Keep an eye out for PRRS virus in swine

Dr. Susan Kerr, WSDA Animal Health Program, education and outreach specialist

Due to the backlog of Midwest market hogs during an earlier phase of the COVID-19 pandemic, thousands were transported out of the area for finishing and processing. At least 4,000 of these animals entered Washington both legally and illegally. Many went to small-scale and first-time food animal owners. That outcome came with its own issues (see box for WSDA resources for beginning livestock owners), but some of these swine imports also came with an unwelcome passenger: the Porcine Reproductive and Respiratory Syndrome (PRRS) virus.

PRRS was first recognized in 1987, but there is serologic evidence of PRRS in 1985 in blood from Iowa pigs. PRRS is now endemic in many swine-producing areas in the U.S. and throughout the world. It is a notifiable disease, affecting any size or type of farm under any kind of management system; it can affect all ages of pigs and males as well as females.

There are two manifestations of disease: a reproductive form and a respiratory form; the latter is more common in younger pigs but can affect all ages of immunologically-naïve populations. Various organizations state PRRS is the most economically important disease for the U.S. swine industry, costing producers about $650 million per year in lost production, animal deaths, and control efforts.

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The agent

The PRRS virus (PRRSv) is in the *Arteriviridae* viral family. Hallmarks of viruses in this family include frequent mutations, replication in macrophages, and creation of carrier animals with active immune responses. An enveloped RNA virus, PRRSv is not very hardy in the environment and is readily killed by common disinfectants. The virus is present in all bodily secretions and excretions; it is highly infectious but not particularly contagious.

Where did PRRSv come from?
Some researchers theorize it developed from a similar mouse virus in the same family.

When the disease was first identified, two related but distinct variants (North American and European strains) emerged at about the same time. There are now many variants and strains; these vary in virulence and other attributes. The constantly-changing genetics of this virus contribute to the difficulty of controlling PRRS.

The PRRS virus’ frequent mutations explains why the disease manifests differently on different farms, why vaccines have variable efficacy, and why previous immunity may not be cross protective.

Pathogenesis

After the virus enters a pig's pharyngeal area either by inhalation or ingestion, it multiplies in lymphoid tissue such as tonsils and intravascular pulmonary and alveolar macrophages; subsequent viremia gives the virus access to the other lymphoid tissues throughout the body. The virus can replicate in spite of the host’s immune response. Interference with pulmonary macrophages predisposes infected animals to secondary infections and pneumonia. Viral arteritis is believed to cause death of some or all fetuses in pregnant pigs. Fetuses infected *in utero* can be born normal and uninfected, normal and infected, weak/small and infected, or dead.

Clinical signs

PRRS is a syndrome manifesting with reproductive and/or respiratory signs, depending on the virus strain involved, health level of the herd, duration of the virus in the herd, animal ages, and other factors. Some farms test positive for the virus, but animals are asymptomatic.

In the acute phase of infection in gilts and sows, animals are febrile (103 to 105°F) and anorexic. Some may abort, especially in the last trimester; abortion rates can range from 1 to 50 percent depending on the virulence of the viral variant. Irregular or delayed cycling and open sows can also be observed. CNS signs sometimes follow abortions earlier in gestation. Some infected females will be asymptomatic. Farrowing females may have premature farrowing; mummified, stillborn, or weak piglets; agalactia or mastitis; and/or skin cyanosis. The reproductive impact on the herd lasts for months, but slowly improves.

Boars typically show few clinical signs. Possible signs include fever, anorexia, depression, respiratory signs, and decreased libido. Semen quality can be affected, and some viral variants can cause death.

Signs in piglets infected *in utero* or at birth usually show severe dyspnea, coughing, fever, depression, anorexia, swollen eyelids, skin discoloration, wasting, and high mortality rates. PRRS can make massive impacts on weaners, growers, and finishers, particularly due to pneumonia, anorexia, and wasting, which reduces rates of gain and feed efficiency. Affected animals can display the same signs seen in younger pigs; secondary infections with various other viruses or...
bacteria are common and can eclipse the impact of the primary PRRS problem. Surviving pigs can shed the virus for months.

PRRS lingers in herds due to carrier animals, persistent viral shedding, and viral mutation to strains without cross protection; repeated or protracted respiratory disease outbreaks can result. Mutations can result in strains with greater or lesser virulence. The underlying health status of animals on a farm makes a huge difference on the ultimate impact of PRRS—those with low rates of contagious pneumonia or gastrointestinal pathogens fare much better. All in, all out management systems are also at an advantage compared to continuously populated premises, which can perpetuate high viral loads.

Lesions

Post-mortem lesions are non-specific but include interstitial pneumonia; pulmonary petechia or edema; lymphadenopathy; gastric or renal petechia and hemorrhage; and aborted or mummified fetuses. Secondary infections influence post-mortem findings.

Diagnosis

PRRS can be suspected through analysis of herd production records, clinical signs, and necropsies, then confirmed with laboratory tests. Testing includes virus isolation, fluorescent antibody tests for the intracellular PRRS antigen, immunohistochemistry, and detection of PRRS viral genome by polymerase chain reaction. Viral detection is most effective in the early stage of infection, such as weak pre-nursing neonates and febrile and symptomatic suckling pigs, weaners, and adults. Sequencing is recommended to determine if more than one viral type is present in a herd and to guide vaccination decisions. Serology can help pinpoint the production phase where pigs are becoming infected with PRRSv; antibody tests include indirect immunofluorescent antibody, serum neutralization, and ELISA.

Tissues to submit for viral isolation include serum, lymph nodes, tonsils, spleen, lung, and bronchoalveolar lavage, and aborted or weak newborn piglets.

Treatment

Treatment is often directed at secondary bacterial infections; antibiotics and NSAIDs can be helpful in acute cases. Sick piglets will need electrolytes and added warmth. Prompt and prolonged antibiotic treatment at the start of an outbreak may be needed for all adults—this can reduce devastating reproductive consequences of PRRS.

Prevention best practices

Control, prevention, and eradication efforts must be developed for individual farms because of the various means of transmission, virus variants, and farm-specific factors.

- Eliminate cross fostering
- Euthanize poor-doing piglets
- Implement strict biosecurity measures, including vehicle disinfection and shower in, shower out
- Institute all in, all out group management, followed by cleaning, disinfection, drying, and vacancy of pens
- Use diagnostic testing to identify where and how transmission is happening on a farm
- Initiate early weaning and segregated piglet rearing
- Do not introduce new sows to a farm
- Introduce groups of PRRS-negative replacement gilts monthly, quarterly, or semi-annually and ensure acclimatization to an infected farm’s PRRS viral strain at least 3 months before they enter sow herd
- Import PRRS-negative boars and quarantine them for at least 3 months, letting them acclimatize to an infected farm’s PRRS viral strain before using them for breeding
- Alternatively, use PRRS-negative semen for AI
- Test to identify and cull chronic carriers
- Use a commercial or autogenous vaccine to reduce clinical signs and viral shedding
- Quarantine new/returning animals for at least 3 months.

Goals

If PRRS is present on a premises, management can focus on either elimination or control.

- Elimination
  - Test and cull
  - Depopulate
  - Clean and disinfect facilities, equipment, etc.
  - Repopulate several weeks later with PRRS-negative animals
  - Keep herd closed for at least 7 months
  - Enact biosecurity measures to prevent re-introduction of PRRSv
- Control
  - Minimize secondary infection pathogens
  - Ensure immunity in breeding stock via vaccination
  - Strive for PRRS-negative neonates
  - Evaluate disease risk for subsequent growth phases; see elimination steps above if/when point of infection is identified

PRRS is an extremely complicated syndrome. Interested practitioners are encouraged to seek more in-depth education via any of the below references.

Where to find PRRS resources

- vetmed.iastate.edu
- www.merckvetmanual.com – Search for PRRS
- www.thepigsite.com – Click on the Disease Index
- porkgateway.org – Search for PRRS also:
  - Alternative pork production: Keeping diseases off the farm
  - Alternative pork production: How diseases can be transferred to the farm
- swine.extension.org
- www.pig333.com
## Washington reportable disease stats

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Vesicular disease in livestock

Dr. Ric Torgerson, WSDA Animal Health Program, field veterinarian

Vesicular diseases are clinically indistinguishable. All vesicular diseases can produce vesicles progressing to erosions in the mouth, nares, muzzle, teats, and feet of livestock. Affected animals are usually febrile, anorexic, and depressed. Although vesicular diseases produce similar clinical lesions, the species they affect and the severity of lesions differ.

Foot and mouth disease

Foot and mouth disease (FMD) is endemic in Asia, Africa, the Middle East, and parts of South America. The U.S. has been FMD-free since 1929. Species affected include cattle, pigs, sheep, goats, and all cloven-hooved wild and domestic animals; equines are NOT affected. Clinical signs in cattle include oral and hoof lesions (vesicles, blisters, ulcers), salivation, drooling, lameness, and abortions. Pigs have mild to severe hoof lesions, lameness, hoof sloughing, snout vesicles, and oral lesions less severe than cattle. Sheep and goats have mild signs, if any. Cervidae have mild to imperceptible signs, but can act as viral reservoirs for domestic animals. Morbidity is typically 100 percent. Mortality is usually less than one percent, but is more severe in young stock.

Vesicular stomatitis

The vesicular stomatitis (VS) virus is found in North, Central, and northern South America. The endemic VS strains in the U.S. are the New Jersey and Indiana 1 subtypes. Species affected include equines, cattle, pigs, sheep, and goats. Recent VS cases in the U.S. have mostly affected horses and occasionally cattle housed with or near horses. Clinical signs in cattle include vesicles in the oral cavity, mammary gland, coronary bands, and interdigital space. Pigs have lesions similar to cattle. Sheep and goats rarely show signs. Horses show severe lesions such as extensive oral vesicles and ulceration, coronary band lesions, drooling, and lameness. Cervidae have only been affected experimentally. Morbidity varies but can be up to 90 percent; mortality is low.

Swine vesicular disease

Many European countries are affected by swine vesicular disease. Pigs are the only species affected. Signs include lameness, salivation, and neurological signs; lesions are less severe than in other vesicular diseases. Younger animals are more severely affected. Morbidity is low and mortality is generally not a concern.

Vesicular exanthema

Vesicular exanthema has only been found in the U.S. and was eradicated in 1956. Only pigs are affected. Clinical signs include deep lesions with granulation tissue formation on the feet. Morbidity can be up to 100 percent, but mortality is low.

Seneca Valley virus

Seneca Valley virus is endemic in the U.S. It is indistinguishable from the other more serious and economically devastating vesicular diseases mentioned above; it must be included in the differential list of possibilities when seen in swine.

Implications of vesicular diseases

Introduction of any non-endemic vesicular diseases would be disastrous to the U.S. economy and livestock industry, with millions to billions of dollars lost directly and indirectly. If you suspect a vesicular disease case, notify animal health officials immediately. Before taking samples and especially before leaving the suspect animal’s farm, contact the USDA veterinary services area office (360-956-7903) or the state animal health official (360-902-1878). You may need to remain on the suspect farm until animal health officials arrive or advise you otherwise. If you are in a group practice, notify your clinic of the pending situation, even before a final diagnosis is made. Neighboring farms may need to be quarantined and other practitioners may need to become involved in the containment effort. In the event you identify a suspected vesicular disease case, you may be required to stay on the farm and help carry out specific disinfection protocols or other duties based on recommendations of the foreign animal disease diagnostician, state veterinarian, and/or the APHIS area veterinarian-in-charge.

Early detection, prompt diagnosis, effective isolation/quarantine, and rigorous biosecurity methods are key to disease control. As the accredited veterinarian first on the scene, you have a critical role in stopping the spread of these highly contagious vesicular diseases. ☒
Practitioner responsibility regarding Foreign Animal Diseases

Dr. Ben Smith and Dr. Ric Torgerson, WSDA Animal Health Program, field veterinarians

Despite efforts to keep them out of the country, Foreign Animal Diseases (FADs) can enter the U.S. and cause preventable animal illness and substantial economic losses to the livestock industry. Private veterinarians are the first line of defense against these foreign invaders. What can a large animal veterinarian do when they encounter an animal that is lame, off feed, drooling, or has worrying lesions on its hooves?

Detection

First, remember that WSDA and the U.S. Department of Agriculture (USDA) are always available for consultation. Never hesitate to call if you have a concern—assisting in these cases is a priority for both state and federal animal services. When preparing for a consultation and in addition to the observed signs, here are some additional questions to consider:

- What has the weather been like? Could the weather have encouraged vectors that might play a role in disease transmission?
- Are multiple species on the farm affected? Are they all cloven hooved animals, for example?
- Has there been any international travel, new workers on the farm, or visitors?
- Based on the history and clinical signs, what could be differential diagnoses?

Private practitioners are responsible for maintaining current knowledge of FADs with the potential to enter the U.S. Information and fact sheets on FADs can be found on the World Organisation for Animal Health’s website. Be aware of clinical/necropsy findings compatible with FADs and routinely include them in differential diagnoses as appropriate until proven otherwise.

Suspected FADs must be confirmed by designated diagnostic laboratories, such as the Washington Animal Disease Diagnostic Laboratory (WADDL) at Washington State University or the USDA National Veterinary Services Laboratory (NVSL). Actions early in the process can contain the scope of an outbreak, minimize disease transmission, and prevent significant economic loss.

Reporting

If you have a potential FAD, the next step is to contact the Foreign Animal Disease Diagnostician (FADD, typically a state or federal veterinarian) so they can obtain samples for analysis. The goal is for an FADD to be on the premises within four hours of a suspected FAD report.

Veterinarians are legally required to notify their state veterinarian if they suspect a reportable disease case. Veterinarians should know the state veterinarian’s contact information and maintain a list of alternative and after-hours contacts. This information is available on the WSDA website.

Waiting for confirmation

If an FAD is suspected, the FADD will issue a hold order restricting movement of animals on or off the premises. The practitioner must assess and make recommendations to mitigate the risks associated with subsequent livestock contact on other premises without extensive decontamination of all equipment, clothing, footwear, and vehicle surfaces. The danger and consequences of veterinarians transmitting FAD agents between premises is real and this risk must be addressed.
The practitioner may be required to remain on the premises until relieved by a WSDA or USDA veterinarian. Biosecurity measures for the farm owner, personnel, and reporting veterinarian will depend on the disease of concern. The disease’s epidemiology is critical when determining the course of action. If foot and mouth disease (FMD) is suspected, for example, no one involved should go to any additional farms without taking extreme biosecurity precautions. A practitioner could be found liable if secondary transmission occurs due to their actions.

Control
If you suspect an FAD, inform the owner without specifying the disease. For example, use “possible foreign animal disease” rather than “FMD.” Briefly explain your obligation to report your suspicions and the possible consequences of a positive diagnosis. Encourage the owner to limit on-site visitors/vehicles to essential visits and enhance on-farm biosecurity measures.

When the USDA or WSDA veterinarian arrives, your assistance may be required to document the history and clinical signs and take samples. Before leaving the suspect premises, understand which products will be effective to disinfect your equipment, vehicle, boots, etc. for the particular suspected disease.

In the event of an FAD outbreak, an emergency response team would be mobilized to control its spread and eradicate the disease. Such a team consists of units with specific tasks: diagnostics, tracing, movement control, evaluation, destruction, disposal, and cleaning and disinfection. Veterinary practitioners could be requested to help in one or more of these areas.

What about non-farm situations?
Small animal practitioners are not off the hook when it comes to FADs. There are also many non-farm animal diseases requiring vigilance to keep out of Washington and the rest of the country. Here is one example:

An owner brought a dog with a wound on its back for examination because the wound seemed to keep getting larger. Close examination revealed a maggot deep in the lesion. After removal, the maggot was examined:

It turned out that this maggot was Cochliomia hominivorax, the New World screwworm. Unlike common maggots, these maggots can cause extensive destruction of otherwise healthy tissues. This parasite had been eliminated from the U.S. since 1966. It came back into Florida a few years ago, but an astute small animal veterinarian identified it, contacted USDA veterinarians for confirmation, and this brief FAD incursion was vanquished.

For more information, visit the National Veterinary Accreditation Program which has review modules covering many FADs available at www.aphis.usda.gov.

Subscribe to the WSDA Ag Briefs blog for updates on issues of interest to the agricultural community and the public.

Read posts and subscribe at: wastatedeptag.blogspot.com
CDC's NORS database summarizes disease outbreak data

Dr. Susan Kerr, WSDA Animal Health Program, education and outreach specialist

For those interested in zoonotic disease outbreaks, the Centers for Disease Control and Prevention (CDC) has a valuable database available. The CDC National Outbreak Reporting System at [cdc.gov/nors](http://cdc.gov/nors) tracks single and multi-state disease outbreaks of foodborne, waterborne, animal contact, environmental, person-to-person, and outbreaks of unknown origin.

Data is available from 1971 to 2018. Searches for zoonotic disease outbreaks can be conducted by year, state, etiological agent, and setting. Each search generates a spreadsheet that can be downloaded. As an example, Figure 1 shows results of a search for human disease outbreaks in Washington State from 2009 to 2018 traced to animal contact.

The CDC clarifies on its website that the NORS dashboard does not contain all data reported through NORS. The CDC advises people to email NORSDashboard@cdc.gov for more data for a scientific study or analysis, or for any questions on how to use or interpret the data.

On a related note, the CDC’s Animal Contact Outbreak Surveillance System (ACOSS) gathers data from local and state departments of health regarding human gastrointestinal disease outbreaks associated with animals or animal environments. The site, at [cdc.gov/acoss](http://cdc.gov/acoss), provides publications, annual reports, and answers to frequently asked questions.

![The general flow of outbreak information to NORS](image)

Figure 1: Human disease outbreaks in Washington state from 2009 to 2018 traced to animal contact. Source: CDC NORS
WSDA Field Veterinarian Regions

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<tr>
<th>Region 1 Field Veterinarian</th>
<th>Dr. Amber Itle</th>
<th><a href="mailto:AItle@agr.wa.gov">AItle@agr.wa.gov</a></th>
<th>(360) 961-4129</th>
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<td><a href="mailto:RTorgerson@agr.wa.gov">RTorgerson@agr.wa.gov</a></td>
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<td>Region 4 Field Veterinarian</td>
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<td><a href="mailto:BSmith@agr.wa.gov">BSmith@agr.wa.gov</a></td>
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<tr>
<td>State Veterinarian</td>
<td>Dr. Brian Joseph</td>
<td><a href="mailto:BJoseph@agr.wa.gov">BJoseph@agr.wa.gov</a></td>
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<tr>
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ANIMAL SERVICES DIVISION:
Animal Health | Animal Disease Traceability (ADT) | Avian Health | Reserve Veterinary Corps (RVC)
Guest column: COVID-19 vaccine campaign to vaccinate America

Dr. Luci Dimick and Dr. Samantha Bruce, U.S. Department of Agriculture veterinarians

Washington veterinarians are answering the call to help by volunteering to vaccinate fellow Washingtonians for COVID-19. Medical knowledge, technical skills, and compassion make veterinarians a prime choice for volunteer vaccinators. Behind the scenes, veterinarians with the U.S. Department of Agriculture (USDA) Veterinary Services started helping in February, working with the Federal Emergency Management Agency (FEMA) to support President Biden’s COVID-19 vaccine campaign.

We were joined in the effort by Drs. Lisa Augustine and Matthew Shere, fellow USDA veterinarians, deployed with FEMA in Washington State and on the east coast.

Locally, USDA veterinarians spent 12-hour days participating in virtual meetings to assist the Washington State Department of Health’s (DOH) Incident Management Team. They worked to build an overall strategic plan with a goal to vaccinate 45,000 people per day while ensuring equitable distribution of vaccine among Washingtonians. USDA veterinarians designed plans detailing the method of vaccine delivery for groups identified in Washington’s COVID vaccination phase schedule. These groups included teachers, childcare workers, residents of correctional facilities, workers in public transit, food production workers, agricultural workers, and hard-to-reach vulnerable populations such as the homeless.

The USDA team also provided population data analysis, researched the vaccines, and created summaries and a presentation for Governor Jay Inslee’s office. After the PREP Act was amended to include veterinarians and veterinary students as vaccinators, Dr. Dimick coordinated discussions and meetings between the DOH and key veterinary partner groups in Washington.

Drs. Bruce and Shere deployed to Maryland to help at a drive-through mass vaccination site, working with the Maryland National Guard, firefighters/paramedics, EMTs, and nurses from across the country. They vaccinated approximately 100 people a day and worked seven days a week. A typical day at the site included approximately 2,400 appointments, sometimes as many as 3,400.

Dr. Bruce describes one experience:

“Many of the people receiving vaccines were very grateful and excited. I remember one of the patients pulled up to the tent, turned the vehicle off, and asked if the veterinarians worked here. I could not read how the patient felt about veterinarians administering vaccines to people. I hesitated for a second and then said, ‘Yep, it sure is’. She smiled wide and said, ‘Oh, yes!’ She was so excited to be vaccinated by a veterinarian. When she found out many of us had traveled from all across the country, even as far away as Washington State (which I quickly learned needed to be clarified otherwise people assumed from D.C.), she was even more surprised.”

If you are interested in volunteering, the Washington State Veterinary Medical Association’s web site has information and helpful links. It would be an experience you won’t forget.