Refining Receiving Protocols

Emerging diagnostic tools could allow more targeted, efficient and effective treatment decisions for shipped cattle.

BY JOHN MADAY

> *"Metaphylaxis is the only thing we do at initial feedlot processing that has consistently shown to improve health outcome in medium-and high-risk cattle."* —John Richeson, Ph.D.

While predicting disease risk in a group of cattle is relatively reliable for experienced cattle feeders, predicting risk in individual animals presents a much greater challenge. Veterinarians and industry partners continue to develop ways to predict risk or detect early signs of disease in individual cattle for more targeted treatments.

Today, emerging chute-side technologies for detecting the earliest signs of respiratory disease have potential to help move the industry toward a goal of more individualized management.

At the recent Academy of Veterinary Consultants (AVC) conference, West Texas A&M Animal Scientist John Richeson, PhD, discussed how new chute-side diagnostic tools may help cattle feeders assess morbidity risk for individual cattle upon arrival, potentially reducing antibiotic use in mass treatments while improving health outcomes. Advanced Animal Diagnostics (AAD) hosted the breakfast presentation.

Metaphylaxis, Richeson says, describes the timely mass medication of a group of animals to minimize an expected outbreak of disease. According to USDA data, about 92 percent of high-capacity feedlots use metaphylaxis in at least some pens of calves upon arrival. Metaphylaxis is, he says, "the only thing we do at initial feedlot processing that has consistently shown to improve health outcome in medium-and high-risk cattle,"

Targeted metaphylaxis, Richeson says, is an alternative disease control strategy applied at the individual animal level, using risk metric as decision tools. Measurement of those metrics must, however, be rapid, repeatable and accurate (but not perfect) and must produce return on investment (ROI).

Richeson notes that for BRD control studies, the median number of animals that need to be treated metaphylactically to prevent one acute case of BRD is five, according to Kansas State University research. So in a 100-head truckload administered metaphylaxis, only 20 head, on average, have a clinical benefit from the practice.

Summary of targeted metaphylaxis strategies

Method:	PROS	CONS	Potential BRD prediction?
Chute order	No test cost or time cost	No pattern, poor Se/Sp	NO
Bulls vs. steers	No test cost and low time cost	Unbalanced in high-risk loads (80%+ bulls)	YES
Leukocyte profile	Good potential for BRD prediction, real-time, research underway	Consumables and blood collection required, time cost	YES
BW quartile	Low test cost and time cost, Bluetooth capable into system	Requires avg. pay-weight entry and input into system, accuracy	YES
Rectal temperature	No test cost, Bluetooth capable	Ambient temperature influence, medium time cost	?
Lung auscultation	Low test cost	Inconsistent, diagnostic rather than predictive?, time cost	NO
Respiratory microbiome	Good potential for BRD prediction	Not real-time currently, high cost?	YES

SOURCE: DR. JOHN RICHESON, WEST TEXAS A&M

If veterinarians and cattle feeders could identify those 20 animals and leave the other 80 untreated, they potentially could reduce production costs significantly while improving antibiotic stewardship and health management.

PREDICTIVE TOOLS RANGE FROM SIMPLE TO HIGH-TECH

Richeson reviewed several methods in use, or under testing, for predicting disease risk upon arrival and guiding treatment decisions. "Chute-side" is a key term in the assessment, as rapid diagnostics and treatment decisions at the time and speed of initial processing offer advantages in terms of labor, logistics, treatment efficacy and animal welfare.

Simple metrics such as calf weight relative to cohorts, intact bulls versus steers and certainly vaccination and weaning history can help predict

"Mass treatments for high-risk arrivals represent considerable expense, and can result in lower cure rates for cattle pulled later." —*Mitch Hockett, Ph.D*

morbidity risk. Simply the presence of a pre-existing ear tag can indicate a particular calf was handled at least once and perhaps vaccinated or better managed at a previous stage. These indicators alone, however, are not reliable for predicting individual risk.

Rectal temperatures can reveal cases of morbidity, but in research trials have not provided a reliable early prediction of disease risk.

Lung auscultation can detect early signs of respiratory disease, but accuracy depends largely on the person operating the stethoscope. The electronic Whisper auscultation system removes much of the subjectivity. Richeson says that while the system can help diagnose early signs of BRD and objectively rate severity of the infection based on lung sounds, it does not necessarily predict those likely to get the disease.

Tests for serum haptoglobin levels provide a non-specific indicator of inflammatory status, but levels need to be measured at a very specific times for reliability as a disease-prediction tool.

Concentration of NEFAs (Non-esterified fatty acids) can serve as an indicator of lipolysis or a negative energy balance. More research is needed to determine if or how NEFA levels predict BRD risk.

Analysis of nasal microbiome signatures shows promise as a

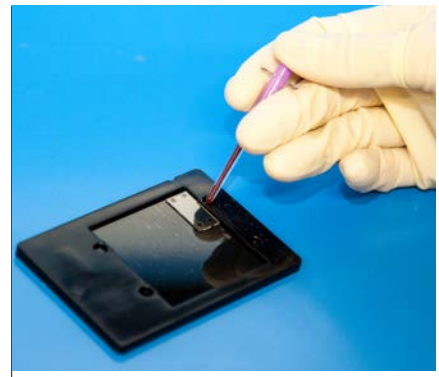
The QScout system provides a chute-side measurement of blood leukocyte differentials as an indicator of disease risk.

predictive tool, Richeson says, but more research is needed and current tests require extensive lab work, so it is not a "chute-side" tool.

MEASURE LEUKOCYTE DIFFERENTIALS

Measurement of blood leukocyte differential (BLD) can provide indications of stress, dehydration and immune challenge, Richeson says. Advanced Animal Diagnostics AAD's QScout® BLD test measures total leukocyte, neutrophil, mononuclear and eosinophil counts and the percentages of neutrophil, mononuclear and eosinophil in the total blood leukocyte count. The test uses an algorithm to analyze BLD parameters and provides a health risk assessment in about 35 seconds. Controlled field trials indicate the test can facilitate targeted metaphylactic treatment on arrival, potentially reducing costs and antibiotic use compared with conventional metaphylaxis without significant differences in morbidity, treatment rates or cattle performance.

Advanced Animal Diagnostics VP of External Research Mitch Hockett, PhD, notes that AAD's founder has a previous background in human-medical diagnostics, including point-of-care blood-test technologies.



PHOTOS: ADVANCED ANIMAL DIAGNOSTICS

Veterinarians have stressed for years they need better tools for guiding treatment decisions, particularly in shipped cattle arriving in feedyards or stocker operations, Hockett says. Mass treatments for high-risk arrivals represent considerable expense, and can result in lower cure rates for cattle pulled later.

Leukocyte differentials have been used in milk tests for sub-clinical mastitis in dairy cows. AAD now is focusing on using the technology for blood tests in beef cattle.

They have conducted several research trials comparing blood tests from mass-treated and untreated groups of calves to develop an index for measuring health risk and guiding individual treatment decisions based on leukocyte differentials.

The system's "Q-Draw™" device uses a needle and small collection

tube coated with an anticoagulant for drawing a small blood sample from the jugular vein. The user places a sample on a test slide and places the slide into the reader. The entire process takes only about 40 seconds and provides a "treat" or "no treat" decision. If wanted, the user can access more detailed differential information including ratios of specific leukocytes such as neutrophils versus lymphocytes. All data is remotely accessible through AAD's QStats™ online portal.

While research continues, trial results have been consistent. Researchers also are exploring additional applications for the technology. For example, Hockett says it could be advantageous to determine individual use of immunostimulants in arriving cattle, leaving the lowest-risk individuals untreated. The system also could be used in hospital pens to assess disease status and guiding treatment decisions for pulled cattle. The company currently has four trials underway exploring outcomes from these applications.

Richeson says in his team's field tests, they have found no statistically significant differences between metaphylaxis and selective treatment groups for responses of:

- Enrollment weight.
- Treatment rate.
- Average daily gains.
- Total weight gain.
- Final weight.

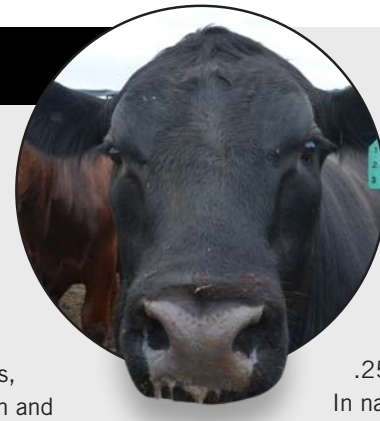
He's now planning to begin a larger test on fall-arrival high-risk cattle.

Hockett says the system also fits well for operations raising cattle for natural programs. Finding cattle with early signs of infectious disease can help prevent more pulls, and disqualified cattle, later.

Research and field testing needs to continue, Richeson says, but chute-side diagnostic testing shows considerable promise for improving health while reducing costs and antibiotic use with more targeted treatment. Current antimicrobial metaphylaxis strategies will need to be refined, with reductions in drug costs and improved outcomes compensating for technology costs. BLD shows promise as a predictive tool, and Richeson says some combination of diagnostic metrics in a predictive algorithm might provide the greatest sensitivity and specificity for BRD risk.

Rifle or shotgun, there is no "magic bullet." Even with more targeted treatments, BRD will remain a problem and pressures for more judicious use of antibiotics will continue. New diagnostic and predictive tools can, however, move us closer to the ideal of improving health outcomes while reducing antibiotic use. **BV**

A SNIFF TEST FOR BRD?



As the search continues for reliable chute-side tests for early signs of bovine respiratory disease (BRD), researchers work to identify indicators beyond clinical signs, rectal temperature and other traditional methods of field diagnosis.

While the research is in its early stages, Jenna Funk, DVM, a resident veterinarian and post-doctoral researcher at Iowa State University, is exploring the potential for essentially a high-tech smell test for early detection of BRD pathogens. Funk and the ISU team theorized that plasma and/or nasal secretions from cattle in early stages of BRD could contain unique volatile organic compounds. Funk presented an abstract of the research at the recent Academy of Veterinary Consultants (AVC) summer conference.

The researchers note that metabolomics – study of how metabolites change due to disease or other influences – has shown potential for diagnostics in human and veterinary medicine.

For this research, the team collected 100 serum samples and 100 nasal secretion samples, half from healthy cattle and half from cattle showing signs of BRD. Criteria for identifying sick cattle included rectal temperatures of 104 or higher and Whisper (electronic auscultation) scores of 2 or higher. They used gas chromatography/mass spectrometry (GC-MS) to sample and analyze the air, or head space in sample vials containing .25ml of serum or nasal secretions.

In nasal swab samples, they found four compounds that differed significantly between sick and normal cattle, and in cattle serum samples they found five compounds that differed significantly. One compound, a phenol, differed significantly in both types of samples.

Funk says more research is needed, and the team is planning a case-control trial to begin this fall. Depending on research outcomes, volatile organic compounds could serve as biomarkers for use in quick and objective treatment decisions for cattle arriving in stocker or feedlot operations.

The open-access research report, titled Detection of volatile compounds emitted from nasal secretions and serum: Towards Non-Invasive Identification of Diseased Cattle Biomarkers," is published in the journal *Separations*.

PHOTO: WYATT BECHTEL