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Classical Swine Fever

Hog Cholera, Peste du Porc, Colera Porcina, Virusschweinepest




Last Modified: May 2008

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Overview

- Organism
- Economic Impact
- Epidemiology
- Transmission
- Clinical Signs
- Diagnosis and Treatment
- Prevention and Control
- Actions to take




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Classical swine fever, also known as hog cholera, peste du porc, colera porcina, and virusschweinepest, is a highly contagious viral disease of pigs. In today’s presentation we will cover information regarding Classical Swine Fever (CSF), including the organism that causes the disease as well as its epidemiology. We will also talk about the economic impact the disease has had in the past and could have in the future. Additionally, we will talk about how it is transmitted, the species it affects, the clinical signs and necropsy findings, as well as the diagnosis and treatment of the disease. Finally, we will provide prevention and control measures for the disease and actions to take if CSF is suspected. Photo courtesy of Dr. Alex Ramirez, DVM, MPH, DACVPM, Iowa State University.

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The Organism

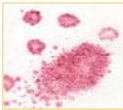


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Classical Swine Fever Virus

- Family Flaviviridae
 - Genus Pestivirus
- Lipid-enveloped RNA virus
- Varies in virulence
- Environmentally stable
 - In tissues (meat)
 - Cold temperatures
 - Refrigerated meat (months)
 - Frozen meat (years)



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Classical swine fever virus (CSFV) is a lipid-enveloped RNA virus that belongs to the family Flaviviridae, genus *Pestivirus*. Only one CSFV serotype has been found, but there is minor antigenic variability between strains. The virus can range from high to low virulence, resulting in acute, subacute, chronic and persistent forms of the disease in infected swine. The virus is closely related to bovine viral diarrhea virus 1 (BVDV-1), BVDV-2 and the ovine Border disease virus. CSFV is moderately fragile in the environment but may survive for 3 to 15 days in the environment (longer periods in cold conditions). In a protein-rich environment, the virus is quite stable and can survive in refrigerated meat (for months) and frozen meat (for years). The virus is not inactivated by smoking or salt curing. Photo: Cells infected with CSFV replicating on a cell culture monolayer. The figure shows a fast replicating, highly virulent (oval and large plaque) virus, and a slow replicating, lower virulence (small and round plaques) virus replicating on a cell plaque.

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Importance



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History

- First confirmed in US in 1833
 - Endemic in late 19th and 20th century
 - Eradicated by late 20th
- 1864: reported in the UK
- By 1989, in 36 countries
 - Suspected in two others
- Successful eradication
 - Australia, Canada, New Zealand, and the US
 - Most of western and central Europe



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Classical swine fever (CSF) was first described in the United States in the early 19th century (1833, in Ohio) and was endemic throughout the late 19th and 20th centuries. The disease was confirmed in the UK in 1864, and spread rapidly until 1878 when steps were taken to control the disease. CSF was eradicated from Great Britain in 1966. Constant progress toward eradication has been made in Eastern Europe, stemming from guidelines developed for CSF control in individual states of Eastern Europe in 1980. In 1989, CSF was recognized in 36 countries, and was suspected of being present in two additional countries. CSF has been successfully eradicated in Australia, Canada, the United States, New Zealand and most of western and central Europe. Photo: historical image of pig undergoing vaccination.

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Economic Impact

- Impact on production
 - Mortality, infertility, other health effects
- Loss of import and export markets
 - Pigs and pork products
- 1997-1998: Netherlands
 - 400 herds affected
 - 12 million pigs euthanized
 - \$2.3 billion
- Control through
 - Quarantine
 - Slaughter

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While CSF has been eradicated from many countries, re-introduction is always a possibility. CSF can have a major impact on production, resulting in excessive morbidity and possibly mortality, as well as infertility and other deleterious health effects at the herd level. Additionally, classical swine fever is an OIE 'priority' disease for international trade. Confirmed cases can lead to a ban on the import and export of pigs and pork products to many different countries. As an example, in 1997-1998, an outbreak of CSF in the Netherlands spread to more than 400 herds in the country. Over 12 million pigs were euthanized (some in eradication efforts, most for welfare reasons) at an estimated cost of \$2.3 billion. Similar re-introductions of the disease have occurred in the United Kingdom (2000), and other European countries (2001). On the farm, control will require quarantine and slaughter of affected and exposed swine.

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Epidemiology



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Geographic Distribution

- Asia, South America, Central America
- Parts of Africa and Caribbean islands
- Mexico
- Eradicated in
 - United States
 - Canada
 - Australia
 - New Zealand
 - Most of Europe

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Classical swine fever is found in much of Asia, some Caribbean islands and African countries and much of South and Central America. The disease has been reported in parts of Mexico. The disease has been eradicated from the United States, Canada, New Zealand, Australia and most of western and central Europe. Photo of CSF outbreaks occurring during January through June 2006. From the OIE (World Organization of Animal Health)- World Animal Health Information Database (WAHID) for Jan-June 2006. The red areas indicate areas of current disease events (2006). The green areas indicate areas where CSF has never been reported.

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Morbidity and Mortality

- Age and immune status important
 - Higher mortality in younger animals
- Varies with viral strain
 - Acute
 - High mortality (up to 100%)
 - Subacute
 - Lower morbidity and mortality rates
 - Chronic
 - Few animals affected - always fatal
 - Some cases are asymptomatic

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The severity of classical swine fever varies with the viral strain. The age and immune status of the animals also affects the disease outcome. Younger animals often have higher mortality rates than adult pigs. Disease from highly virulent strains most commonly result in acute infection with high morbidity and mortality rates; the case fatality rate can approach 100%. Subacute disease usually has lower case-fatality rates compared to acute cases; mild cases of illness have lower mortality rates. Less virulent strains may be more difficult to detect as can chronic infections of CSF. Only a few animals in the herd may show signs of illness and these signs can resemble other swine diseases. Some infections of CSF can be asymptomatic; these animals may serve as carriers for further dissemination of the disease.

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Transmission

Classical swine fever virus is highly contagious. Sources of virus include blood and all tissues, secretions and excretion (saliva, urine, feces, semen) of sick and dead animals. Transmission primarily occurs from ingestion of the virus. This can occur following feeding of contaminated garbage or meat products. Transfer of the virus can also occur through direct contact of pigs with infected animals; this can occur through the mucous membranes, conjunctiva, and skin abrasions. Transfer of the virus by contaminated objects (fomites), such as boots, vehicles, equipment is also possible. Aerosol spread can occur in confined spaces; however the virus does not travel long distances in the air. This is a less common route of transmission as is transfer by insect vectors. Infected pigs are the only reservoir of virus. Humans are not susceptible to CSF infection.

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Animal Transmission

- Highly contagious
 - Blood, saliva, urine, feces
 - Tissues of infected pigs
- Transmission
 - Ingestion
 - Contaminated garbage or meat products
 - Direct contact or fomites
 - Less common: aerosol, semen, vectors
- Infected pigs are the only reservoir


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Classical swine fever virus is highly contagious. Sources of virus include blood and all tissues, secretions and excretion (saliva, urine, feces, semen) of sick and dead animals. Transmission primarily occurs from ingestion of the virus. This can occur following feeding of contaminated garbage or meat products. Transfer of the virus can also occur through direct contact of pigs with infected animals; this can occur through the mucous membranes, conjunctiva, and skin abrasions. Transfer of the virus by contaminated objects (fomites), such as boots, vehicles, equipment is also possible. Aerosol spread can occur in confined spaces; however the virus does not travel long distances in the air. This is a less common route of transmission as is transfer by insect vectors. Infected pigs are the only reservoir of virus. Humans are not susceptible to CSF infection.

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**Animals
and Classical
Swine Fever**



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Clinical Signs

- CSF only affects pigs
- Incubation period: 2-14 days
- Disease variable
 - Acutely fatal to asymptomatic
- Persistent viremia
 - Congenitally infected piglets
 - Shed the virus for months
- Signs mimic other swine diseases

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Classical swine fever only affects domesticated and wild pigs. The incubation period ranges from 2 to 14 days. The clinical signs of CSF vary with the strain of the virus and the susceptibility of the pigs. More virulent strains cause acute disease, while less virulent strains can result in a high percentage of chronic, mild, or asymptomatic infections. Highly virulent strains were once more prevalent, most epizootics are now caused by mild to moderately virulent strains. Clinical signs of CSF resemble other common swine diseases and are clinically indistinguishable from those of African swine fever.

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Clinical Signs

- Acute disease
 - Huddling, dullness
 - High fever (105°F)
 - Anorexia
 - Erythema, cyanosis
 - Petechiae
 - Staggering, weakness
 - Convulsions
- Poor reproductive performance
 - Abortions, stillbirths
 - Deformities



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In acute infections, common clinical signs include a high fever, dullness, weakness, drowsiness, tendency to huddle, anorexia, and constipation followed by diarrhea. Several days after the first symptoms appear, the abdomen, inner thighs and ears may become cyanotic (purplish discoloration). Hemorrhages can also occur in the skin. Incoordination, staggering, posterior paresis and convulsions may be seen in the terminal stages, and recovery is rare. Chronic disease symptoms include fever, anorexia, stunted growth, and alopecia; these symptoms may wax and wane for months. Chronic infections are almost always fatal. Reproductive symptoms may also be seen with any level of virulence. Photos: Top: Weak, huddling pigs (www.fao.org); Middle: cyanotic ears; Bottom: Hemorrhages in the skin. (middle and bottom photos from Dr. R. Thanawongnuwech, Veterinary Pathology-Chulalongkorn University with permission).

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Post Mortem Lesions

- Highly variable
- Acute infection
 - Hemorrhage
 - Necrotic foci in tonsils
 - Petechiae
 - Kidney, larynx, trachea, intestines, spleen, lungs



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The post mortem lesions of CSF are highly variable. With acute infection, the most common lesion is hemorrhage, often seen on serosal and mucosal surfaces (particularly the kidney, urinary bladder, epicardium, larynx, intestines, spleen and lungs). Necrotic foci are common in the tonsils, sometimes with pustules and severe congestion. Photos: Top: Pig, kidney. There are numerous disseminated cortical petechiae ("turkey egg kidney"). From Plum Island Animal Disease Center. Middle: Pig, lung. The cortex contains multiple petechiae and pale infarcts surrounded by hemorrhage. From Plum Island Animal Disease Center (PIADC). Bottom: Necrotic tonsils. From Dr. R. Thanawongnuwech, Veterinary Pathology-Chulalongkorn University.

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Post-Mortem Lesions

- Chronic infection
 - Necrotic foci
 - Intestinal mucosa ("button" ulcers)
 - Epiglottis
 - Larynx
- Congenital infection
 - Cerebellar hypoplasia, thymic atrophy, deformities of head and legs




Photo: Live report of Dr. R. Panciera, Oklahoma State University, School of Veterinary Medicine, Noah's Arkive.

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The lesions of chronic disease are less severe and may be complicated by secondary infections. Petechial or 'button' ulcers may be found in the intestinal mucosa (shown in the bottom photo in the colon), epiglottis, and larynx. In congenitally infected piglets, common lesions include cerebellar hypoplasia, thymic atrophy, ascites, and deformities of the head and legs. Photo: Pig, colon. The mucosa is reddened and contains multiple discrete ("button") ulcers surrounded by zones of hemorrhage. From Dr. R. Panciera, Oklahoma State University, School of Veterinary Medicine, Noah's Arkive.

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Differential Diagnosis

- Diagnosis is impossible without lab testing
 - Porcine reproductive and respiratory syndrome (PRRS)
 - Porcine circovirus associated disease
 - Salmonellosis
 - Erysipelas
 - Leptospirosis
 - Aujeszky's disease (pseudorabies)
 - African swine fever
- Tonsil samples should be sent with every submission to your state diagnostic lab

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The differential diagnosis varies with the form of the disease, and include septicemic diseases such as salmonellosis, erysipelas, eperythrozoonosis, salmonellosis, pasteurellosis, actinobacillosis, and *Haemophilus parasuis* infections. Porcine reproductive and respiratory syndrome and porcine circovirus associated diseases (especially porcine dermatitis nephritis syndrome) should also be considered. Additional differentials include African swine fever, hemolytic disease of the newborn,, thrombocytopenic purpura, anticoagulant (e.g. warfarin) poisoning, salt poisoning, Aujeszky's disease (pseudorabies) and parvovirus infections. Congenital infections with the pestiviruses that cause bovine virus diarrhea or border disease can resemble classical swine fever.

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Sampling

- If Classical Swine Fever is suspected:
 - The proper animal health authorities should be contacted, before collecting or sending any samples,
 - Samples should only be sent under secure conditions, to authorized laboratories to prevent spread of the disease

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Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

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Diagnosis

- Clinical signs
 - Septicemia and high fever
 - Purple discoloration of the skin or ears
 - History
 - Feeding uncooked or undercooked scraps or garbage, especially meat products
 - Addition of new animals to herd
 - Recent international travel
 - Presence of foreign visitors or workers
 - Lack of response by ill pigs to routine treatments

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CSF should be suspected in pigs with septicemia and a high fever. Other previously described clinical signs may be noted. History of the pigs or traffic onto the farm is also important. Potential introduction should be considered if the history includes feeding of uncooked or undercooked scraps or garbage, particularly meat products; addition of new or returning animals to the herd, recent international travel of personnel on the farm, the presence of foreign visitors or workers, and/or lack of response by ill pigs to routine treatments.

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Diagnosis

Laboratory Tests

- Detect virus, antigens, nucleic acids
 - Tissue samples (tonsils, spleen, kidneys, distal ileum)
 - Whole blood
 - ELISA or direct immunofluorescence
- Serology
 - ELISA or virus neutralization
 - Comparative neutralization test
 - Definitive test

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Differentiation of classical swine fever from other diseases (especially African swine fever, from which CSF is clinically indistinguishable) requires laboratory testing. CSF can be distinguished by detecting the virus or its antigens in whole blood or tissue samples. CSF surveillance most commonly uses rRT-PCR (real time reverse transcriptase polymerase chain reaction) testing on tonsils and nasal swabs. Virus antigens may also be detected by direct immunofluorescence or ELISAs. Serology is used for diagnosis; the most commonly used tests are virus neutralization tests and ELISAs. The definitive test for differentiation is the comparative neutralization test.

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Treatment

- No treatment should be attempted
- Actions needed will be directed by State and/or federal animal health authorities
- Slaughter
 - Confirmed cases
 - In-contact animals
 - Possibly complete herd slaughter
- Area restrictions on pig movements
- Vaccination?


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No treatment should be attempted for pigs suspected with CSF. The state veterinarian or federal Area Veterinarian in Charge (AVIC) should be contacted immediately upon suspicion of disease. Actions needed will be directed by these animal health authorities. Confirmed cases and in-contact animals should be slaughtered, and measures taken to protect other pigs in the area. This may entail complete herd slaughter combined with area restrictions on pig movements, or vaccination (depending on local disease control regulations). **Note: Producers will only receive indemnity for animals destroyed under the order of animal health officials.** In countries where classical swine fever is endemic, vaccines may be used to protect animals. Both modified live and subunit (marker) vaccines are manufactured, although availability varies with the country.

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Classical Swine
Fever in Humans



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Disease in Humans

- Humans are not susceptible to CSF


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Humans are not susceptible to classical swine fever infection.

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Prevention and
Control



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Recommended Actions

- Notification of Authorities
 - Federal:
 - Area Veterinarian in Charge (AVIC)
 - www.aphis.usda.gov/vs/area_offices.htm
 - State Veterinarian
 - www.aphis.usda.gov/vs/sregs/official.htm
- Quarantine

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If you suspect a case or outbreak of classical swine fever, contact your state and/or federal veterinarian immediately. State and/or federal animal health authorities will direct the disease response. Official herd quarantines may be imposed in efforts to control the spread of the disease.

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U.S. Surveillance

- USDA-APHIS-VS
- Passive reporting
 - FADD dispatch
- Active monitoring
 - High risk populations
 - Tissue sampling (tonsils, nasal swabs)
 - Serology


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Currently, Veterinary Services (VS) relies on three surveillance programs for detection of CSF. Passive reporting is conducted by private practitioners (or producers, diagnosticians, slaughter plant inspectors) of suspicious cases with clinical signs similar to a foreign animal disease such as CSF. Once reported to the Area Veterinarian in Charge (AVIC), a Foreign Animal Disease Diagnostician (FADD) is dispatched to investigate the case and collect samples for shipment to the Foreign Animal Disease Diagnostic Laboratory (FADDL) at Plum Island, New York. Additionally, active surveillance is conducted and involves specimen collection from high risk populations, such as waste feeding operations along the Texas – Mexican border. Serum testing has declined dramatically as the focus has shifted to testing tissue samples (e.g., tonsils, nasal swabs) for antigen rather than serum for antibodies. The December 2003 CSF surveillance plan provides the rationale for this transition.

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Quarantine

- Suspicion or diagnosis
 - Confirmed cases, contact animals slaughtered
 - Strict quarantine imposed
 - Prevents spread of disease




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When there is diagnosis or suspicion of CSF, confirmed cases and contact animals are slaughtered and strict quarantine (pictured above) is imposed to prevent the spread of disease. Picture courtesy of Katie Steneroden, ISU.

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Disease Control

- Disinfectants
 - Sodium hypochlorite
 - Phenolic compounds
- Virus sensitive to
 - Drying
 - Ultraviolet light
 - pH of less than 3 or greater than 11
- Killed at high temperatures
 - 150°F for 30 minutes; 160°F 1 minute



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CSFV is moderately fragile in the environment. The virus is sensitive to drying and ultraviolet light. It is rapidly inactivated by pH 3 or less or pH greater than 11. The virus is stable at pH 5-10. Sodium hypochlorite and phenolic compounds are effective disinfectants. The virus can be destroyed by cooking at temperatures of 65.5 °C (150 °F) for greater than 30 minutes or 71 °C (160 °F) for one minute.

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Prevention Measures

- Do not feed uncooked garbage or meat products to swine
- Minimize visitors on the farm
 - Especially those who have traveled internationally in the last 5 days
- Monitor visitors; insist on appropriate biosecurity measures
 - Clean/disinfect boots
 - Clean coveralls

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To prevent the introduction of CSF into the U.S., pigs should not be fed uncooked or undercooked garbage (swill) or meat products. Since the CSFV is stable in the tissues of infected animals, feeding these materials may transfer the virus to susceptible swine. Additionally, visitors onto the farm should be minimized. This is especially important for those who have traveled internationally within the last 5 days. Some visitors are essential to the continued operation of the farm. For these individuals, they should check-in with farm personnel upon arrival and follow biosecurity measures while on the farm (e.g., wearing clean coveralls and cleaning and disinfecting boots before entering and after leaving animal areas).

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Prevention Measures

- Monitor animals closely for illness or signs of disease
 - Inspect animals daily
 - Train farm personnel to report sick animals and the signs of CSF
- Clean and disinfect
 - Vehicles
 - Equipment
 - Boots and clothing



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Prompt recognition of the disease is essential to minimize the spread. Monitor and inspect animals daily for signs of illness or disease. Farm personnel should be familiar with signs to look for and who to contact when signs are noted. Vehicles and equipment can serve as fomites for the spread of the virus. They should be cleaned after each use. Additionally, boots should be disinfected and clean clothing should always be worn when coming in contact with pigs.

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Prevention Measures

- Isolate ill animals immediately
- Quarantine newly introduced animals
 - Minimum of 30 days
 - New purchases, returning animals
- Keep health records on every animal

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Animals infected with CSF can rapidly spread the virus to other susceptible pigs, therefore any animals showing signs of illness should be isolated immediately. Additionally, because pigs can be asymptomatic or can shed the virus before clinical signs are seen, newly purchased or returning animals should be quarantined a minimum of 30 days prior to introduction into the herd. Keeping health records on every animal is equally as important as it will help in the history and possible trace back (if needed) for the animals in the herd.

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Vaccination

- Available in endemic countries
 - Protects from disease
 - Does not eliminate infections
- Helpful in outbreak control
- We all need to do our part
 - Keep our pigs healthy and free of disease



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Vaccines are available in endemic countries. While vaccination can protect animals from clinical disease, it does not eliminate infections and therefore may be inappropriate in countries with an eradication policy. In countries free of CSF, periodic surveillance is necessary to confirm freedom from infection.

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Additional Resources

- World Organization for Animal Health (OIE) website
 - www.oie.int
- U.S. Department of Agriculture – Animal and Plant Inspection Service (USDA – APHIS) website
 - www.aphis.usda.gov

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Acknowledgments

Development of this presentation was funded by grants from the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS) to the Center for Food Security and Public Health (CFSPH) at Iowa State University College of Veterinary Medicine.



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