Thinking Outside the Shots: Management Approach to Feedyard Morbidity and Mortality

Daniel U. Thomson, *PhD, DVM;* **Brad J. White,** *DVM, MS*
Department of Clinical Sciences, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506

Abstract

Bovine respiratory disease complex is one of the most costly diseases in the beef industry. Prevention of this disease starts with procurement of cattle ready for the auction market. If preconditioned cattle are not economical or available, applying the correct management strategy to each subpopulation of animals is essential. Matching animal flow with the amount and experience of your labor pool is important. A proper vaccine program along with metaphylaxis is important for controlling morbidity in high risk calves. Quality pen riding, proper diagnosis, treatment and supportive care are all a function of a quality health program in the feedyard. Feedyard morbidity and mortality is mostly dependent on the type and number of cattle procured. Realizing what is normal will allow us to change the process without distorting the data.

Résumé

Le complexe respiratoire bovin est l'une des maladies les plus coûteuses pour l'industrie bovine. La prévention de la maladie commence avec l'achat de bovins prêts pour l'encan. Si les bovins préconditionnés ne sont pas disponibles ou trop coûteux, il est essentiel d'adopter la bonne stratégie de gestion pour chaque sous-population d'animaux. Il est important de bien jumeler la quantité d'animaux au nombre et à l'expérience des travailleurs disponibles. Un programme de vaccination approprié avec métaphylaxie est important pour contrôler la morbidité chez les veaux à haut risque. Un programme de santé de qualité dans le parc d'alimentation inclus des enclos de bonne qualité, un diagnostic approprié, et le traitement et des soins pour les animaux. La mortalité et la morbidité dans le parc d'engraissement dépendent du type et du nombre de bovins qui ont été achetés. Réaliser qu'une norme existe permettra de changer les procédures sans déformer la réalité.

Introduction

The latter part of the twentieth century provided veterinarians with several new pharmaceutical and biological agents to prevent infection and battle bacterial pathogens. These tools are useful, but have failed to eliminate all disease problems. A recent survey conducted by the National Animal Health Monitoring System observed that the mortality ratio in US feeder calves increased from 10.3 deaths / 1000 cattle in 1994 to 14.2 deaths / 1000 cattle in 1999.[5] Increasing mortality is the result of multiple factors, but it does suggest that the advent of new antimicrobial agents did not eliminate cattle death due to infectious organisms.

These factors lead to the conclusion that production of healthy cattle must include proper management, prevention and treatment procedures aimed at reducing disease risk factors. New and improved molecules to eliminate or prevent infection from pathogens will not abolish disease from cattle. Management of the traditional epidemiological triad of pathogen, host and environmental factors must be incorporated into generating a wellness program. Many producers request a "health" program from their veterinarian expecting a list of vaccines and times to process cattle, but what they are really asking for is a system to reduce the negative impact of diseases and enhance herd production.

Animal Procurement

Animal selection for placement in a calf growing facility is a major factor in the economic and health outcomes of this phase. Purchase price greatly impacts final profitability. The initial price is significantly influenced by market conditions, body weight and health risk. Groups of calves should be divided into risk classifications of high or low risk based on the assessment of historical, animal and environmental risk factors. This classification drives specific health protocols and reasonable expectations for group performance.

Animal weight is a significant factor in risk classification of incoming calves. Initial weight is easily quantifiable and is strong predictor of morbidity and mortality due to bovine respiratory disease (BRD). Loneragan[1] examined data from the VetLife Benchmark Performance program to explore the relationship between arrival weight and mortality.[5] This data set included cattle that closed out from 1997 to 2003 with an average arrival weight range of 500 to 899 lb (227 to 409 kg). He found that most death loss was attributed to bovine respiratory disease (BRD), and mortality rates increased by 20-35% for each hundredweight decrease in cattle arrival weight.

Risk classification of cattle can be confounded due to factors other than arrival weight. Mortality rates vary between pens of cattle within each arrival weight class due to factors associated with previous management. Examples include gonadal status of male calves, pregnancy status of females, calf source (geographic), marketing method, previous management history (or lack of) and seasonality. Accounting for these variables increases the accuracy of the risk classification.

The purchase of intact male calves is relatively common in stocker operations. Many times these calves are purchased at a discounted rate relative to steers. Castration of feeder calves on arrival decreases performance (ADG) and increases morbidity. Renfro *et al* illustrated that bull calves castrated after arrival experienced 140% more respiratory morbidity than steer pen mates.[9] Mortality (142% increase) and realizer rates (163% increase) were also significantly higher in bulls relative to steers. Male calves entering the backgrounding operation to be castrated or banded should be considered high risk. Economics must be considered in the purchase of intact males, and the lower purchase price must be contrasted with potentially greater expenses associated with decreased performance and increased health problems.

Pregnancy during the feeding phase may be detrimental for heifer performance and health. The expected pregnancy rate dictates the handling of potentially pregnant animals. The length of time the cattle are held and potential marketing implications (reputation) of selling bred heifers should be considered when deciding how to manage heifers of unknown pregnancy status.

Animals from certain regions of the country are viewed as high risk based on previous experiences with calves from this region. Regional industry infrastructure and herd size differences in different parts of the country influence reputation. Southeastern states have smaller average cow herd sizes than other regions of the country.

Differences in herd size impacts backgrounding health through two mechanisms: disease exposure and time to transport. Animals are grouped in truckload sized lots (50,000 lbs; 22,727 kg) for most efficient transportation. Cattle purchased from areas with relatively small cow herd sizes are most likely commingled with animals from other sources (farms) to reach the trucking threshold. These cattle have a higher probability of exposure to disease causing organisms because of the increased number of sources. In contrast, if calves are purchased from an area with a relatively high herd size, only two or three sources may be necessary to fill a load of same sex animals.

The time to transport the cattle to the backgrounding yard is also a function of the geographic source of the animals. The distance from the purchase point to the stocker operation is important, but the time it takes to assemble the animals is also critical. At certain times of year, it may take longer than one day to assemble a uniform group of calves in an area with low herd sizes. The delay means that cattle acquired first have potentially been exposed to disease, but must wait at a collection point until the load is completed. These regional effects should not be used to condemn one area of the country, but rather used to establish guidelines for purchasing animals in these locations.

Seasonality is another important consideration when classifying cattle. Seasonality includes both external climate factors and annual cattle cycle dynamics. Labor is often a limiting factor in backgrounding operations, and the operation should evaluate current resources to match the purchase pattern to ensure proper animal management. Purchasing all high risk calves in the fall can overwhelm the system and result in higher levels of treatment failures.

Risk classification influences initial animal management, treatment protocols and labor allocation for the pen. Increasing the percentage of high risk cattle in the population significantly increases overall morbidity and mortality. Tools such as metaphylaxis are available to manage the health on high risk cattle at arrival. Human resources and hours in the day are limiting factors in how well we manage the health of newly received calves. The value of categorizing animals based on expected health is to project resource allocation and predicted performance.

Disease Prevention

The goal of the farm wellness program is two-fold: enhance the animal's ability to overcome illness and reduce disease challenges. The animal's immune status is critical for warding off pathogens. The objective is to improve the animal's ability to respond to pathogens in conjunction with avoiding undue stress that decreases immune function. Cattle are the reservoir for most pathogens in the stocker environment. Decreasing the disease challenge occurs through proper animal management and instituting protocols that reduce contact between susceptible and clinically ill (shedding) animals.

Enhancing Immune Response - *Vaccinations*

The goals of the vaccination program in the backgrounding operation are to stimulate an effective immune response, prevent shedding of the antigens and improve performance through decreasing subclinical disease. Common viral pathogens associated with BRD include infectious bovine rhinotracheitis (IBR, Bovine Herpesvirus-1), bovine viral diarrhea virus (BVDV), parainfluenza-3 (PI3), and bovine respiratory syncytial virus (BRSV). Common bacterial pathogens include *Mannheimia haemolytica, Pasteurella multocida, Histophilus somni* (formerly *Haemophilus somnus)* and *Mycoplasma bovis.* Commercial or autogenous vaccines are available for all of the pathogens listed above. One option is to vaccinate all cattle on arrival for all potential pathogens. A more appealing alternative is to use evidence based guidelines to select appropriate immunization protocols for the cattle.

The first decision regarding viral vaccines is whether to use modified-live or killed virus vaccines. Killed vaccines stimulate humoral immunity and generally require a booster vaccination. Modified-live vaccines (MLV) stimulate cell mediated and humoral immunity while stimulating an effective immune response with one vaccination. Recent evidence reveals that parenteral MLV vaccines are effective at stimulating rapid immune responses. Fairbanks *et al* recently provided evidence that calves vaccinated with a subcutaneous modified-live virus combination 72 or 96 hours prior to challenge with infectious bovine rhinotracheitis (bovine herpesvirus-1) mounted at least some immune response.[1] Due to the type of immunity and speed of response, modified-live vaccines are recommended for stocker calves upon arrival.

The next choice is the antigens to include in the vaccination program. IBR and BVD are significant components of the BRD complex and efficacious vaccines are available for both pathogens. BVD virus has two biotypes (noncytopathic and cytopathic) and two genotypes (Type I and Type II). Some cross protection has been shown between genotypes, yet, for the most complete coverage, both Type I and Type II should be included in the vaccination program.

In a recent study by MacGregor and Wray, BRSV vaccination decreased respiratory morbidity rates and overall death loss in feedlot cattle.[6] Including BRSV in the initial processing protocol is recommended. The clinical importance of PI3 has not been established, but must multivalent vaccines include this pathogen. Therefore, we recommend vaccinating for IBR, BVD (Type I and Type II), BRSV and PI3.

Mannheimia haemolytica (MH) is the most common bacterial pathogen involved in the BRD complex. Studies evaluating MH vaccination of cattle at arrival have had mixed results regarding prevention of disease. The jury is still out on the effectiveness of MH vaccines post-arrival for prevention of BRD complex in cattle in a backgrounding or feeding operation. The good news is there does not seem to be negative effects associated with the vaccination of cattle with licensed MH bacterin-toxoids.

Little to no work has been done to show the effectiveness of the other bacterial pathogens associated with BRD complex in cattle. Most studies have focused on MH rather than *Histophilus, Pasteurella,* or *Mycoplasma.* Today the use of both commercially available and autogenous *Mycoplasma* vaccines is becoming more common. There are no peer-reviewed papers documenting the efficacy of these products in high risk cattle subjected to normal marketing and feeding practices. There are many research avenues to be reviewed with regard to mycoplasma and BRD complex. Until this work is done, we can not recommend the use of mycoplasma vaccines on arrival in high risk calves.

Enhancing Immune Response - *Stress Management*

The most significant impact of stress on newly received calves is reduced feed intake and a challenged immune system. Our goal is to utilize appropriate management and animal husbandry tools to minimize these negative effects. Cattle will likely enter the facility after having incurred some stress through transport, commingling and potentially weaning. Animal stress can be divided into the broad categories of psychological (restraint, handling, or novelty) or physical stresses (hunger, thirst, fatigue, injury, or thermal extremes).[3]

Proper cattle handling and facilities are imperative to cattle health and performance, yet, quantitative research has not been conducted to put an objective value on these practices. Psychological stresses can result from cattle handling techniques. Processing animals is a quality, not quantity, driven task. Calves should be handled carefully and calmly. The quality of each procedure is more important than the speed at which it is performed. Biological and pharmaceutical products are used to reduce incidence of disease in animals, yet if products or animals are mishandled, efficacy could be impacted. Processing is an investment of labor and product cost; therefore, care should be taken to receive maximum return on investment.

Cattle working facilities should be managed to provide a safe working environment for both cattle and people. Most cattle should move through the processing barn with minimal stimulation. If they do not readily move through the facility, personnel should look for visual or physical stimuli causing the cattle to balk at moving forward.!àCattle should be observed exiting the chute to identify possible injuries incurred during travel through the alley and chute. If a pattern of trauma is identified, the facility should be examined to determine the cause of injury.

Initial processing timing and technique is critical because stressed animals do not generate an adequate immune response; thus care should be taken to avoid undue stress. Timing of initial processing is influenced by initial calf evaluation and history of travel. Calves that have traveled a long distance should be placed in receiving pens that have plenty of space for the cattle to eat and drink prior to initial processing. Hay should be placed in the feed bunk before any cattle arrive. Also, the water tank should be run over so calves can see and smell the water on the ground around the water tank. New cattle need to lay down and rest after long hauls. In times of high rainfall or snowfall, bedding should be placed in the receiving pens to give cattle a comfortable place to rest and recover. The general rule of thumb is that cattle should be allowed one hour of rest for every hour that they were transported to the facility. Cattle that traveled a short distance may be processed on arrival and placed in their pen.

Processing timing should be planned to avoid weather stress events. Extreme heat can result in animal death, yet even moderate levels of heat stress can reduce feed intake and impair immune functions. Heat Index accounts for ambient temperature and relative humidity. Cattle should not be processed or reimplanted when the Temperature Humidity Index (THI) is in 80 or above.[7] Cattle do not cool down immediately after a hot day. Thus, cattle worked at the end of the day or immediately after sunset may still incur a large amount of heat stress. During the hot times of the year, early morning is optimal for working the cattle because there has been sufficient time for heat dissipation. The night recovery period is an important element of coping with heat stress. Avoiding heat stress in cattle should not be restricted to the processing area. Riding pens to identify cattle suffering from BRD and treatment of BRD should be done before the THI reaches 80 as well.

Decreasing Disease Challenge

Animals enter the stocker unit in one of three basic classifications: sick (clinically or subclinically ill), susceptible to disease, or protected from disease through innate or specific immunity. BRD pathogens are horizontally transmissible through oronasal contact, airborne exposure and environmental contamination. Therefore, the percentage of the group in each category changes throughout the feeding phase until equilibrium is reached. Reduction of disease challenge at arrival is based on managing animal movement to minimize exposure and reducing the number of animals shedding pathogens.

Strict all-in/all-out animal movement is the standard in many production animal operations. For the stocker operation, purchasing an entire pen of cattle from a single source at one time may not be feasible. After arrival, infected animals begin to shed pathogens. This exposure to other calves in the pen generates more infected calves, resulting in an exponential spread of disease through the pen.

Animals are exposed to an increasing challenge in the environment and either become ill (susceptible population) or defeat the infection (protected population). Adding calves to the pen several days after arrival puts the new calves in an environment with a high pathogen load due to the increasing number of clinically ill or shedding animals. As these animals become sick, the process continues and prolongs the peak disease challenge in the pen. To minimize the effects of disease spread, a pen should be filled in the minimum time possible.

Visual appraisal cannot accurately identify all animals in the population that are shedding pathogens. All animals can be mass treated to reduce the number of infected animals, or efforts can be placed toward identification and removal of animals known to harbor specific pathogens. Both procedures are valuable in the correct circumstances. The biological (performance) impact should be evaluated in the context of economic efficiency to decide if these strategies are appropriate for specific classifications of animals.

Decreasing Disease Challenge - Metaphylaxis

Prophylactic or metaphylactic antimicrobial administration to calves at arrival is a valuable tool in stocker operations. Metaphylactic utilization of parenteral antimicrobial drugs has been shown to improve performance and reduce BRD related morbidity and mortality rates when compared to negative controls.[2] Reductions in morbidity are variable, but as a rule of thumb, metaphylaxis can reduce BRD morbidity by 50% from control animals. The effects of treatment on increased performance are most likely attributable to relative incidence of morbidity between treated and control groups. Higher levels of morbidity would be expected to depress feed intake and ADG. Several products are currently approved for mass medication of calves at arrival (Table 1).

Metaphylaxis can be used in conjunction with an immunization program. Mass treatment on arrival is appropriate for calves that may suffer acute illness prior to generation of an effective immune response from the vaccination protocol. The goal of metaphylaxis is to reduce the incidence of acute onset BRD in highly stressed, newly received calves.

Economic efficiency is an important consideration in the selection of a metaphylactic agent. In addition to drug cost, expected incidence of BRD should be considered. In low risk calves, the cost of mass administration of antibiotics may be greater than a slight increase in morbidity. The metaphylactic agent should be selectively utilized when cattle are presented at an expected high risk for BRD.

Table 1. Antimicrobials labeled for metaphylactic usage in beef cattle.

Generic	Trade	Dose	Route of administration	Pre-harvest withdrawal (days)
Ceftiofur crystalline free acid	Excede®	6.6 mg/kg	SQ*	13
Chlortetracycline plus sulfamethazine	AureoS-700®	350 mg CTC/hd/d 350 mg SMZ/hd/d	Feed	7
Chlortetracylcine (CTC)	Aureo®	350 mg CTC/hd/d	Feed	0
Tilmicosin	Micotil®	10 mg/kg	SQ	28
Florfenicol	Nuflor®	40 mg/kg	SQ	38 (SQ)
Oxytetracycline	Tetradure 300®	30 mg/kg	IM/SQ	28
Tulathromycin	Draxxin®	2.5 mg/kg	SQ	18

*Ear route of administration, see label for directions

Chlortetracycline (CTC) or chlortetracycline-sulfamethazine (CTC + SMZ) are orally administered antimicrobials labeled for treatment or control of BRD. Delivery of medication via feed and water is advantageous from a labor and animal management standpoint. Yet, clinically ill animals often exhibit reduced frequency and duration of eating and drinking. Therefore, achieving effective levels of medication in target tissues may be difficult with erratic ration consumption.

Decreasing Disease Challenge - BVD Testing

Bovine viral diarrhea virus (BVDV) is an immunosuppressive virus affecting cattle in a multitude of manners. Infection with this virus is responsible for a variety of economically important disease syndromes in beef cattle, including bovine respiratory disease in (BRD) in stocker calves. The persistently infected (PI) animal is a unique reservoir for BVDV. PI cattle have a persistent viremia and shed copious amounts of virus into the environment. These animals are a major source of virus in stocker and feedlot cattle and pose a significant threat for spreading disease in the feedlot.

The only method for the stocker operation to control this disease is through testing and elimination of PI animals. Identification of PI calves is critical, but visual appraisal is not an accurate method of discovering these animals. Various diagnostic methods are available for identifying BVDV infections. Testing goals are important when considering appropriate diagnostic methods. Collection of skin biopsies (ear notches) and IHC or ACE testing on the samples has been recommended for identification or confirmation of BVD PI animals.

From a biological standpoint, identification and removal of BVD PI animals in high risk populations is a reasonable approach to decrease viral exposure to other animals in the operation. The decision to screen a group of cattle for BVD should be based on the known epidemiologic data, diagnostic test sensitivity and specificity data and the economic costs of the condition and its treatment.[4] At this time the literature does not support the economic feasibility of testing all animals in order to remove PI animals.

Conclusions

Prevention of disease is based on applying the correct management strategy to each subpopulation of the animals. Vaccines should be given to stimulate rapid immunity against appropriate pathogens in susceptible, yet healthy animals. Metaphylaxis can be utilized when animals are expected to be clinically infected upon arrival. Animal flow through the facility can be used to help minimize exposure to high levels of infectious agents. These techniques can be combined to form generic treatment protocols for specific risk classifications of animals.

References:

1. Fairbanks KF, Campbell J, Chase CC: Rapid onset of protection against infectious bovine rhinotracheitis with a modified-live virus multivalent vaccine. *Vet Ther* 5(1):17-25, 2004.
2. Galyean ML, Gunter SA, Malcolm-Callis KJ: Effects of arrival medication with tilmicosin phosphate on health and performance of newly received beef cattle. *J Anim Sci* 73(5):1219-1226, 1995.
3. Grandin T: Assessment of stress during handling and transport. *J Anim Sci* 75(1):249-257, 1997.
4. Larson RL, *et al*: Economic costs associated with two testing strategies for screening feeder calves for persistent infection with bovine viral diarrhea virus. *J Am Vet Med Assoc* 226(2):249-254, 2005.
5. Loneragan GH, *et al*: Trends in mortality ratios among cattle in US feedlots. *J Am Vet Med Assoc* 219(8):1122-1127, 2001.
6. MacGregor S, Wray MI: The Effect of Bovine Respiratory Syncytial Virus Vaccination on Health, Feedlot Performance and Carcass Characteristics of Feeder cattle. *Bov Pract* 38(2):162-170, 2004.
7. Mader T, Griffin D, Hahn L: Managing feedlot heat stress. Cooperative Extension University of Nebraska-Lincoln, 2000.
8. Peel DS: Beef cattle growing and backgrounding programs. *Vet Clin North Am Food Anim Pract* 19(2):365-85, 2003.
9. Renfro DC, *et al*: Effects of castration on arrival on male bovine health and performance in the commercial feedyard, in Proc Plains Nutrition Council, San Antonio, TX, 2004.