



Zoonotic Diseases of Cattle

Zoonotic Disease	R	Transmission	Clinical Signs in Cattle	Clinical Signs in People
Etiologic Agent			Prevention for Cattle	Prevention for People
Anthrax <i>Bacillus anthracis</i>	A H	Direct contact: spores in soil, blood Ingestion: undercooked meat Inhalation: spores from hides or wool Vector: biting flies (minor risks)	Incubation period: 1-10 days Cutaneous: pustules; dark black scab (eschar) Gastrointestinal: severe vomiting; bloody stools Respiratory: flu-like signs; respiratory distress All forms: sepsis, shock, death	Incubation period: 1-10 days, can be variable Cutaneous: pustules; dark black scab (eschar) Gastrointestinal: severe vomiting; bloody stools Respiratory: flu-like signs; respiratory distress All forms: sepsis, shock, death
			Clean and disinfect; dispose of carcasses – burn if possible; do not allow soil to be contaminated with infectious blood; vaccination	Wash hands; wear personal protective equipment (PPE) (gloves, mask, eye protection, coveralls); cover wounds; ventilate animal areas; disinfect hides; avoid suspect animals and do not eat the meat
Bovine papular stomatitis <i>Parapoxvirus</i>		Direct contact: wounds, skin abrasions; bites	Incubation period: 2-4 days Asymptomatic Cutaneous: lesions in/around mouth (nostrils, palate, lips), young animals; teat lesions; may look like vesicles Gastrointestinal: fever, diarrhea, salivation, anorexia	Incubation period: 3-8 days Cutaneous: papule or wart-like nodule on finger or hand, resolves within a month; may become vesiculated; similar to contagious ecthyma or pseudocowpox
			Clean and disinfect (especially feed and water troughs, equipment used for feeding and watering)	Wash hands; wear gloves; cover wounds
Bovine spongiform encephalopathy (BSE) Prion Mad cow disease Variant Creutzfeldt-Jakob disease (vCJD) in humans	A	Ingestion: prion-containing tissues from infected animals <i>Risks in the U.S. are low due to federal inspection requirements for cattle and removal of specified risk materials (SRMs) in slaughter plant</i>	Incubation period: 2-8 years Asymptomatic (signs take years to develop) Neurologic: hind limb ataxia; tremors; changes in behavior; hyperresponsive to stimuli; recumbency; coma; death	Incubation period: 11-12 years Asymptomatic Neurologic: depression, anxiety, insomnia; months later ataxia, memory loss, slurred speech, deterioration of motor, cognitive function, sight; death within 2 yrs.
			Clean and disinfect (but prion NOT destroyed with standard disinfection); don't feed ruminant tissues to cattle that could contain prions; don't cross-contaminate cattle feed with other feeds/fertilizers	NOT destroyed by cooking; do not home-slaughter, consume cattle exhibiting neurologic signs; use caution handling tissues during necropsies
Bovine tuberculosis <i>Mycobacterium bovis</i>	A H	Direct contact: body tissues/fluids Inhalation: aerosols Ingestion: raw milk/dairy; contaminated water; raw or undercooked meat	Incubation period: varies; months to years Asymptomatic Systemic: weight loss; weakness; emaciation; fever; dissemination Respiratory: chronic cough, bronchopneumonia; tachypnea; dyspnea Gastrointestinal: intermittent diarrhea; constipation Reproductive: abortion; infertility; mastitis; metritis	Incubation period: variable; several months to years Respiratory: fever; cough; chronic weight loss Systemic: fever; weight loss; malaise; other signs vary Neurologic: meningitis; meningoencephalitis (rapidly fatal for all ages); chronic meningitis

R=Reportable Disease; A=for animals, H=for humans

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Bovine tuberculosis, continued		Reservoirs: wildlife (especially deer and elk); rodents	Clean and disinfect (organism may be resistant); remove manure; avoid high pressure hoses when cleaning; provide good ventilation; don't overcrowd barns; control rodents; minimize exposure to reservoirs (deer fencing, barriers, protect feed from rodents); tuberculin testing; quarantine reactors until negative then cull	Wash hands, wear PPE (gloves, mask or respirator); clean, cover wounds; don't consume raw dairy; cook meat to proper internal temperature; don't eat carcasses with lesions; wear a mask if you are infected
Brucellosis <i>Brucella abortus</i> Undulant fever in humans	A H	Direct contact: reproductive tissues/fluids Ingestion: reproductive tissues/fluids; contaminated feed, water; raw milk/dairy Fomites Injection: (people): RB-51 vaccine Inhalation: aerosols	Incubation period: Varies Reproductive: abortion, stillbirths; retained placenta; placentitis; orchitis; epididymitis Musculoskeletal: arthritis; lameness; spondylitis Cutaneous: (horses) suppurative bursitis, "fistulous withers" or "poll evil"; (pigs) abscesses	Incubation period: 2-4 weeks, up to 6 months Flu-like: headache; fever; fatigue; chills; aches Chronic: waxing, waning fever; bone, joint infections Reproductive: epididymo-orchitis; seminal vesiculitis and prostatitis; abortion or premature birth
			Clean and disinfect; vaccinate cattle; prevent exposure to reservoirs (double fencing for swine); obtain animals from <i>Brucella</i> -free sources; screening; isolate/cull infected animals; establish separate area for birthing; remove, destroy aborted fetuses, placentas	Wash hands; wear PPE (gloves, mask, eye protection, coveralls); cover wounds; don't touch your face; be cautious when vaccinating; handle infected animal tissues with gloves; don't eat carcasses with lesions
Campylobacteriosis <i>Campylobacter jejuni</i> , <i>Campylobacter coli</i> , <i>Campylobacter fetus</i>	H	Ingestion: feces; reproductive tissues; contaminated soil, water; raw milk; raw or under-cooked meat; cross-contaminated food; Direct contact: infected animals Fomites	Incubation period: 3-25 days Asymptomatic Gastrointestinal: mucoid, blood-flecked diarrhea Reproductive: abortion	Incubation period: 1-10 days Gastrointestinal: mild to severe GI distress; fulminant or relapsing colitis; fever; headache; muscle pain; children/vulnerable people most at risk for diarrhea Reproductive: (<i>C. fetus</i>) miscarriage; premature birth; infant meningitis followed by death Neurologic: Guillain-Barré syndrome; meningitis
			Clean and disinfect (including AI equipment); remove manure; prevent overcrowding; vaccinate (animals may still be carriers); isolate aborting animals; remove, destroy aborted fetuses, placentas	Wash hands; wear gloves; control rodents; use footbaths; keep children/vulnerable people away from animals, feces; don't consume undercooked meat, raw dairy, untreated water; wash fruits, vegetables; disinfect kitchen surfaces; don't cross-contaminate
Chlamydiosis <i>Chlamydia abortus</i>		Inhalation: aerosols Direct contact: reproductive tissues/fluids Ingestion: contaminated feed, water	Incubation period: varies Asymptomatic Reproductive: (sheep, goats) late term abortion, stillbirth, low birth weight or premature offspring; (cattle) abortion, retained placentas, mastitis	Incubation period: unknown Reproductive: stillbirth; abortion; pre-term labor Flu-like: fever; headache; dry cough; vomiting Systemic: septicemia; renal dysfunction; pneumonia
			Clean and disinfect; remove manure; maintain closed herd; isolate aborting animals; establish separate area for birthing; remove, destroy aborted fetuses, placentas	Wash hands; wear PPE (gloves, mask, coveralls); don't touch your face; clean, disinfect boots



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Colibacillosis <i>Escherichia coli</i> STEC-Shiga-toxin producing <i>E. coli</i> VTEC-Verotoxin-producing <i>E.coli</i> EHEC-Enterohemorrhagic <i>E. coli</i>	H	Ingestion: contaminated soil, food, water Direct contact: feces Fomites	Incubation period: varies Asymptomatic: cattle are maintenance hosts Gastrointestinal: (calves) diarrhea Reproductive: mastitis	Incubation period: 1-16 days with most signs in 3-4 days Great risk to children <5 years of age Asymptomatic Gastrointestinal: watery diarrhea; hemorrhagic colitis; nausea; vomiting; abdominal pain; cramping Systemic: hemolytic uremic syndrome (HUS); fever
			Clean and disinfect; remove manure; vaccinate pregnant animals to reduce shedding; provide colostrum; minimize stress at weaning/diet changes; prevent crowding; use all-in, all-out management	Wash hands; wear gloves; keep boots outside the home; launder dirty clothing separately; prevent manure from leaching into groundwater; don't consume raw dairy; cook meat thoroughly, especially ground beef; avoid cross-contamination in kitchen
Cryptosporidiosis <i>Cryptosporidium</i> spp.	H	Ingestion: oocyst-contaminated food, water, soil Fomites oocysts are very hardy and survive in the environment	Incubation period: 3-5 days Asymptomatic Gastrointestinal: (common in neonatal calves) watery diarrhea; tenesmus; anorexia; weight loss, death may occur secondary to dehydration	Incubation period: 2-3 days to 2 weeks Asymptomatic Gastrointestinal: mild to severe profuse, watery diarrhea; abdominal cramps; anorexia; nausea; gas; malaise
			Clean and disinfect (organism is resistant); remove manure; prevent overcrowding; provide colostrum; isolate sick animals; prevent/treat other infections	Wash hands; wear PPE (gloves, coveralls); don't drink untreated water; wash fruits, vegetables; don't cross-contaminate; avoid young, sick animals if vulnerable
Cysticercosis/ Taeniasis <i>Taenia saginata</i> (Beef tapeworm)		Ingestion: (cattle) gravid proglottids in pastures; contaminated food, water, soil; (people) raw or undercooked beef	Incubation period: months to years Asymptomatic Gastrointestinal: unthrifty; poor appetite; diarrhea	Incubation period: variable; 8 weeks to years Asymptomatic Severity depends upon number and location of larvae Gastrointestinal: proglottids in stools; nausea; gas; diarrhea; constipation; abdominal pain; poor appetite Neurologic: (neurocysticercosis) seizures; increased intracranial pressure; headaches; blindness
			Clean and disinfect; remove manure; deworm farm dogs and cats; remove and destroy dead animals; do not use river water for animals; keep animals away from human feces	Wash hands; do not defecate in fields, pastures or waterways; treat infected people; do not eat raw or undercooked meat; cook meat to proper internal temperature; avoid cross-contamination in the kitchen
Dermatophilosis <i>Dermatophilus congolensis</i>		Direct contact: skin lesions Fomites: soil, thorns Mechanical vectors: biting insects	Incubation period: 1-30 days Asymptomatic Cutaneous: serous exudates at base of hair shaft ("paintbrush lesions"), crusts, alopecia	Incubation period: 1-10 days Asymptomatic Cutaneous: multiple pustules on hands, forearms; rupture, leaving reddish crater-like cavity
			Clean and disinfect (especially equipment like tack, grooming tools); isolate infected animals; control mechanical vectors; keep skin dry; prevent zinc deficiency	Wash hands; wear gloves; cover wounds



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Dermatophytosis <i>Microsporum</i> spp., <i>Trichophyton</i> spp. <i>Trichophyton verrucosum</i> (cattle specifically) Ringworm in humans		Direct contact: infected animals; skin lesions Fomites: objects, environment	Incubation period: 2-4 weeks Cutaneous: alopecia, scaling, crusts, erythema; legs, chest, intermaxillary skin, dewlap most common Clean and disinfect, specially shared equipment; quarantine and test new animals; isolate and treat affected animals; may need to euthanize severely affected birds; prevent exposure to rodents; don't overcrowd; burn remains or hairs/scales	Incubation period: 1-2 weeks Cutaneous: pink to red, scaly, slightly elevated skin lesions; follicular papules, pustules, or vesicles at the borders Wash hands; wear PPE (gloves, coveralls); clean, disinfect equipment; treat infected animals; treat infected people s
Echinococcosis <i>Echinococcus granulosus sensu lato</i> complex (cystic echinococcosis), <i>E. multilocularis</i> (alveolar echinococcosis) Hydatid disease		Ingestion: (cattle) gravid proglottids on fur; from plants, contaminated water, soil; (people) larval cysts in raw or undercooked meat; contaminated fruits, vegetables, water, or soil	Incubation period: not known Asymptomatic: Many animals slaughtered before onset of clinical signs; infections increase with age Respiratory: bronchopneumonia; respiratory difficulty Systemic: abdominal distension; ascites; icterus; heart failure; lameness; sudden death Clean and disinfect; deworm cats and dogs; don't let dogs and cats roam in pastures; don't feed viscera to dogs and cats	Incubation period: variable, months to years Asymptomatic: very slow growing, symptoms vary depending upon location of cysts Various organs: cysts in liver and lungs (most common) Wash hands; wear PPE (gloves, coveralls) if handling feces; deworm dogs, cats; don't drink untreated water; wash fruits, vegetables; cook meat properly
Giardiasis <i>Giardia duodenalis</i> or <i>G. intestinalis</i>	H	Ingestion: cysts in contaminated food, water, or soil Direct contact: infected animals; grooming (self or others)	Incubation period: 3-10 days Asymptomatic, young more affected Gastrointestinal: pasty to fluid, mucoid diarrhea; weight loss or failure to gain Clean and disinfect; remove manure; change bedding frequently; do not overcrowd; provide colostrum; house calves separately; keep animals away from fresh water/don't use fresh water as your water source	Incubation period: 1-45 days; signs usually within 1-2 weeks Asymptomatic Gastrointestinal: mild-severe, acute-chronic diarrhea Systemic: anemia; anorexia; weight loss Wash hands; wear gloves; don't drink untreated water (treat or filter fresh water prior to drinking); treat infected animals; prevent contact with feces;
Leptospirosis <i>Leptospira</i> spp. - Hardjo and Pomona serovars Weil's disease in humans	H	Direct contact: infected urine; contaminated water; aborted tissues Ingestion: contaminated feed, water Inhalation: aerosolized urine, water bulls and cows may carry bacteria for over a year Reservoirs: rodents carry bacteria in urine	Incubation period: 7-12 days Asymptomatic Reproductive: abortion; decreased fertility; stillbirth; weak offspring Systemic: (calves) fever; icterus; anemia; meningitis; death; Ocular: conjunctivitis Clean and disinfect, especially breeding/birthing areas; vaccinate; control rodents; prevent contact with reservoirs; provide safe, clean water for drinking; avoid contaminated water sources/ flood waters; quarantine and test new animals; prevent contact between cattle and swine.	Incubation period: 7-12 days Acute/septicemic phase: fever, chills, conjunctival suffusion, headache; myalgia; nausea; vomiting Immune phase: anicteric (common) or icteric forms; aseptic meningitis; stiff neck; headache; kidney failure; pulmonary hemorrhage; edema; dyspnea; death Wash hands; wear PPE (gloves, mask, eye protection, coveralls); cover wounds; control rodents; avoid wildlife; avoid contaminated water (like floodwaters); drain standing water if possible



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Listeriosis <i>Listeria monocytogenes</i>	H	Ingestion: (cattle) improperly fermented silage; spoiled/decaying feed, plant matter; soil; (people) contaminated foods Direct contact: reproductive tissues/fluids Reproductive: vertical	Incubation period: 1 day to 7 weeks Asymptomatic Reproductive: abortion; stillbirth Systemic: (calves) dyspnea, meningitis, death in 12 hrs. Neurologic: ataxia; circling; nystagmus; torticollis; cranial nerve deficits Ocular: "silage eye," keratoconjunctivitis	Incubation period: within 2 weeks for nonpregnant individuals; 2 weeks to 2 months for pregnant women Reproductive: abortion; stillbirth; premature birth Neurologic: meningitis; meningoencephalitis Systemic: septicemia; fever; chills; headache; dizziness
			Clean and disinfect, especially silage handling equipment; remove manure; keep manure away from feed; feed high quality silage, remove first few layers before feeding—may be moldy/spoiled; dispose of leftover silage after feeding; don't feed rotting vegetation; isolate sick animals; remove and destroy placenta, fetuses	Wash hands; wear gloves; keep foods refrigerated; wash fruits, vegetables; avoid high risk foods - deli meats, meat spreads, raw dairy (soft cheeses), smoked seafood; heat deli meat and leftovers to steaming hot
Mange/Acariasis <i>Sarcoptes scabiei</i> var. <i>bovis</i> Scabies		Direct contact: infested animals Fomites: contaminated bedding; crusts can have large numbers of mites but usually do not survive for long periods of time in the environment	Incubation period: 10-60 days Cutaneous: pruritus; dermatitis; alopecia; crusted skin on head, face, neck, shoulders, inner thigh, udder/scrotum;	Incubation period: <24 hours to 4 days Cutaneous: severe pruritus on arms, chest, abdomen, thighs; Self-limiting, mites usually leave the body within a few days; signs resolve within 1-3 wks.
			Clean and disinfect; power spray mite hiding places; quarantine and treat new or affected animals; nest/litter management; prevent exposure to rodents, wild birds; monitor for signs of pruritus and agitation	Wash hands; wear gloves; treat infested animals; remove wild bird nests from buildings; keep bird housing areas clean
Pseudocowpox <i>Parapoxvirus</i> Milker's nodule		Direct contact: teats, udders with active lesions Fomites: milking machines; contaminated objects; hands	Incubation period: 6 days Cutaneous: udder, teat lesions; small papules with vesicle; depression forms; pustular phase; dark red scabs; center desquamates; forms ring/horseshoe layer Oral: calves may have buccal lesions if nursing	Incubation period: 5-14 days Cutaneous: pruritic red papules on fingers or hands, possibly other body parts; may take 4-6 weeks to develop; firm nodules, gray to reddish-blue or brown
			Clean and disinfect, especially milking machines; teat dips; keep environment clean to prevent reinfection	Wash hands, especially between milkings; wear gloves when handling teats, udders; cover wounds
Q Fever <i>Coxiella burnetii</i>	A H	Inhalation: aerosols Direct contact: reproductive tissues Ingestion: (animals) contaminated feed, water; (people) raw milk/dairy Fomites Vectors: ticks	Incubation period: 1-3 weeks; varies Asymptomatic: may persist in mammary glands, surrounding lymph nodes, and uterus Reproductive: (cattle, sheep, goats, horses) abortion; stillbirth; weak offspring	Incubation period: 2 days to 6 weeks, average of 2-3 weeks Asymptomatic Flu-like: fever; chills; malaise; joint pain; sweating Respiratory: mild productive cough Gastrointestinal: (children) nausea; vomiting; diarrhea Cutaneous: (children) rash
			Clean and disinfect (especially birthing areas, bacteria are resistant); remove manure; establish separate area for birthing; remove aborted fetuses or placentas after birth, then burn or bury; don't spread manure on windy days; tick control	Wash hands; wear PPE (gloves, mask or respirator; eye protection), especially if around births; don't spread manure on windy days; don't share dirty laundry; don't consume raw milk or dairy products



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Rabies <i>Lyssavirus</i>	A H	Direct contact: infected animal saliva (bite, droplet on mucous membrane, aerosol, broken skin)	Incubation period: 10 days to 6 months Paralytic: progressive paralysis; dysphagia; hypersalivation; ataxia; ascending paralysis; death in 2-6 days Furious: tremors; restlessness; aggression; ascending paralysis; death in 4-8 day	Incubation period: a few days to several years, most commonly 1-3 mos. Neurologic: headache; fever; pain at inoculation site Encephalitic form: anxiety; confusion; agitation, inability to swallow; hydrophobia; death; Paralytic form: generalized paralysis; death
			Clean and disinfect; vaccinate (including dogs and cats); quarantine exposed animals (can re-vaccinate exposed animals and confine under strict observation for 45 days); isolate, euthanize, test symptomatic animals; prevent access to wildlife	Wash hands; wear PPE around exposed animals (gloves, eye protection, coveralls); avoid saliva; get rabies vaccine if high-risk; cover wounds; stay away from places where bats live (wear PPE if you can't)
Salmonellosis <i>Salmonella</i> spp. serovar Dublin (cattle specifically) ser. Typhimurium ser. Enteritidis (humans)	H	Ingestion: (animals) contaminated feed, water; (people) raw milk; raw or undercooked meat, poultry or eggs; contaminated produce or water Direct contact: infected animal, feces Fomites Mechanical vectors: flies	Incubation period: varies; less than 1-2 days if severe Gastrointestinal: severe enteritis +/- blood; young most affected Reproductive: abortion; decreased milk Systemic: septicemia; CNS signs; pneumonia (calves)	Incubation period: 6-72 hours Children, elderly, and immunocompromised most at risk Gastrointestinal: acute diarrhea (+/- blood); abdominal pain; nausea; vomiting; dehydration Flu-like: fever; muscle pain; headache; malaise; chills Systemic: (in immunocompromised) bacteremia; septicemia
			Clean and disinfect, especially equipment, buildings; remove manure; practice good biosecurity; control vectors; reduce stress; prevent overcrowding; provide colostrum; purchase from <i>Salmonella</i> -free sources; quarantine new animals; isolate and treat, or cull, carriers; all-in, all-out; vaccinate (does not protect fully)	Wash hands; wear gloves; wash and/or peel fruits, vegetables; don't consume raw dairy; cook meat to proper internal temperature; reheat foods thoroughly; refrigerate leftovers; don't cross-contaminate; don't drink untreated water
Staphylococcosis including methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)		Direct contact: skin wounds; feces Ingestion: contaminated foods Fomites Inhalation: aerosols (dust)	Incubation period: variable Cutaneous: wound infections, abscesses; (swine) exudative epidermitis; (poultry) bumblefoot, comb necrosis Reproductive: (cattle, sheep, swine) mastitis; metritis Systemic: (poultry) septicemia; salpingitis; synovitis	Incubation period: 1-2 weeks suspected - Illness in humans is rare Asymptomatic Cutaneous: skin, soft tissue infection; necrotizing fasciitis; staphylococcal scalded skin syndrome Gastrointestinal: acute gastroenteritis (food poisoning); nausea; vomiting; diarrhea; abdominal pain; +/- fever; headache; blood, mucous in vomit, stool
			Clean and disinfect; remove manure; don't overcrowd; isolate infected animals; good hand hygiene when milking; separate grooming equipment/tack for each horse; wear face mask, gloves when handling animals	Wash hands; wear PPE (gloves, mask); cover wounds; avoid touching animal wounds, secretions; don't share personal items (razors, towels); refrigerate leftovers; don't cross-contaminate foods; refrigerate raw milk immediately to prevent enterotoxin formation



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<p>Streptococcosis <i>Streptococcus equi</i> subsp. <i>zooepidemicus</i>,</p> <p><i>S. pyogenes</i> Strep throat in humans, mastitis in cattle through reverse zoonosis</p>		<p>Direct contact: infected animals, tissues, fluids; skin wounds</p> <p>Inhalation: aerosols</p> <p>Fomites</p> <p>Ingestion: contaminated feed, water; (people) raw milk/dairy</p>	<p>Incubation period: varies</p> <p>Asymptomatic</p> <p>Reproductive: mastitis, metritis, placentitis, abortion</p> <p>Respiratory: purulent lung lesions;</p>	<p>Incubation period: varies with form of disease; may be a few hours to 3 days</p> <p>Asymptomatic</p> <p>Flu-like: chills; fever; malaise; upper respiratory disease</p> <p>Gastrointestinal: nausea; vomiting; abdominal pain</p> <p>Systemic: septicemia; endocarditis; glomerulonephritis; meningitis, septic shock</p>
			Clean and disinfect; remove manure; control flies; minimize stress; keep wounds clean; practice good animal husbandry; use good hygiene when milking (dip teats, keep milking machines clean, wear gloves); keep hair around udder short	Wash hands; wear PPE (gloves, coveralls) when handling animals; clean, cover wounds; don't consume raw dairy
<p>Vesicular stomatitis <i>Vesiculovirus</i></p> <p>Sore mouth of cattle</p>	A	<p>Direct contact: skin lesions, exudate from vesicles; saliva, nasal secretions</p> <p>Fomites</p> <p>Vectors: (animals) black flies, sand flies, biting (<i>Culicoides</i>) midges; other flying insects mechanical vectors</p>	<p>Incubation period: 3-7 days</p> <p>Asymptomatic</p> <p>Cutaneous: fever; papules, vesicles in/on oral cavity, udder, teats, prepuce, interdigital space, coronary band; inflammation; edema; pain</p> <p>Musculoskeletal: lameness</p> <p>Reproductive: mastitis</p>	<p>Incubation period: 1-6 days</p> <p>Asymptomatic or subclinical (most cases)</p> <p>Flu-like: fever; headache; myalgia; malaise</p> <p>Cutaneous: (rare) vesicles</p> <p>Gastrointestinal: nausea; vomiting; diarrhea</p>
			Clean and disinfect, including milking equipment; milk animals with lesions last; minimize stress; control vectors; quarantine new animals; isolate infected animals; avoid hard, abrasive feeds to prevent mucosal injury; rule out foot-and-mouth disease	Wash hands; wear PPE (gloves, coveralls); clean and cover wounds

