From the Editor – The WSU Veterinary Medicine Newsletter was initiated by Dr. Moore when she arrived in 2007 and has been going strong ever since. The intent from the onset has been to support the mission of the Agricultural Animal Health Group to transfer current, relevant information to food animal owners and veterinarians in the Pacific Northwest. However, given the retirement of Dr. Moore and recent hire of Dr. Figueiredo we thought it was time for a bit of a makeover.

We are currently revamping the Veterinary Medicine Extension website and hope to have the new and improved version up and running later this summer. As part of that effort we are planning to reinvigorate the newsletter in terms of both content and accessibility. However, we really need your help as we move forward and would appreciate it if you could take a minute to answer four questions via a brief, anonymous survey. Your answers will help guide the next generation of newsletters so that we can serve you better. Thank you for your help with this.

-Craig

http://vetextension.wsu.edu/newsletters/
WSDA: This Virus Isn’t Horsing Around! A Review of the US Vesicular Stomatitis Virus (VSV) Outbreak, Canadian Export Restrictions, and the Importance of this Reportable Disease

By Dr. Dana R Dobbs, WSDA Field Veterinarian and Marissa Nelson, WSDA Animal Health Technician

Why are so many horses and some cattle “down in the mouth lately?” Unfortunately, Vesicular Stomatitis Virus (VSV) is hitching a ride north from Mexico with its arthropod vectors during ideal, warm conditions. Vesicular stomatitis is a viral disease that primarily affects horses and cattle. It occasionally affects swine, sheep, goats, llamas, alpacas, and people who handle infected animals. VSV is an RNA virus belonging to the family Rhabdoviridae, genus Vesiculovirus. The two serotypes of particular importance in the United States are VSV New Jersey and VSV Indiana, with VSV New Jersey being confirmed during the current outbreak.

Hopefully, this article will shed some light on the current VSV outbreak, its associated Canadian import restrictions, and the importance of this reportable disease.

2023 Vesicular Stomatitis Virus (VSV) Outbreak Update:

On May 17th, 2023, the National Veterinary Services Laboratory (NVSL) confirmed Vesicular Stomatitis Virus (VSV) in San Diego County, California. Texas soon followed suit with their first case on June 15, 2023. Since the first detection, there have been a total of 119 VSV affected premises identified in California and Texas. Forty of those premises were confirmed positive by NVSL, whereas 79 are suspect. In this current outbreak, 116 equine species, 2 bovine species, and 1 rhinoceros have been clinically affected.

As the outbreak continues to evolve, USDA posts regular situation reports and updates, along with other useful information for veterinarians available at: USDA APHIS | Vesicular Stomatitis (VS)

Thankfully, VSV has not been detected in Washington State; however, there have been issues with horses from affected states trying to enter Canada for special events or exhibitions. Unfortunately, some were turned away at the border when suspicious lesions were discovered.

Canadian Export Suspension for Horses, Swine and Ruminants in VSV Affected States:

At this time, export of horses, swine, and ruminants into Canada from VSV infected states is suspended. Exceptions may be granted to those animals moved out of VSV affected states to reside elsewhere for 21 days. Veterinarians should check with these destination states for any special animal health or testing requirements prior to movement. Additionally, USDA must certify these animals prior to export as follows:

“All states in which the animal(s) have resided in the past twenty-one (21) days have been free from clinical and epidemiological evidence of vesicular stomatitis during the twenty-one (21) days immediately prior to export to Canada”.

**It is recommended that US origin animals exporting to Canada and Canadian animals returning home avoid passing through VSV affected states.** If this isn’t possible, the Canadian Food Inspection Agency (CFIA) will require further declarations prior to entry and should be contacted well in advance.

Exceptions:

Canadian horses, swine, and ruminants in the United States on a Canadian health certificate may return from a VSV affected state within three days of the state being declared affected by the disease. These animals must be inspected by a CFIA Port of Entry veterinarian, or the Canadian health certificate will be invalid.

Traveling to Canada from VSV affected states is still possible for events that have been pre-approved by the Canadian Food Inspection Agency (CFIA). This applies only to horses and ruminants traveling to these
competitions and exhibitions, and they must have all requisite documentation. The pre-approved events include:

- Royal Winter Fair
- Agribition
- Calgary Stampede
- Thunderbirds
- Spruce Meadows
- Longines Global Tour
- Denver Stock Show
- Houston Livestock Show and Rodeo

To qualify for the exemption, an accredited veterinarian must: 1) Request a CFIA import permit, 2) Use the Veterinary Export Health Certification System (VEHCS) to create a health certificate that includes the addendum statements for VSV and other requirements*, 3) Attach test results for EIA (within 6 months of import) and VSV cELISA results (within 7 days of export), 4) Obtain USDA’s endorsement for the export, 5) Combine all these documents together, and make an appointment for inspection by a CFIA veterinarian. The inspector may ask for the documents to be emailed prior to inspection.

* In VEHCS, select “other” as the commodity and PDF upload certificate. Fill out the certificate and line out/initial statement #7. The required addendums will be on the following page and must be signed by the accredited veterinarian and endorsing USDA Veterinary Medical Officer.


CFIA permits: [My CFIA - Canadian Food Inspection Agency (canada.ca)](https://www.canada.ca)

CFIA veterinary inspection appointments: [Contact a Canadian Food Inspection Agency office by telephone - Canadian Food Inspection Agency (canada.ca)](https://www.canada.ca)

**Additional information regarding Vesicular Stomatitis Virus?**

**Transmission:**

In the Western Hemisphere, VSV circulates annually between livestock and insect vectors in southern Mexico where the virus is considered endemic. During the warmer months, from late Spring or Summer to late Autumn, arthropod vectors may move north into the United States, favoring areas along waterways. Common arthropod vectors include black flies, sand flies and biting midges. However, other insects such as horseflies and mosquitoes, have also been implicated. It is possible that wind currents may play a role in the insects being able to travel over long distances.

The virus also may be spread when moving infected horses to events, by direct contact between horses with lesions, and transfer on contaminated clothing, feed containers, equipment, and other fomites.

**Clinical Signs:**

Once exposed, clinical signs typically appear within 2-8 days, and owners initially may notice a slight fever and excessive drooling. Lesions often appear as pale, raised areas or blisters on the lips, nostrils, commissures of the mouth, tongue, oral mucosa, coronary band, prepuce, vulva, and teats. The blisters eventually swell and
rupture, causing pain, discomfort, and reluctance to eat or drink. Older lesions may appear as crusted erosions or ulcers. In addition, severe weight loss or lameness may occur, depending on where the lesions are located.

Some common “imposters” of VSV may include course feed, grass awns, wood chips, cribbing, toxins from blister beetle ingestion, other infectious diseases, sunburn, and trauma. If there is any doubt, it is best to play it safe and call the State Veterinarian’s for assistance. A picture is worth a thousand words, and it is very helpful when consulting with the USDA Area Veterinarian in Charge (AVIC) to determine if investigation is warranted and establish its priority.

**Treatment:**

Vesicular stomatitis is usually short lived and self-limiting, lasting between 7-14 days. Treatment is supportive, and softening grain, hay cubes, and providing anti-inflammatories may be useful. **Currently, there is no vaccine approved for use in horses within the United States.**

**Containing the Virus:**

Once an animal is diagnosed with vesicular stomatitis, the premises will be placed on quarantine for at least 14 days past onset of lesions in the last affected animal. Other susceptible species on site, such as cattle and swine, will also be placed under quarantine. Horses are not susceptible to Foot and Mouth Disease (FMD), and if VSV is ruled out in a horse and other livestock on site begin to show clinical signs, this testing is especially critical.

**Prevention:**

Horses with clinical signs should be isolated immediately and strict biosecurity practices put in place. Moving them to a smaller, easier to sanitize area can help eliminate further spread of the virus. It is important to care for healthy animals first, and sick animals last. Having specific clothing and boots for this purpose is ideal. Make sure all feed containers and equipment are cleaned regularly and avoid sharing these items.

Having an insect control program that eliminates or reduces insect breeding areas will slow or stop insects from infecting more hosts. Remove any areas of standing water such as kiddie pools, old tires, and consider housing animals inside with screens and fans. Manure management is also an important tool for keeping insect vectors under control.

Always use personal protective equipment, such as gloves, to avoid human exposure.

General biosecurity guidelines for equids are available at: [General Biosecurity Guidelines | AAEP](https://www.aaepp.org)

**Vesicular Stomatitis in Humans:**

If owners, farm personnel, or veterinary professionals are exposed to VSV, they may experience influenza like symptoms such as fever, muscle aches, headache, fatigue, and occasional lesions. Most of the time this is rare, but avoiding contact with vesicular fluids, saliva, or nasal secretions and use of gloves or other appropriate personal protective equipment (PPE) is recommended.

**Reporting Suspicious Cases:**

**VSV is a reportable disease at both the state and federal levels.** If you suspect an animal may have vesicular stomatitis, immediately contact the State Veterinarian’s office. The disease cannot be diagnosed on clinical signs...
alone and may resemble other diseases of economic importance. Samples must be submitted to NVSL without delay by a Foreign Animal Disease Diagnostician (FADD). Typical samples include swabs or tissue samples from lesions, fluid from vesicles, and blood for serology. Results are typically available within a few days and there is no charge to the owner.

For further questions or concerns, please contact the WSDA State Veterinarian’s office at 360-902-1878, or for more detailed information, including VSV fact sheets, visit USDA’s website at: USDA APHIS | Vesicular Stomatitis (VS)

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**WSDA: Bang Bangs, It’s Dead!**

By Dr. Amber Itle, Washington State Veterinarian

USDA declares the “win” against brucellosis, 69 years after the initiation of the US Brucellosis Eradication Program. All 50 states are now considered FREE by USDA standards and the risk to cattle outside of the Greater Yellowstone Area has been deemed negligible. WOO HOO! Thank you to all the veterinarians and producers out there who have been part of getting us to this important milestone.

As with all successful programs, USDA has decided to phase out the Program with proposed changes in 9 CFR Part 78 -- Brucellosis by the close of 2023. USDA is shifting funding and resources to other higher priority, higher risk disease response efforts. As a result, there is a national proposal to:

1) remove vaccination requirement for all states without infected wildlife,

2) eliminate vaccination requirement in all low-risk counties in GYA states,

3) focus on surveillance at slaughter and movement testing strategies to replace mandatory vaccination programs.

Brucellosis has evolved from being a domestic cattle disease, to being a wildlife disease that only persists in bison and elk in the Greater Yellowstone Area (GYA) in Wyoming, Montana and Idaho. Due to the robust herd management requirements in the GYA, early detection has confined the disease to that area, with an average of 2.6 herds detected in the GYA per year since 2010. There have been no infected dairies since 1998, and no affected beef herds outside the GYA since 2011. These successes in the last decade have proven that the program based on robust testing, surveillance, and early detection has worked. USDA feels confident that the risk outside of the GYA is negligible.

Brucellosis vaccination reduces brucellosis transmission but does not prevent infection. According to the Idaho State Veterinarian, all the herds that have been positive in the Idaho GYA were vaccinated cattle. The concern is that vaccinated animals delay detection because clinical signs are masked. Most veterinarians would agree that a test negative animal is much more reliable for disease detection. The idea here is to move away from vaccination (putting something in) and replacing that with testing (taking something out) to ensure that we are truly importing brucellosis free animals. The only cattle that really benefit from vaccination are cattle directly exposed to infected GYA wildlife. State Veterinarians in GYA states work closely with producers to develop plans that avoid contact with wildlife by thinking through seasonality of exposure, geographic spatial mapping of the pasture and associated risks with wildlife birthing and migration patterns. Risk-based vaccination requirements are currently under consideration in GYA states.

Initially, the program relied heavily on test and cull programs and used vaccination to control the disease. As brucellosis prevalence dropped, the program evolved from vaccination control programs to slaughter surveillance targeting high-risk areas. Current slaughter surveillance targets the four largest plants (2 in ID, 1 CA and 1 in CO) based on catchment from GYA states. Each year, USDA is still meeting/exceeding a target of
1/100,000 prevalence with 95% confidence using Standard Operating Procedures for Submission and Testing of Brucellosis Serological Specimens (usda.gov).

WSDA proposes moving towards a voluntary brucellosis vaccination program in the next year to harmonize with other states and align our rules with federal changes. We will continue to work with veterinarians and producers on coming up with ideas for replacing the mandatory vaccination program with a mandatory identification program for breeding age animals and all cattle imported from out of state in order to maintain our robust animal disease traceability program. Please feel free to let us know your ideas for how we can best do that to meet your needs.

Using Automated Activity Monitoring Systems to Aid in Dairy Practice Management

By Caio Figueiredo, Veterinary Medicine Extension

The use of automated activity monitors (AAM) in dairy operations has become more frequent as the dairy industry moves toward automation/robotization. Part of the observed successful implementation of AAM is attributed to the increased research effort that has focused on assessing the efficacy of the various advantages associated with the technology (i.e., collars and ear tags; Figure 1). In fact, 45% of projects presented at the 2023 American Dairy Science Association Annual Conference (Section Reproduction 1 only) employed the use of AAM. Among the several applications of AAM, recent studies have focused on evaluating their use for the prediction/diagnosis of diseases, as well as for the reduction of hormone use by implementing selective reproductive protocols.
A series of studies from Cornell University aimed to evaluate the performance of AAM to identify diseases based on health alerts - Health Index Score (HIS). Those studies depicted the varying sensitivity of AAM (cows fitted with collars) for the detection of cows with metabolic and digestive diseases, mastitis, or metritis. For instance, high sensitivity of HIS to detect cows with displaced abomasum (≥ 95%), ketosis (≥ 89%), and indigestion (≥ 86%) was observed (Stangaferro et al., 2016a). In addition, AAM highlighted cows with low HIS, before the identification of clinical signs of displaced abomasum, ketosis, or indigestion by herd veterinarians or farm personnel (-2.5 to -1.7 days relative to observed clinical signs; Stangaferro et al., 2016a). Despite high sensitivity of AAM to detect cows with metabolic or digestive diseases, a lower sensitivity to detect cows with mastitis (≥ 55%; Stangaferro et al., 2016b) or metritis (≥ 53%; Stangaferro et al., 2016c) was observed for AAM. Nevertheless, changes in HIS in cows with mastitis or metritis were observed before the identification of clinical signs by herd veterinarians or farm personnel (-1.2 to -0.5 days relative to observed clinical signs).

A recent study from the University of Florida evaluated the efficacy of cow behavior (i.e., feeding time, rumination time, idle time, and active time) in predicting the occurrence of metritis and clinical cure failure of metritis in postpartum dairy cows (Merenda et al., 2021). In that study, cow behavior by itself did not yield high sensitivity (≥ 59%) for the detection of cows with metritis in multivariable models; however, increased sensitivity (≥ 67%) was observed when cow behavior was combined with routinely available farm data in multivariable models. Furthermore, cow behavior yielded high sensitivity (≥ 86%) to detect cows with clinical cure failure of metritis up to 1 day before metritis diagnosis. Altogether, AAM represent an opportunity for early diagnosis of diseases and a potential strategy to circumvent limitations in farm personnel availability.

As an example, AAM has been investigated as a means to reduce the use of exogenous hormones in reproductive management protocols by prioritizing AI based on estrus detection using AAM (Rial et al., 2022; Gonzalez et al., 2023). Specific reproductive outcomes from each of these studies are described in Table 1 and Table 2. Although more studies are necessary in order to fully develop a targeted reproductive program, both studies show promising evidence that reducing the use of exogenous hormones while maintaining similar reproductive performance in dairy cows is possible using AAM.
Table 1. Pregnancies per AI at 39 ± 3 d after first AI based on the assigned reproduction management program and detection of estrus between 21 and 49 DIM. Adapted from Rial et al. (2022).

<table>
<thead>
<tr>
<th>Group</th>
<th>Item</th>
<th>E-VWP</th>
<th>NE-VWP</th>
<th>E-VWP</th>
<th>NE-VWP</th>
<th>P-value</th>
<th>E-group</th>
<th>Trt × E-group</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL-TAI</td>
<td>ALL</td>
<td>49.1</td>
<td>46.2</td>
<td>41.8</td>
<td>38.8</td>
<td>0.02</td>
<td>0.07</td>
<td>0.62</td>
</tr>
<tr>
<td>P-AIE</td>
<td>AIE</td>
<td>—</td>
<td>—</td>
<td>43.4</td>
<td>40.7</td>
<td>0.86</td>
<td>0.06</td>
<td>0.23</td>
</tr>
<tr>
<td>TP-AIE</td>
<td>TAI</td>
<td>49.6</td>
<td>45.8</td>
<td>52.8</td>
<td>37.7</td>
<td>0.07</td>
<td>0.27</td>
<td>0.38</td>
</tr>
</tbody>
</table>

**AIE** = Al at detected estrus; **TAI** = timed AI. **ALL-TAI** = cows received all TAI after a Double-Ovsynch protocol, TAI at 83 ± 3 DIM. **P-AIE** = cows received AIE if detected in estrus for 24 ± 3 d after a 49-d voluntary waiting period (VWP), and if not AIE received TAI at 83 ± 3 DIM after Ovsynch with progesterone supplementation and 2 PGF2α treatments (P4-Ov). **TP-AIE** = cows received AIE if detected in estrus for 31 ± 3 or 17 ± 3 d after a 49 d VWP. Cows not AIE with or without AEA during the VWP received TAI after P4-Ov at 90 ± 3 or 74 ± 3 DIM, respectively. **E-VWP** = cows with at least one estrus event based on AEA recorded during the VWP. **NE-VWP** = cows without an estrus event based on AEA recorded during the VWP. **Trt** = treatment used for first service. **E-group** = cows grouped based on detection of estrus (yes vs. no) based on AEA during the VWP (E-VWP vs. NE-VWP).

Table 2. Effects of treatment on outcomes referent to first postpartum insemination. Adapted from Gonzalez et al. (2023).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Primiparous</th>
<th>Multiparous</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>TRM</td>
<td>Control</td>
</tr>
<tr>
<td>Insemination in estrus, %</td>
<td>0.0</td>
<td>55.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Pregnancy d, %</td>
<td>32 (269)</td>
<td>29.2 (260)</td>
<td>44.5 (470)</td>
</tr>
<tr>
<td>Pregnancy d, %</td>
<td>67 (277)</td>
<td>37.6 (259)</td>
<td>41.0 (463)</td>
</tr>
</tbody>
</table>

**Control**: cows subjected to the Double-Ovsynch protocol at 55 and 56 DIM (primiparous, herds 1 and 2, respectively) and 41 and 42 DIM (multiparous, herds 1 and 2, respectively) for first postpartum AI at fixed time. Cows re-inseminated when detected in estrus by herd personnel [herd 1: visual detection of signs of estrus; herd 2: visual detection of signs of estrus and activation of Estrotect (Rockway Inc.)]. **Targeted reproductive management (TRM)**: cows that had at least one estrus detected by the automated device with heat index ≥70
(0 = minimum, 100 = maximum) by 54 and 55 DIM (primiparous; herds 1 and 2, respectively) and 40 and 41 DIM (multiparous; herds 1 and 2, respectively) were allowed to be inseminated upon estrus detected by the automated device starting at 64 DIM (primiparous) and 50 DIM (multiparous). Cows not inseminated in estrus within 42 d were submitted to the Double-Ovsynch protocol and fixed-time insemination. Cows that were not detected in estrus or had heat index <70 were subjected to the Double-Ovsynch protocol and fixed-time insemination as in the control treatment. Cows were re-inseminated upon detection of estrus by herd personnel, as described for the control treatment, and automated device.

Liver Health Index: A Potential Tool to Identify Cows at High Risk of Developing Diseases After Calving

By Caio Figueiredo, Veterinary Medicine Extension

The transition period is considered one of the most challenging stages in the life of a dairy cow, and also one of the most delicate times to manage in dairy herds. Several studies have depicted the importance of a “smooth” transition of cows into lactation on subsequent health, welfare, productive and reproductive performance, and survival. A potential aid in the identification of cows at high risk of developing diseases during the early postpartum period involves the use of negative acute phase proteins and related molecules as an indicator of detrimental inflammation. One diagnostic mechanism is termed the Liver Health Index (LHI = \[(\text{Alb} – \mu\text{Alb})/\sigma\text{Alb}\] + \[(\text{Chol} – \mu\text{Chol})/\sigma\text{Chol}\] – \[(\text{Bili} – \mu\text{Bili})/\sigma\text{Bili}\]). Briefly, LHI is calculated using each individual cow’s albumin, cholesterol, and bilirubin values and the sampled population mean and standard deviation. Albumin, cholesterol, and bilirubin are negative acute phase proteins (and related compounds) that indicate liver function and severity of inflammatory status. Although such compounds may not illustrate the biological processes in their entirety, LHI has been associated with differences in biomarkers of energy metabolism (i.e., glucose), liver function (i.e., bilirubin and cholesterol), inflammation (i.e., albumin, ceruloplasmin, haptoglobin, IL-1β, and IL-6), and oxidative stress (i.e., paraoxonase and glutathione).

A recent publication reported that LHI is associated with differences in cow health and performance (Kerwin et al., 2022). More specifically, postpartum cows that were affected by clinical diseases within 2 weeks postpartum had lower LHI compared with cows without clinical diseases (Table 1). Differences in productive and reproductive performance were also associated with LHI (Figure 1).

Other publications have also reported differences in cow health, performance, and behavior associated with LHI. For instance, a greater number of health problems was observed in cows with low LHI compared with cows with high LHI within 30 days postpartum (Trevisi et al., 2012; Zhou et al., 2017). Milk production within 35 days postpartum was also reduced in cows with low LHI compared with cows with high LHI (36.2 vs. 46.3 kg, respectively). Finally, LHI was highly correlated to the number of minutes of rumination per day (r = 0.75), suggesting that LHI could be used as a proxy for cow health and welfare (Calamari et al., 2014). Altogether, LHI may be a useful tool for the identification of cows at higher risk of developing diseases and aid early diagnosis of disease in dairies, particularly for those that do not possess automated activity monitoring systems (i.e., collars or ear tags).
Table 1. Least squares means and standard error of the mean (SEM) of the liver health index for cows diagnosed or not diagnosed with the negative health event of interest for a retrospective cohort study involving 72 farms across the northeastern United States. Adapted from Kerwin et al., 2022.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Disorder</th>
<th>No disorder</th>
<th>Disorder</th>
<th>No disorder</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MET</td>
<td>71 (9.0)</td>
<td>722 (91.1)</td>
<td>-1.79</td>
<td>-0.54</td>
<td>0.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DA</td>
<td>23 (2.7)</td>
<td>818 (97.3)</td>
<td>-3.23</td>
<td>-0.57</td>
<td>0.42</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CK</td>
<td>72 (8.6)</td>
<td>761 (91.4)</td>
<td>-2.22</td>
<td>-0.50</td>
<td>0.26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cull</td>
<td>27 (3.2)</td>
<td>814 (96.8)</td>
<td>-3.55</td>
<td>-0.55</td>
<td>0.38</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Any of 3</td>
<td>132 (16.8)</td>
<td>653 (83.2)</td>
<td>-1.97</td>
<td>-0.35</td>
<td>0.21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2 or more</td>
<td>25 (3.2)</td>
<td>760 (96.8)</td>
<td>-3.05</td>
<td>-0.58</td>
<td>0.41</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

1MET = metritis; DA = displaced abomasum; CK = clinical ketosis; Cull = culling within 30 DIM; Any of 3 = 1 or more of DA, CK, and MET; 2 or more = more of DA, CK, and MET.

Figure 1. Summary of findings from Kerwin et al., 2022.

WSDA: Nothing to be Mad About… 20 Years After BSE in Washington

By Dr. Amber Itle, Washington State Veterinarian

Bovine spongiform encephalopathy (BSE) is a progressive neurological disease of cattle caused by prions, which are infectious agents made up of protein material. The prion proteins affect the brain structure of infected animals, resulting in neurologic signs including behavioral changes, coordination problems, weight loss, and death. There are two types of BSE—classical and atypical. Neither form is contagious.

Christmas Eve 2003, Washington State had the country’s first detection of Classical Bovine Spongiform Encephalitis (BSE) in a cow imported from Canada. That was also the last detection of
classical BSE in the United States likely due to USDA APHIS implementing a three-tiered strategy to mitigate the disease including 1) removal of specified risk materials - or the parts of an animal that would contain BSE should an animal have the disease - from all animals presented for slaughter 2) imposing universal changes in cattle feeding practices that ban potentially BSE infectious tissues known as “specified risk materials” (SRM) from all animal feeds, pet foods, and fertilizers 3) implementation of the ongoing BSE surveillance program that allows USDA to detect the disease if it exists at very low levels in the U.S. cattle population.

Since 2003, there have been 6 sporadic and rare detections of atypical BSE detected in the United States due to a spontaneous change in the prion proteins in older adult cattle. The most recent case was detected in May 2023 in a 5 year old mixed breed beef cow that was down on arrival at a slaughter facility in South Carolina. Unfortunately, the carcass had been processed prior to results resulting in 13,000 pounds of beef that had to be disposed of. The EID tag in the infected animal was key in being able to trace out to 3 direct progeny (1 heifer and 2 steers). The trace also was able to determine that the cow was purchased at a bred heifer sale between 2015-16 at a Tennessee livestock market, came on a truck with 20 animals that could be traced to 5 locations. This is a true testament to the importance of animal disease traceability and the use of electronic individual identification for rapid response.

At about the same time, the World Organization for Animal Health (WOAH) adopted changes to the BSE chapter, removing atypical BSE from reporting, and investigation sampling/surveillance plan requirements. That means that atypical BSE will not impact trade negotiations, will make surveillance requirements less burdensome and will allow more opportunities to focus on those extremely rare classical cases. Because feed bans have been in place long enough to bypass the lifespan of animals that may have been exposed to the practice, surveillance efforts are being updated to reflect risk. As a result USDA APHIS has updated their BSE response plan in June 2023.

For more information and historical information on BSE, please visit the USDA APHIS website.

Images from the WOAH Website
African swine fever (ASF) is a highly contagious viral pig disease. It can spread very quickly in pig populations through direct or indirect contact. There is no vaccine or treatment available. ASF is considered a foreign animal disease in the U.S., and if detected would likely eliminate completely our entire export market for an unknown amount of time. ASF would affect the 76 million pigs in the US Swine herd and cost the United States an estimated $50 billion to eradicate. One of the biggest risk factors for introduction of ASF into the United States is the importation of the virus in smuggled meat products and garbage-feeding those products to pigs. The virus is known to persist for months.

What’s happening around the World?
Since 2021, ASF has been reported in 50 countries around the globe, affecting more than 944,000 domestic pigs and 27,000 wild boars with more than 1,450,000 animal losses (deaths + animals killed and disposed of) according to WOAH (World Organization of Animal Health). In July 2021, ASF was first reported in the Dominican Republic and Haiti, the closest the virus has been to the continental United States in decades.

In order to protect the United States commercial pork industry, USDA APHIS has been focusing on seven key areas for ASF eradication in the Dominican Republic including 1) biocontainment, 2) laboratory diagnostics, 3) surveillance design and implementation, 4) incident command, 5) biosecurity, 6) movement controls, 7) compensation. Although USDA APHIS has been able to rapidly provide expertise, diagnostic support, and funding for eradication, the virus is persisting.

The response has been plagued with political complexities, civil unrest and illegal immigration. Recent efforts to increased response personnel to mitigate illegal boat landing (IBLs) in the Dominican Republic has showcased...
concerns about illegal transportation of pork products which are likely carriers of the virus. On average, illegal boats carry 30-40 people with 30-50 pounds of pork or pork products that are known to harbor the virus. The concern here is that there are a large number of IBLs in the Northwest corner of the Dominican Republic which also has the largest concentration of active garbage feeding operations in the Dominican Republic. Currently, USDA APHIS is testing 36 garbage feeding operations every 6 months in the Virgin Islands, but it has not been enough to curb the spread.

To complicate the situation further, there are many feral/domestic swine on the loose across the Dominican Republic. Although Wildlife Services is trying to lethally remove feral swine in the country, the largest populations are concentrated in urban centers. As a result of political complexities, demographics, feeding practices and feral swine, surveillance and control activities have also been somewhat limited and extremely difficult. The situation in Haiti is likely even worse.

What is WSDA doing to prevent and prepare for ASF in Washington?

Washington is considered a small swine state with an estimated 5,000 breeding sows and approximately 18,000 exhibition swine. With the onset of COVID and the real concern about food insecurity, we saw an uptick in swine imports into the State. WSDA reports an average of 3,330 swine imports into the state per year from approximately 23 different states. Swine herd demographics in Washington are unique with large numbers of small, niche, backyard hobby farms that may have few numbers of pigs, but large numbers of premises making pigs hard to track during a foreign animal disease outbreak. Washington is also a port state with SeaTac reporting 4.4 million international travelers in 2022. The interstate movement of swine and the potential for international travelers bringing pork products into our state is a concern and WSDA has been taking steps to prevent and prepare for ASF in Washington.

1. **Prohibit garbage feeding**—Feeding meat or meat products to pigs, known as “garbage feeding” is an extremely high-risk practice for spreading both ASF and Foot and Mouth Disease. Washington will return to the legislature again this year to submit another request to prohibit garbage feeding to pigs in the state. Twenty-six other states in the country already prohibit the practice.

2. **Mandatory individual identification of Swine**—Being able to track swine movement both intra and interstate is critical to our mission to detect, contain, and eradicate diseases to protect the economic viability of swine production in Washington and across the United States. This year, WSDA updated language in 16-80 WAC Official Identification of Swine to state: “All swine that leave the farm of origin or move through a public livestock market or collection facility and all exhibition swine, must have official USDA-approved identification unless going direct to slaughter.”

3. **Increased surveillance**—Pigs with ASF can be difficult to detect as clinical signs can be nonspecific including high fever, decreased appetite, weakness, red, blotchy skin, diarrhea and vomiting, coughing and difficulty breathing. WSDA works closely with WSU Washington Animal Disease Diagnostic Laboratory, an approved National Animal Health Laboratory Network (NAHLN) member, to pay for testing for all pigs submitted with clinical signs consistent with ASF. WSDA will also respond to any reports of suspicious lesions and send a field veterinarian trained as a Foreign Animal Disease Diagnostician to do an epidemiological investigation at no cost to the producer or veterinarian.

4. **Secure Pork Supply Plans**—Both WSDA and WSU Vet Med extension are working with pork producers to develop Secure Pork Supply (SPS) Continuity of Business Plans to voluntarily prepare before an outbreak. This will better position pork premises with animals that have no evidence of infection to limit exposure of their animals through enhanced biosecurity, move animals to processing or another pork production premises under a movement permit issued by Regulatory Officials, and maintain business continuity for
the swine industry, including producers, haulers, and packers during an outbreak. Contact Dr. Craig McConnel (cmcconnel@wsu.edu) or Dr. Mindy Buswell (mbuswell@agr.wa.gov) for more information.

5. **Planning and Preparedness activities**—This year WSDA veterinarians and staff are participating in several exercises in an effort to help us plan for and be ready to detect, contain, and eradicate any detection of ASF in the state. This year we will actively participate in exercises across the spectrum of International (Feral Swine, Animal/Wildlife Health Tabletop Exercise with Canada), Interstate (Oregon African Swine Fever Tabletop and Spring Fever exercises), and Intrastate (National Pork Board – ASF functional exercise). In addition, our WSDA Emergency Response Program lead by Erin Coyle received NADPRP funding to develop, enhance, and exercise State/Tribal Animal Disease Emergency Response Plans through two efforts 1) *Foreign Animal Disease Mitigation and Response Preparedness Exercise Series* ($326,057), and 2) *Development of a Western States Agriculture Mitigation and Response Consortium* ($178,068).

African Swine Fever is likely to remain a threat for the unforeseeable future for Washington and the United States. Stay vigilant, Squeal on Pigs, and report any concerns to WSDA to protect our pigs!

Resources on ASF: WOAH, Pork checkoff, USDA APHIS

*From WOAH SITUATION REPORT 37*
WSDA: Livestock Identification Program Rulemaking Impacts
Veterinarians

By Brennan Kimbel, WSDA Livestock Identification Program Manager

The WSDA proposed to amend chapter 16-610 of the Washington Administrative Code (WAC), Livestock Identification, to align with recently enacted legislation. In April 2023, the Washington State Legislature passed Substitute Senate Bill 5439 (SSB 5439) (Chapter 46, Laws of 2023). The department proposed amending chapter 16-610 WAC to align with this recently enacted legislation by:

- Adding a statement that the $20.00 call out fee is not charged by certified veterinarians and field livestock inspectors; and
- Adding a requirement that the Livestock Identification Advisory Committee must review the costs and operations of the livestock identification program.

These changes mirror the legislation.

The Department also proposed to amend the definition of ‘Call Out Fee’ by clarifying that it is a fee charged by Department Inspectors.

The final rulemaking orders were filed on July 5, 2023. The amended regulations will become effective August 5, 2023, however the effective date of the SSB 5439 is July 23, 2023. This means that even though the amended regulations will not go into effect until August 5th, certified veterinarians and field livestock inspectors must stop charging call out fees on July 23rd.

The most current information is available on our website at https://agr.wa.gov/services/rulemaking
Additional Resources: Transition of Over-The-Counter Medically Important Antimicrobials for Animals to Prescription Status

By CS McConnel, Veterinary Medicine Extension

By now you are well aware that the FDA has finalized guidance to bring remaining approved over-the-counter medically important antimicrobial drugs used for animals under veterinary oversight. Per the FDA, the successful implementation of GFI #263 is an encouraging demonstration of the commitment of animal drug sponsors and veterinarians to support the judicious use of antimicrobials in animals. Some additional resources that you might find useful can be accessed below:

- Guidance for industry (GFI) #263: Recommendations for Sponsors of Medically Important Antimicrobial Drugs Approved for Use in Animals to Voluntarily Bring Under Veterinary Oversight All Products That Continue to be Available Over-the-Counter
- GFI #263: Frequently Asked Questions for Farmers and Ranchers
- List of Approved New Animal Drug Applications Affected by GFI #263
- Antibiotic Stewardship in Beef and Dairy Cattle - Español
- Antibiotic Stewardship in Poultry - Español
- Antibiotic Stewardship in Sheep and Goats - Español

Honey Bee Survey

By CS McConnel, Veterinary Medicine Extension

Michigan State University is working to improve training for veterinarians, veterinary students, and veterinary technicians in honey bee medicine. They have asked for your input via a short survey so that they can improve honey bee medicine training for veterinary practitioners. This survey will help them understand what veterinary practitioners need to help them work better with bees and beekeepers. This survey is part of a program between Michigan State University, University of Florida, University of Minnesota, and Texas A&M. Extension educators and specialists from these universities are working with national partners to develop better training for vets. If you have any questions or want more information, you can contact the program director: Meghan Milbrath / honeybees@msu.edu / 517-884-9518.

Survey link: https://msu.co1.qualtrics.com/jfe/form/SV_0jkawRZLnCqGD3g

WSU Ag Animal Faculty Research Updates


Abstract: Bovine respiratory disease (BRD) is a leading cause of calf morbidity and mortality, and prevalence remains high despite current management practices. Differential gene expression (DGE) provides detailed insight into individual immune responses and can illuminate enriched pathways and biomarkers that contribute to disease susceptibility and outcomes. The aims of this study were to investigate differences in peripheral leukocyte gene expression in Holstein preweaned heifer calves 1) with and without BRD, and 2) across weeks of
age. Calves were enrolled for this short-term longitudinal study on two commercial dairies in Washington State. Calves were assessed every two weeks throughout the pre-weaning period using clinical respiratory scoring (CRS) and thoracic ultrasonography (TUS), and blood samples were collected. Calves were selected that were either healthy (n = 10) or had BRD diagnosed by CRS (n = 7), TUS (n = 6), or both (n = 6) in weeks 5 or 7 of life). Three consecutive time point samples were analyzed for each BRD calf consisting of PRE, ONSET, and POST samples. Nineteen genes of interest were selected based on previous gene expression studies in cattle: ALOX15, BPI, CATHL6, CXCL8, DHX58, GZMB, HPGD, IFNG, IL17D, IL1R2, ISG15, LCN2, LIF, MX1, OAS2, PGLYRP1, S100A8, SELP, and TNF. Comparisons were made between age and disease time point matched BRD and healthy calves as well as between calf weeks of age. No DGE was observed between diseased and healthy calves; however, DGE was observed between calf weeks of age regardless of disease state. Developmental differences in leukocyte gene expression, phenotype, and functionality make pre-weaned calves immunologically distinct from mature cattle, and early life shifts in calf leukocyte populations likely contribute to the age-related gene expression differences we observed. Age overshadows disease impacts to influence gene expression in young calves, and immune development progresses upon a common trajectory regardless of disease during the preweaning period.

WSU Ag Senior Paper Highlights

1. Regenerative Agriculture: A Veterinary Guide to Integrative Control of GI Parasites in Pastured Livestock

By Emily Love (Advisor: Dr. Jennifer Sexton)

Summary: Since the organic movement, other sustainable practices have also become widespread such as regenerative agriculture. The focus of regenerative agriculture is in improving soil health and resilience through grazing. Producers commonly avoid chemical inputs not just to their land, but also in management of their livestock. Since gastrointestinal nematodes are a significant concern in pastured animal production, but anthelmintics are not an option, management practices are the primary tool for reducing parasitism. The objective of this paper is to provide information for veterinarians working with producers utilizing non-chemotherapeutic parasite mitigation. A review of integrative parasite control in pastured animals will follow with a focus on enteric nematodes in temperate climates affecting sheep, goats, cattle, and swine. Strategies explored will include grazing systems, forage utilization, and herd management.

Conclusions: In conclusion, decades of research already validate several non-chemotherapeutic strategies for mitigation of nematode infections. Even for producers willing to use traditional anthelmintics, a veterinarian’s knowledge of integrative controls can help slow the development of resistant parasites. Comprehensive understanding of GIN ecology and epidemiology paired with rotational grazing management of diverse pastures can reduce livestock exposure and boost defenses. Use of specialized bioactive forages may increase host resistance and resilience during infection, and even potentially impair developing larvae. These may be benefitted by herd systems that include selective breeding and stock selection, administration of copper oxide wire particles, and nematophagous fungi. While not comprehensive, the present report highlights important options for addressing parasitism in pastured livestock. For additional resources about sustainable and regenerative agriculture, please see the provided resources below.

Dirt to Soil: One Family’s Journey into Regenerative Agriculture; Gabe Brown (2018)
Art and Science of Grazing: How Grass Farmers Can Create Sustainable Systems for Healthy Animals and Farm Ecosystems; Sarah Flack (2016)
VetSustain; https://vetsustain.org/
Sustainable Agriculture Research and Agriculture; https://western.sare.org/
https://doi.org/10.3184/003685017X14876775256165
2. **Lop, Lop, Snip, Snip, Sizzle. That's gotta Hurt! How are we doing Managing Pain in Cattle**

By Emily Violini (Advisor: Dr. John Wenz)

*Summary:* Commonly performed painful procedures in beef and dairy calves include the practice of disbudding, dehorning, castration, and branding. Reasons to perform these procedures include concerns for human health and safety, ensuring carcass value, legally binding animal identification, and managing herd dynamics. There are many ways to perform each procedure, each with its list of pros and cons. The sum of discussion is that the methods we use to brand, castrate, and dehorn/disbud our bovines are all painful in some way or form. Consensus statements from both the American Veterinary Medical Association (AVMA) and American Association of Bovine Practitioners (AABP) are that they should be performed at the earliest age possible and should be performed with adequate analgesia. Despite these recommendations, using analgesia for these procedures varies in compliance. Access to analgesia is limited to producers due to the lack of FDA approved drugs for the control of pain in food animals. There is currently only one drug with a label for the use of pain management in calves, and all other drugs are considered extra label drug use (ELDU). ELDU requires more veterinary oversight and the establishment of proper protocol to ensure the withdrawal times are followed. This is just one barrier to proper analgesia implementation, including cost, producer perceptions of pain, and the logistics/timing of drug administration. While the administration of adequate analgesia may seem to lie solely in the hands of producers, a review of the problem reveals a multifaceted issue that lies at the junction of government, veterinarian, and producer. As food animal veterinarians, we are compelled to utilize our knowledge and expertise to break down these barriers in order to ensure the welfare of our patients while maintaining a safe and secure food supply.

*Conclusions:* While the administration of adequate analgesia may seem to lie solely in the hands of producers, a review of the problem reveals a multifaceted issue that lies at the junction of government, veterinarian, and producer. Food animal veterinarians are compelled to utilize our knowledge and expertise to break down these barriers in order to ensure the welfare of our patients while maintaining a safe and secure food supply. The lack of economic incentives are a difficult barrier to the implementation of adequate analgesia for our patients, but the social benefits in the eyes of the consumer are invaluable. Methods for low-cost, effective analgesia exist and utilizing those should be the standard for all food animal veterinarians. By making analgesia a part of the standard of care an example can be set for producers, creating an industry that shows that it values animal welfare in all stages of life. Food animal veterinarians assume the duty as advocates for their patients, as well as ensuring safe and secure food supply.

3. **Common Diseases in Backyard Flocks: Laying Hens**

By Paloma Beyer (Advisor: Dr. Marcie Logsdon)

*Summary:* More and more families across the United States are deciding to raise their flock of birds for egg production. The experience level of these bird raisers varies, from the experienced small farmers to families that have never been around livestock. Compared to the commercial industry, producer expectations, goals, and biosecurity levels differ in a backyard flock. The human-animal bond varies among different flocks. Some have a mixed view of their chickens as pets and livestock, while many others see them more as pets that also provide eggs. Most common diseases these birds may face are related to improper management or biosecurity.

*Conclusions:* The common thread among all these diseases is that prevention strategies are better than treatment, which typically entails good biosecurity, cleanliness, and management. Unfortunately, there is a wide range of biosecurity, management, and sanitation practices among backyard poultry owners. And they are not typically seeking out veterinary professionals for preventative care advice before their chickens become ill. Chickens are a vital part of the food animal industry, and backyard flocks are at risk of becoming a reservoir of disease that can potentially affect the commercial industry. Therefore, veterinary professionals need to be well informed and better prepared to communicate with owners of backyard chickens.
4. Differential Gene Expression in Peripheral Leukocytes of Pre-Weaned Holstein Heifer Calves with Respiratory Disease

By Lily Elder (Advisor: Dr. Craig McConnel)

Summary: Bovine respiratory disease (BRD) is a leading cause of calf morbidity and mortality, and prevalence remains high despite current management practices. Differential gene expression (DGE) provides detailed insight into individual immune responses and can illuminate enriched pathways and biomarkers that contribute to disease susceptibility and outcomes. The aims of this study were to investigate differences in peripheral leukocyte gene expression in Holstein preweaned heifer calves 1) with and without BRD, and 2) across weeks of age. Calves were enrolled for this short-term longitudinal study on two commercial dairies in Washington State. Calves were assessed every two weeks throughout the pre-weaning period using clinical respiratory scoring (CRS) and thoracic ultrasonography (TUS), and blood samples were collected. Calves were selected that were either healthy (n = 10) or had BRD diagnosed by CRS (n = 7), TUS (n = 6), or both (n = 6) in weeks 5 or 7 of life). Three consecutive time point samples were analyzed for each BRD calf consisting of PRE, ONSET, and POST samples. Nineteen genes of interest were selected based on previous gene expression studies in cattle: ALOX15, BPI, CATHL6, CXCL8, DHX58, GZMB, HPGD, IFNG, IL17D, IL1R2, ISG15, LCN2, LIF, MX1, OAS2, PGLYRP1, S100A8, SELL, and TNF. Comparisons were made between age and disease time point matched BRD and healthy calves as well as between calf weeks of age. No DGE was observed between diseased and healthy calves; however, DGE was observed between calf weeks of age regardless of disease state. Developmental differences in leukocyte gene expression, phenotype, and functionality make pre-weaned calves immunologically distinct from mature cattle, and early life shifts in calf leukocyte populations likely contribute to the age-related gene expression differences we observed. Age overshadows disease impacts to influence gene expression patterns in young calves, and immune development progresses upon a common trajectory regardless of respiratory disease.

Conclusions: Nineteen genes that are candidate biomarkers of inflammatory disease in postweaned and adult cattle were not differentially expressed in pre-weaned Holstein heifer calves with BRD. However, differential expression was observed relative to calf age between three and nine weeks of life. Factors related to age and immune system development overshadow disease impacts to influence gene expression patterns in young calves, and immune development progresses upon a common trajectory during the preweaning period regardless of respiratory disease.

https://doi.org/10.1371/journal.pone.0285876

5. Regulatory Involvement Throughout Highly Pathogenic Avian Influenza Outbreak

By Claire Stein (Advisor: Dr. Craig McConnel)

Summary: Avian Influenza (AI) is a viral infection that circulates among wild birds. The United States Department of Agriculture (USDA) considers the disease a Foreign Animal Disease when it becomes recognized in domestic poultry as a highly pathogenic strain, causing mortality in greater than 75% of poultry. The virus is spread across migratory flyways by wild birds, increasing infections across both wild and domestic bird populations. A presumptive or confirmed positive sample among domestic birds must be reported to the appropriate animal health authority, the State Veterinarian. The facility becomes an infected premises by definition of a confirmed positive result and is dealt with according to USDA guidelines. Guidelines include quarantine, rapid depopulation, cleaning/disinfecting (or 120-day fallow), and surveillance. The effort to contain the virus and prevent further spread is coordinated between the State and USDA. Strict biosecurity is the most effective method to avoid exposing poultry to the virus. Biosecurity practices include both structural boundaries and operational protocols such as footbaths and handwashing. Vaccination is rarely used as a method to prevent illness in poultry, as there is not yet an effective way to determine between infected and vaccinated birds. Many United States trade partners that import poultry or poultry products typically require poultry to be unvaccinated for this reason. Avian Influenza outbreak in domestic flocks has a range of impacts, including possible zoonoses, threat to wildlife, and major US trade markets.
Conclusions: The impact of Avian Influenza is extensive. It has potential to impact global trade, market prices, commercial business, and human, avian, and wildlife health. Due to this, domestic poultry with symptoms of Avian Influenza warrant a thorough investigation, which is far beyond the scope of an individual clinician. State and Federal agricultural agencies have the highest authorities during a disease investigation, and it is their responsibility to control the disease for the sake of trade and health. It is also the responsibility of these agencies to prevent the entrance of a Foreign Animal Disease into the US. HPAI is preventable with enhanced biosecurity practices. Measures such as development of an effective DIVA (Differentiate Infected from Vaccinated Animals) vaccine may be necessary in the future as AI becomes more endemic.

6. Comparative Diagnoses of Respiratory Disease in Preweaned Dairy Calves Using Sequential Thoracic Ultrasonography and Clinical Respiratory Scoring

By Holly Hinnant (Advisor: Dr. Craig McConnel)

Summary: Bovine respiratory disease (BRD) has serious impacts on dairy production and animal welfare. It is most commonly diagnosed based on clinical respiratory signs (CRS), but, in recent years, thoracic ultrasonography (TUS) has emerged as a diagnostic with improved sensitivity and specificity. In this study, 60 calves on two farms were followed from the 2nd week of life through the 12th week of life and assessed on a weekly basis for lung consolidation on ultrasound and CRS. Data points were then grouped based on progression of disease seen on TUS and alignment with CRS was assessed. Receiver operator curves and area under the curves were combined with Cohen’s kappa, sensitivity, and specificity to assess alignment of CRS against TUS consolidation. This study aimed to look at the dynamics of lung consolidation seen with TUS and alignment with CRS on a week-by-week basis. Furthermore, it aimed to assess how severity of lung consolidation impacts CRS alignment. Results showed that CRS aligned best with TUS lesions that were considered lobar (TUS score ≥3, lesion >1cm wide and full lobar thickness) and were at the onset of consolidation (first week seeing consolidation). There was an acceptable level of discrimination for this comparison (AUC=0.76), and fair agreement (kappa=0.28) with a sensitivity of 39% and specificity of 93%. Alignment dropped slightly with addition of less severe consolidation (TUS score=2, consolidation >1cm wide but not full lobar thickness) to acceptable discrimination (AUC=0.71), fair agreement (kappa=0.27), sensitivity of 30% and specificity of 94%. Overall, CRS showed fair agreement and acceptable discrimination at best, though this alignment decreased as consolidation became chronic or recovered. This indicates that CRS may not be an accurate representation of the true amount of BRD present in pre-weaned dairy heifers.

Conclusions: The major finding of this study was that the best alignment between CRS and TUS was at onset of lobar consolidation determined by TUS (AUC=0.76, kappa=0.28, Se=39%, Sp=3%). Even though this is the best alignment found in the study it is still only acceptable discrimination per the AUC and fair alignment per the kappa, indicating that CRS does not provide a representative snapshot of BRD in a population. Additionally, this study found that there was a slight decrease in alignment when lobular consolidation (TUS=2) was included in the diseased population (AUC=0.71, kappa=0.27, Se= 0.30, Sp=0.94).

Continuing Education

2. WSU Veterinary Continuing Education Fall Conference. Pullman WA. November 11, 2023. 3 CE credits available. In-person or online.
3. WSU Veterinary Continuing Education Spring Conference. Pullman WA. March 22-24, 2024. 12 CE credits available. In-person only.
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Send newsletter comments to the Editor: ag animal health
Veterinary Medicine Extension - Washington State University
P.O. Box 646610
Pullman, WA 99164-6610
(509) 335-8221 VetExtension@vetmed.wsu.edu

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