

# Foot and Mouth Disease (FMD)

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*A Disease Fact Sheet  
for Livestock Specialists*

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[http://www.cfsph.iastate.edu/  
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## Importance

Foot-and-mouth disease (FMD) is a highly contagious viral disease that infects cattle, swine, pigs, and other cloven-hooved animals. The disease is widespread in certain parts of the world but has not been seen in the United States since 1929. In a FMD outbreak, the disease spreads quickly by animals, people, or materials that bring the virus into physical contact with susceptible animals. Biosecurity practices that restrict visitors, the movement of animals, and minimize exposure to the virus are the best approach to protect herds from a FMD outbreak.

## Etiology

Foot-and-mouth disease is caused by an Aphthovirus in the family Picornaviridae. This virus is very hardy and can survive in the ground for up to a month under the right environmental conditions. The virus can also survive normal pasteurization temperatures of milk and milk products as well as temperatures below freezing in meat.

## Species affected

FMD primarily affects cloven-hooved domestic and wild animals, including cattle, pigs, sheep, goats, and water buffalo. Other susceptible species include hedgehogs, armadillos, nutrias, elephants, capybaras, rats, and mice.

## Geographic distribution

The last U.S. outbreak was in 1929. Countries that have reoccurring problems with FMD include: Asia, Africa, the Middle East, and parts of South America. In recent years, outbreaks have occurred in Taiwan, South Korea, Japan, Mongolia, Britain, France, and the Netherlands. North and Central America, Australia, and New Zealand have been free for many years.

## Transmission

FMD is highly contagious and easily transmitted from animal to animal by direct contact, from inanimate objects that become contaminated with the virus or through the air when animals are exhaling. The peak time of disease transmission occurs when blisters formed in the mouth rupture, releasing large amounts of FMD virus. The virus can also travel outside a host by being dispersed long distances by wind under the right conditions. Humans who come in contact with infected animals should be aware they can spread this disease on contaminated shoes and clothing or by carrying the virus in their nasal passages. To complicate transmission further, the disease does not affect all species of animals the same. When cattle become infected, they are indicators of the disease. Indicators are animals that become ill upon infection and develop blisters in their mouth and on their feet, making the presence of the disease known. When animals are recognized to have the disease, control measures must be quickly implemented to stop the spread of the disease. When sheep and goats are infected, they become maintenance hosts of the disease. Maintenance hosts are a threat to livestock because they spread the virus to other animals without exhibiting obvious signs of illness. If sheep infected with FMD are exposed to cattle, many animals can become infected before the source of the disease is discovered. Pigs are considered amplifying hosts, multiplying and producing large amount of virus and exposing other animals.

Ruminants (cattle, sheep, and goats) can also become carriers of FMD. A carrier is an animal infected with the disease but does not appear sick. Animals can become carriers after recovering from FMD or after being vaccinated.

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Cattle can be carriers for 6 to 24 months and sheep 4 to 6 months after recovering from FMD. Pigs with FMD always appear sick and do not develop a carrier state of the disease.

## Incubation period

Susceptible animals exposed to FMD generally develop signs of illness in 3 to 5 days. Pigs ingesting the virus from contaminated garbage may develop signs of illness in as little as 1 to 3 days.

## Clinical signs

Foot-and-mouth disease is characterized by sick animals having fever and developing blisters, which progress to erosions in the mouth, nostrils, muzzle, feet, and/or teats. Typical clinical signs include depression, anorexia, excessive salivation, clear nasal discharge, decreased milk production, lameness, and reluctance to move. Abortions may occur in pregnant animals due to the high fever. Death in young animals may occur due to severe heart damage caused by the virus.

Cattle, who are indicator hosts of the disease, develop blisters on their tongue, dental pad, gums, soft palate, nostrils, or muzzle. The blisters can rupture forming painful open sores. Hoof lesions are in the area of the coronary band and the space between the digits (toes).

In pigs, hoof lesions develop causing blisters on the coronary band, heel, and digits (toes). Blisters and open sores can also be seen on the snout. Oral lesions are not as common in pigs making drooling in these animals rare. Pigs are an amplifying host and can be the source of infections for many other animals such as cows and sheep. Sheep and goats are considered maintenance hosts and show very mild, if any, signs of fever, oral lesions, and lameness. This group of animals generally recovers in about two weeks with very low mortality in adult animals. Secondary infections may lead to a longer recovery time.

## Post mortem lesions

The diagnostic lesions of foot-and-mouth disease are single or multiple blisters from 2 mm to 10 cm in size (pin-point to hand-width). Lesions may be seen in any stage of development from a small white area to a fluid filled blister, sometimes joining with nearby lesions. The blisters rupture, leaving a red eroded area, which is then covered with a gray fibrinous coating. This coating becomes yellow, brown, or green and then is replaced by new tissue with a line of demarcation that gradually fades. Occasionally the fluid may escape

through the skin instead of forming a vesicle. These “dry” lesions appear as sores instead of blisters. “Dry” lesions are more common in the pig’s mouth. Lesions at the coronary band progress similarly: the skin and hoof separate and, as healing occurs, a line showing evidence of coronitis appears on the hoof. Pigs may actually lose the hoof in severe cases. “Tiger heart” lesions may also be seen; these lesions are characterized by a gray or yellow streaking in the heart caused by tissue death. Vesicular lesions may also be seen in the cow’s stomach (rumen).

## Morbidity and mortality

In an infected herd, there can be a 100% sickness (morbidity) rate. Death rate (mortality) is generally less than 1%. In younger animals, the death rate can be higher.

## Diagnosis

### *Clinical*

If FMD is suspected, a veterinarian should be notified immediately. Animals showing signs of salivation and lameness with blister-like lesions make foot-and-mouth disease a consideration. Fever is often the first sign, so these animals should be carefully examined for early lesions on the mouth and hooves. The mouth of any lame animal and the feet of animals with oral lesions or drooling should also be checked. Tranquilization may be necessary for a thorough examination as vesicles may be difficult to see. Laboratory testing is a requirement to confirm FMD as all blister causing diseases have similar clinical signs.

### *Differential diagnosis*

The clinical signs of foot-and-mouth disease can be similar to vesicular stomatitis, swine vesicular disease, vesicular exanthema of swine, foot rot, and chemical and thermal burns. In cattle, oral lesions seen later in the progression of FMD can resemble rinderpest, infectious bovine rhinotracheitis (IBR), bovine virus diarrhea (BVD), malignant catarrhal fever (MCF), and bluetongue. In sheep, these later lesions can resemble bluetongue, contagious ecthyma (orf), and lip and leg ulceration.

### *Laboratory tests*

FMD is confirmed using specialized tests performed at a diagnostic laboratory.

### *Samples to collect*

Since FMD cannot be distinguished clinically from other vesicular diseases, lab tests are necessary

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to confirm the disease. Before collecting and sending samples from a FMD suspect animal, the proper authorities should be contacted. Samples should only be sent under secure conditions to prevent the spread of the disease. The types of samples the attending veterinarian will collect may include: fluid from the oral blisters, skin from the blisters, esophageal-pharyngeal fluid (back of the throat), unclotted whole blood collected from fever stricken animals and feces.

## Recommended actions if foot-and-mouth disease is suspected

### *Notification of authorities*

A quick response is important in containing an outbreak of foot-and-mouth disease. If you suspect a case of FMD, consult a veterinarian, who will decide whether state and federal veterinarians should be alerted.

### *Quarantine and disinfection*

Suspected animals should be quarantined immediately and the premises should be disinfected. Virkon-S® is an effective disinfectant. Other disinfectants include: sodium hydroxide (2%), sodium carbonate (4%), and citric acid (0.2%).

### *Vaccination*

If vaccination is required as determined by regulatory authorities, use vaccine only as directed.

## Public health

Foot-and-mouth disease is not considered a public health problem.

## For More Information

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World Organization for Animal Health (OIE)

<http://www.oie.int>

OIE Manual of Standards

[http://www.oie.int/eng/normes/mmanual/a\\_summary.htm](http://www.oie.int/eng/normes/mmanual/a_summary.htm)

OIE International Animal Health Code

[http://www.oie.int/eng/normes/mcode/A\\_summary.htm](http://www.oie.int/eng/normes/mcode/A_summary.htm)

USAHA Foreign Animal Diseases book

[http://www.vet.uga.edu/vpp/gray\\_book/FAD/](http://www.vet.uga.edu/vpp/gray_book/FAD/)

## References

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"Foot and mouth disease." In Manual of Standards for Diagnostic Tests and Vaccines. Paris: World Organization for Animal Health, 2000, pp. 77-92.

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