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ag animal health *is devoted to the transfer of current, relevant information to food animal owners and veterinarians in the Pacific Northwest.*

From the Editor – Happy Spring! This will be my last time as editor of this newsletter. I am heading out to pasture at the end of June and letting Dr. McConnel create something with his own flair.

It has been a pleasure serving the ag animal owners, veterinarians, Extension educators, 4H, industry groups, state veterinarian's office, and students interested in agriculture with Extension programs, information and outreach. From Beef Quality Assurance, BVDV, *E coli* myth busting, dairy cow lameness, biosecurity, calf care audits and ventilation assessments, dairy genomics, drug residue avoidance, antimicrobial resistance and stewardship, and dairy farm communication, my 14 years at WSU has been rich with research and relationships. Special thanks go to the farmers and veterinarians who invited me in to see their cattle--critters I have adored since working on a small dairy in Custer, WA in 1978. Good-bye all!

Dairy: Disease Detection in Calves is Hard!

By Dale A. Moore, WSU Extension Veterinarian

Over the course of many research studies of calves on dairy farms in the last 20 years, we have made the conclusion that disease detection for pre-weaned calves can be difficult. We published a paper in 2019 (Olson et al., 2019) looking at the differences in disease detection in pre-weaned calves on 4 farms between calf caretakers and a veterinarian. We also published results of a study looking at the differences between calf disease diagnosis compared to what was found at necropsy (McConnel et al., 2019). This means that what was seen in calves that was treated was often different from the diagnosis made at post-mortem. We also examined how changing antimicrobial use policy for calf treatment can impact resistant bacteria grown from calf feces (Afema et al, 2019). Survey results about calf care personnel and their educational opportunities (Sischo et al.,

2019) revealed that the training for calf caretakers is mostly done by co-workers or middle management on the dairy and that there is an opportunity for the health professional (veterinarian) to help train caretakers on disease diagnostics in addition to treatment protocols.

In a paper just published (see abstracts below – O'Keefe et al. 2021), and one soon to be submitted (Slanzon et al., *In Progress*), we highlight the difficulty of truly identifying sick calves as well as promote a different classification of gastrointestinal (GI) disease that appears to also be associated with the microbiota of calves. This classification scheme has an impact on the need for antimicrobials for treatment of GI disease.

If you were to look at calves every day, or even twice a day, for signs of diarrhea, particularly if the calves are on nice, fluffy bedding, you may not be able to discern if their feces are watery or not. You might be able to see soiling around the rear, something on the calf hutch wall, or nothing. Also, we recognize that feces can have different consistencies, categorized as fecal scores from 0 to 3, where a fecal score of 0 = normal consistency, 1 = semiformed or pasty, 2 = loose feces, and 3 = watery feces; calves with a fecal score of 2 or 3 are classified as having diarrhea. But even if you do see the diarrhea (in current studies we take a rectal sample to see for ourselves) you might be lucky because diarrhea is intermittent, and consistency is on a scale with a lot more gradation. We are now determining the dry matter percent of the feces in research trials.

The intermittence of diarrhea has to do with the fluid intake of the calves. If they are not drinking or eating there will not be consistent fluid loss into the feces because there is not much left to lose and there is no substrate for the feces to form.

In addition to finding signs of diarrhea this condition is caused by different pathogens that are reacted to differently by the calves' GI track. Some calves have runny feces but have normal attitudes and appetites. Some calves have runny feces and they have stopped drinking their milk or are slow to eat and are "droopy" or spend a lot of time lying down. All these calves, if suspected to have diarrhea, are traditionally treated the same, they may get oral electrolytes, maybe bismuth and almost always get treated with an antimicrobial.

But the question is: does every calf with GI disease need an antimicrobial? Based on the research, distinguishing between calves that have signs of diarrhea but are bright, alert and still eating and calves that have signs of diarrhea but are dull, depressed and/or are not drinking their milk fully could lead to the need for different treatment protocols.

Every calf with suspected diarrhea needs to get more fluids and oral electrolytes each day they have diarrhea because they are losing fluids in their feces. We found in several studies that there was an opportunity to treat more calves with oral electrolyte solutions as the first treatment. Instead, an antimicrobial was usually the first treatment. Calves that have diarrhea and have a sign of being more severe or systemically sick, not eating and/or dull and depressed, might benefit from parenteral antibiotic therapy because of the chance for overgrowth of *E coli* in the intestine and to prevent or treat septicemia. But, assigning these two different treatment regimens requires training.

To summarize, there are 4 main conclusions from our research: (1) Diagnosis of calf disease conditions so that appropriate treatment is applied requires more careful examination so as to not misclassify the calves; (2) There is ample opportunity for training on disease detection as well as treatment protocols; (3) There is an opportunity to improve the use of oral electrolyte solutions as well as reduce antimicrobial use; and (4) There is an opportunity to follow-up on disease diagnosis and treatment protocols with calf necropsies to validate the treatments being given.

Cattle: Considerations Regarding Microbial-based Probiotics and Prebiotics for Cattle

By Craig McConnel, WSU Extension Veterinarian

Dr. Chris Chase from South Dakota State University wrote an interesting article in 2018 entitled Enteric Immunity: Happy Gut, Healthy Animal (Vet Clin Food Anim. 34. 2018). The article highlights that the gastrointestinal (GI) mucosa is the largest organ of the immune system and begins development in the fetus; however, it does not become functional until epithelial cells of the mucosa in the neonate interact with microorganisms (microbiota) and/or their products in the gut lumen. This interaction between the epithelial cells and the microbiota is necessary for immune system maturation, regulation, and maintenance of homeostasis. As the calf develops there is a succession of microbes as the gut transitions to an anaerobic environment. Nutrition, stress, and the environment influence microbial succession and the eventual development of a community that helps protect the animal by improving GI mucosal barrier and immune function. Consequently, understanding the complexity of the gut microbial ecosystem is essential if we are to understand the impacts of major microbial population shifts due to stressors such as weaning, co-mingling and abrupt dietary changes.

The microbiota is readily changeable by diet, ingestion of antibiotics, infection by pathogens, and other life events. Stress can lead to dysbiosis (the loss of beneficial bacteria and an overgrowth of harmful organisms) and the resultant depletion of an epithelial cell mucous layer called the “kill zone” that forms a functional barrier against pathogens. As the mucous layer of the “kill zone” becomes thinner the barrier weakens allowing pathogens to interact with the mucosa and cause disease. In addition, there is a reduction in commensal organisms that help maintain an anti-inflammatory environment with resultant pro-inflammatory responses further weakening the gut epithelium. Similarly, antibiotics also can induce a dysbiotic state that impacts gut immunity and the incidence of disease. In fact, it can take weeks to months to return the GI microbial populations back to normal following antibiotic treatment.

Maintaining a stable microbiome is essential for good health and production. As a result, manipulation of the gut microbiota by feeding probiotics or prebiotics has been widely studied in livestock as a strategy to improve production and health. Probiotics are defined as live strains of strictly selected microorganisms which, when administered in adequate amounts, confer a health benefit (e.g., decrease in diarrhea incidence) on the host. Prebiotics are defined as substrates that are selectively used by host microorganisms, conferring a health benefit to the host. Compared with probiotics, prebiotics are nonviable substrates that serve as nutrients for healthy microbes (e.g., lactic acid-producing bacteria and *Bifidobacteria*) and can be used to defend against pathogens and modulate the immune system. It is worth noting that although “prebiotics” has been a term used for the past few decades, the definition of what constitutes a prebiotic has evolved. New terms such as paraprobiotic or postbiotic have emerged to denote that non-viable microbial cells, microbial fractions, or cell lysates might also offer physiological benefits to the host by

providing additional bioactivity (Aguilar-Toalá et al., Trends in Food Science & Technology. 75. 2018).

A recent Invited Review in Applied Animal Science (Cangiano et al., 2020) synthesized available peer-reviewed literature describing the effects of pro- and prebiotics on gut health, function, and disease prevention during early life and at weaning in dairy calves. Young preruminants can be supplemented with probiotics in milk or starter feed to promote gut health, stimulate earlier solid feed consumption, and improve growth. The most commonly used probiotics fed to young calves are live yeast, mainly *Saccharomyces cerevisiae* (SC), yeast cultures of SC, and bacterial-based probiotics such as *Lactobacillus* spp., *Enterococcus* spp., and *Bacillus* spp. The most significant effects on growth and performance from supplementation with yeast or bacterial-based probiotic products during the preweaning phase were found when they were included in the diet of animals during stressful periods (e.g., high diarrhea incidence). Similarly, the most consistent response of supplementation with yeast cultures, live yeast, and bacteria-based probiotics on health has been a reduction in the incidence and severity of diarrhea through the modulation of gut mucosal immunity, improved gut barrier integrity, regulation of the inflammatory response, and the prevention of pathogenic bacteria from binding to intestinal epithelial cells.

The most commonly used prebiotics fed to calves are oligosaccharides (OS) and ß-glucans. Cangiano et al., (2020) evaluated studies of fructooligosaccharides, galactoooligosaccharides, mannanoligosaccharides, cellooligosaccharides, ß-glucans, and other prebiotic compounds (e.g., lactulose and ß-cyclodextrin) and surmised that there are no prebiotics boasting substantial evidence of positive effects on calf growth, health, or immune status. In addition, the mechanisms of action for these prebiotics are severely understudied, with the main connection to any positive health benefit currently stated as “prebiotics promote growth of beneficial bacteria.”

Overall, the authors concluded that based on current studies investigating supplementation with pro- and prebiotics, most study responses in growth, feed efficiency, and health have either been nonsignificant (39/68, 32/70, and 15/68, respectively) or positive (22/68, 9/70, and 31/68, respectively). The results highlighted that health and growth were the outcomes most positively affected by supplementation and that most of the beneficial effects were observed when these products were supplemented during a bout of illness. Overall, it appears that pro- and prebiotic supplementation to calves is low risk with potentially positive benefits that are worthy of further investigation to fully understand mechanisms and develop formulations that contain combinations of direct-fed microbials for different applications and age groups.

Beef: What Affects the Stress of Transport in Beef Cattle?

By Dale Moore, WSU Extension Veterinarian

We know that weaning and transportation are stressful events for beef calves and that this stress can affect calf immunity. As a result, the most likely time to develop Bovine Respiratory Disease is in the first 21 days of arrival to the feedlot or stocker operation. But, what if weaning and transportation are done close together in time? Or, what if calves are preconditioned first before transport?

A recently-published study from Canadian investigators (Melendez et al., 2021) examined the effects of conditioning, source or calves, and rest on the road on indicators of stress in weaned beef cattle being transported long-distances. In Canada, regulations require that weaned cattle are rested (fed and watered) for 8 hours after a 36-hour transport. The US has a 28-hour law with a 5-

hour rest period that includes water and feed. Thus, the transport time as well as rest time can be different from country to country. In addition, there is little consistency in results of previous studies on rest periods and little information on what other factors might impact animal welfare during and after transport.

The Canadian investigators looked at various conditions that might impact stress on 320, 7 to 8-month old Angus cross calves sourced from two locations. Calves were (pre) conditioned or not, sourced from an auction or ranch-direct, and provided 0 or 8 hours of rest after 36 hours of travel by truck. Conditioning occurred 20 to 21 days before the long haul and consisted of two groups of calves that were weaned and moved 1 hour away. Calves were then processed with a 7-way clostridial vaccine, 5-way respiratory vaccine, given a tulathromycin antibiotic injection and dewormed. For the 3 weeks after processing, they were housed in groups of 40 and fed corn silage, alfalfa hay and barley supplemented with minerals and vitamins. After 3 days they got mostly a corn silage and barley ration. Forty non-conditioned calves were mixed with the conditioned ones prior to long-haul. Conditioned and non-conditioned calves were sampled and transported 20 minutes to an auction market and the remaining calves were considered as “ranch direct” calves. For the exquisite details of their complicated study methods, see their paper.

Weight and rectal temperature were recorded from all calves and a subset of 12 calves per treatment (3 calves per pen) were sampled for physiological and behavioral indicators of welfare prior to long haul and after unloading for the 36 hour transport, and prior to the next leg and after unloading. In addition, calves were sampled on day 1, 2, 3, 5, 14 and 28 after unloading at their destination.

The major finding of this complicated study was that non-conditioned calves had greater physiological and behavioral indicators of reduced welfare compared to conditioned calves. Conditioned calves ate more after arrival on days 0, 1, and 2 but there were inconsistent results after that. Non-conditioned calves had higher indicators of body fat depletion (NEFA concentration in the blood) than conditioned calves. Serum amyloid concentration was also higher in non-conditioned calves representing an indicator of stress, inflammation, infection or trauma, as were creatinine kinase concentrations in the blood, indicating muscle fatigue.

They concluded that conditioning before transport can improve cattle welfare, based on the indicators they evaluated, and that auction markets should offer feed to cattle to minimize stress before they are transported again. Rest did not consistently affect welfare, likely because there are many other factors, such as conditioning, that can affect stress after transport.

Reference

Melendez DM, Marti S, Haley DB, Schwinghamer TD, Schwartzkopf-Genswein KS. 2021 Effects of conditioning, source, and rest on indicators of stress in beef cattle transported by road. PLoS ONE 16(1): e0244854. https://doi.org/10.1371/journal.pone.0244854

Sheep: What Impacts Lamb and Ewe Survival After a C-section?

By Dale Moore, WSU Extension Veterinarian

Abnormal delivery of lambs is common in sheep. Sometimes, the lamb cannot be delivered vaginally so a C-section is required. What are the possible consequences of a C-section in ewes? Data from cases in a German veterinary teaching hospital with owner follow-up were used in a

retrospective cohort study (Voigt et al., 2021) to evaluate the outcomes of ewe and lamb survival and subsequent reproductive performance in the ewes after a C-section.

Their paper highlighted that the primary causes of dystocia requiring a C-section in the 212 ewes they studied was inadequate cervical dilatation (44%), uterine torsion (24%), and big lambs (15%). For a great review of what can go wrong in lambing, see the manuscript.

Overall survival rate among ewes was 90%. The major predictors of ewe mortality after C-section included the presence of post-surgical complications (retained placenta, incisional swelling, and infection) that increase the risk for mortality by two times and a history of another disorder prior to C-section that increased the risk for mortality by almost four times. The different risks for developing post-surgical complications were all compared to insufficient cervical dilatation. The two most important risks included poor general condition or metabolic condition in the ewes (32 times greater risk), fetal maldisposition (9 times greater risk), and vaginal prolapse during pregnancy (4 times greater risk).

Over 350 lambs were delivered by C-section. About 50% were stillborn, died or were euthanized in the first few days of life. In a multivariate model, the most important risks for lamb mortality (compared to insufficient cervical dilatation) were fetal malformation, lesions due to vaginal prolapse, and duration of labor greater than 12 hours.

Follow-up information was available for 156 ewes. All those with a history of vaginal prolapse were culled. Of the 89 rebred, 83 were confirmed pregnant and 65 lambed with no complications.

As a result of their study, the investigators confirmed that culling ewes with vaginal prolapse is still advisable. They also concluded that future reproduction does not seem overly compromised following C-section. Pre-existing and concurrent conditions of the ewe influenced mortality while prolonged lambing was influential in lamb survival after C-section. Early intervention, whether for treatment of metabolic conditions in ewes, or identifying dystocias early, are important for both ewe and lamb survival.

Reference

Viogt K, Najm NA, Zablotski Y, et al. Factors associated with ewe and lamb survival, and subsequent reproductive performance of sheep undergoing emergency caesarean section. Reproduction of Domestic Animals. 2021;56:120-129.

Swine: Reviewing Recommendations to Prevent Disease Transmission from Feed

By Dale Moore, WSU Extension Veterinarian

Strategies to reduce the risks of disease transmission from swine feed were reviewed by investigators from Kansas State University in a paper published last year. It is worth looking at their summary recommendations because recent outbreaks have highlighted the role that feed can play in pig outbreaks of porcine epidemic diarrhea virus as well as the potential introduction of African Swine Fever virus. Their summary recommendations included 4 major points:

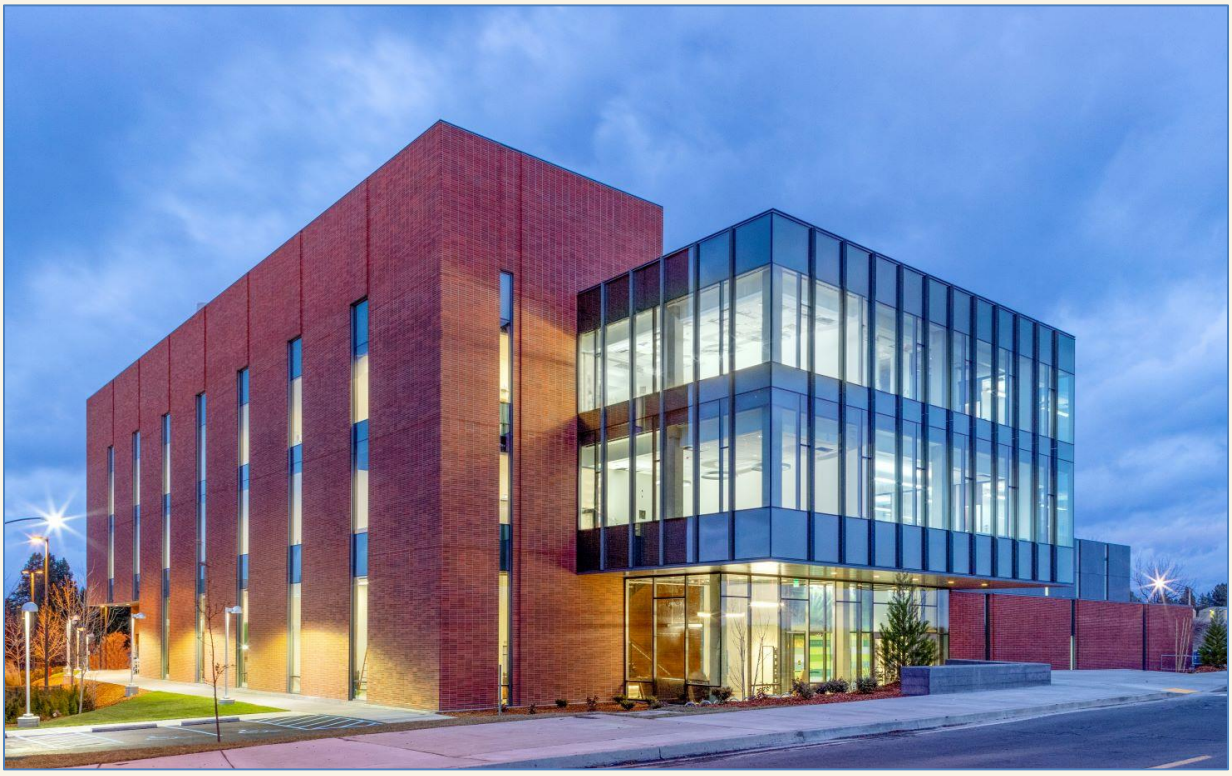
(1) The feed manufacturer has a role. They need to assess the potential risks of hazards from materials they bring in as well as distribute to customers.

(2) The feed manufacturers need to define protocols to address entry of potentially hazardous ingredients, including the ingredients themselves and people and equipment.

(3) The feed manufacturers should develop mitigation strategies to prevent risks for each type of hazard in the mill.
(4) The feed mill should have outlined decontamination procedures.

We also know that everyone in the industry has a role to play, include pig owners. For Secure Pork Supply continuity of business plans, see SecurePork for information for both pig owners as well as veterinarians. Their major points are that before an outbreak occurs, they need to have a plan to limit exposure of pigs to potential pathogen, develop a disease surveillance program, and maintain movement records. Doing all these things keeps the pork supply safe.

New WADDL Building is Open for Business!



The Washington Animal Disease Diagnostic Laboratory (WADDL) has been housed in WSU's Bustad Hall in Pullman, WA since 1978 (the program also contains the Avian Health Laboratory, on the campus of the Western Washington Regional Extension Center in Puyallup, WA). The following year, it became the first laboratory in the western US to achieve accredited full-service laboratory status under the auspices of the American Association of Veterinary Laboratory Diagnosticians, and it's been re-accredited continuously since. The lab provides bacteriology, parasitology, pathology, serology, toxicology (through the Analytical Sciences Laboratory, University of Idaho), and virology services. Its services cover all of Washington State, much of Idaho and the Pacific Northwest, plus Alaska and Hawaii. Not only does WADDL serve the private sector, it also provides support for the WSU veterinary teaching hospital, university herds and flocks, WSU laboratory animal programs, and the Field Disease Investigation Unit (FDIU).

And now WADDL has new digs! The university in 2018 approved plans for the Global Animal Health Phase II Building (GAH2), a new wing on the Paul G. Allen School for Global Animal Health, to accommodate the WADDL program and its modern biosecurity and workflow needs. The site

contains diagnostic laboratories, research and development laboratories, and an instructional laboratory utilized by veterinary students, post-DVM and other health professionals, and both graduate and undergrad students.

The new building has a new access from Olympia Drive, off Grimes Way on the Pullman campus by the Allen Center and is accepting clients to this site (by the time of this publication). For more information, go to the WADDL website: https://waddl.vetmed.wsu.edu/

WSU Ag Animal Faculty Research Updates

1) D.A. Moore, C.C. Blackburn, J.A. Afema, D.R. Kinder, W.M. Sischo. Describing motivation for health and treatment decisions and communication choices of calf-care workers on western United States dairies. Journal of Dairy Science. 2021;104(3):3197-3209. https://doi.org/10.3168/jds.2020-18669

On large dairy farms, animal health assessments and treatments are made by farm employees. Little is known about how employees make decisions about illness detection or treatment, information critical to improving antimicrobial stewardship. The objectives of this study were to describe calf-care employee motivations for decisions associated with preweaned calf health and treatments, describe on-farm worker communication networks, and determine information sources used by these employees to support their decisions. Personal interviews were conducted with 103 calf-care employees on 28 farms in the western United States. The interview consisted of 10 motivation source type (MST) questions and questions about training, communication and educational opportunities. A latent class analysis created a summary for MST and resulted in 4 classes. Forty-three percent of calf-care employees fell into a class where responses were a combination of internal and intrinsic (personal beliefs or values and task fulfillment, respectively) and 23% were a combination of internal and goal internal (aligned with organizational goals). This latter class aligned health decisions with internal motivation and treatment decisions with goal internal. A network analysis summarized dominant communication relationships and established that feeders and treaters perceived more communication with supervisors than was reciprocated by supervisors, and that there was less communication between workers and management for tasks relative to daily work. Employee training was primarily done by herdsman, calf manager, or coworkers, and information for skill improvement and problem solving was sought from these individuals. Although veterinarians were not often involved in employee training, when they were involved, employees were likely to use them as an information source for skill improvement and problem solving. Few participants had ever used social media, but almost all had a device that could access the internet; more than 60% indicated interest in a social media platform for work-related information. Work motivation for many calf caretakers appeared to be sourced from personal beliefs, values, and job fulfillment, particularly when deciding to treat a sick calf. Investigation and incorporation of beliefs and values in training programs could help with alignment of protocols with actual treatment and further efforts to implement judicious use of antimicrobials.

2) Olivia Char O'Keefe, Dale Ann Moore, Craig S. McConnel, William Sischo. Parenteral antimicrobial treatment diminishes fecal Bifidobacterium quantity but has no impact on health in neonatal dairy calves: Data from a field trial. Frontiers in Veterinary Science. 31 March 2021. https://doi.org/10.3389/fvets.2021.637271

There is evidence that neonatal calves are over treated with antimicrobials that may disrupt colonization of their gastrointestinal tract (GIT) microbiota. The study objectives were to assess the decision-making process of antimicrobial use on a commercial dairy and impacts of parenteral antibiotics on dairy calves' GIT Bifidobacterium and calf health. Unhealthy pre-weaned dairy calves were enrolled based on farm personnel identification with age-matched healthy calves. Half the calves in each group were treated with IM ampicillin and half were given supportive therapy as needed. Health scores (appetite, fecal consistency, attitude, and temperature) were recorded twice daily throughout the study. Based on objective clinical observations plus fecal dry matter, the 121 enrolled calves were reclassified into 3 health categories: healthy, uncomplicated diarrhea (bright attitude and good appetite but with diarrhea), and sick. This resulted in 6 post enrollment health categories. Calves were followed for 14 days post-enrollment and fecal samples collected at 6 time points. Bifidobacterium was quantified using quantitative PCR from fecal samples collected throughout the study. The objective criteria for disease definition reclassified many "unhealthy" calves as uncomplicated diarrhea. Including all calves, on average, the quantity of Bifidobacterium decreased from the day of enrollment (median 8 days of age) across time to 14 days post-enrollment. Calves given an antibiotic the day of enrollment had a greater decrease in Bifidobacterium 4 and 9 days later relative to enrollment Bifidobacterium compared to untreated calves. Sick calves or those with uncomplicated diarrhea at enrollment were more likely to have low Bifidobacterium counts on that day and if classified as sick at enrollment to be categorized as sick or uncomplicated diarrhea 4 days later following a 3-day treatment protocol. Our results indicate that relying on farm personnel to identify morbidity may lead to some clinical misclassification. There was no indication that antimicrobials affected subsequent health outcomes. These results highlight the importance and difficulty in assigning appropriate illness classification on farms and point to a need to develop better point of care diagnostics to help the industry improve stewardship of antimicrobials and mitigate their effect on GIT flora..

3) Dale A Moore, Craig S McConnel, Roselle Busch, William M Sischo. Dairy veterinarians' perceptions and experts' opinions regarding implementation of antimicrobial stewardship on dairy farms in the western United States. Journal of the American Veterinary Medical Association. 2021;258(5):515-526. DOI: 10.2460/javma.258.5.515

Objective: To explore veterinarians' perceptions and veterinary experts' opinions regarding antimicrobial stewardship (AMS) on dairy farms in the western United States.
Sample: 20 dairy veterinarians and 9 AMS experts.
Procedures: 3 focus group discussions involving 20 dairy veterinarians from California, Idaho, and Washington and an expert opinion study involving 9 North American AMS experts were conducted. During focus group discussions, participants were asked open-ended questions regarding implementation of AMS programs on dairy farms. Discussions were recorded and transcribed for thematic analysis. An asynchronous nominal group process was used for the expert opinion study. Participants were asked to complete a series of 3 online surveys consisting of open-ended questions. Expert opinion data underwent thematic analysis and were compared with results obtained from focus group discussions.
Results: Veterinarian-perceived barriers to implementation of AMS on dairy farms included variable relationships with clients and farm employees, ensuring AMS provided value to the farm, and uncertainty about regulations for monitoring on-farm antimicrobial use (AMU). Veterinarians were willing to accept additional responsibility for AMU provided that protocols were adopted to ensure them more complete control of on-farm AMU and they were compensated. The AMS experts indicated that effective implementation of AMS on dairy farms requires producer buy-in and tools to facilitate treatment protocol development and monitoring.
Conclusions and clinical relevance: Additional veterinary oversight of AMU on dairy farms will require engagement by both veterinarians and producers and practical value-added methods for

AMS. Continuing education programs should address treatment protocol development, AMU monitoring strategies, and employee training.

Continuing Education

Veterinarians

Academy of Dairy Veterinary Consultants Spring Meeting April 9-10, 2021.
https://academyofdairyveterinaryconsultants.org/

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Veterinary Medicine Extension - Washington State University
P.O. Box 646610
Pullman, WA 99164-6610
(509) 335-8221 VetExtension@vetmed.wsu.edu