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<th>Animal Group(s) Affected</th>
<th>Transmission</th>
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<td>Artiodactyla</td>
<td>Horizontal: Primarily from a persistently infected animal (“PI”) but also from transiently infected animals. In “PI”, virus is shed heavily and continuously in all bodily secretions. Virus also transmitted by fomites. <strong>Vertical:</strong> Infection of dam during first trimester can produce “PI”.</td>
<td>Horizontal: Sub-clinical, respiratory disease, diarrhea, mucosal ulcers, fever, hemorrhagic syndrome, secondary infections, peracute death, and reproductive failure</td>
<td>Species and viral strain dependent. Infections can be sub-clinical or cause severe disease and death</td>
<td>Supportive care for transiently infected animals.</td>
<td>Testing, identification and elimination of “PI”. Vaccination with MLV is common in cattle and has been reported to prevent infection in alpacas without ill effects.</td>
<td>No</td>
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**Fact Sheet compiled by:** Peregrine Wolff  
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**Fact Sheet Reviewed by:** Julia Ridpath; Anette Rink  

**Susceptible animal groups:** Ungulates belonging to the order Artiodactyla (including Bovidae, Suidae, Camelidae, Antilocapridae, Tragulidae and Cervidae).  

**Causative organism:** Single stranded RNA viruses belonging to the genus Pestivirus and Family Flaviviridae. Two species, BVDV-1 (11 sub-genotypes) and BVDV-2 (2 sub-genotypes), have different profiles. In the US, the three commonly isolated sub-genotypes from cattle are BVDV1a, 1b and 2a. Within the genotypes or strains, two 2 biotypes of BVDV classification are based on their effects on cell culture (cytopathic [CP] or non-cytopathic [NCP]). Infections with NCP strains are the most common and it is the NCP strains that result in “PI” animals. Because BVDV is an RNA virus it readily mutates resulting in genetic, antigenic and pathogenic variation.  

**Zoonotic potential:** This disease is not considered to have zoonotic potential at this time. However, the virus can infect human cell lines.
**BOVINE VIRAL DIARRHEA VIRUS**

**Distribution:** Worldwide distribution. The principal reservoirs of BVDV are persistently infected ("PI") domestic cattle. Numerous wildlife species, both captive and free-ranging have been shown to be serologically positive for BVDV. Persistently infected individuals have been identified in both captive and free-ranging wildlife primarily cervid species.

**Incubation period:** Experimental infection in mule deer, white-tail deer and cattle, indicates that virus may be isolated from white blood cells, serum, plasma or nasal secretions as early as two days post infection.

**Clinical signs:** Infections can be transient with no apparent clinical signs or severe with pronounced morbidity and mortality. Both genotypes BVD-1 and BVDV-2 can cause the full spectrum of clinical presentations. BVDV is lymphotrophic and immunosuppressive so diseased animals have an increased susceptibility to infectious disease. Hematology may show mild to severe lymphopenia and neutropenia depending on the virulence of the strain to the host. "Acute", "Transient" or "Primary" disease syndromes are described From horizontal transmission which include:

- Respiratory: Oculonasal discharge. Due to BVDV immunosuppressive effects clinical signs may be indicative of disease caused by other respiratory pathogens.

- Gastrointestinal: Diarrhea and clinical signs resulting from lesions which are primarily ulcerous or erosive and which may involve any region of the GIT. Mixed infections with other common gastrointestinal organisms are not uncommon.

- Hemorrhagic/thrombocytopenic: Thrombocytopenia, bloody diarrhea, prolonged bleeding times, petechial and ecchymotic hemorrhages, epistaxis, death.

- Mucosal disease (MD): Seen only in "PI" animals that become “super infected” with a CP strain of BVDV. Clinical signs are secondary to severe ulcerative and erosive lesions throughout the gastrointestinal tract and potentially including lameness secondary to lesions associated with inter-digital ulcerations.

From vertical transmission, disease syndromes include:

- Reproductive and fetal: Early fetal losses, mummified fetuses, abortions, still births and congenital defects

- Persistently infected animals: Persistently infected animals result if the dam becomes infected during the first trimester of gestation. In cattle, infection must occur between 45-125 days with a non-cytopathic strain of BVDV. In white-tail deer, infection occurring between days 45-52 of gestation resulted in a "PI" fawn. The fetus becomes infected and is immunotolerant to the infecting strain of BVDV and will shed high amounts of virus from all bodily fluids throughout its life. The “PI” animal may mount an immune response to heterologous strains of BVDV. Persistently infected individuals may exhibit, rounting, immunosupression and secondary infections, but “clinically normal” animals have been documented.

**Post mortem, gross, or histologic findings:** There are no pathognomonic lesions for BVDV. Pathological diagnosis may be made based on virus isolation or demonstration of the virus within tissues. Transiently infected animals will have gross and histopathological lesions consistent with their clinical syndrome. Persistently infected, but healthy animals may have few postmortem and histopathological lesions. Lymphoid depletion has been reported in both “PI” cattle and experimentally infected fawns.
**BOVINE VIRAL DIARRHEA VIRUS**

**Diagnosis:** Primary goal is to identify the “PI” animal. Virus isolation is the “gold standard”. However, antigen capture ELISA (ACE), immunohistochemistry and RT-PCR are commonly utilized tests as they are rapid, sensitive, affordable and repeatable amongst diagnostic laboratories. Many tests do not differentiate between BVDV1 and 2 and other pestiviruses such as classical swine fever virus, border disease virus (endemic worldwide), pronghorn virus, HoBi-like (isolated in South America and Southeast Asia, Bungowannah (isolated in Australia) and giraffe (isolated in Africa). Most tests cannot differentiate between an acute and a persistent infection. The standard for diagnosis of PI infection is two positive tests on samples collected at least two weeks apart.

**Material required for laboratory analysis:**

- **Antemortem:** Haired skin sample (ear notch or caudal tail fold – can be used as it is in a hidden location), or whole blood (buffy coat – collected in EDTA) are preferred samples.
- **Postmortem:** Haired skin and lymphoid tissue (mesenteric lymph nodes, thymus, tonsils) spleen, and brain. These tissues should be collected for culture or immunohistochemistry (fresh and formalin fixed). Archived formalin fixed tissue blocks can be tested for BVD via PCR, however detection rates drop after 3 months – 1 year.

**Relevant diagnostic laboratories:** Check with your local veterinary diagnostic lab to see what tests they perform and the limitations of these tests for the species you are testing.

**Treatment:** Supportive care of transiently infected animals. Persistently infected individuals should be eliminated from the herd.

**Prevention and control:** Identification and removal of “PI” individuals. All incoming artiodactyls (particularly domestic cattle, sheep and goats) should be quarantined and tested for the presence of BVDV virus.

1) **Animals that can only be handled once and with risk of exposure to BVDV:** Combination of Antigen-capture ELISA (ACE) on haired skin combined with PCR on whole blood (buffy coat – collected in EDTA) and antibody detection via serum neutralization will have the greatest likelihood of identifying “PI” that may be transiently infected. An animal that is positive on both ELISA (ACE) on haired skin, as well as RT-PCR on whole blood but is negative on serology is considered highly suspicious of being “PI” and should undergo follow up testing in 4-6 weeks. Animals that that are positive on RT-PCR and have serum titers are most likely transiently infected individuals.

2) **Pregnant females that have a serum antibody titer to BVDV may have been exposed to the virus within the first trimester of pregnancy and be carrying a “PI” fetus.** These animals should be quarantined until the offspring is born. The offspring should then be tested for persistent infection via whole blood (buffy coat) RT-PCR in combination with ELISA (ACE) or immunohistochemistry on a haired skin sample. This will differentiate presence of virus in the face of maternal antibodies if the offspring is sampled post nursing.

3) **Animals with viremia should not be introduced to other artiodactyls that may be in the first trimester of gestation.**

4) **Individuals utilizing reproductive manipulation techniques should be alerted that BVDV has been isolated from commercial fetal calf serum.**

5) **Vaccination has not been well studied in wildlife.** Alpacas are reported to be protected with no negative effects when vaccinated with a MLV. Vaccination in cattle is primarily focused on the prevention of fetal infections.
**BOVINE VIRAL DIARRHEA VIRUS**

**Suggested disinfectant for housing facilities:** BVDV is an enveloped virus and susceptible to the following classes of disinfectants when used per recommended protocols - hypochlorites, chlorhexadine, alcohol, iodine and iodophores, quaternary ammonium compounds, phenolic disinfectants and aldehydes

**Notification:** None Required

**Measures required under the Animal Disease Surveillance Plan:** None

**Measures required for introducing animals to infected animal:** Pregnant animals should not be exposed to animals that are viremic. “PI” animals should be identified and removed from the herd.

**Conditions for restoring disease-free status after an outbreak:** Identify and remove “PI” individuals. Any off-spring born to dams that were pregnant during the outbreak should be tested to insure that they are not “PI” and all new additions that may be at risk for infection with BVDV should undergo testing and quarantine prior to introduction to any artiodactyl species.

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**References:**