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A Survey to Describe Current Feeder Cattle Health and Well-Being Program Recommendations made by Feedlot Veterinary Consultants in the United States and Canada

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Abstract

Feedlot veterinarians (n=23) representing 11,295,000 cattle on feed in the United States and Canada participated in a beef cattle health and well-being recommendation survey. Veterinarians were directed to an online survey to answer feeder cattle husbandry, health, and preventive medicine recommendation questions. The feedlot veterinarians visited feedyards in their practice 1.7 times per month. All survey participants train feedlot employees on cattle handling and pen riding, while only 13% of respondents speak Spanish. All recommend infectious bovine rhinotracheitis and bovine viral diarrhea vaccination for high-risk (HR) cattle at processing; other vaccines were not recommended as frequently. Autogenous bacterins were recommended by 39.1% of feedlot veterinarians for HR cattle, while metaphylaxis and feed-grade antibiotics were recommended by 95% and 52% of respondents, respectively, for HR cattle. Banding was more frequently recommended than surgical castration as calf body weight increased. Feedlot veterinarians recommended starting HR cattle in smaller pens (103 head per pen) and allowing 13 inches (33 cm) per head of bunk space. They further recommend that feedlots employ one feedlot doctor per 7,083 head of HR cattle, and one pen rider per 2,739 head of HR cattle. Ancillary therapy for treating respiratory disease was recommended by 47.8% of veterinarians surveyed; vitamin C was recommended (30.4%) twice as often as any other ancillary therapy. Cattle health risk on arrival, weather patterns, and labor availability were most important factors for predicting feedlot morbidity, while metaphylactic antibiotic, therapy antibiotic, and brand of vaccine were least important. This survey provides valuable insight into feeder cattle health recommendations by feedlot veterinarians in the US and Canada, and provides direction for future research.

Keywords: feedlot, health management, vaccination, BVDV PI, metaphylaxis, castration, abortion, training

Résumé

Les vétérinaires des parcs d'engraissement (n = 23) représentant 11 295 000 bovins en production aux États- Unis et au Canada ont participé à un sondage sur la santé des bovins de boucherie et les recommandations pour le bien-être et la santé animale. Les vétérinaires étaient dirigés vers un sondage en ligne afin de répondre à des questions sur l'élevage des bovins d'engraissement, la santé et les recommandations en médecine préventive. Les vétérinaires de parcs visitaient les parcs dans leur pratique 1.7 fois par mois. Tous ces vétérinaires forment les employés des parcs pour la manipulation des bovins et les techniques équestres dans les enclos bien que seulement 13% des répondants parlaient l'espagnol. Tous ces vétérinaires recommandent la vaccination contre la rhinotrachéite infectieuse bovine et la diarrhée virale bovine des veaux à haut risque au moment du traitement; les autres vaccins n'étaient pas recommandés aussi souvent. Les bactérines autogènes étaient recommandées par 39.1% des vétérinaires pour les bovins à risque élevé alors que la métaphylaxie et des antibiotiques de moulée étaient recommandés, respectivement, par 95% et 52% des vétérinaires pour les veaux. L'utilisation des bandes élastiques était plus fréquemment recommandée que la castration par chirurgie lorsque les veaux étaient plus gros. Les vétérinaires des parcs recommandaient de mettre les veaux à risque élevé dans de plus petits enclos (103 têtes par enclos) et permettant 13 pouces (33 cm) d'espace par animal pour se coucher. Les répondants indiquaient que les parcs devraient utiliser un médecin par 7083 têtes de veaux à haut risque et un cavalier par 2739 têtes de veaux à risque élevé. Une thérapie auxiliaire pour traiter les

maladies respiratoires était recommandée par 47.8% des vétérinaires; la vitamine C était recommandée (30.4%) deux fois plus souvent que n'importe quelle autre thérapie auxiliaire. Le risque pour la santé des bovins à leur arrivée, les facteurs météorologiques et la disponibilité de la main d'œuvre étaient les facteurs les plus importants pour prédire la morbidité dans le parc alors que l'antibiotique métaphylactique, l'antibiotique de thérapie et la marque du vaccin étaient les moins importants. Ce sondage permet de mieux saisir les recommandations des vétérinaires pour la santé des bovins dans les parcs et montre la voie pour des travaux futurs.

Introduction

Cattle health recommendations are given daily to feedyard managers by veterinary consultants relating to all areas of animal health management, including vaccination,[15,16,41,44] metaphylaxis,[13,14,20,24,27,31,35,39,43,44,48] ancillary therapy,[1,2,8,9,11,12,17,21,29,30] castration,[6,51] pregnant heifer management,[7,26,33] use of parasiticides,[23,34,40] and bovine viral diarrhea virus (BVDV) testing and management.[4,18,25,28,32,38,47] Research on the cost and benefits of the various management options is conducted on a somewhat routine basis; however, little data is available about what practices are being advised or implemented in feedlot settings.

Feedlot veterinarians make feeder cattle health and well-being recommendations based on field experience and peer-reviewed publications. Vanconcelos and Galyean conducted a survey and reported baseline recommendations of select feedlot nutritionists in the United States.[49] This survey is repeated every four to five years to report changes in recommendations and nutritional practices due to philosophical or technological changes in beef cattle nutrition. These surveys then lead to prospective and retrospective studies to answer questions in areas where there is lack of agreement between nutritionists surveyed. This type of baseline study has not been conducted for feedlot veterinary recommendations, therefore the purpose of this study was to survey selected feedlot veterinarians in the United States and Canada on recommended practices for feeder cattle health and well-being.

Materials and Methods

Feedlot Veterinarians

Feedlot veterinarians were selected for this study through personal knowledge of their geographic consulting areas and reputation within professional veterinary organizations. Twenty-three feedlot veterinarians were first contacted by phone to inform them of the survey and to request their participation in the study. If interested, participants were then provided a link to the survey via both email and written letter. All 23 veterinarians agreed to participate, and all completed the survey. Approval to conduct this survey was granted by the Kansas State University Institutional Review Board.

Data Collection

Data were collected using a web-based survey system through Kansas State University.[a] Participants were provided a URL to the survey location via email and written letter. All participants completed the survey through the URL provided. Each participant was given five weeks after receiving the URL to complete the survey.

Survey Questions

The survey consisted of 58 questions covering general information (n=8); employee training (n=6); processing and receiving of cattle (n=13); castration and pregnancy management (n=6); bovine viral diarrhea virus (BVDV) testing (n=2); revaccination (n=5); cohort size and facilities requirements (n=2); animal health labor requirements (n=8); and feedlot morbidity and mortality (n=8).

Data Analysis

Data collected via the web-based survey system were downloaded into Microsoft Excel[b] for data summary and statistical analysis. Answers given as ranges, i.e. bunk space 12-14 inches (30-36 cm), were reported as a calculated average for summary statistics and analysis. The mean, mode, number of responses, and the variation around those means from the survey were calculated using Microsoft Excel.

Results and Discussion

General Information

Twenty-two of the 23 respondents listed their home offices in the United States (95.65%), and one respondent's home office was in Canada (4.35%). Of the respondents located in the United States, one (4.35%) was in Colorado, one (4.35%) in Idaho, one (4.35%) in Iowa, eight (34.78%) in Kansas, two (8.7%) in Nebraska, two (8.7%) in Oklahoma, and seven (30.43%) in Texas. Annual feedyard head count for each consulting practice averaged 491,087, with a maximum head count of 1,100,000 and a minimum of 20,000. The average feedyard capacity for the majority of veterinarians (82.61%) was between 16,000 and 50,000 head. The average percent finishing yards as clients of respondents was 84%, with a maximum of 100% and a minimum of 25%. The average percent backgrounding yards as clients was 16%, with a maximum of 75% and a minimum of 0%.

Twenty-one (91.3%) of veterinarians surveyed had clients in the Central Plains (defined as Colorado, Kan-

sas, Nebraska); three (13.04%) in the Corn Belt (Illinois, Iowa, Minnesota, Missouri, Wisconsin); one (4.35%) in the Northeast (Michigan, New England States, New York, Ohio, Pennsylvania, West Virginia); one (4.35%) in the Northern Plains (Manitoba, Montana, North Dakota, Saskatchewan, South Dakota, Wyoming); five (21.74%) in the Northwest (Alberta, British Columbia, Idaho, Oregon, Washington); none (0%) in the Southeast (Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia); 12 (52.17%) in the Southern Plains (New Mexico, Mexico, Oklahoma, Texas); and two (8.7%) in the Southwest (Arizona, California, Nevada, Utah).

The average number of visits to each feedlot was 1.7 per month, with a minimum of one visit per month, a maximum of four visits per month, and a mode of one visit per month.

Employee Training/Animal Welfare

Training of feedlot employees by veterinarians can be critical for implementation of management recommendations for health and well-being of feeder cattle. Animal welfare in commercial feedlots has become the focus of animal activist groups, producer organizations, and the media. Feedlot veterinarians were asked six questions on employee training and animal welfare practices (Table 1). All 23 respondents indicated they spend time training feedyard employees on cattle handling, 12 (52.17%) conducted animal welfare audits/assessments at their clients' feedlots, while 11 (47.83%) did not. The types of audits/assessments were not specified. All respondents were actively involved in training of pen riders in the feedyards. A follow-up question asked respondents to select training methods and mediums used for training feedyard staff. Audio-visual tools, such as video, were used by 20 (86.96%) respondents, printed material by 18 (78.26%), pictures by 19 (82.61%), hands-on training by all 23, and live web demonstrations by two (8.7%) of the respondents. Of the 23 veterinarians questioned, three (13.04%) speak Spanish. Fifteen (65.20%) veterinarians train employees to use lung auscultation to aid in diagnosis of bovine respiratory disease (BRD), while eight (34.78%) did not.

Processing and Receiving Cattle

After receiving short-haul cattle (defined as less than eight hours in transit) 12 (52.17%) veterinarians do not require a rest period for the cattle prior to processing; five (21.74%) require a six-hour rest period; three (13.04%) require a 12-hour rest period; and three (13.04%) require a 24-hour rest period (Table 2). After receiving long-haul cattle (defined as greater than eight hours) one (4.35%) veterinarian does not require a rest period prior to processing; one (4.35%) requires a six-hour rest period; six (26.09%) require a 12-hour rest period; and 15 (65.22%) require a 24-hour rest period.

Vaccines are administered to feeder cattle at the time of processing to immunize them against pathogens likely to cause disease. Table 3 lists recommendations for arrival-vaccinations for high- and low-health-risk feeder cattle by feedlot veterinarians. All feedlot veterinarians surveyed recommended that high-risk cattle be vaccinated with infectious bovine rhinotracheitis (IBR) and BVDV (types 1 and 2) vaccine. Fifteen of 23 (65.22%) recommended bovine respiratory syncytial virus (BRSV) and 14 (60.87%) recommended parain-

Table 1. Number and percentage of feedlot veterinarians that responded positively when asked about training feedlot employees, conducting animal welfare audits, or if they spoke Spanish.

Item	Number of responses	% of responses
Train employees in cattle handling	23	100
Conduct animal welfare audits	12	52.17
Train pen riders	23	100
Speak Spanish	3	13.04

Table 2. Recommendations by feedlot veterinarians for rest periods from arrival to processing based on length of time cattle were transported to the feedlot (% of total responses).

	Hours of rest				
	None	6 hours	12 hours	24 hours	>48 hours
Short haul cattle*	12 (52.17%)	5 (21.74%)	3 (13.04%)	3 (13.04%)	0 (0%)
Long haul cattle**	1 (4.35%)	1 (4.35%)	6 (26.09%)	15 (65.22%)	0 (0%)

*Short haul cattle were transported less than eight hours to the feedlot.

**Long haul cattle were transported eight or more hours to the feedlot.

fluenza type 3 (PI3) vaccines for high-risk cattle at processing. Only five (21.74%) veterinarians recommended *Histophilus somni*, one (4.35%) recommended *Leptospira*, 14 (60.87%) recommended clostridials, 17 (73.91%) recommended *Mannheimia haemolytica*, and eight (34.78%) recommended *Pasteurella multocida* as bacterial components to vaccinate high-risk cattle. Autogenous bacterins were recommended by nine (39.13%) veterinarians for use in high-risk cattle, while 14 (60.87%) did not recommend autogenous bacterins. No respondents recommended the use of *Moraxella bovis* or *Mycoplasma bovis* antigens.

Vaccine recommendations made by feedlot veterinarians for low-health-risk cattle were slightly different than the recommendations for high-risk cattle. All veterinarians surveyed recommended IBR vaccine at the time of processing for low-risk cattle, 22 (95.65%) recommended BVDV (types 1 and 2) vaccine, and 12 (52.17%) recommended BRSV and PI3 vaccine. Approximately half (56.52%) of veterinarians surveyed recommended the use of clostridial bacterins in low-risk cattle. There were virtually no other vaccines recommended for use in low-risk cattle (Table 3).

Table 3. Vaccination recommendations by feedlot veterinarians for low- and high-health-risk feeder cattle at time of processing (% of total responses).

Antigen	High-risk cattle	Low-risk cattle
IBR[a]	23 (100%)[e]	23 (100%)
BVD[b] type 1	23 (100%)	22 (95.65%)
BVD type 2	23 (100%)	22 (95.65%)
BRSV[c]	15 (65.22%)	12 (52.17%)
PI3[d]	14 (60.87%)	12 (52.17%)
Histophilus somni	5 (21.74%)	1 (4.35%)
Moraxella bovis	0 (0%)	0 (0%)
Mycoplasma bovis	0 (0%)	0 (0%)
Leptospira vaccine	1 (4.35%)	1 (4.35%)
Clostridial bacterin-toxoids	14 (60.87%)	13 (56.62%)
Mannheimia haemolytica	17 (73.91%)	0 (0%)
Pasturella multocida	8 (34.78%)	0 (0%)
Autogenous bacterins	9 (39.13%)	0 (0%)

[a]Infectious bovine rhinotracheitis virus
[b]Bovine viral diarrhea virus
[c]Bovine respiratory syncytial virus
[d]Parainfluenza-3 virus
[e]Number of responses (percentage of responses)

Revaccination of Cattle

This question was intended to capture the revaccination recommendations for high-risk feedlot cattle. However, the actual question did not specify high-risk or low-risk cattle, therefore the interpretation was open to the respondent. When asked, 16 (69.57%) veterinarians recommended revaccination of feedlot cattle, whereas eight (34.78%) did not. When asked when they recommend revaccination, 10 (43.48%) recommended 10 days post-processing; 10 (43.48%) recommended 14 days post-processing; four (17.39%) recommended 21 days post-processing; none recommended 30 days; and two (8.7%) recommended greater than 30 days post-processing. When asked which antigens they recommended when revaccinating feeder cattle, 18 (78.26%) recommended IBR, 15 (65.22%) recommended type 1 and type 2 BVDV, and eight (34.78%) recommend BRSV and PI3. Revaccination with bacterial antigens was rarely recommended. Only 4.35% of consulting veterinarians surveyed recommended revaccination with *Histophilus* or *Mannheimia* bacterin-toxoids. No other bacterial antigens were recommended for revaccinations, including clostridial bacterins. The majority (82.61%) of veterinarians surveyed recommend revaccination at the time of re-implant. Revaccination recommendations for viral antigens at the time of re-implant included IBR (78.26%); types 1 and 2 BVDV (43.48%); and BRSV and PI3 (34.78%).

Metaphylaxis and Feed-grade Antibiotics

Twenty-one veterinarians surveyed (95.65%) recommended metaphylaxis at arrival for high-risk cattle, and only two (8.7%) veterinarians recommended metaphylaxis for low-risk cattle (Table 4). Researchers

Table 4. Recommendation of metaphylaxis or feed-grade antibiotics by feedlot veterinarians for low- and high-health-risk feeder cattle (% of total responses).

Recommended practices	Response		
	Yes	No	Depends
Metaphylaxis – high-risk cattle	22 (95.65%)	4 (4.35%)	NA
Metaphylaxis – low-risk cattle	2 (8.7%)	21 (91.3%)	NA
Feed-grade antibiotics – high-risk cattle	12 (52.17%)	6 (26.09%)	5 (21.74%)
Feed-grade antibiotics – low-risk cattle	4 (17.39%)	16 (69.57%)	3 (13.04%)

have demonstrated a decrease in treatment rates for BRD using various protocols for metaphylaxis,[14,20,27] as well as improved performance. When asked if they recommend feed-grade antibiotics for prevention of BRD in high-risk cattle, 12 (52.17%) responded yes, six (26.09%) responded no, and five (21.74%) said it depends, with additional comments such as using it to prevent *Histophilus somni* infections from August to December, and depending on consumption levels. For feed-grade antibiotic use for prevention of BRD in low-risk cattle, only four (17.39%) veterinarians responded yes; three (13.04%) responded with additional comments of depending on expression of clinical signs or on a prescribed basis; and 16 (69.57%) did not recommend feed-grade antibiotics be fed to low-health-risk feeder cattle. Research has demonstrated the benefit of feed-grade antimicrobial use for reducing morbidity and increasing performance.[10,19,39]

Less than half (47.83%) of feedlot veterinarians are included in developing the steroid implant programs. The preferred route of administration for parasiticides for 16 (69.57%) of veterinarians was injectable only; 8.7% preferred pour-on only; none preferred only oral administration of parasiticides; and 21.74% preferred a combination of administrations. Research has shown a benefit of oral fenbendazole treatment given in combination with ivermectin pour-on, versus the pour-on alone and versus injectable dormectin alone.[40] Guichon *et al* reported that the use of ivermectin topically, versus oral fenbendazole in combination with topical permethrin and fenthion, improved final weight, weight gain, average daily gain, and dry matter intake-to-gain ratio.[23] Of the 23 respondents, six (26.09%) recommended the use of generic parasiticide products in place of trade-name products, while 17 (73.91%) recommend name-brand parasiticides. Finally, when processing, 13 (56.52%) of the veterinarians recommended bobbing the hair of the tail compared to 10 (43.48%) that did not recommend the practice.

Castration and Pregnancy Management

Feedlot veterinarians were asked which castration method they recommend for each of four weight classes of cattle. In general, surgical castration was recommended more frequently for lightweight cattle, whereas banding was recommended more frequently for heavier cattle (Figure 1). For cattle less than 300 lb (136 kg), surgical castration was recommended by 65.22% of veterinarians, whereas 4.35% recommended banding, and 30.43% recommended either method. For cattle weighing 300 to 500 lb (136 to 227 kg), surgical castration was recommended by 43.48% of veterinarians, banding was recommended by 13.04%, and 43.48% recommended either method. For cattle weighing 501 to 800 lb (227 to 364 kg), surgical castration was recommended by 21.74% of veterinarians, banding was recommended by 56.52%, and 21.74% recommended either method. For cattle weighing more than 800 lb (364 kg), surgical castration was recommended by 8.7% of respondents, banding was recommended by 65.22%, and 26.09% recommended either method. Earlier research did not indicate a significant difference in average daily gain between surgical and banding castration, but regardless of method, the degree of weight loss post-castration increases quadratically as the age of castration increases.[6] However, more recent research demonstrated a lower occurrence of undifferentiated fever (P=0.021) and improved average daily gain (P=0.048 on a carcass-weight basis) in cattle castrated with a band compared to surgical castration.[5] Improvements in health and performance were also seen when delaying castration 70 days post-arrival versus castrating on arrival. In two other studies, significantly lower average daily gain was seen in banded cattle than those surgically castrated.[22,42] Each of these studies, one conducted over a 28-day period and the other over 42 days, indicated most of the lost performance in cattle castrated by banding was observed in the third and fourth weeks of the trials. When banding bulls, 22 (95.65%) veterinarians recommended concurrent administration of tetanus toxoid, while one (4.35%) did not respond.

To manage pregnancy in newly arrived heifers, 18 (78.26%) of 23 feedlot veterinarians recommended that producers pregnancy-check heifers, while five (21.74%) did not. Classes of heifers for which veterinarians recommended pregnancy checking were described by respondents that answered yes to pregnancy-checking incoming heifers. In the comment box, respondents emphasized checking those of unknown origin or no management history. When asked about recommending mass-abortion protocols, eight (34.78%) veterinarians responded that they recommend mass abortions without pregnancy checking, compared to 15 (65.22%) that did not. Classes of heifers deemed appropriate candidates

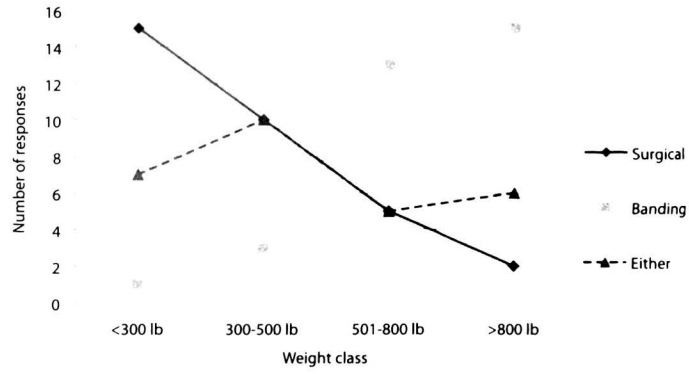

Figure 1. Recommendations by feedlot veterinarians for castration method in different weight ranges of bulls.

for mass abortion were again described in an additional comment box, with the majority indicating mixed-sex lots or all heifers received at the feedlot during August through December. The economic implications of pregnant feedlot heifers compared to open heifers and aborted heifers were addressed in previous research.[7,26] One research group observed that open heifers returned $39.94 per head more than aborted heifers, and $66.35 more than pregnant heifers. Aborted heifers had $26.41 per head greater return than pregnant heifers.[26] A simulation study demonstrated that net returns declined if pregnant heifers were retained as pregnant in the feedlot.[7]

BVD PI Testing

Routine BVD testing of high-risk cattle on arrival was recommended by nine (39.13%) of veterinarians. Protocols for disposition of positive cattle were added as comments. Most responded that cattle persistently infected (PI) with BVDV were placed in quarantine or sold directly to salvage slaughter. Only two (8.7%) consultants recommended routine BVD testing on arrival in low-risk cattle. The prevalence of BVDV-PI cattle, and the economic impact of exposure to BVD PI cattle due to performance losses or decreased health status, has been extensively reviewed.[4,25,28,32,47] Questions still surround the value of this biosecurity practice at the feedlot level.

Cohort Size and Facilities

The number of cattle fed per pen and the amount of bunk space can significantly impact the ability of pen riders to find morbid cattle. The optimal number of cattle per pen for high-risk cattle was given by 18 respondents. The maximum number given was 200 and the minimum was 50, with a mean of 103, and a mode of 100. Linear bunk space recommendations were given by all 23 feedlot veterinarians. The average recommendation was 13.9 inches (35 cm) per head, the minimum was 10 inches (25.4 cm) per head, the maximum was 21 inches (53 cm) per head, and the mode was 12 inches (30.5 cm) per head. In general, veterinarians recommended that high-risk cattle be started in a single-truckload (100 head) size pen with close to 116 feet (35.4 m) of linear feedbunk space.

Pen Riding and Treatment

Respondents were asked to indicate the number of times per day they recommend that pen riders check high-risk cattle. Of the 23 respondents, four (17.39%) recommended checking the cattle once daily, 18 (78.26%) recommended checking them twice daily, and one (4.35%) recommended checking three times a day. Twenty veterinarians recommended checking low-risk cattle once daily, while three recommended checking them twice daily.

Veterinarians were asked a series of questions regarding the number of employees required to adequately address the health and well-being of high- and low-risk cattle (Figure 2). Veterinarians surveyed replied, on average, that one pen rider could tend to 2,739 head of high-risk cattle with a maximum recommendation of 5,000 head per pen rider, a minimum of 1,000 head per pen rider, and a mode of 3,000 head per pen rider. The recommendation for low-risk cattle was one pen rider per 5,591 head, with a maximum of 10,000 head per pen rider, a minimum of 2,500 head per pen rider, and a mode of 5,000 head per pen rider. Veterinarians surveyed recommended on average that one feedlot doctor could tend to 7,083 head of high-risk, cattle with a maximum recommendation of 20,000 per feedlot doctor, a minimum of 1,000 per feedlot doctor, and a mode of 5,000 head per feedlot doctor. The recommendation for low-risk cattle was one feedlot doctor for each 15,972 head, with a maximum recommendation of 50,000 head for each feedlot doctor, a minimum of 2,500 head, and a mode of 10,000 head per feedlot doctor.

Nearly all (91.3%) feedlot veterinarians recommended that the rectal temperature of cattle pulled for BRD be taken. The use of rectal temperature to initiate treatment of cattle with BRD was recommended by 11 (47.83%) participants. The rectal temperature utilized to initiate BRD treatment of cattle ranged from 103.5°F (39.3°C) to 104.5°F (39.9°C), with a mode of 104.0°F (39.6°C).

Morbidity and Mortality

Seven factors related to prediction of morbidity and mortality of feeder cattle were presented to the feedlot veterinarians to be ranked in order of importance. Factors presented were brand of vaccine, class of antibiotic used for treatment, class of antibiotic used

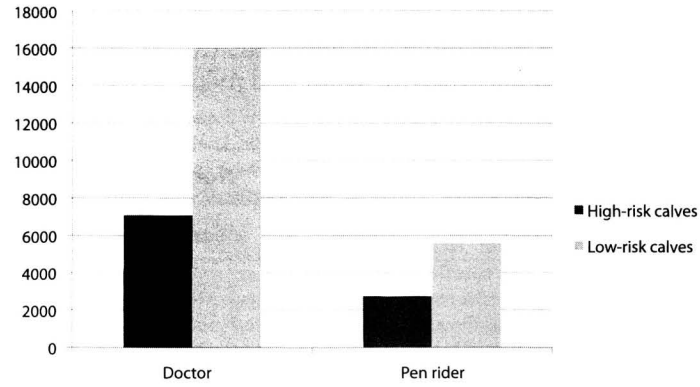

Figure 2. Recommendations by feedlot veterinarians for the number of high- or low-health-risk cattle per employee type in a commercial cattle feeding operation.

for metaphylaxis, cattle health risk, weather patterns, receiving nutrition program, and amount and quality of labor. Factors were ranked in order of importance, with 1 being most important and 7 being least important. The means and modes were closely correlated among responses (Table 5). The most important predictive factor for consultants was cattle health risk, with a mean of 1.32 and a mode of 1. The second most important predictive factor was weather patterns, with a mean of 3.18 and a mode of 2. The middle-ranked factors were the amount and quality of labor and the receiving nutrition program, means of 3.41 and 3.86 and modes of 4 and 3, respectively. The class of antibiotic used for metaphylaxis had a mean rank of 4.36 and a mode of 5, while class of antibiotic used for treatment had a mean rank of 5.64 and a mode of 6. Brand of vaccine used was ranked by veterinarians as the least important factor for prediction of morbidity and mortality, with a mean rank of 6.23 and a mode of 7.

Ancillary BRD Therapy

Ancillary therapy for treatment of BRD was recommended by 47.83% of the veterinarians. Specific ancillary treatments recommended were probiotics (13.04%), viral vaccine (8.7%), B-vitamins (8.7%), vitamin C (30.43%), dexamethasone (4.35%), non-steroidal anti-inflammatory (flunixin meglumine) (17.39%), and antihistamine (13.04%) (Figure 3). Little data is available to show improved treatment success with the use of ancillary therapies. However, Cusack *et al* did show a decrease in mortality in cattle treated for BRD with vitamin C and an antibiotic, versus cattle that only received an antibiotic for BRD treatment.[9] Use of non-steroidal anti-inflammatory drugs has been shown to reduce pyrexia in cattle with BRD, but does not show a difference in treatment success or a decrease in mortality.[17,30] Because nearly 50% of veterinarians in the survey recommended using some type of ancillary therapy, research to demonstrate whether clinical outcomes are improved with the use of these therapies may be needed.

Railer Cattle

Railer cattle are unthrifty, non-producing animals sold prior to pen mates to salvage some monetary value. Several outlets are available for feedlot managers to dispose of railer cattle. Veterinarians were asked which outlet or outlets were used by feedlots they work with. They indicated that 96.65% of their feedlot clients sell railers for salvage slaughter, 69.6% sell railers through private-treaty sale, 69.6% euthanize and render the railer cattle, and 30.43% sell railer cattle through an auction market. The most common reasons for cattle to be railed were chronic BRD (43.48%), lameness (47.83%), and chronic non-performance issues (8.7%).

Euthanasia

Although one of the most unpleasant duties in the feedlot, euthanasia is an important part of animal care and husbandry. Feedlot veterinarians were asked what method of humane euthanasia was utilized in feedlots they serve. Gunshot was used for euthanasia by the majority (86.86%) of feedyards, with only 13.04% using captive bolt. All respondents indicated they had a program in place for care and handling of non-ambulatory cattle. They were then asked how long they waited with no clinical improvement in non-ambulatory cattle before recommending euthanasia. Participants were given four time categories to choose: five (21.74%) veterinarians would initiate euthanasia in less than 24

Table 5. Ranking of seven factors utilized by feedlot veterinarians to predict morbidity and mortality in feeder cattle in commercial feedyards (items are listed in order of importance by mean and mode with 1 (most predictive) to 7 (least predictive)).

	Numerical ranking	
	Mean	**Mode**
Cattle health risk	1.32	1
Weather patterns	3.18	2
Amount and quality of labor	3.41	4
Receiving nutrition program	3.86	3
Class of antibiotic use for metaphylaxis	4.36	5
Class of antibiotic use for treatment	5.64	6
Brand of vaccine	6.23	7

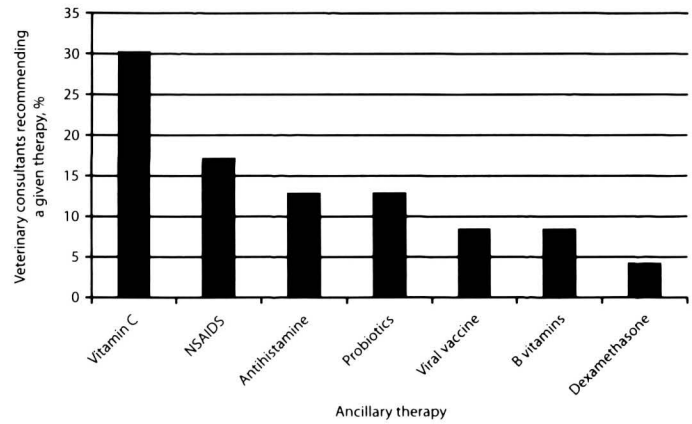

Figure 3. Recommendations by feedlot veterinarians in the US and Canada for use of specific ancillary therapy options when treating feedlot cattle for bovine respiratory disease.

hours for non-ambulatory animals not responding; 12 (52.17%) would wait 24 to 48 hours with no improvement; six (26.09%) would wait 49 to 72 hours; and none of the veterinarians surveyed would wait longer than 72 hours with no clinical improvement before euthanizing non-ambulatory cattle.

Conclusion

Application of relevant research findings by veterinarians can help increase efficiency and production in feedlots. While this survey only had 23 respondents, those respondents represented approximately 34% of the cattle fed in the US each year.[37] Thus, the survey provided valuable insight into the most common recommendations by feedlot veterinarians in the US and Canada. The purpose of this survey was to stimulate focused discussion and research on common feedyard practices where there may or may not be established bodies of research.

Endnotes

[a]Axio Online, K State Survey Services, Manhattan, KS
[b]Microsoft, Redmond, WA

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References

1. Apley M: Ancillary therapy of bovine respiratory disease. *Vet Clin North Am Food Anim Pract* 13:475-492, 1997.
2. Balmer TV, Williams P, Selman IE: Comparison of carprofen and flunixin meglumine as adjunctive therapy in bovine respiratory disease. *Vet J* 154:233-241, 1997.
3. Blecha F, Boyles SL, Riley JG: Shipping suppresses lymphocyte blastogenic responses in Angus and Brahman x Angus feeder calves. *J Anim Sci* 59:576-583, 1994.
4. Booker CW, Abutarbush SM, Morley PS, Guichon PT, Wildman BK, Jim GK, Schunicht OC, Pittman TJ, Perret T, Ellis JA, Appleyard G, Haines DM: The effect of bovine viral diarrhea virus on health and performance of feedlot cattle. *Can Vet J* 49:253-260, 2008.
5. Booker CW, Abutarbush SM, Schunicht OC, Pollock CM, Perret T, Wildman BK, Hannon SJ, Pittman TJ, Jones CW, Jim GK, Morley PS: Effect of castration timing, technique, and pain management on health and performance of young feedlot bulls in Alberta. *Bov Pract* 41:1-11, 2009.
6. Bretschneider G: Effects of age and method of castration on performance and stress response of beef cattle: a review. *Livestock Production Sci* 97:89-100, 2005.
7. Buhman MJ, Hungerford LL, Smith DR: An economic risk assessment of the management of pregnant feedlot heifers in the USA. *Prev Vet Med* 59:207-222, 2003.
8. Carter JN, Meredith GL, Montelongo M, Gill DR, Krehbiel CR, Payton ME, Confer AW: Relationship of vitamin E supplementation and antimicrobial treatment with acute-phase protein responses in cattle affected by naturally acquired respiratory tract disease. *Am J Vet Res* 63:1111-1117, 2002.
9. Cusack PMV, McMeniman NP, Lean IJ: Effects of injectable vitamins A, B, E, and C on the health and growth rate of feedlot cattle destined for the Australian domestic market. *Aust Vet J* 86:81-87, 2008
10. Depenbusch BE, Drouillard JS, Loe ER, Higgins JJ, Corrigan ME, Quinn MJ: Efficacy of monensin and tylosin in finishing diets based on steam-flaked corn with and without wet distillers grains with solubles. *J Anim Sci* 86:2270-2276, 2008.
11. Dubeski PL, d'Offay JM, Owens FN, Gill DR: Effects of B vitamins injection on bovine herpesvirus-1 infection and immunity in feed restricted beef calves. *J Anim Sci* 74:1367-1374, 1996.
12. Dubeski PL, Owens FN, Song WO, Coburn SP, Mahuren JP: Effects of B vitamins injection on plasma B vitamin concentrations of feed restricted beef calves infected with bovine herpesvirus-1. *J Anim Sci* 74:1358-1366, 1996.
13. Duff GC, Galyean ML: Recent advances in management of high stressed, newly received feedlot cattle. *J Anim Sci* 85:823-840, 2007.
14. Duff GC, Walker DA, Malcolm-Callis KJ, Wiseman MW, Hallford DM: Effects of preshipping vs. arrival mediation with tilmicosin phosphate and feeding chlortetracycline on health and performance of newly received beef cattle. *J Anim Sci* 78:276-274, 2000.
15. Fairbanks KF, Campbell J, Chase CCL: Rapid onset of protection against infectious bovine rhinotracheitis with a modified-live virus multivalent vaccine. *Vet Therapeutics* 5:17-25, 2004.
16. Frank GH, Briggs RE, Duff GC, Loan RW, Purdy CW: Effects of vaccination prior to transit and administration of florfenicol at time of arrival in a feedlot on the health of transported calves and detection of *Mannheimia haemolytica* in nasal secretion. *Am J Vet Res* 63:251-256, 2002.
17. Friton GM, Cajal C, Ramirez Romero R, Kleeman R: Clinical efficacy of meloxicam (Metacam®) and flunixin (Finadyne®) as adjuncts to antibacterial treatment of respiratory disease in fattening cattle. *Berliner und Münchener tierärztliche Wochenschrift* 117:304-309, 2004.
18. Fulton RW, Hessman B, Johnson BJ, Ridpath JF, Saliki JT, Burge LJ, Sjeklocha D, Confer AW, Funk RA, Payton ME: Evaluation of diagnostic test used for detection of bovine viral diarrhea virus and prevalence of subtypes 1a, 1b, and 2a persistently infected cattle entering the feedlot. *J Am Vet Med Assoc* 228:578-584, 2006.
19. Gallo GF, Berg JL: Efficacy of a feed-additive antibacterial combination for improving feedlot cattle performance and health. *Can Vet J* 36:223-229, 1995.
20. 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* 73:1219-1226, 1995.
21. Gill DR, Smith RA, Ball RL: The effect of probiotic feeding on health and performance of newly-arrived stocker calves. *Okla Agric Res Station* 202-204, 1987.
22. González LA, Schwartzhopf-Genswein KS, Caulkett NA, Janzen E, McAllister TA, Fierheller E, Schaefer AL, Haley DB, Stookey JM, Hendrick S: Pain mitigation after band castration of beef calves and its effects on performance, behavior, *Escherichia coli*, and salivary cortisol. *J Anim Sci* 88:802-810, 2010.
23. Guichon PT, Jim GK, Booker CW, Schunicht OC, Wildman BK, Brown JR: Relative cost-effectiveness of treatment of feedlot calves with ivermectin versus treatment with a combination of fenbendazole, permethrin, and fenthion. *J Am Vet Med Assoc* 216:1965, 1969.
24. Guthrie CA, Laudert SB, Zimmerman AG: Metaphylaxis for undifferentiated bovine respiratory disease. *Comp Contin Educ Pract Vet* 22:S62-S67, 2000.
25. Hessman BE, Fulton RW, Sjeklocha DB, Murphy TA, Ridpath JF, Payton ME: Evaluation of economic effects and the health and performance of the general cattle population after exposure to cattle persistently infected with bovine viral diarrhea virus in a starter feedlot. *Am J Vet Res* 70:73-85, 2009.
26. Jim GK, Ribble CS, Guichon PT, Thorlakson BE: The relative economics of feeding open, aborted, and pregnant feedlot heifers. *Can Vet J* 32:613-617, 1991.

27. Johnson JC, Bryson WL, Barringer S, Hunsaker BD: Evaluation of on-arrival versus prompted metaphylaxis regimens using ceftiofur crystalline free acid for feedlot heifers at risk of developing bovine respiratory disease. *Vet Therapeutics* 9:53-62, 2008.
28. Larson RL, Miller RB, Kleiboeker SB, Miller MA, White BJ: Economic costs associated with two testing strategies for screening feeder calves for persistent infection with bovine viral diarrhea virus. *J Am Vet Med Assoc* 226:249-254, 2005.
29. Lekeux P: A therapeutic strategy for treatment of bovine respiratory disease complex: the rationale for the combination of a non-steroidal anti-inflammatory drug with an antibiotic. *Cattle Pract* 15:115-119, 2007.
30. Lockwood PW, Johnson JC, Katz TL: Clinical efficacy of flunixin, carprofen, and ketoprofen as adjuncts to the antibacterial treatment for bovine respiratory disease. *Vet Rec* 152:392-394, 2003.
31. Lofgreen GP: Mass medication in reducing shipping fever - bovine respiratory disease complex in highly stressed calves. *J Anim Sci* 56:529-536, 1983.
32. Longeragan GH, Thomson DU, Montgomery DL, Mason GL, Larson RL: Prevalence, outcome, and health consequences associated with persistent infection with bovine viral diarrhea virus in feedlot cattle. *J Am Vet Med Assoc* 226:595-601, 2005.
33. MacGregor DS, Falkner TR, Stokka GL: Managing pregnant heifers in the feedlot. *Comp Contin Ed Pract Vet* 19:1389-1391;1395;1407, 1997.
34. MacGregor DS, Yoder DR, Rew RS: Impact of doramectin treatment at the time of feedlot entry on the productivity of yearling steers with natural nematode infections. *Am J Vet Res* 62:622-624, 2001.
35. McClary DG, Corbin MJ, Carter B, Homm J, Vogel G, Platter W, Guthrie CA: A comparison of 3-, 5-, 7-, and 10-day post-metaphylaxis evaluation periods on health and performance following on-arrival treament with tilmicosin in feeder cattle - a summary of two studies. *Bov Pract* 42:117-127, 2008.
36. Nagaraja TG, Lechtenberg KF: Liver abscesses in feedlot cattle. *Vet Clin North Am Food Anim Pract* 23:351-369, 2007.
37. NASS-USDA: *Livestock Slaughter 2009 Summary.* Washington, DC. USDA National Agricultural Statistics Service. April 2010.
38. O'Connor AM, Sorden SD, Apley MA: Association between the existence of calves persistently infection with bovine viral diarrhea virus and commingling on pen morbidity in feedlot cattle. *Am J Vet Res* 66: 2130-2134, 2005.
39. Pollreiz JH, Bechtol DT, Upson DW: Problems and practice in mass medication of beef cattle. *Vet Clin North Am Food Anim Pract* 7:659-668, 1991.
40. Reinhardt CD, Hutcheson JP, Nichols WT: A fenbendazole oral drench in addition to an ivermectin pour-on reduces parasite burden and improves feedlot and carcass performace of finishing heifers compared to endectocides alone. *J Anim Sci* 84:2243-2250, 2006.
41. Richeson JT, Beck PA, Gadberry MS, Gunter SA, Hess TW, Hubbell DS, Jones C: Effects of on-arrival versus delayed modified live virus vaccination on health, performance, and serum infectious bovine rhinotracheitis titers of newly received beef calves. *J Anim Sci* 86:999-1005, 2008.
42. Rust RL, Thomson DU, Loneragan GH, Apley MD, Swanson JC: Effect of different castration methods on growth, performance, and behavior responses of postpubertal beef bulls. *Bov Pract* 41:111-118, 2009.
43. Schunicht OC, Guichon PT, Booker CW, Jim GK, Wildman BK, Hill BW, Ward TI, Bauck SW, Jacobsen JA: A comparison of prophylactic efficacy of tilmicosin and a new formulation of oxytetracycline in feedlot calves. *Can Vet J* 43:355-362, 2002.
44. Shumann FJ, Janzen JD, McKinnon JJ: Prophylactic tilmicosin medication of feedlot calves at arrival. *Can Vet J* 31:285-288, 1990.
45. Smith RA: North American cattle marketing and bovine respiratory disease (BRD). *Anim Health Res Rev* 10:105-108, 2009.
46. Snowder GD, Van Vleck LD, Cundiff LV, Bennet GL: Bovine respiratory disease in feedlot cattle: environmental, genetic, and economic factors. *J Anim Sci* 84:1999-2008, 2006.
47. Stevens ET, Thomson DU, Loneragan GH, Lindberg N: Effects of short-term exposure of feeder cattle to calves persistently infected with bovine viral diarrhea virus. *Bov Pract* 41:151-155, 2009.
48. Van Donkersgoed J: Meta-analysis of field trial of antimicrobials for mass medication for prophylaxis of bovine respiratory disease in feedlot cattle. *Can Vet J* 33:786-795, 1992.
49. Vanconcelos JT, Galyean ML: Nutritional recommendation of feedlot consulting nutritionists: the 2007 Texas Tech survey. *J Anim Sci* 85:2772-2781, 2007.
50. Wallace JO, Reinhardt CD, Thomson DU: Effect of concurrent metaphylaxis with chlortetracycline and tulathromycin on the health and performance of high-risk calves. *Bov Pract* 43:14-17, 2009.
51. Zweiacher ER, Durham RM, Boren BD, Gaskins CT: Effects of method and time of castration of feeder calves. *J Anim Sci* 49:5-9, 1979.