellosis was probably introduced into the Yellowstone area from infected bison that were transplanted into Yellowstone National Park from a brucellosis-infected cattle ranch. In addition, elk likely contracted brucellosis when they shared feed



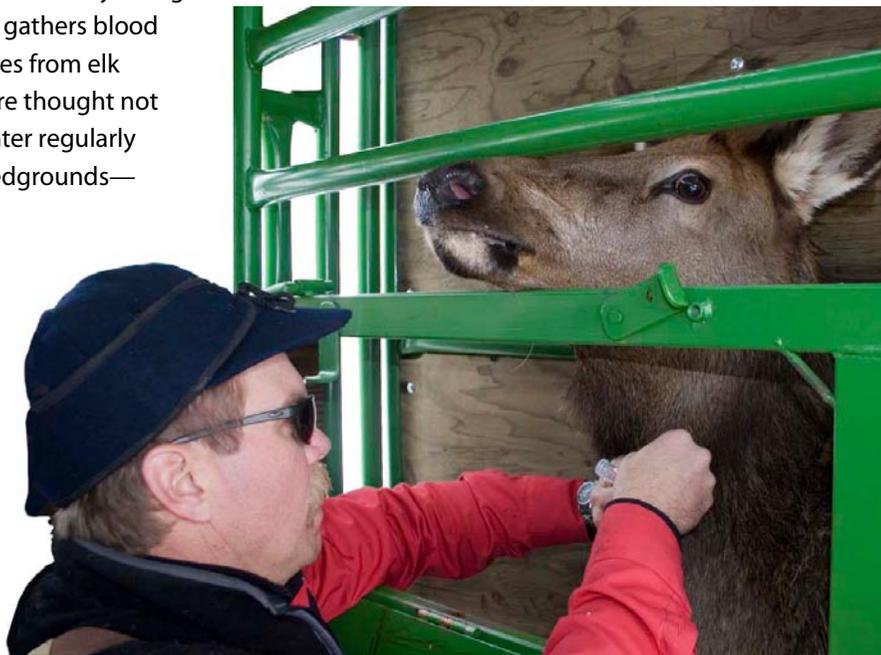
with infected cattle in and near the park in the early 1900s.

Infection of the female reproductive tract results in abortion. A cow usually aborts her first calf following infection; a few cows will abort their second, or even third, calf. Fetuses delivered near term often are stillborn or fail to thrive due to overwhelming *Brucella* infection. The male reproductive tract (testes, seminal vesicles, prostate) can also be infected. Infection of the bone or joint membranes results in lameness that may make the animal more susceptible to predation.

The most common route of transmission is thought to be oral. Elk, bison, and most other ungulates lick newborn young, whether the youngster is alive or dead, whether it is one of their own offspring or not. They often eat placentas, fetal sacs, and even stillborn young. This instinctive reaction to a birth gives *Brucella* a perfect avenue for infecting new animals. Licking or eating an infected fetus or placenta, licking the vulva of an infected female that has just given birth, consuming any of the fluids that leave an infected female at birth— any of these is enough to transmit brucellosis to another animal.

Under cool, moist conditions, *Brucella* bacteria can survive for more than 100 days in the environment. An elk or bison that consumes feed or water contaminated by vaginal discharges or fetal membranes may develop brucellosis. Treatment of the disease in wild animals is difficult because it requires multiple drugs administered daily for several weeks.

The Game and Fish Department tests elk for brucellosis at many of its feedgrounds in northwest Wyoming. It also gathers blood samples from elk that are thought not to winter regularly on feedgrounds—



these samples are taken from elk killed by hunters.

Blood testing shows the proportion of animals that have been exposed to brucellosis and developed antibodies— veterinarians call this proportion “seroprevalence.” This testing doesn’t necessarily mean that the animal can transmit the disease. Another test is used to culture the bacteria from tissue samples— a positive case or “culture positive” indicates that the animal actually harbors the bacteria and may be able to transmit to other animals. These tests can only be done postmortem.



Governor's Brucellosis Coordination Team

In 2004, cattle in a herd south of Pinedale developed brucellosis. Investigation strongly suggested that the cattle had contracted the disease from elk on the nearby Muddy Creek feedground. Subsequent testing also found positive herds in Teton County. As a result, the U.S. Department of Agriculture revoked Wyoming’s classification as a brucellosis-free state— the change meant that many of the cattle leaving the state had to be tested and certified as brucellosis-free. In response to these developments, Wyoming Governor Dave Freudenthal formed the Wyoming State Brucellosis Coordination Team, which presented twenty-eight recommendations to the governor and Wyoming state legislature. Major goals in the report include re-establishing class-free brucellosis status for the state; developing a plan that can be followed if another case of brucellosis is reported in cattle; addressing human health concerns; educating the public about brucellosis-related issues; and reducing and eventually eliminating brucellosis in wildlife.

Wyoming regained its brucellosis “class-free” status in September 2006 thanks in large part to the work of the Brucellosis Coordination Team. The Game and Fish Department will continue surveillance in wildlife, research, and cooperation in the management of this disease to continue to maintain the state’s status. This reinstatement has eased some of the restrictions statewide for the cattle industry, however within the brucellosis “endemic” area of northwest Wyoming, cattle producers are still required to remain vigilant.

Feedground Debate

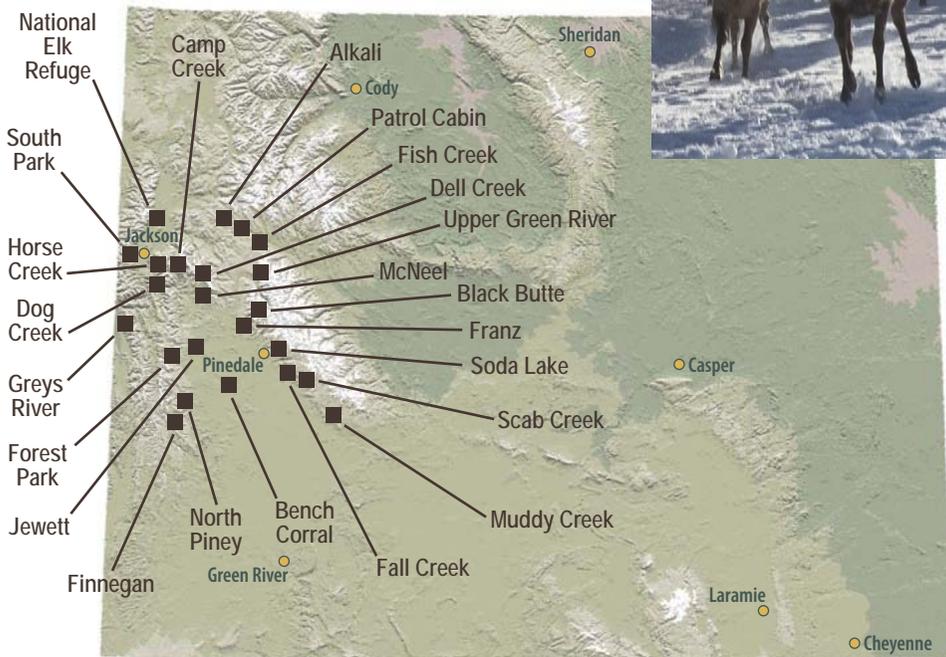
Winter elk feedgrounds in northwest Wyoming have been at the center of the brucellosis controversy. The Game and Fish Department operates twenty-two feedgrounds in northwest Wyoming, and the U.S. Fish and Wildlife Service operates a supplemental feeding program on the National Elk Refuge near Jackson. In an average year, around 13,000 elk are fed on state feedgrounds, and 6,000 are fed on the National Elk Refuge.

Winter-feeding of elk has been a part of Wyoming's culture for almost a century. Wyoming's first elk feedground was established on the National Elk Refuge in 1912 to compensate for the loss of historic elk winter habitat in the Jackson Hole area, to help prevent elk from starving during winter months, and to keep elk out of hay stored on the valley's ranches.

Since then, development has altered much of the traditional elk winter habitat in Jackson Hole and other areas of northwest Wyoming and created "bottlenecks" that prevent elk from migrating to traditional winter ranges. Today, because of the limited amount of natural

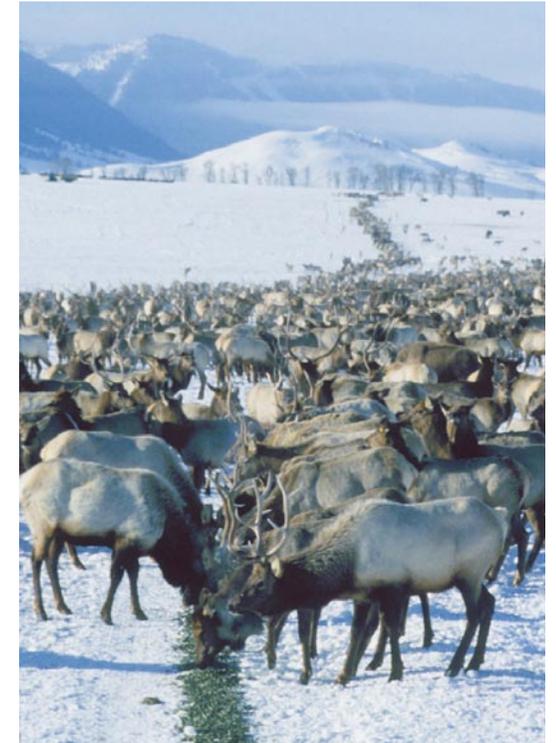


WYOMING'S ELK FEEDGROUNDS



habitat available, many of these elk have nowhere to go to find food in the winter except feedgrounds or livestock feed lines. In most situations, the only realistic alternative to feeding elk in the winter is a drastic reduction in the number of elk.

Though these feedgrounds were established as a solution to the problems of habitat loss and conflicts with private landowners, they have exacerbated other problems, most notably disease and public expectations in wildlife numbers. When animals are crowded together, as they are during most feedground operations, they often have higher rates of disease. Closing feedgrounds could reduce the prevalence of brucellosis among elk, but it would also create additional problems. Without feedgrounds, many elk would wander onto nearby private lands in search of food, where they would come into contact with livestock. One of the main benefits of feedgrounds today is that they help keep elk away from private ranches, where they could transmit brucellosis to cattle. Once elk find accessible stores of hay, they can eat large amounts of forage. The Wyoming Game and Fish Department is also required to compensate ranchers for the loss of hay, a key reason for the development of state-run feedgrounds.



Stable populations of elk have both an economic and recreational value in western Wyoming. Feedgrounds stabilize herds in this region and minimize the impact that winter and calf losses due to brucellosis have on the overall population.

The Governor's Brucellosis Coordination Team recommended several actions to help solve problems related to feedgrounds and disease. The team considered proposals to phase out some existing feedgrounds and ultimately recommended against any immediate closures. Instead, they directed the Game and Fish Department to take a comprehensive look at all brucellosis-related issues in northwestern Wyoming, including feedgrounds, and create "brucellosis management action plans" for each of the elk herds in the area.



Brucellosis Management Action Plans

The Governor's Brucellosis Coordination Team recommended the development of brucellosis management action plans for the seven-feedground elk herd units and two bison herd units in northwestern Wyoming. The plans, completed in 2008, provide guidelines for management of elk and bison that will reduce rates of brucellosis infection and the risk of transmission to livestock.

Each plan considers a variety of ways to avoid mixing livestock and elk during the winter and to reduce the prevalence of the disease. These include relocating or closing feedgrounds, reducing numbers of elk, changing the way cattle producers operate, installing fences, testing elk for brucellosis and removing infected animals, continuing vaccination programs, enhancing elk habitat, and buying winter range or conservation easements on winter range.

Test-and-Removal Project

One of the more controversial recommendations from the governor's brucellosis coordination team was an experimental five-year test-and-removal study on the feedgrounds of the Pinedale elk herd. As part of this experiment, cow elk are being tested for brucellosis, and any animals that test positive are removed and killed—the meat is then donated to food banks across the state. A similar test-and-removal approach was used to eliminate brucellosis in domestic livestock and a current program is occurring in Yellowstone bison.

Wildlife managers hope to determine whether this approach will reduce the prevalence of the disease in the Pinedale elk herd, and at the same time they expect to find

out more about the biology of the disease as it affects elk. Tissue samples from slaughtered elk are providing researchers the opportunity to develop better field tests to determine the relationship between elk that test seropositive (indications of brucellosis infection in the blood) and culture positive (confirmed brucellosis infection in other tissues).

The experiment will be evaluated by monitoring change in prevalence of brucellosis on the feedground over 5 years. The scientific community will also critically review the experiment.

Brucellosis in Cattle of Teton and Sublette Counties

When Wyoming lost its brucellosis-class-free status in 2004, it was a devastating blow to the state's livestock industry. Though the infections occurred only in western Wyoming, the entire state was affected. Costly testing restrictions were imposed on all cattle before being exported from the state. In some cases cattle weren't marketable because of a fear within other states of transmission to their herds. Additionally, there is a reduction of calf crops due to abortion "storms" that may occur within infected herds and potentially the loss of an entire herd and its bloodline if quarantined and slaughtered.

There is hope for cattle producers. The development of a more effective vaccine with a longer efficacy may prevent brucellosis transmission to cattle in the future. Also, each livestock producer in the affected region is being encouraged to develop a plan for managing his herd in cooperation with the Wyoming Livestock Board, State Veterinary Laboratory, and the Animal and Plant Health Inspection Service (APHIS). These plans are intended to minimize the possibility of brucellosis transmission from wildlife to livestock.



Brucellosis Feedground Habitat Program

The Wyoming Game and Fish Department's Brucellosis-Feedground-Habitat (BFH) program is managing brucellosis in northwest Wyoming. BFH biologists document brucellosis rates on feedgrounds by trapping elk and collecting blood samples to be tested for brucellosis. They are also responsible for the Strain 19 vaccine program at nineteen state feedgrounds and the National Elk Refuge. The last facet of the program—habitat—benefits all wildlife species in the region. Currently, elk man-

agers believe that habitat improvement near feedgrounds reduces transmission of the disease by spreading elk spatially or decreasing the length of time that the elk spend in close proximity on the feedground. Managers typically use prescribed fire or mechanical treatments to stimulate the growth of more nutritious forage in these projects. Over the last decade this group, in cooperation with the Game and Fish Department habitat biologists, has been instrumental in completing several habitat improvement projects near feedgrounds in the Jackson/Pinedale region, and many more are planned for the future.

The Game and Fish Department continues to pursue research projects and stay abreast of current efforts taking place throughout the Greater Yellowstone Area. This research is mostly conducted through the BFH program

and Wyoming State Veterinary Laboratory, with the cooperation of other agencies and academic institutions. These efforts have led to adaptive management of brucellosis.

One such project began on the Franz feedground in the Big Piney elk herd unit. Researchers studied potential transmission of brucellosis from fetuses to elk congregated on feedgrounds. Fetuses that tested negative for brucellosis were removed from elk on the Greys River feedground and placed strategically on the Franz feedground to find out how elk contacted them and how quickly scavengers removed them. This research led to a best management practice to eliminate scavenger hazing and control on and adjacent to state feedgrounds.

In addition, a new research effort began last January to examine the ways habitat may influence brucellosis seroprevalence and transmission. This project is a cooperative effort involving the Game and Fish Department, University of Wyoming, and Iowa State University. Researchers captured cow elk at each of three state feedgrounds and

elk that spend the winter on native winter range in the Buffalo River Valley. The three feedgrounds (Scab Creek, Soda Lake, and Bench Corral) have varying degrees of habitat improvement in their vicinity. Each cow was tested for brucellosis, given a radio transmitter, and released. The transmitters allow researchers to locate each cow as she aborts or calves. These locations will help biologists find out whether improved habitat around the feedgrounds is dispersing cows before they give birth, thereby reducing the chances of spreading brucellosis.

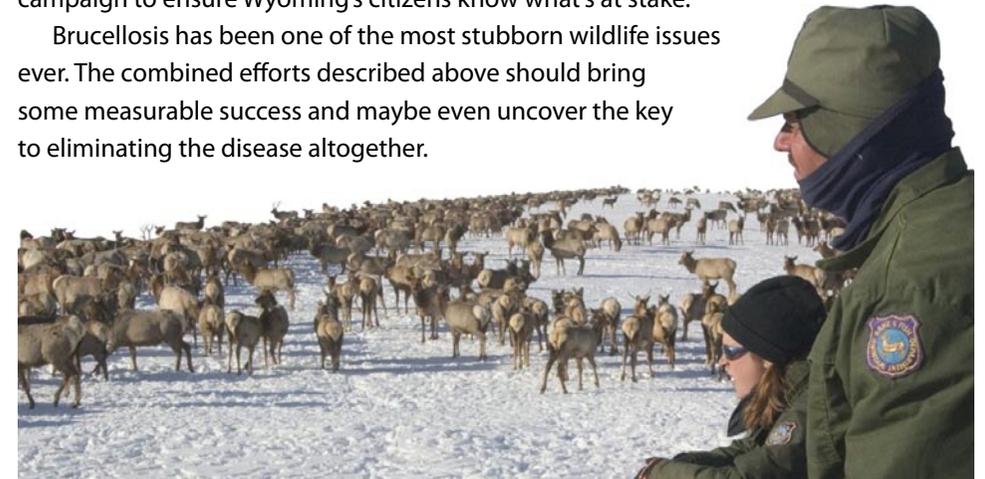
Through research such as this, the Game and Fish Department has identified feedgrounds where significant long-term reductions in brucellosis seroprevalence might be achieved by implementing management practices based on feeding and disease data from elk feedgrounds.

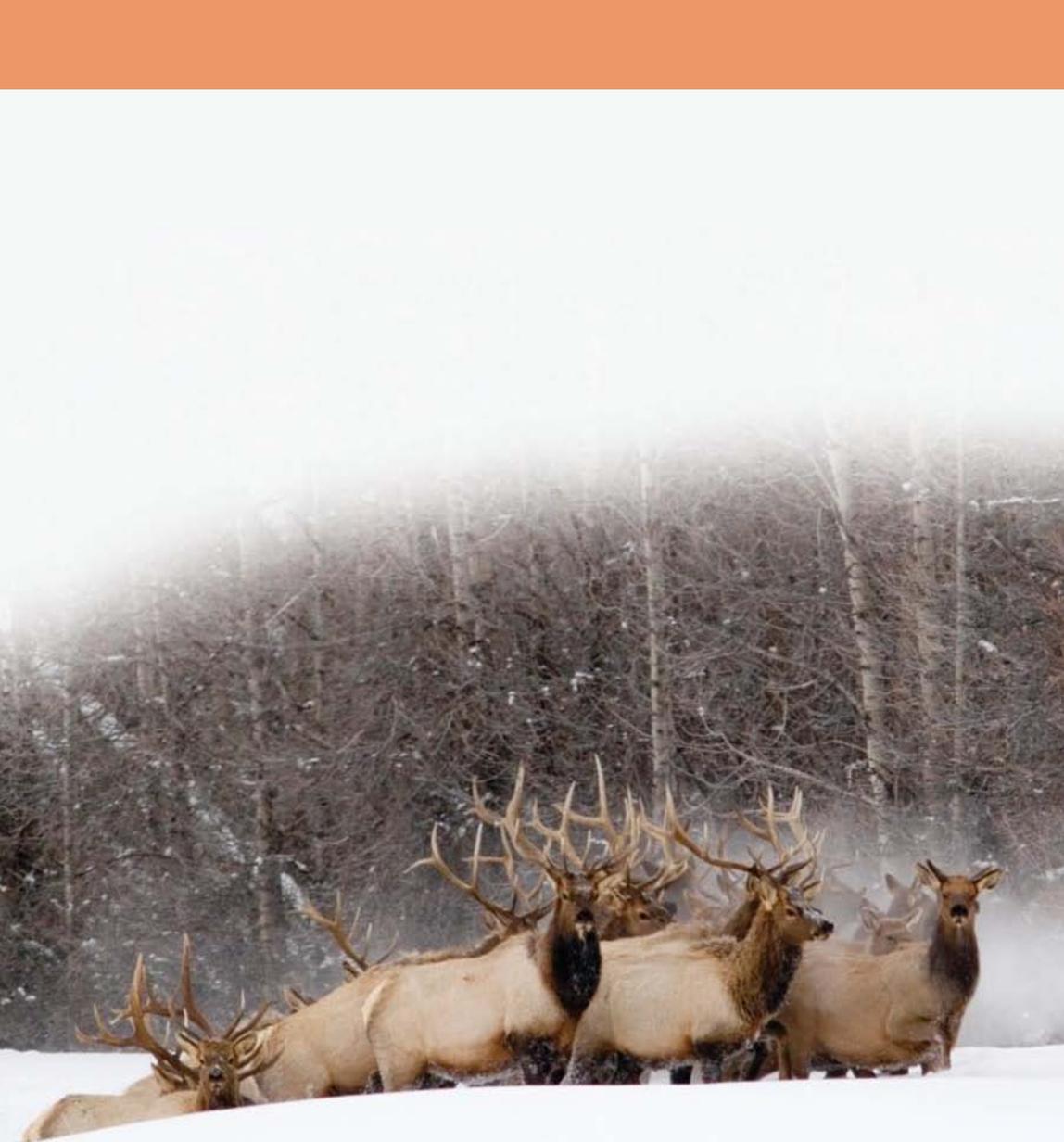
The Future of Brucellosis

Through the work of the Governor's Brucellosis Coordination Team, and through the cooperative efforts of many agencies, individuals, and organizations, more is being done now to address brucellosis in Wyoming than ever before. Brucellosis has been present in Wyoming for more than a century, and it's clear that there is no magic bullet to beat brucellosis in Wyoming. Any solutions to the complex issues surrounding this disease will require a multi-faceted, cooperative approach.

Currently, research is being conducted on new vaccines, while ranchers and wildlife managers are implementing practices to reduce commingling among elk and cattle. At the same time, biologists are learning more about how the disease is transmitted, and managers are implementing procedures to reduce transmission among elk. Habitat projects are being planned and implemented while new sources of funding for habitat treatments, conservation easements, and other efforts are being pursued. A number of agencies are also cooperating on a comprehensive public education campaign to ensure Wyoming's citizens know what's at stake.

Brucellosis has been one of the most stubborn wildlife issues ever. The combined efforts described above should bring some measurable success and maybe even uncover the key to eliminating the disease altogether.





WYOMING GAME & FISH DEPARTMENT

Conserving Wildlife – Serving People



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Brucellosis Fact Sheet and Investigation Protocol

Wyoming Department of Health

August 2008

Tracy D. Murphy, MD, State Epidemiologist

What is brucellosis?

Brucellosis is an infectious disease caused by the bacteria of the genus *Brucella*. These bacteria are primarily passed among animals, and they cause disease in many different vertebrates. Various *Brucella* species affect sheep, goats, cattle, deer, elk, bison, pigs, dogs, and several other animals. Humans become infected by coming in contact with animals or animal products that are contaminated with these bacteria. In humans brucellosis can cause a range of symptoms that are similar to the flu and may include fever, sweats, headaches, back pains, and physical weakness. Severe infections of the central nervous systems or lining of the heart may occur. Brucellosis can also cause long-lasting or chronic symptoms that include recurrent fevers, joint pain, and fatigue.

How common is brucellosis?

Brucellosis in humans is not very common in the United States, where 100 to 200 cases occur each year. But brucellosis can be very common in countries where animal disease control programs have not reduced the amount of disease among animals. Brucellosis in humans in Wyoming is uncommon, with usually no more than 1 to 2 cases reported per year and many years with no reported cases. Many of these reported infections are long standing.

Where is brucellosis usually found?

Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animal health programs. Areas currently listed as high risk are the Mediterranean Basin (Portugal, Spain, Southern France, Italy, Greece, Turkey, North Africa), South and Central America, Eastern Europe, Asia, Africa, the Caribbean, and the Middle East. Unpasteurized cheeses, sometimes called "village cheeses," from these areas may represent a particular risk for tourists.

How is brucellosis transmitted to humans, and who is likely to become infected?

Humans are generally infected in one of three ways: eating or drinking something that is contaminated with *Brucella*, breathing in the organism (inhalation), or having the bacteria enter the body through skin wounds. The most common way to be infected is by eating or drinking contaminated milk products. When sheep, goats, cows, or camels are infected, their milk is contaminated with the bacteria. If the milk is not pasteurized, these bacteria can be transmitted to persons who drink the milk or eat cheeses made it. Inhalation of *Brucella* organisms is not a common route of infection, but it can be a significant hazard for people in certain occupations, such as those working in laboratories where the organism is cultured. Inhalation is often responsible for a significant percentage of cases in abattoir employees. Infection can be acquired through the handling of infected animal tissues, blood, urine, vaginal discharges, birth products, and aborted fetuses. Contamination of skin wounds may be a problem for persons working in slaughterhouses or meat packing plants or for veterinarians. Hunters may be infected through skin wounds or by accidentally ingesting the bacteria after cleaning deer, elk, moose, or wild pigs that they have killed.

Can brucellosis be spread from person to person?

Direct 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 also been reported. Although uncommon, transmission may also occur via contaminated tissue transplantation or blood transfusion.

Is there a way to prevent infection?

Yes. Do not consume unpasteurized dairy products. Protective clothing and gloves should be worn when handling potentially infected materials from animals (see "How is Brucellosis Transmitted..."), and care should be taken to avoid aerosolization or splashing of potentially infected animal materials. Hunters and animal herdsman should use rubber gloves when handling viscera of animals. There is no vaccine available for humans.

How is brucellosis diagnosed?

Brucellosis can be diagnosed in a laboratory by finding *Brucella* organisms in samples of blood, bone marrow, or other tissues. Also, blood tests can be done to detect antibodies against the bacteria. If this method is used, two blood samples should be collected 2 weeks apart. Consultation and assistance with laboratory testing can be obtained from the Wyoming Department of Health Public Health Laboratory.

Recommendations for Safe Laboratory Practices for *Brucella* spp.

- When brucellosis is suspected, clinicians should note 'suspect or rule out brucellosis' on the laboratory submission.
- Review laboratory containment methods and microbiological procedures to ensure compliance with recommendations in the Biosafety in Microbiological and Biomedical Laboratories (BMBL), 5th edition.
- Use primary barriers: use safety centrifuge cups, personal protective equipment, and class II or higher Biological Safety Cabinets (BSCs) for procedures with a high likelihood of producing droplet splashes or aerosols.
- Use secondary barriers: restrict access to the laboratory when work is being performed and maintain the integrity of the laboratory's air handling system by keeping external doors and windows closed.
- Perform all procedures on unidentified isolates carefully to minimize the creation of splashes or aerosols.
- Prohibit sniffing of opened culture plates to assist in the identification of isolates.
- Manipulate isolates of small gram-negative or gram-variable rods within a BSC.

Human brucellosis is a reportable disease that must be reported immediately. Laboratories, health care providers and county health departments are required to immediately report any suspected or confirmed cases of human brucellosis to the Wyoming Department of Health at (307)777-3593 or 1-877- 996-9000 (during business hours) or at 1-888-996-9104 (24 hours a day).

Is there a treatment for brucellosis?

Yes, but treatment can be difficult. Doctors can prescribe effective antibiotics. Usually, doxycycline and rifampin are used in combination for 6 weeks to prevent reoccurring infection. Depending on the timing of treatment and severity of illness, recovery may take a few weeks to several months. Mortality is low (<2%), and is usually associated with endocarditis.

Is preventative therapy recommended in some circumstances?

Yes, in certain circumstances it may be recommended to give someone exposed to brucellosis antibiotics to reduce the likelihood of infection. Individual circumstances and the likelihood that the exposure will result in infection must be considered on a case-by-case basis. However in general preventative therapy should be considered in the following circumstances:

- Brucellosis animal vaccine exposure via splashing into eyes, other mucous membranes, or open wounds, or via inoculation.
- High risk laboratory exposures to confirmed *Brucella* organisms.
- High risk exposures to infected animal products.

Wyoming Department of Health Follow-up and Investigation Protocol for Cases of Human Brucellosis

In Wyoming human brucellosis is a reportable disease and as such is required to be reported to WDH. Laboratories, health care providers and county health departments are required to immediately report any suspected or confirmed cases of human brucellosis to the Wyoming Department of Health at (307)777-3593 or 1-877- 996-9000 (during business hours) or at 1-888-996-9104 (24 hours a day).

The WDH Infectious Disease Epidemiology Program will conduct follow-up on all reported cases of brucellosis to ascertain if the reported case meets the surveillance case definition, to determine possible exposures that may have resulted in infection, and to assess if there is a public health threat.

If a public health threat exists, control measures will be recommended or enforced upon direction of the State Health Officer or the State Epidemiologist.

Appendix Two Links and Resources

Usefull Brucellosis Links/Resources

Information from USDA:

http://www.aphis.usda.gov/animal_health/animal_diseases/brucellosis/

Information from the JAVMA:

http://www.avma.org/avmacollections/zu/javma_233_6_900.pdf

Information on Swine Brucellosis from USDA:

http://www.aphis.usda.gov/animal_health/animal_dis_spec/swine/

Information from the Wyoming Department of Health:

<http://wdh.state.wy.us/phsd/epiid/brucellosis.html>

Information from the Wyoming Brucellosis Coordination Team:

<http://www.wyomingbrucellosis.com/bct.asp>

Information from CDC:

http://www.cdc.gov/NCIDOD/DBMD/DISEASEINFO/brucellosis_g.htm

Appendix Three Follow-Up Report Form

Brucellosis Case Report Form

Case is: Confirmed Probable Suspect

Patient Information

Name _____ Date of Birth ___/___/___ Sex _____

Parent's Name (if child < 18) _____

Address _____ City _____ State _____ Zip _____

Telephone _____ Alternate Telephone _____

Hispanic: Yes No Unknown

Race: White Black Asian/Pacific Islander Native American Other Unknown

Pregnant: Yes No Underlying Immunodeficiency: Yes No If yes, specify _____

Worksites/school/daycare center _____ Address _____

Occupation/grade _____ Employer _____

Source of Report

Lab Infection Control Practitioner Physician Other _____

Name _____ Phone _____ Date ___/___/___

Primary M.D. _____ Phone _____

Present Illness

Onset date ___/___/___ Onset was: Acute Insidious Unknown

Attending or consulting physician _____ Telephone _____

Hospitalized? Yes No Hospital name _____ Telephone _____

Admission date ___/___/___ Discharge date ___/___/___

Specific antibiotic therapy _____ First dose ___/___/___ Last dose ___/___/___

Outcome of case: Recovered? Yes No Died? Yes No if yes, Date of death: ___/___/___

Symptoms

Fever (intermittent)	Y N	Backache	Y N	Anorexia	Y N
Fever (constant)	Y N	Fatigue	Y N	Weight loss	Y N
Max temp: _____		Muscle aches	Y N	Abdominal pain	Y N
Chills	Y N	Weakness	Y N	Lymphadenopathy	Y N
Sweating	Y N	Abscess	Y N		

Others (list): _____

Laboratory Data

Culture Yes No If yes: Specimen source _____ Date collected: ___/___/___

Isolation results: Positive Negative Unsatisfactory

Species isolated: _____

Acute serology Yes No If yes: Date collected: ___/___/___ Results: _____

Convalescent serology Yes No If yes: Date collected: ___/___/___ Results: _____

Possible Sources of Infection During Exposure Period (*Exposure Period is within 60 days of onset of illness*)

Animal contact in the 6 months prior to illness onset? Yes No Unknown

If yes, check all that apply: Cattle Swine Sheep Goats Dogs Elk Deer Bison

Other (List) _____

Where and when? _____

Who owns the animals? _____ Phone _____

Contact with an aborting animal? Yes No Unknown

If yes, where and when: _____

Contact with a cattle, deer, elk, or swine herd known to be infected with brucellosis? Yes No Unknown

If yes, where and when: _____

Hunted in an area with known infected herds? Yes No Unknown

If yes, describe: _____

Consumed unpasteurized milk or milk products? Yes No Unknown Date of last consumption: ___/___/___

If yes, describe: _____

Exposure to brucella vaccine? Yes No Unknown

If yes, date and type of exposure: _____

Exposure to *Brucella* sp. in a laboratory setting? Yes No Unknown

If yes, date and type of exposure: _____

Does the patient have a history of travel outside of home county in the 60 days before illness onset? Yes No

If yes, document travel history _____

Other relevant exposure information: _____

Additional Information

Similar Illness in Household Member or Close Contact? Yes No Unknown

If yes, complete below:

Name	Relationship	Phone Number	Onset date

Additional Remarks:

Case Definition: Brucellosis

CDC/MMWR, May2, 1997/Vol. 46/No. RR-10, "Case Definitions for Public Health Surveillance"

Clinical description

An illness characterized by acute or insidious onset of fever, night sweats, undue fatigue, anorexia, weight loss, headache, and arthralgia

Laboratory criteria for diagnosis

- Isolation of *Brucella* sp. from a clinical specimen, or
- Fourfold or greater rise in *Brucella* agglutination titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart and studied at the same laboratory, or
- Demonstration by immunofluorescence of *Brucella* sp. in a clinical specimen

Case classification

Probable: a clinically compatible case that is epidemiologically linked to a confirmed case or that has supportive serology (i.e., *Brucella* agglutination titer of greater than or equal to 160 in one or more serum specimens obtained after onset of symptoms)

Confirmed: a clinically compatible case that is laboratory confirmed

Appendix Four Strategic National Stockpile



Emergency Preparedness and Response

OFFICE OF PUBLIC HEALTH PREPAREDNESS AND RESPONSE (OPHPR)

Strategic National Stockpile (SNS)

On this page:

[What the Stockpile Means to You](#)

[Helping State and Local Jurisdictions Prepare for a National Emergency](#)

[A National Repository of Life-Saving Pharmaceuticals and Medical Materiel](#)

[Determining and Maintaining SNS Assets](#)

[Supplementing State and Local Resources](#)

[Rapid Coordination & Transport](#)

[Transfer of SNS Assets to State and/or Local Authorities](#)

[When and How is the SNS Deployed?](#)

[Training and Education](#)

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Additional Resources:

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SNS: What it Means to You



CDC's Strategic National Stockpile (SNS) has large quantities of medicine and medical supplies to protect the American public if there is a public health emergency (terrorist attack, flu outbreak, earthquake) severe enough to cause local supplies to run out. Once Federal and local authorities agree that the SNS is needed, medicines will be delivered to any state in the U.S. within 12 hours. Each state has plans to receive and distribute SNS medicine and medical supplies to local communities as quickly as possible.

What should you know about the medicines in the SNS?

The medicine in the SNS is FREE for everyone.

The SNS has stockpiled enough medicine to protect people in several large cities at the same time.

Federal, state and local community planners are working together to ensure that the SNS medicines will be delivered to the affected area to protect you and your family if there is a terrorist attack.

How will you get your medicine if the SNS is delivered to your area?

- Local communities are prepared to receive SNS medicine and medical supplies from the state to provide to everyone in the community who needs them.
- Find out about how to get medicine to protect you and your family by watching TV, listening to the radio, reading the newspaper, checking the community Web site on the Internet or learning from trusted community leaders.

Helping State and Local Jurisdictions Prepare for a National Emergency

An act of terrorism (or a large scale natural disaster) targeting the U.S. civilian population will require rapid access to large quantities of pharmaceuticals and medical supplies. Such quantities may not be readily available unless special stockpiles are created. No one can anticipate exactly where a terrorist will strike and few state or local governments have the resources to create sufficient stockpiles on their own. Therefore, a national stockpile has been created as a resource for all.



In 1999 Congress charged the Department of Health and Human Services (HHS) and the Centers for Disease Control and Prevention (CDC) with the establishment of the National Pharmaceutical Stockpile (NPS). The mission was to provide a re-supply of large quantities of essential medical materiel to states and communities during an emergency within twelve hours of the federal decision to deploy.

The Homeland Security Act of 2002 tasked the Department of Homeland Security (DHS) with defining the goals and performance requirements of the SNS Program, as well as managing the actual deployment of assets. Effective on 1 March 2003, the NPS became the Strategic National Stockpile (SNS) Program managed jointly by DHS and HHS. With the signing of the BioShield legislation, the SNS Program was returned to HHS for oversight and guidance. The SNS Program works with governmental and non-governmental partners to upgrade the nation's public health capacity to respond to a national emergency. Critical to the success of this initiative is ensuring capacity is developed at federal, state, and local levels to receive, stage, and dispense SNS assets.

The Cities Readiness Initiative (CRI) of CDC's SNS was established in 2004 and focuses on enhancing preparedness in the nation's largest cities and metropolitan statistical areas, where more than 50% of the U.S. population resides. Through CRI, state and large metropolitan public health departments have developed plans to respond to a large-scale bioterrorist event by dispensing antibiotics to the entire population of an identified MSA within 48 hours.

A National Repository of Life-Saving Pharmaceuticals and Medical Supplies

The SNS is a national repository of antibiotics, chemical antidotes, antitoxins, life-support medications, IV administration, airway maintenance supplies, and medical/surgical items. The SNS is designed to supplement and re-supply state and local public health agencies in the event of a national emergency anywhere and at anytime within the U.S. or its territories.

The SNS is organized for flexible response. The first line of support lies within the immediate response 12-hour Push Packages. These are caches of pharmaceuticals, antidotes, and medical supplies designed to provide rapid delivery of a broad spectrum of assets for an ill defined threat in the early hours of an event. These Push Packages are positioned in strategically located, secure warehouses ready for immediate deployment to a designated site within 12 hours of the federal decision to deploy SNS assets.



If the incident requires additional pharmaceuticals and/or medical supplies, follow-on vendor managed inventory (VMI) supplies will be shipped to arrive within 24 to 36 hours. If the agent is well defined, VMI can be tailored to provide pharmaceuticals, supplies and/or products specific to the suspected or confirmed agent(s). In this case, the VMI could act as the first option for immediate response from the SNS Program.

Determining and Maintaining SNS Assets

To determine and review the composition of the SNS Program assets, HHS and CDC consider many factors, such as current biological and/or chemical threats, the availability of medical materiel, and the ease of dissemination of pharmaceuticals. One of the most significant factors in determining SNS composition, however, is the medical vulnerability of the U.S. civilian population.

The SNS Program ensures that the medical materiel stock is rotated and kept within potency shelf-life limits. This involves quarterly quality assurance/quality control checks (QA/QC's) on all 12-hour Push Packages, annual 100% inventory of all 12-hour Push Package items, and inspections of environmental conditions, security, and overall package maintenance.



Supplementing State and Local Resources

During a national emergency, state, local, and private stocks of medical materiel will be depleted quickly. State and local first responders and health officials can use the SNS to bolster their response to a national emergency, with a 12-hour Push Package, VMI, or a combination of both, depending on the situation. The SNS is not a first response tool.

Rapid Coordination & Transport

The SNS Program is committed to have 12-hour Push Packages delivered anywhere in the U.S. or its territories within 12 hours of a federal decision to deploy. The 12-hour Push Packages have been configured to be immediately loaded onto either trucks or commercial cargo aircraft for the most rapid transportation. Concurrent to SNS transport, the SNS Program will deploy its Stockpile Service Advance Group (SSAG). The SSAG staff will coordinate with state and local officials so that the SNS assets can be efficiently received and distributed upon arrival at the site.



Transfer of SNS Assets to State and/or Local Authorities

HHS will transfer authority for the SNS materiel to the state and local authorities once it arrives at the designated receiving and storage site. State and local authorities will then begin the breakdown of the 12-hour Push Package for distribution. SNS TARU members will remain on site in order to assist and advise state and local officials in putting the SNS assets to prompt and effective use.

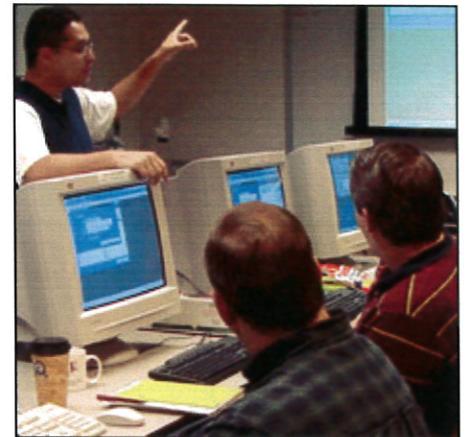
When and How is the SNS Deployed?

The decision to deploy SNS assets may be based on evidence showing the overt release of an agent that might adversely affect public health. It is more likely, however, that subtle indicators, such as unusual morbidity and/or mortality identified through the nation's disease outbreak surveillance and epidemiology network, will alert health officials to the possibility (and confirmation) of a biological or chemical incident or a national emergency. To receive SNS assets, the affected state's governor's office will directly request the deployment of the SNS assets from CDC or HHS. HHS, CDC, and other federal officials will evaluate the situation and determine a prompt course of action.

Training and Education

The SNS Program is part of a nationwide preparedness training and education program for state and local health care providers, first responders, and governments (to include federal officials, governors' offices, state and local health departments, and emergency management agencies). This training not only explains the SNS Program's mission and operations, it alerts state and local emergency response officials to the important issues they must plan for in order to receive, secure, and distribute SNS assets.

To conduct this outreach and training, CDC and SNS Program staff are currently working with HHS, Regional Emergency Response Coordinators at all of the U.S. Public Health Service regional offices, state and local health departments, state emergency management offices, the Metropolitan Medical Response System cities, the Department of Veterans' Affairs, and the Department of Defense.



Related Information

- MedicalCountermeasures.gov provides a central source of information on initiatives from the Public Health Emergency Medical Countermeasures Enterprise regarding research, development, and acquisition of medical countermeasures for public health emergencies, both naturally occurring and intentional.
- Page last reviewed May 21, 2010
- Page last updated May 21, 2010
- Content source: Office of Public Health Preparedness and Response (OPHPR, formerly the Coordinating Office for Terrorism Preparedness and Emergency Response [COTPER])

Appendix Five Bioterrorism Related Info from CDC



Department of Health and Human Services

Centers for Disease Control and Prevention

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Brucellosis

(Brucella melitensis, abortus, suis, and canis)

For comprehensive CDC information about bioterrorism and related issues, please visit <http://www.bt.cdc.gov>.

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[Frequently Asked Questions about Brucellosis](#)

[Recommendations for Risk Assessment, Post-Exposure Prophylaxis and Follow-up of Laboratory Personnel Exposed to Pathogenic *Brucella* Species](#)

[Frequently Asked Questions about *Brucella abortus* RB51 Laboratory Exposures](#)

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(800) 232-4636
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International Travel

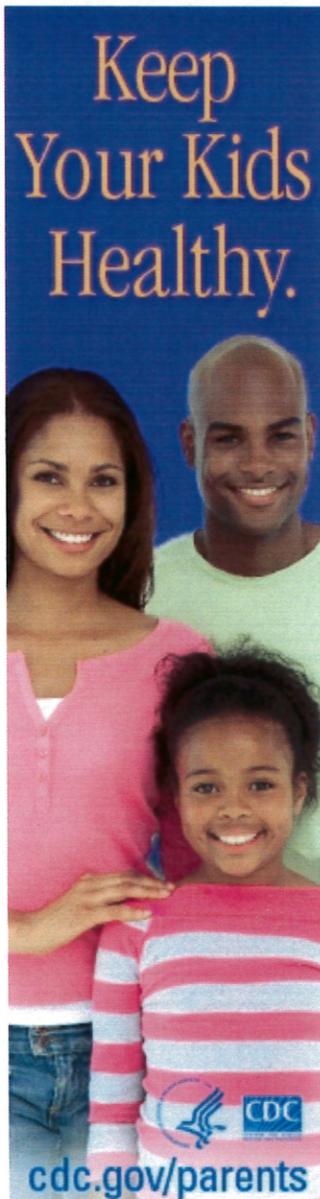
Phone: 1-887-394-8747
email: cdcinfo@cdc.gov

Frequently Asked Questions about Brucellosis

- [What is brucellosis?](#)
- [How common is brucellosis?](#)
- [Where is brucellosis usually found?](#)
- [How is brucellosis transmitted to humans, and who is likely to become infected?](#)
- [Can brucellosis be spread from person and person?](#)
- [Is there a way to prevent infection?](#)
- [My dog has been diagnosed with brucellosis. Is that a risk for me?](#)
- [How is brucellosis diagnosed?](#)
- [Is there a treatment for brucellosis?](#)
- [I am a veterinarian and I recently accidentally jabbed myself with the animal vaccine \(RB-51 or strain 19, or REV-1\) while I was vaccinating cows \(or sheep, goats\). What do I need to do?](#)

What is brucellosis?

Brucellosis is an infectious disease caused by the bacteria of the genus *Brucella*. These bacteria are primarily passed among animals, and they cause disease in many different vertebrates. Various *Brucella* species affect sheep, goats, cattle, deer, elk, pigs, dogs, and several other animals. Humans become infected by coming in contact with animals or animal products that are contaminated with these bacteria. In humans brucellosis can cause a range of symptoms that are similar to the flu and may include fever, sweats, headaches, back pains, and physical weakness. Severe infections of the central nervous systems or lining of the heart may occur. Brucellosis can also cause long-lasting or chronic symptoms that include recurrent fevers, joint pain, and fatigue.



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How common is brucellosis?

Brucellosis is not very common in the United States, where 100 to 200 cases occur each year. But brucellosis can be very common in countries where animal disease control programs have not reduced the amount of disease among animals.

Where is brucellosis usually found?

Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animal health programs. Areas currently listed as high risk are the Mediterranean Basin (Portugal, Spain, Southern France, Italy, Greece, Turkey, North Africa), South and Central America, Eastern Europe, Asia, Africa, the Caribbean, and the Middle East. Unpasteurized cheeses, sometimes called "village cheeses," from these areas may represent a particular risk for tourists.

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How is brucellosis transmitted to humans, and who is likely to become infected?

Humans are generally infected in one of three ways: eating or drinking something that is contaminated with *Brucella*, breathing in the organism (inhalation), or having the bacteria enter the body through skin wounds. The most common way to be infected is by eating or drinking contaminated milk products. When sheep, goats, cows, or camels are infected, their milk is contaminated with the bacteria. If the milk is not pasteurized, these bacteria can be transmitted to persons who drink the milk or eat cheeses made it. Inhalation of *Brucella* organisms is not a common route of infection, but it can be a significant hazard for people in certain occupations, such as those working in laboratories where the organism is cultured. Inhalation is often responsible for a significant percentage of cases in abattoir employees. Contamination of skin wounds may be a problem for persons working in slaughterhouses or meat packing plants or for veterinarians. Hunters may be infected through skin wounds or by accidentally ingesting the bacteria after cleaning deer, elk, moose, or wild pigs that they have killed.

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Can brucellosis be spread from person to person?

Direct person-to-person spread of brucellosis is extremely rare. Mothers who are breast-feeding may transmit the infection to their infants. Sexual transmission has also been reported. For both sexual and breast-feeding transmission, if the infant or person at risk is treated for brucellosis, their risk of becoming infected will probably be eliminated within 3 days. Although uncommon, transmission may also occur via contaminated tissue transplantation.

Is there a way to prevent infection?

Yes. Do not consume unpasteurized milk, cheese, or ice cream while traveling. If you are not sure that the dairy product is pasteurized, don't eat it. Hunters and animal herdsman should use rubber gloves when handling viscera of animals. There is no vaccine available for humans.

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My dog has been diagnosed with brucellosis. Is that a risk for me?

B. canis is the species of *Brucella* species that can infect dogs. This species has occasionally been transmitted to humans, but the vast majority of dog infections do not result in human illness. Although veterinarians exposed to blood of infected animals are at risk, pet owners are not considered to be at risk for infection. This is

partly because it is unlikely that they will come in contact with blood, semen, or placenta of the dog. The bacteria may be cleared from the animal within a few days of treatment; however re-infection is common and some animal body fluids may be infectious for weeks. Immunocompromised persons (cancer patients, HIV-infected individuals, or transplantation patients) should not handle dogs known to be infected with *B. canis*.

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How is brucellosis diagnosed?

Brucellosis is diagnosed in a laboratory by finding *Brucella* organisms in samples of blood or bone marrow. Also, blood tests can be done to detect antibodies against the bacteria. If this method is used, two blood samples should be collected 2 weeks apart.

Is there a treatment for brucellosis?

Yes, but treatment can be difficult. Doctors can prescribe effective antibiotics. Usually, doxycycline and rifampin are used in combination for 6 weeks to prevent reoccurring infection. Depending on the timing of treatment and severity of illness, recovery may take a few weeks to several months. Mortality is low (<2%), and is usually associated with endocarditis.

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I am a veterinarian, and I recently accidentally jabbed myself with the animal vaccine (RB-51 or strain 19, or REV-1) while I was vaccinating cows (or sheep, goats). What do I need to do?

These are live vaccines, and strain 19 is known to cause disease in humans. Although we know less about the other vaccines, the recommendations are the same. You should see a health care provider. A baseline blood sample should be collected for testing for antibodies. We recommend that you take antibiotics (doxycycline and rifampin for strain 19 and REV-1, or doxycycline alone for RB-51) for 3 weeks. At the end of that time you should be rechecked and a second blood sample should be collected. (The sample can also be collected at 2 weeks.) The same recommendations hold true for spraying vaccine in the eyes (6 weeks of treatment in this case) or spraying onto open wounds on the skin.

Recommendations for Risk Assessment, Post-Exposure Prophylaxis and Follow-up of Laboratory Personnel Exposed to Pathogenic *Brucella* Species

- ▶ [I work with *Brucella* in the laboratory, am I at risk for acquiring brucellosis?](#)
- ▶ [If my lab learns we have worked with *Brucella*, how do we determine who is at risk for developing brucellosis?](#)
- ▶ [What are the recommendations for post-exposure prophylaxis \(PEP\) to prevent brucellosis?](#)
- ▶ [How long should exposed workers be observed for the development of illness?](#)
- ▶ [Recommendations for Safe Laboratory Practices for *Brucella* spp.](#)
- ▶ [Recommendations for Surveillance and Post-Exposure Prophylaxis for Laboratory Exposure to *Brucella* isolates](#)

I work with *Brucella* in the laboratory, am I at risk for acquiring brucellosis?

Brucellosis is the most commonly reported laboratory-associated bacterial infection. A number of factors contribute to the risk of an accidental *Brucella* exposure. Laboratories may lack experience working with the organism, as it has become less

common in the United States due to an aggressive immunization program in cattle. In addition, the organism is often “unknown” when the sample arrives for analysis. Work may be performed on an open bench before it is recognized as a gram-negative rod. Certain characteristics of the bacterium, such as its low infectious dose and the fact that it is easily aerosolized, also contribute to the risk of acquisition of the organisms in a laboratory setting.

Specifically implicated procedures or events related to pathogenic *Brucella* species include sniffing bacteriological cultures, direct skin contact, mouth pipetting, inoculations, and sprays into eyes, nose, and mouth. Manipulation of *Brucella* organisms on an open bench without use of the recommended practices has led to infections. Anyone who practiced a specifically implicated procedure (above), anyone who was within five feet of any manipulation of *Brucella* on an open bench, or anyone present in a laboratory during a *Brucella* aerosol-generating event is at risk for acquiring brucellosis.

If my lab learns we have worked with *Brucella*, how do we determine who is at risk for developing brucellosis?

Related to pathogenic *Brucella* species, specifically implicated events associated with laboratory-acquired *Brucella* infections include sniffing bacteriological cultures, direct skin contact, presence when aerosols have been generated (such as during catalase testing), mouth pipetting, inoculations, and sprays into eyes, nose, and mouth. Manipulation on an open bench without use of the recommended practices has led to infections. Any worker present in the laboratory during the work-up and identification of a pathogenic *Brucella* isolate is considered a *Brucella*-exposed worker.

High-risk exposure: Individuals who performed a specifically implicated practice (see above), individuals who were near (within five feet) work with *Brucella* on an open bench, or individuals present in the laboratory during a *Brucella* aerosol-generating event should be considered as having a high risk exposure.

Low-risk exposure: Others in the lab at the time of manipulation on an open bench, but who do not have high-risk exposures as defined above, have a low-risk exposure.

What are the recommendations for post-exposure prophylaxis (PEP) to prevent brucellosis?

Interim PEP recommendations are:
Doxycycline 100 mg orally twice a day plus rifampin 600 mg orally once a day for 21 days.

Note: PEP recommendations for [B. abortus RB51](#) (attenuated vaccine strain) differ from those for fully pathogenic *Brucella* spp. As RB51 was derived by selection in rifampin-enriched media and is resistant to rifampin in vitro, the use of rifampin for PEP or treatment will not be effective for RB51. Post-exposure prophylaxis for those at high risk of exposure should include doxycycline 100 mg orally twice daily for at least 21 days. For those with contraindication to doxycycline, trimethoprim-sulfamethoxazole may be used.

After a potential laboratory exposure, all individuals classified as high-risk should begin PEP. PEP should be discussed with, and offered to, laboratory workers with low-risk exposures. For women who are pregnant, PEP should be considered in consultation with their obstetricians.

Serial serum specimens should be monitored for all exposed workers. Obtain baseline serum as soon as possible after the exposure has been recognized, and obtain available pre-exposure stored specimens. Arrange for serologic testing (*Brucella* microagglutination testing) at 2, 4, 6, and 24 weeks. These tests will monitor for the development of infection and can be performed at your state public health laboratory or CDC. Note: [RB51](#) does not induce a measurable antibody response. Monitoring serum specimens in individuals exposed to RB51 will not provide a useful indicator of infection.

How long should exposed workers be observed for the development of illness?

All exposed individuals, regardless of risk status, should be monitored for the development of symptoms. From the last exposure, temperature should be actively monitored for fever for four weeks. Broader symptoms of brucellosis should be passively monitored for six months from the last exposure. These symptoms include:

Acutely: fever, chills, headache, low back pain, joint pain, malaise, occasionally diarrhea

Sub-acutely: malaise, muscle pain, headache, neck pain, fever, sweats

Chronically: anorexia, weight loss, abdominal pain, joint pain, headache, backache, weakness, irritability, insomnia, depression, constipation.

Recommendations for Safe Laboratory Practices for *Brucella* spp.

- When brucellosis is suspected, clinicians should note 'suspect or rule out brucellosis' on the laboratory submission.
- Review laboratory containment methods and microbiological procedures to ensure compliance with recommendations in the Biosafety in Microbiological and Biomedical Laboratories (BMBL), 5th edition.
- Use primary barriers: use safety centrifuge cups, personal protective equipment, and class II or higher Biological Safety Cabinets (BSCs) for procedures with a high likelihood of producing droplet splashes or aerosols.
- Use secondary barriers: restrict access to the laboratory when work is being performed and maintain the integrity of the laboratory's air handling system by keeping external doors and windows closed.
- Perform all procedures on unidentified isolates carefully to minimize the creation of splashes or aerosols.
- Prohibit sniffing of opened culture plates to assist in the identification of isolates.
- Manipulate isolates of small gram-negative or gram-variable rods within a BSC.

Recommendations for Surveillance and Post-Exposure Prophylaxis for Laboratory Exposure to *Brucella* isolates

1. Determine number of workers exposed to *Brucella* isolates and **classify exposures** into high- and low-risk
2. Recommend **PEP** for workers with high-risk exposures to *Brucella*:
 - a. **doxycycline** 100mg twice daily and **rifampin** 600mg once daily for 3 weeks
 - b. trimethoprim-sulfamethoxazole should be considered for those patients with contraindications to doxycycline
 - c. pregnant workers with high-risk exposures should consider PEP in consultation with their obstetricians
3. Discuss PEP with workers with only low-risk exposures to *Brucella*
4. Obtain **baseline serum samples** from all workers as soon as possible after a potential *Brucella* exposure is recognized. If available, obtain pre-exposure stored specimens.
5. Arrange for sequential serologic testing on all workers exposed to *Brucella* (e.g. **2, 4, 6, and 24 weeks** post exposure) using agglutination test at state public health laboratory or CDC.
6. Arrange for regular (e.g. weekly) **active surveillance** for development of febrile illness or other signs and symptoms of brucellosis among all workers exposed to

Brucella isolates for 6 months following last exposure.

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Frequently Asked Questions About *Brucella abortus* RB51 Exposures

- ▶ [What is *Brucella abortus* RB-51?](#)
- ▶ [Can RB51 cause infections in people?](#)
- ▶ [What laboratory activities are considered high risk exposures to RB51?](#)
- ▶ [What can those exposed do to decrease their risk of developing brucellosis?](#)

What is *Brucella abortus* RB-51?

Brucella abortus is a bacterium that causes disease in cattle (and other animals), and also in humans. *B. abortus* RB-51 (RB51) is a strain of this bacterium developed specifically for an immunization for cattle against brucellosis. RB51 was selected because it is less likely to cause severe disease in cattle than other strains of *B. abortus* and is presumed to be less likely to cause severe disease in humans. Cattle immunizations against brucellosis started in 1941. The RB51 immunization represents a safer immunization both for cattle and for the veterinarians administering it. The vaccine was conditionally licensed for use in cattle in 1996 and received full licensure in March 2003 and is used in 49 states, Puerto Rico, and the US Virgin Islands. RB51 does not induce an antibody response measurable with standard assays. This means that testing cattle for brucellosis will correctly identify naturally occurring cases that could affect other cattle and humans, and not identify antibody response resulting from immunization.

Can RB51 cause infections in people?

Accidental human exposure to RB51, although uncommon, has resulted in disease. Exposures have included needle sticks, eye and wound splashes, and exposure to infected material. In a series of exposures reported to CDC, described below, most of those exposed developed local symptoms of brucellosis infection; and of those ill, most exhibited some systemic symptoms.

In the CDC review, 26 individuals reported exposure to the RB51 vaccine from January 1998 through December 1999. Of these, 21 (81%) reported needlestick injuries; of 5 patients (19%) who were splashed with the RB51 vaccine, 4 were splashed in their conjunctiva and 1 was splashed in an open wound. Even though most individuals (69%) reported receiving prophylactic antibiotics, 19 (73%) reported at least 1 systemic symptom. Of those ill, three (12%) reported persistent local reactions with systemic involvement, and 7 (27%) had persistent symptoms for 16 months. One patient required surgery and RB51 was isolated from the patient's surgical wound. Very limited published information is available regarding laboratory exposures to RB51.

What laboratory activities are considered high risk exposures to RB51?

Laboratories working specifically with RB51 isolates should perform all manipulations in a class II biological safety cabinet, utilizing biosafety level 3 (BSL-3) practices as described in *Biosafety in Microbiological and Biomedical Laboratories*, 5th edition. The risk for accidental exposure is highest for procedures or manipulations that would have occurred outside the class II biological safety cabinet and that have the potential for creating aerosols or splashes; examples of such procedures include pipetting, centrifuging, grinding, blending, shaking, mixing, sonicating, and opening containers of infectious materials.

What can those exposed do to decrease their risk of developing brucellosis?

Although RB51 was developed as a less pathogenic strain, it does retain pathogenicity for humans so exposures can pose a human health risk. Post-exposure prophylaxis should therefore be considered for persons with RB51 exposure. RB51 was derived by selection in rifampin-enriched media and is resistant

to rifampin in vitro. Use of rifampin for post-exposure prophylaxis or treatment, a recommended choice for other pathogenic bacteria, will not be effective for RB51. Post-exposure prophylaxis for those at high risk of exposure should include doxycycline 100 mg orally twice daily for at least 21 days. For those with contraindication to doxycycline, trimethoprim-sulfamethoxazole 160 mg/800 mg orally twice daily for at least 21 days may be used. Persons with contraindications to these antimicrobial agents should consult with their health care provider for alternative post-exposure prophylaxis. Should brucellosis occur despite prophylaxis, treatment regimens would need to be selected based on antimicrobial susceptibility results. Those with low risk exposures may also opt to take post-exposure prophylaxis.

Both those with high and low risk exposures should be monitored for the development of symptoms of brucellosis. Routine serologic tests for brucellosis will not be effective in monitoring for infection. From the last exposure, temperature should be actively monitored for fever for four weeks. Broader symptoms of brucellosis should be passively monitored for six months from the last exposure. Persons potentially exposed to RB51 who develop symptoms should consult with a health care provider. These symptoms include:

Acutely: fever, chills, headache, low back pain, joint pain, malaise, occasionally diarrhea

Sub-acutely: malaise, muscle pain, headache, neck pain, fever, sweats

Chronically: anorexia, weight loss, abdominal pain, joint pain, headache, backache, weakness, irritability, insomnia, depression, constipation.

In individuals who exhibit clinical symptoms, bacteriologic isolation may be possible using blood culture.

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Date: December 7, 2007

Content source: National Center for Immunization and Respiratory Diseases: Division of Bacterial Diseases

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[Department of Health and Human Services](#)