A SURVEY TO DESCRIBE CURRENT FEEDER CALF HEALTH AND WELL-BEING PROGRAM RECOMMENDATIONS MADE BY FEEDLOT VETERINARY CONSULTANTS IN THE UNITED STATES AND CANADA

by

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Abstract

Consulting veterinarians (CV; n=23) representing 11,295,000 head of 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 preventative medicine recommendation questions. The CV visited their feedyards 1.7 times per month. All CV train employees on cattle handling and pen riding while only 13% of CV speak Spanish. All CV recommend IBR and BVD vaccination for high-risk (HR) calves at processing. Other vaccines were not recommended as frequently by CV. Autogenous bacterins were recommended by 39.1% CV for HR cattle. Metaphylaxis and feed-grade antibiotics were recommended by 95% and 52% of CV, respectively, for HR calves. Banding was more frequently recommended than surgical castration as calf body weight increased. The CV recommended starting HR calves in smaller pens (103 hd/pen) and allowing 13 inches/hd of bunk space. The CV indicated feedlots need to employ one feedlot doctor per 7,083 hd of HR calves and one pen rider per 2,739 hd of HR calves. Ancillary therapy for treating respiratory disease was recommended by 47.8% of CV. 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 in predicting feedlot morbidity while metaphylactic antibiotic, therapy antibiotic and brand of vaccine were least important. This survey has provided valuable insight into feeder cattle health recommendations by CV and points to needed research areas.

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Dedication

This thesis is dedicated to Bryan Terrell, my late cousin, who encouraged and inspired me throughout my academic career. He inspires me as he lived his life demonstrating hard work, perseverance, compassion, and an appreciation for family. Additionally to my wife, Kelly, for her inspiration, love, and encouragement and to my parents, Vern and Marjean, for there living example of finding balance in life.

Chapter 1 - Feedlot Health and Well-Being Practices, A Literature Review

Veterinary consultants provide recommendations to feedlot producers on a range of topics including cattle handling, processing, vaccination, antibiotic therapy, and other health and production decisions. The recommendations made by feedlot veterinary consultants have a profound impact on the health, performance, and well-being of feedlot cattle. These decisions should be guided by research and practice experience to improve both the economic viability of the producer and animal welfare.

The most costly disease in feeder beef cattle in North America is bovine respiratory disease (BRD). The economic impact of BRD on beef cattle production is due to multiple factors. Cattle suffering from BRD can exhibit production losses due to respiratory morbidity, death loss, and treatment and processing costs. The National Animal Health Monitoring System (NAHMS) most recently published data for respiratory morbidity and mortality was in 1999.[52] The data in the 1999 publication represented 21,753,082 cattle fed in the years of 1994 to 1999. These data indicated 14.4% of all cattle arriving in the feedyard were treated for BRD. Loneragan *et al* (2001) reported the overall risk of mortality in the feedyard in 1999 was 14.2 deaths/ 1,000 head of cattle entering the feedyard while the risk of cattle dying from complications due to BRD was 8.7 deaths/1,000.[34] These data indicates that BRD accounts for a large portion of both feedlot respiratory morbidity and mortality.

McNeil and McCollum (2000) summarized data collected from 1992-2000 in the Texas A&M Ranch to Rails program.[51] The economic return was $87.60 greater for steers that remained healthy the entire period as compared with cohort steers treated for BRD. Brooks *et al.*

(2009) also reported significant economics losses when comparing cattle treated 3 times or more for BRD when compared to those never treated. These groups were able to achieve similar final live weights and carcass weights, but heifers treated 3 times for BRD lost $72.01 per head more than heifers not treated for BRD. Also, chronically ill feeder heifers lost $143.28 per head than heifers not treated for BRD.[7]

Many of the management practices recommended by veterinary consultants in the feedyard are based on the prevention, control, and treatment for BRD in feeder cattle. The use of feedgrade antibiotics, vaccination with viral and bacterial antigens, cattle management in transport, arrival management, and pen rider training are all areas considered when addressing BRD in feedlot cattle by veterinary feedlot consultants. Antibiotic therapies, ancillary therapies, hospital pen management, cattle handling, and hospital personnel training for the treatment of BRD are also addressed by these consultants. A better understanding of the evidence to support BRD prevention, control, and management practices is required to attain perspective on industry practices and to make better management decisions.

Metaphylaxis

Metaphylactic antimicrobial treatment is a practice used for management of respiratory disease in feedlot cattle. It is defined as treatment for control of respiratory disease for cattle at high risk for developing bovine respiratory disease (BRD), as compared to prophylaxis, which is the used for the prevention of disease in apparently healthy animals. Metaphylactic antimicrobial treatment in feedlot cattle has been found to reduce Bovine Respiratory Disease Complex (BRDC) incidence and increase feed conversion.[56] Decisions for the use of

metaphylactic antibiotic therapy must consider potential for losses due to bovine respiratory disease if metaphylaxis is not utilized.

Johnson *et al.* (2008) conducted a study evaluating the use of ceftiofur crystalline free acid (CCFA) in heifers on arrival and by prompted by pen morbidity.[29] Heifers receiving CCFA on arrival had 14% more animals not treated for BRDC compared to animals not receiving metaphylaxis (72.7% compared to 58.2%; P≤.02). In a separate group, heifers that received CCFA as metaphylaxis that was prompted by pen morbidity had 15% more animals not treated for BRDC than those (73.4 compared to 58.2; P≤.02) never receiving metaphylaxis. No difference found was found in average daily gain between treatment groups.

Duff *et al.* (2000) examined the use of tilmicosin phosphate on-arrival and preshipping in 2 experiments.[15] These treatments were compared against each other and to a control group receiving no medication in the first experiment. The second experiment also looked at the use of chloretetracyline at 22 mg/kg from day 5 to 9 for each of the treatments in the previous experiment along with a control group for each of the treatments. In the first experiment, calves not receiving metaphylaxis had a BRD treatment rate of 71.9% compared to 45.2% for calves given tilmicosin phosphate preshipping and 46.9% for calves receiving tilmicosin phosphate at arrival to the feedyard (P<.05). Similarly, in the second study reported, calves not receiving metaphylaxis with tilmicosin phosphate had a BRD treatment rate of 40% compared to 18.7% of calves receiving tilmicosin phosphate on arrival and 7.5% of calves receiving tilmicosin phosphate preshipping (P<.05).

In a study in which they conducted three separate trials, Galyean *et al.* (1995) again demonstrated that metaphylatic treatment with tilmicosin phosphate on arrival reduced the percentage of calves treated for respiratory disease (Trial 1 from 46% to 0 %, Trial 2 from 32.8%

to 12.1%, and Trail 3 from 43.6 % to 11.9%).[21] Trial 3 also demonstrated that metaphylatic treatment on arrival based on a rectal temperature cutoff of ≥ 39.7 °C reduced the percentage of treated calves from 43.6% to 12.9%. The performance advantage of Metaphylaxis in trial 3 was an increased average daily gain during the initial receiving period (Day 0-28) of .30 kg/day (1.66 to 1.36). This advantage in ADG due to metaphylactic treatment was also significant over a 56 day feeding period as calves that received metaphylaxis gained 1.57 kg/day while calves that didn't receive metaphylaxis only gained 1.42 kg/day.

Schumann *et al.* (1990) administered tilmicosin on arrival in 304 steer calves.[47] Their results showed a statistically significant decrease in treatments for BRD and for treatment of all diseases for the first first month after arrival (decreases of 12% to 1% and 23% to 6%, respectively). This study also showed an increase in the mean time of arrival to first treatment in the tilmicosin treatment group as compared to the controls, with the mean first treamtment times of 9 and 21 days, respectively.

McClary *et al.* (2008) compared post metaphylaxis evaluation periods following on-arrival treatment with tilmicosin.[38] Two studies were conducted. In these studies the treatments included cattle that received no on-arrival metaphylaxis and 3 groups of cattle that received metaphylaxis on arrival but had different moratorium periods post metaphylaxis in which cattle were not eligible for BRD therapy (3, 5, and 7 days in the first trial and 3,5,7, and 10 days in the second trial). After the moratorium period, cattle in all treatments were monitored and considered treatment failures if they exhibited clinical signs of BRD along with elevated rectal temperatures. In the first study, cattle in all groups receiving tilmicosin on arrival had a significantly reduced respiratory morbidity rates compared to the controls (9.6% vs. 33.8%)

along with improved average daily gain. The second study also found a reduced respiratory morbidity rate in all cattle treated with tilmicosin compared to cattle in the control group.

A meta-analysis was performed by Van Donkersgoed (1992) that summarized data of randomized field trials that gave prophylacitic parenteral mass medication on arrival.[53] After performing the analysis, Van Donkersgoed indicated that there were significantly significant decreases in BRD morbidity rates in calves that received prophalactic mass medication parenterally with long-acting oxytetracyline or tilmicosin ($p<0.001$).

In earlier work, Lofgreen (1983) compared the use of intramusclar oxytetracycline injections for 3 consecutive days after arrival, a single oral treatment of sulfadimethoxine on arrival, and a no treatment control group in two different experiments.[33] The three day oxytetracycline treatment significantly reduced BRD treatment days in calves by 21% compared to BRD treatment days in calves that had not received prophalactic oxytetracycline on arrival. The same results were observed in a subsequent study where there was a significant decrease in the number of treatment days in cattle that received oxytetracycline (31%) compared to cattle that did not. Lofgreen also reported that the administration of a single oral treatment of sulfadiamethoxine reduced treatment days in calves by 20% in the first experiment and 54% in the second experiment compared to cattle that did not receive an oral sulfadiamethoxine bolus in these two experiements.

Schunicht *et al.* (2002) compared the prophalactic use of tilmicosin and oxytetracycline upon arrival at the feedyard.[46] In this comaparison, there was a higher first treatment rate for undeifferenciated fever in cattle given prophylactic oxytetracycline than those receiving prophylactic tilimicosin (22.55% vs. 19.36%, $P=0.017$). There was no significant difference, however, in overall mortalities or in subsequent treatment rates.

Feedgrade Antibiotics

The use of feedgrade antibiotics is another tool available in the feedlot to help manage health risk in feedlot cattle. There is, however, growing pressure from influences outside and inside the industry to decrease the use of these feedgrade antibiotics.

Gallo *et al*. (1995) demonstrated the efficacy of a feed additive antibacterial for improving health of 4325 high risk feeder calves.[20] Steers fed 700 mg per head/day of a chlortetracycline and sulfamethazine combination product in their conventional ration for 56 days after arrival had statistically significant improvements in performance and health. The study showed calves fed the antibiotic were 11.6 kg heavier than the control cattle at 56 days on feed and had a decrease in BRD morbidity from 33.66% to 23.29%. Both respiratory and lameness morbidity were decreased. This study also showed a decrease in medicine costs per head throughout the feeding period due to feeding antibiotics up front to newly arrived feeder cattle.

The use of chlortetracycline concurrently with tulathromycin was researched by Wallace *et al.* (2009).[55] All calves in this study received metaphylactic tulathromycin at arrival. Calves were then divided into three treatments; calves receiving a growing diet with no pelleted feed added, calves receiving pelleted feed containing chlortetracycline (CTC) at a rate of 22 mg/kg/day for two 5 day periods, and calves receiving pelleted feed without CTC at the same rate for two 5 day periods. There was no difference in performance, morbidity, or mortality due to the addition of CTC in the feed.

The decision to use a feedgrade antibiotic should be made considering several factors including anticipated health cost, ability to manage morbid cattle based on facility and personnel requirements, and ability to consistently deliver the feedgrade product.

Antiparasitacides

Parasite control in the feedlot can be a cost effective practice. Different programs have been used and implemented over the years. The use of oral fenbendazole, topical or injectable avermectins, or a combination of these products is commonly used currently in feedlots. The use of these products to increase production and improve the overall health of feedlot animals should be considered in feedlot health protocols.

MacGregor *et al.* demonstrated the performance and health impacts of doramectin injectable used in yearling steers.[37] Steers that received injectable doramectin had an improved mean daily gain of 0.11 kg/day (P=0.002) and a significantly lower fecal egg count (0.2 eggs per gram in treatment group vs. 0.7 eggs per gram for controls, P=0.011) than did the control group.

Reinhardt *et al.* (2006) compared the use of fenbendazole as an oral drench with ivermectin topically in cattle compared to cattle that only received topical ivermectin alone and in a second study compared the performance of cattle that received fenbendazole as an oral drench with ivermectin topically verses cattle that received an injectable doramectin product alone.[43] In these two experiments, heifers (n=1,106 for experiment 1, n= 756 for experiment 2), that received treatment with the fenbendazole drench in addition to ivermectin compared to ivermectin alone or doramectin alone had a decreased parasite burden, increased ADG (Experiment 1- 1.54 kg vs. 1.48kg, P =.01) (Experiment 2- 1.48kg vs. 1.42 kg, P=.06), and increased hot carcass weight (Experiment 1- 338 kg vs. 333 kg, P =.01)(Experiment 2- 354 kg vs. 346 kg, P=.06)

In a study comparing ivermectin topically against a control group that received fenbendazole orally along with permethrin and fenthion topically, Guichon *et al.* (2000) found significant performance differences.[25] Cattle treated with ivermectin had increased final weight, increased weight gain, increased average daily gain, and improved feed to gain ratio (P<0.05).

There was not, however, a significant difference found in fecal-egg-reduction between the ivermectin treated cattle and the control cattle.

A similar study was conducted by Schunicht *et al.* (2000), where the researchers compared the use of topical ivermectin with topical fenthion in feedlot cattle.[46] Fenthion provided external parasite control but no control of internal parasites. The cattle that received ivermectin had an average daily gain significantly higher than cattle that were treated with fenthion (1.86 kg/day vs. 1.79 kg/day) ($P<0.05$). There was also a significantly improved dry matter intake to gain ratio, increased final weight, and increased weight gain in the cattle that received ivermectin treatment compared to the cattle in the treatment group receiving fenthion.

Common practice in the feedyard industry is the use of an injectable avermectin with or without the concurrent oral administration of fenbendazole. As this is a common practice, more research comparing the addition of fenbendazole to the parasite control program is necessary.

Castration Method

Castration of cattle is a husbandry technique employed by farmers, ranchers, and veterinarians to decrease secondary sex characteristics and improve the quality of the beef produced. Many different methods of castration are utilized. All methods of castration have some amount of stress. Feedlot veterinary consultants must take positive and negative attributes of all castration methods when making recommendations for feeder cattle today.

Surgical castration and banding castration methods were compared by Kreikermier *et al.* (1995) in stocker bulls weighing 685 lbs. Ninety-six head of bull calves were assigned to one of two castration technique groups (banded using latex tubing or surgically castrated using a surgical blade and an emasculator). The only difference was an increase in feed intake in cattle surgically castrated compared to those banded, but no other measured criteria were different. In

a review of the effects of age and castration on performance Bretschneider (2005) looked at weight loss, ADG, and stress response.[6] The review indicated that weight loss increased quadratically as the age of castration increased regardless of method. Differences between surgical castration and banding were not seen in ADG or cortisol levels, however, peak plasma cortisol concentration in cattle castrated before 6 months of age tended to be lower (P=0.01) when compared to cattle castrated after 6 months of age 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 calves castrated with a band than calves surgically castrated. This research, conducted by Booker *et al.* (2009) also demonstrated improvements in health and performance associated with delaying castration to 70 days post arrival versus castrating on arrival.[5]

In contrast, Rust *et al.* (2009) had a significantly lower average daily gain(ADG) and gain to dry matter intake ratio (Gain/DMI) in banded calves as compared to those surgically castrated ($P<0.01$).[44] When compared to a non-castrated control group, surgically castrated steers had a lower ADG and Gain/DMI ($P<0.01$). Rust *et al.* also found no added benefit to the use of local lidocaine anesthesia when comparing performance and post castration behavior. However, there was a decrease in vocalization in cattle receiving local lidocaine anesthesia compared to cattle that did not ($P<0.05$). González *et al.* (2009) noted a significantly reduced feed intake and growth in band castrated calves at the 3 and 4 week post castration period compared to those not castrated.[23]

As indicated by Rust *et al.*, the use of local anesthesia may not have any significant performance benefit with surgical or band castration of cattle. With the apparent chronic pain associated with band castration, especially around 3 to 4 weeks post castration, a need to control

long term pain should be considered. If it is not possible to control pain over longer periods, then other castration techniques may need to be considered.

Castration practices are an important tool to improve the end product and assist in cattle management. Castration technique and age of castration are important considerations for animal welfare and performance and continued research will be required for these practices.

Pregnancy Management

Another important issue that has both production and animal welfare implications is the management of heifers with unknown pregnancy status at arrival into the feedyard. Decisions for preventing females from maintaining pregnancy at the feedyard are made considering balance of labor, production, and animal welfare. Young pregnant heifers have an increased risk of dystocia and decreased performance.

The economic implications of pregnant feedlot heifers compared to open heifers and aborted heifers were addressed by a study by Jim *et al.* (1991).[28] In a 90 day finishing trial with 144 heifers, pregnant heifers were either aborted or remained pregnant along with a group of open heifers. Once adjusted for total uterine weight, the aborted and open heifers had improved ($p<.05$) carcass weight, ADG, and FE when compared to the pregnant heifers along with higher carcass weight, rib eye area, dressing percentage, and cutability. When economics were analyzed the open heifers returned $39.94 per head more than the aborted heifers and $66.35 more than the pregnant heifers. The aborted heifers had $26.41 per head greater return than pregnant heifers.

Buhman *et al.* (2003) conducted an economic assessment of the cost of pregnancy and its management in the feedyard by applying a computer simulation model.[8] The model compared

pregnancy checking heifers and subsequently aborting only pregnant females, mass injection of abortifacient without pregnancy checking heifers, and doing nothing to the heifers upon arrival into the feedyard. The model concluded that feeding open or aborted heifers returned over $100 per head more than pregnant heifers if sold on a live basis and $200 per head more if sold on a carcass basis compared to heifers pregnant at slaughter. In this model, if pregnancy rate was greater than 43% in a group of heifers, mass abortion of the entire pen was the most economical. If pregnancy rate was less than 43% in a group of heifers, pregnancy diagnosis and abortion of pregnant heifers was most economical.

An understanding of the risk of pregnancy in a group of heifers entering the feedyard is important. As indicated, there is a significant cost to pregnant heifers. Management decisions must be made with an understanding of these costs.

BVD Testing

Researchers continue to discuss and study the effects of cattle exposure to cattle that are persistently-infected (PI) with bovine viral diarrhea virus (BVDV) on feeder cattle performance and health. The practice of identifying and removing PI positive cattle is a common practice in the beef industry today. The economic feasibility of testing may depend on many factors, but several papers have attempted to quantify the impact of PI positive impacts within a population of feedlot cattle.[4, 19, 27, 30, 35, 41, 50]

Longergan *et al.* (2005) found that PI feeder calves exhibited higher morbidity rates than their non-PI cattle cohorts.[35] However, when analyzing the effect of a PI animal exposure to other calves within the pen, the researchers found no statistical difference in risk of BRD between the exposed groups of cattle and those groups of cattle not exposed to a PI calf in their

home pen. When the researchers in this study examined morbidity rates in cattle housed with a PI calf or housed in a pen adjacent to a pen that housed a PI calf, they found that these cattle exhibited a 43% greater risk of initial treatment for respiratory tract disease than those not exposed to a PI calf (P=0.04)

Stevens *et al.* (2009) showed an increased morbidity in calves with short-term exposure to PI animals than those with no exposure to PI animals (29.6% vs. 18.8%).[50] In comparison, in a study conducted by O'Connor *et al.* (2005), there was a significant decrease in respiratory morbidity at the pen level when a single PI calf was present compared with pens that did not contain a PI animal.[41]

Booker *et al.* (2008) investigated the effects or differences in outcomes of cattle health and performance based on type I or type II BVDV PI cattle exposure.[4] After arrival ear notch samples were taken from all cattle. Ear notches were tested by polymerase chain reaction (PCR) and subsequently by immunohistochemical (IHC) staining for PI calf diagnosis. If a PI positive calf was found, it was then identified as a type I BVDV infection, type II BVDV infection, or both type I and type II BVDV infection. If BVDV ear notches were PCR positive and IHC negative, the pens were categorized as having evidence of acute BVDV infection and the cattle in which the ear notch samples were obtained were also categorized by type. When the researchers compared pens with a least one PI calf to those without a PI calf there was no significant difference in morbidity, mortality, average daily gain, or dry matter intake to gain ratio. However, when categorized by type of infection, cattle housed in pens with a type I BVDV PI cattle had a significantly higher mortality rate than cattle housed in pens with all cattle testing negative ($P<0.05$). In contrast, mortality was lower in cattle housed in pens with a type II BVDV PI calf than cattle with no PI cattle ($P<0.05$).

Generally, the use of testing for BVD PI positive cattle at the feed yard depends on the risk to the feedlot population with the type or risk of cattle entering the yard. Continued evaluation of the possible loss of performance and increased health risk along with the cost of testing will be necessary when making decisions on testing for PI BVD cattle on arrival.

Bunk Space

Bunk space requirements are important when designing feedlots and placing cattle into pens. Little research has been done in feedlot cattle, although a small amount was conducted with the onset of the practice of limit feeding steers in the 1980s.[24, 57]

Zinn *et al.* (1989) found that manger space requirements greater than 15 cm (6 in.) per head did not improve growth performance in yearling cattle.[57] Gunter *et al.* (1993) also found similar results in receiving cattle, showing no difference in 500 to 700 lb. limit–fed steers in manger space above 5 inches per head.[24]

More research in this area is warranted to examine the effects of limited bunk space on the health, behavior and performance of high risk cattle.

Ancillary Therapy

Various ancillary therapies can be used in conjunction with antimicrobials in treatment for BRD. These therapies, while often used by producers and recommended by veterinarians, have little data showing a benefit to clinical outcome of BRD cases. Ancillary therapies often included in the treatment include probiotics, vitamins, and different anti-inflammatories. Cusack *et al.* (2008) used 2465 head of feedlot cattle to examine the effects of various injectable vitamin A,D and E combinations (a commercial Vitamin A, D, and E at the label dose; the same

Vitamin A,D and E prodcut at twice the labeled dose; the same formulation with Vitamin A and E but without Vitamin D: the same formulation with a lower concentration of Vitamin A and higher concentration of Vitamin E with no Vitamin D; and an oil based placebo carrier).[10] They reported no benefit from injection of any of the formulations at the time of treatment for BRD. In another study, these researchers compared the health and treatment responses in cattle administered or not administered Vitamin C intramuscularly at the time of treatment for BRD. Cattle administered Vitamin C with antibiotic therapy had decreased mortality compared to cattle that did not receive Vitamin C as an ancillary BRD therapy (P=0.04).

Treatment with non-steroidal anti-inflammatory drugs (NSAIDS) such as flunixin meglumine along with treatment with an antibacterial was studied by Lockwood *et al.* (2003).[32] In this study, cattle were randomly assigned to one of 4 ancillary BRD treatment groups: flunixin meglumine, the second and third were two NSAIDS not approved in cattle in the United States, and the last was the control group (no NSAIDS). The study found no difference between any of the cattle regardless of treatment group in reference to clinical depression, illness scores, dyspnea, or coughing. The researchers did find that cattle treated for BRD with flunixin meglumine as an ancillary therapy did exhibit less lung consolidation at necropsy than cattle in the other treatment groups. The use of ancillary therapies, though often utilized, has little data showing an improvement in case outcome or performance.

Conclusion

Vanconcelos and Galyean (2007) conducted a survey of feedlot nutritionists in the United States and reported the standards of practice or recommendations that these nutritionist make to their feedlot clients.[54] This survey has been repeated every four to five years to report the

changes in recommendations and nutritionist practices due to philosophical or technological changes in beef cattle nutrition in US feedlots. These surveys have led to prospective and retrospective studies to answer questions in areas where there is lack of agreement between the consultants surveyed. This type of baseline study has not been conducted for feedlot veterinary consulting recommendations. Therefore, a survey of selected feedlot consulting veterinarians in the United States and Canada on their recommended practices for animal health and well-being for feeder cattle has significant value.

Veterinary feedlot consultants make management recommendations that have significant impacts on the health and performance of feedlot cattle. Many management tools, such as metaphylaxis, have consistently been shown to be useful in management in the certain groups of cattle. Other practices, including many ancillary therapies, have not been consistently shown to improve performance or case outcomes. Continued research is warranted in many management areas to ensure that the best decisions are being made to keep the beef industry efficient and profitable.

Chapter 2 - Current feeder calf health and well-being program recommendations made by feedlot veterinary consultants in the United States and Canada.

Materials and Methods

Veterinary Consultants

Veterinary consultants were selected for this study based on geographic practice area and being recognized as providing health care for a large number of feedlot cattle. Twenty-three feedyard veterinary consultants 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 veterinary consultants agreed to participate in the survey, and all 23 completed the survey. Approval was granted by the Kansas State University Institutional Review Board to conduct this survey.

Data Collection

Data were collected using a web based survey system through Kansas State University (Axio Online, K State Survey Services, Manhattan, KS). 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 5 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 (Microsoft, Redmond, WA) for data summarization and statistical analysis. Answers given as ranges i.e. bunk space 12-14 inches, 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 (95.7%) with 1 respondent's home office in Canada (4.4%). Of the respondents located in the United States 1 (4.4%) was in Colorado, 1 (4.4%) in Idaho, 1 (4.4%) in Iowa, 8 (34.8%) in Kansas, 2 (8.7%) in Nebraska, 2 (8.7%) in Oklahoma, and 7 (30.4%) in Texas. Annual feedyard headcount for each consulting practice averaged 491,087 with a maximum headcount of 1,100,000 and a minimum of 20,000. The average feedyard capacity for the majority of the consultants (82.6%) 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 max of 75% and a min of 0%.

In regard to the geographic location of their clients' feedyards, 21 (91.3%) had clients in the Central Plains (defined as Colorado, Kansas, Nebraska), 3 (13.0%) in the Corn Belt (Illinois, Iowa, Minnesota, Missouri, Wisconsin), 1 (4.4%) in the Northeast (Michigan, New England States, New York, Ohio, Pennsylvania, West Virginia), 1 (4.4%) in the Northern Plains (Manitoba, Montana, North Dakota, Saskatchewan, South Dakota, Wyoming), 5 (21.7%) in the Northwest (Alberta, British Columbia, Idaho, Oregon, Washington), 0 (0%) in the Southeast (Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia), 12 (52.2%) in the Southern Plains (New Mexico, Mexico, Oklahoma, Texas),and 2 (8.7%) in the Southwest (Arizona, California, Nevada, Utah).

The mean number of feedlot visits per month for consultants was 1.7 visits per month per feedlot with a minimum of 1 visit per month, a maximum of 4 visits per month and a mode of 1 visit per month.

Employee Training/Animal Welfare

Training of feedlot employees by veterinarians can be critical for the implementation of management recommendations for the health and well-being of feeder cattle. Animal welfare in commercial feedlots has become the focus of animal activists groups, producer organizations and the media. The feedlot veterinary consultants were asked 6 questions on employee training and animal welfare practices. All 23 respondents (100%) indicated that they spend time training feedyard employees on cattle handling. Of the veterinary consultants surveyed, 12 (52.2%) conducted animal welfare audits/assessments at their client's feedlots while 11 (47.8%) did not.

The types of audits/assessments were not specified. All 23 (100%) were actively involved in the training of the pen riders in the feedyards. The follow-up question then asked respondents to select the training methods and mediums they used for training feedyard staff. Audio/visual tools such as video were used by 20 (87.0%) respondents, printed material by 18 (78.3%), pictures by 19 (82.6%), hands on training by all 23 (100%), and live web demonstrations by 2 (8.7%) of the respondents. Of the 23 veterinary consultants questioned, 3 (13.0%) responded that they could speak Spanish. When asked if they train employees to use auscultation to aid in diagnosis of bovine respiratory disease (BRD) 15 (65.2%) said they did, while 8 (34.8%) did not. (Table 2-1)

Processing and Receiving Cattle

Allowing cattle to rest prior to processing at the feedlot has been debated for many years. After receiving short haul cattle (defined as less than 8 hours) 12 (52.1%) consultants do not require a rest period for the cattle prior to processing, 5 (21.7%) require a 6 hour rest period, 3 (13.0%) require a 12 hour rest period, and 3 (13.0%) require a 24 hour rest period (Table 1). After receiving long haul cattle (defined as greater than 8 hours) 1 (4.4%) consultant did not require a rest period prior to processing, 1 (4.4%) requires a 6 hour rest period, 6 (26.1%) require a 12 hour rest period, and 15 (65.2%) require a 24 hour rest period. (Table 2-2)

Vaccines are administered to feeder cattle at the time of processing to immunize the animals against pathogens that can cause disease. Table 2.3 is a list of the recommendations for arrival vaccinations for high and low health risk feeder calves by consulting feedlot veterinarians. All consulting feedlot veterinarians surveyed recommended that high risk calves be vaccinated for infectious bovine rhinotracheitis (IBR) and bovine viral diarrhea (BVD) types 1, and type 2. Of the 23 consulting veterinarians surveyed, 15 (65.2%) recommend bovine

respiratory syncytial virus (BRSV) and 14 (60.9%) recommend parainfluenza type 3 (PI3) for viral antigens at processing for high risk calves. Only 5 (21.7%) consultants recommend *Histophilus somni*, 1 (4.4%) recommends *Leptospira*, 14 (60.9%) recommend Clostridials, 17 (73.0%) recommend *Mannheimia haemolytica*, and 8 recommend *Pasteurella multocida* as bacterial components to vaccinate high risk calves. Autogenous bacterins were recommended by 9 (39.1%) veterinarians in for use in high risk cattle, while 14 (60.9%) did not recommend autogenous bacterins. No respondents recommended the use of *Moraxella bovis* or *Mycoplasma bovis* antigens.

Vaccine recommendations made by consulting veterinarians for low health risk cattle was slightly different than the recommendations for the high risk cattle. All 23 (100%) consulting veterinarians surveyed recommend IBR vaccination at the time of processing for low risk cattle. Twenty- two (95.7%) of the veterinarians surveyed recommend BVD type 1 and type 2 antigens while 12 (52.2%) recommend BRSV and PI3 as viral antigens for vaccination of low risk cattle. Approximately half (56.5%) of the veterinarians surveyed recommended the use of Clostridial bacterins in low risk cattle. A single consulting veterinarian (4.4%) recommended either *Leptospira* or *Pasteyrella multocida bacterial components* for use in low risk cattle (Table 2-3).

Revaccination of Calves

This question was intended to capture the revaccination recommendations for high risk feedlot cattle. However, the actual question did not specify between high risk and low risk cattle, therefore the interpretation was open to the respondent. When asked about revaccinating calves 16 (69.6%) consultants recommend revaccination of calves, whereas 8 (34.8%) did not recommend revaccination at all. When asked when they recommend revaccination 10 (43.5%)

consultants recommend 10 days post-processing, 10 (43.5%) consultants recommend 14 days post-processing, 4 consultants (17.4%) recommend 21 days post-processing, none recommend 30 days and 2 (8.7%) consultants recommend greater than 30 days post-processing. When asked what antigens they recommended revaccinating for, 18 consultants (78.3%) recommend IBR, 15 (65.2%) consultants recommend type 1 and type 2 BVD, and 8 (34.8%) consultants recommend BRSV and PI3. Revaccination with bacterial antigens was rarely recommended. Only 4.4% of consulting veterinarians surveyed recommended revaccination with the bacterial antigens *Histophilus somni* or *Mannheimia haemolytica*. No other bacterial antigens were recommended for revaccinations, including Clostridial bacterins. The majority (82.6%) of the consultants recommend revaccination at the time of reimplant. Revaccination recommendations for viral antigens at the time of reimplant included, IBR (78.3%), type 1 and type 2 BVD (43.5%), and BRSV and PI3 (34.8%).

Metaphylaxis and feed grade antibiotics

Nearly all veterinarians surveyed (95.7%) recommend metaphylaxis on arrival for high risk cattle but only 2 (8.7%) veterinarians recommend metaphylaxis for low risk cattle (Table 2.4). Researchers have demonstrated a decrease in treatment rates for BRD using various protocols for metaphylaxis.[15,21,29] Improvements in performance has also been noted with use of metaphylaxis.[21] When asked if they use feed grade antibiotics for prevention of BRD in high risk calves, 12 (52.2%) responded yes, 6 (26.1%) responded no, and 5 (21.7%) said it depends, with additional comments such as using it to prevent *Histophilus somni* from August to December and depending on consumption levels. For feed grade antibiotic use for prevention of BRD in low risk calves, only 4 (17.4%) consultants responded yes, 3 (13.0%) responded that it

depends with additional comments of depending on expression of clinical signs or on a prescribed basis, and 16 (69.57%) do not recommend feed grade antibiotics be fed to low health risk feeder calves. (Table 2-4) Research has demonstrated the benefit of feedgrade antimicrobial use in reducing morbidity and increased performance.[11,20,42]

Less than half (47.8%) of the feedlot veterinary consultants are included in developing the steroid implant programs. The preferred route of administration for antiparasiticides for 16 (69.6%) of the consultants was injectable only, 8.7% preferred pour-on only method, none preferred only oral administration of antiparasiticides, while 21.7% of veterinarians preferred a combination of various administrations. Research has shown a benefit of oral fenbendazole treatment given in combination with an ivermectin pour-on versus the pour-on alone and versus an injectable dormectin alone.[43] 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.[25] Of the 23 respondents, 6 (26.1%) recommend the use of generic antiparasiticide products in place of trade name products while 17 (73.9%) recommend name brand antiparasiticides. Finally, when processing 13(56.5%) of the consultants recommended bobbing the hair of the tail when processing cattle compared to 10(43.83%) that did not recommend the practice.

Castration and Pregnancy Management

The veterinary feedlot consultants were asked which castration method they recommend for each of four weight classes of calves. In general, surgical castration was recommended more frequently for light weight cattle whereas banding was recommended more frequently for heavier weight class cattle (Figure 2.1). For calves less than 300 lbs surgical castration was

recommended by 65.2% of veterinarians (banding 4.4%; either method 30.4%). For calves 300-500 lbs surgical castration was recommended by 43.5% of veterinarians (banding 13.0%; either method 43.5%). When considering calves 501-800 lbs surgical castration was recommended by 21.7% of veterinarians (banding 56.5%; either method 21.7%). For calves more than 800 lbs surgical castration was recommended by 8.7% of veterinarians (banding 65.2%; either method 26.1%). Earlier research did not indicated 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 calves castrated with a band than calves surgically castrated.[5] Improvements in health and performance were also seen in delaying castration 70 days post arrival versus castrating on arrival. In two other studies, a significantly lower average daily gain was seen in banded calves than those surgically castrated.[23,45] Each of these studies, one over a 28 day period and the other over 42 days, indicated most of the lost performance in calves castrated by banding was observed in the 3rd and 4th weeks of the trials. When banding, 22 (95.7%) veterinary consultants recommend the concurrent administration of tetanus toxoid, while 1 (4.4%) did not respond. (Figure 2-1)

In managing newly arrived heifers, 18 (78.3%) of 23 veterinary consultants recommend that producers pregnancy check heifers, while 5 (21.7%) did not recommend a pregnancy check. Classes of heifers for which consultants recommended pregnancy checking were described for those respondents that answered yes to pregnancy checking incoming heifers. In the comment box respondents emphasized checking those with unknown origins or no history. When asked about recommending mass abortion protocols, 8 (34.8%) veterinarians responded that they

recommend mass abortions without pregnancy checking compared to 15 (65.2%) that do not. Classes of heifers that were deemed appropriate candidates for mass abortion were again described in an additional comment box with the majority of responses indicating mixed sex lots or all heifers received at the feedyard during the months August through December. The economic implications of pregnant feedlot heifers compared to open heifers and aborted heifers were addressed in previous research.[8,28] One research group observed that open heifers returned $39.94 per head more than aborted heifers and $66.35 more than the pregnant heifers. The aborted heifers had $26.41 per head greater return than pregnant heifers.[28] In a simulation study, it was demonstrated that net returns declined if pregnant heifers were retained as pregnant in the feedlot.[8]

BVD PI Testing

Routine BVD testing of high risk cattle on arrival is recommended by 39.1% of the veterinarians. Protocols for disposition of positive cattle were added as comments. Most responded that PI calves are placed in quarantine or sold directly to salvage slaughter. Only 2 (8.7%) consultants recommend routine BVD testing on arrival in low risk cattle. The prevalence of PI BVD calves and the economic impact of exposure to BVD PI calves due to performance losses or decrease health status has been extensively reviewed in previous studies.[4,27,30,35,50] There are still questions that surround the value of this biosecurity practice at the level of the cattle feeding facility.

Cohort Size and Facilities

The number of cattle fed per pen and the amount of bunk space can have a significant impact on the ability for pen riders to find morbid cattle. The optimal number of calves per pen for high risk calves was given by 18 respondents. The maximum number given was 200; the minimum was 50, with a mean of 103, and a mode of 100. Linear bunk space recommendations were given by all 23 veterinary feedlot consultants. The average recommendation was 13.9 in/hd, the minimum was 10 in/hd, the maximum was 21 in/hd, and the mode was 12 in/hd. In general veterinarians recommend that high risk cattle be started in a single truckload (100 hd) size pen with close to 116 ft of linear feedbunk space.

Pen Riding and Treatment

The consultants were asked to indicate the number of times per day they recommend that pen riders check high risk calves. Of the 23 respondents 4(17.4%) recommended checking the cattle once daily, 71.4% recommend checking them twice daily, and 4.4% recommended checking 3 times a day. Twenty of the 23 consultants recommend checking low risk cattle once daily while 3 recommend checking them twice daily.

Consultants were then asked a series of questions to recommend the number of employees required to adequately address the health and well-being of high and low risk cattle (Figure 2-2). The veterinarians surveyed recommended 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 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. The

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 per 15,972 head, with a maximum recommendation of 50,000 head per feedlot doctor, a minimum of 2,500 head per feedlot doctor and a mode of 10,000 head per feedlot doctor. (Figure 2-2)

Nearly all (91.3%) of the consultants recommended that a rectal temperature of cattle pulled for BRD be observed. The use of rectal temperature to initiate treatment of cattle with BRD is recommended by 11 (47.8%) of the participants. The rectal temperature utilized to initiate BRD treatment of cattle ranged from 103.5° F to 104.5° F with a mode of 104.0° F.

Morbidity and Mortality

Seven factors related to the prediction of morbidity and mortality of feeder cattle were presented to the consultants and they were asked to rank these factors in order of importance. The factors presented were brand of vaccine, class of antibiotic use for treatment, class of antibiotic used for metaphylaxis, cattle health risk, weather patterns, receiving nutrition program, and the amount and quality of labor. Factors were ranked in order of importance with a 1 being most important and a 7 being least important. The means and modes were closely correlated among responses and are reported in Table 2-5. The most important predictive factor to consultants was the cattle health risk with a mean of 1.3 and a mode of 1. The second most important predictive factor was weather patterns with a mean of 3.2 and a mode of 2. The middle ranked factors were the amount and quality of labor and the receiving nutrition program, means of 3.4 and 3.9; and modes of 4 and 3, respectively. The class of antibiotic used for

metaphylaxis had a mean rank of 4.4 and a mode of 5, while class antibiotic used for treatment had a mean rank of 5.6 and a mode of 6. Brand of vaccine used was ranked by the consultants as the least important factor in prediction of morbidity and mortality with a mean rank of 6.2 and a mode of 7 (Table 2-5).

Ancillary BRD Therapy

Ancillary therapy for treatment of BRD is recommended by 47.83% of the consultants. Specific ancillary treatments recommended by consultants are probiotics (13.04%), viral vaccine (8.7%), B vitamins (8.7%), Vitamin C (30.4%), dexamethazone (4.4%), Banamine (17.4%), and antihistamine (13.0%) (Figure 2-3). Little data is available to show improved treatment success with the use of ancillary therapies. However, Cusack *et al.* (2008) did show a decrease in mortality in cattle treated for BRD with Vitamin C and an antibiotic verses cattle that only received an antibiotic for BRD treatment.[10] The use of non-steroidal anti-inflammatories has shown to reduce pyrexia in cattle with BRD, but the does not show a difference in treatment success or a decrease in mortality.[18,32] As nearly 50% of the consultants in the survey recommended the use of some type of ancillary therapy, research to demonstrate whether there is improved clinical outcomes with the use of these therapies may be needed.

Railer cattle

Railer cattle are unthrifty, non-producing animals that are sold prior to other pen mates to salvage some monetary value. There are several outlets for feedlots to dispose of railer cattle. The veterinary consultants were asked which outlet or outlets the feedlots in which they consult utilize. The consulting veterinarians indicated that 96.7% of their feedlot clients sell railers for

salvage slaughter, 69.6% sell railers to private treaty sale, 69.6% euthanize and renderer the railer cattle and 30.4% sell railer cattle through an auction market. The most common reasons for cattle to be railed were BRD (43.5%), lameness (47.8%), and chronic non-performance issues (8.7%).

Euthanasia

Although one of the most unpleasant duties in the feedyard, euthanasia is an important part of animal care and husbandry. Consultants were asked what method of humane euthanasia was utilized in their feedyards. Gunshot was used for euthanasia by the majority (86.9%) of feedyards with only 13.0% using captive bolt. All respondents indicated they had a program in place for the care and handling of nonambulatory cattle. Consultants were then asked how long they wait with no clinical improvement in the nonambulatory cattle before recommending euthanasia. The veterinarians were given 4 time categories to choose: 5 (21.7%) veterinarians initiated euthanasia in less than 24 hrs for nonambulatory animals not responding, 12 (52.2%) wait 24 to 48 hrs with no improvement, 6 (26.1%) wait 49-72 hrs, and none of the veterinarians surveyed wait longer than 72 hrs with no clinical improvements before initiating euthanasia.

Conclusion

Application of relevant research findings to feedlot clients by veterinary consultants can help increase efficiency and production. While this survey only had 23 respondents, those respondents represented approximately 34% of the cattle on feed in the U.S.[40] Thus, this survey has provided valuable insight into the most common recommendations being provided by

veterinary feedlot consultants in the U.S. and Canada. The purpose of this survey is to stimulate focused discussion and research on common feedyard practices in which there may or may not be established bodies of research.

Figure 2-1 Consulting feedlot veterinary survey responses when asked about their recommendation for castration method in different weight classes of bull calves.

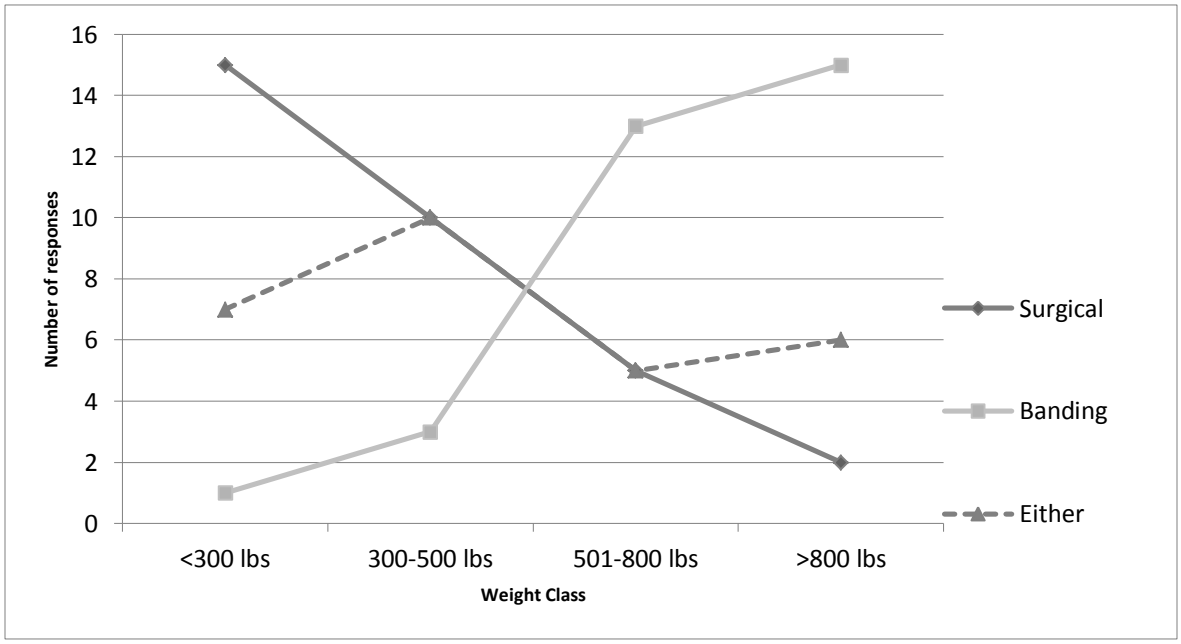

Figure 2-2 Consulting feedlot veterinary recommendations for the number of high or low health risk cattle per employee type in a commercial cattle feeding operation.

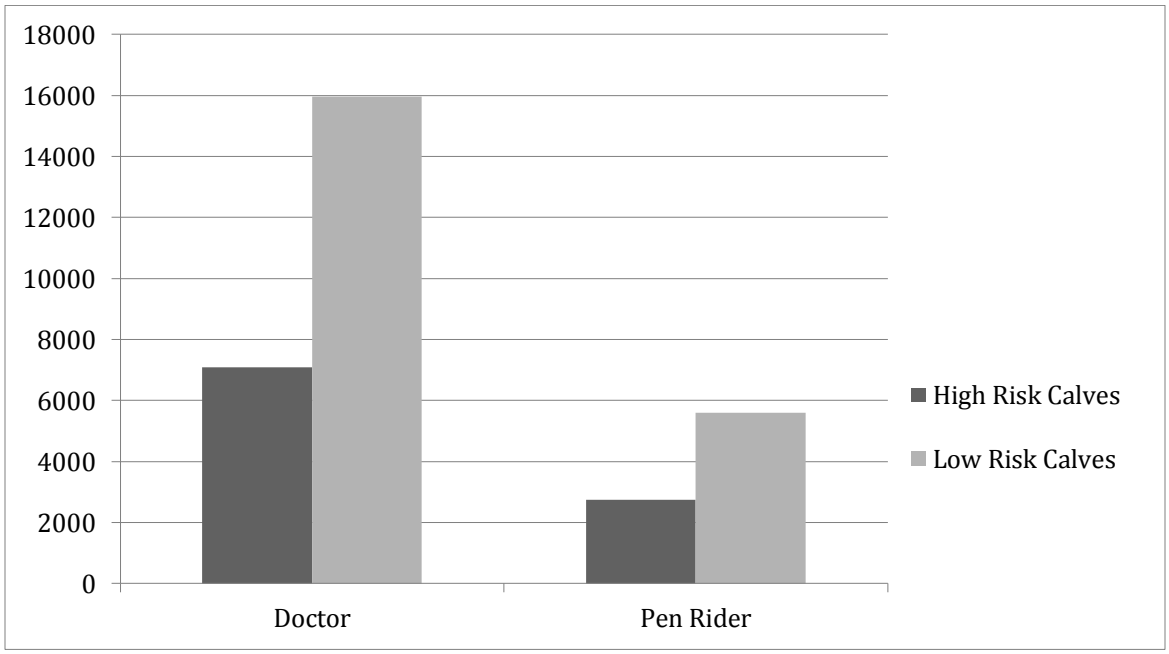

Figure 2-3 Recommendations made by consulting veterinarians in the United States and Canada for the use of specific ancillary therapy options when treating feedlot cattle for Bovine Respiratory Disease Complex.

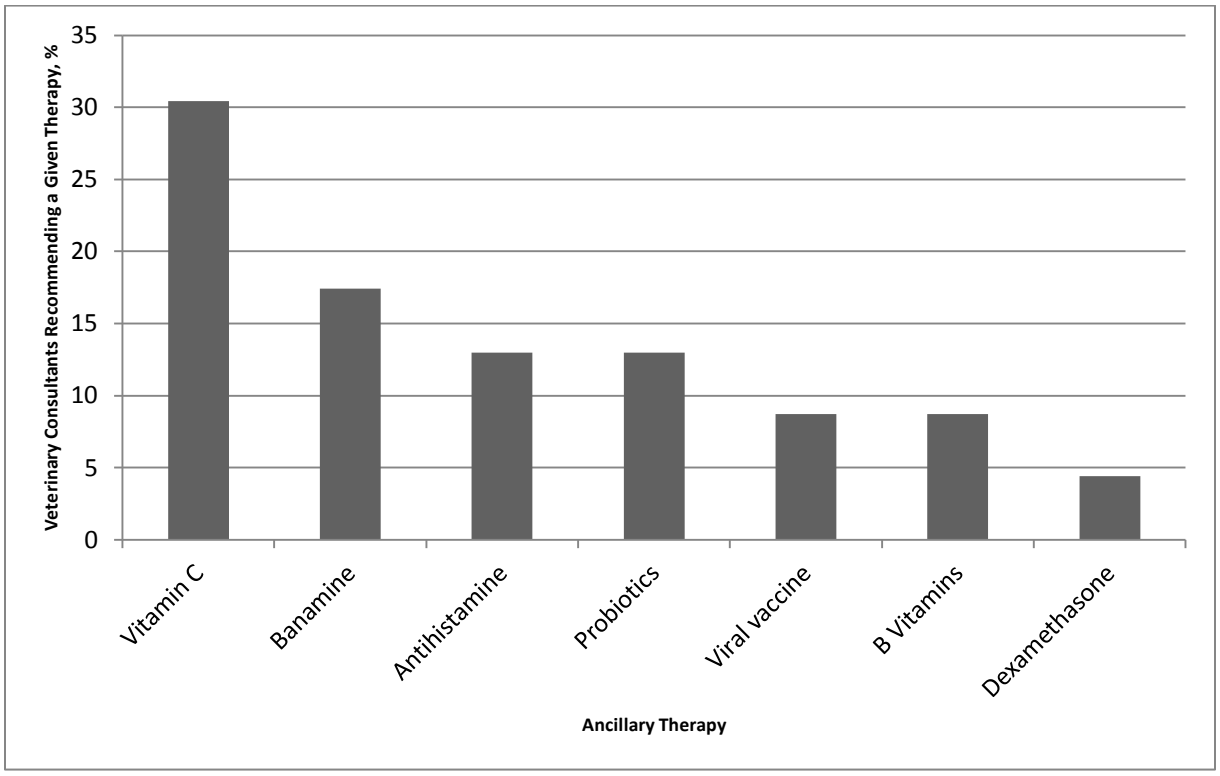

Table 2-1 Percentage or number of consulting feedlot veterinarians that responded positively when asked about training feedlot employees, conducting animal welfare audits or if they spoke Spanish.

Item	Number of Responses	% of responses
Train employees in cattle handling	23	100
Conduct animal welfare audits	12	52.2
Train pen riders	23	100
Speak Spanish	3	13.0

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

	Hours of Rest				
	No	**6 hrs**	**12 hrs**	**24 hrs**	**>48 hrs**
Short haul cattle*	12 (52.2%)	5 (21.7%)	3 (13.0%)	3 (13.0%)	0 (0%)
Long haul cattle	1 (4.4%)	1 (4.4%)	6 (26.1%)	15 (65.2%)	0 (0%)

*Short haul cattle were defined as cattle that had less than 8 hours of transport to the feeding facility. Long haul cattle were cattle that were exposed to 8 hours or more transportation to the cattle feeding facility.

Table 2-3 Vaccination recommendations by consulting feedlot veterinarians for low and high health risk feeder cattle at the 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 (95.7%)
BVD Type 2	23 (100%)	22 (95.7%)
BRSV[c]	15 (65.2%)	12 (52.2%)
PI3[d]	14 (60.9%)	12 (52.2%)
Histophilus somnus	5 (21.7%)	1 (4.4%)
Moraxella bovis	0 (0%)	0 (0%)
Mycoplasma bovis	0 (0%)	0 (0%)
Leptospira vaccine	1 (4.4%)	1 (4.4%)
Clostridial bacterins	14 (60.9%)	13 (56.6%)
Mannheimia haemolytica	17 (73.9%)	0 (0%)
Pasturella multocida	8 (34.8%)	0 (0%)
Autogenous bacterins	9 (39.1%)	0 (0%)

[a]Infectious Bovine Rhinotracheitis virus

[b]Bovine Viral Diarrhea virus

[c]Bovine Respiratory Syncitial Virus

[d]Parainfluenza III virus

[e] Number of responses (Percentage of responses).

Table 2-4 Recommendation of use of metaphylaxis or feed grade antibiotics by consulting feedlot veterinarians for low and high health risk feeder cattle (% of total responses).

Recommended practices	Response		
	Yes	No	Depends
Metaphylaxis –high risk cattle	22 (95.7%)	4 (4.4%)	NA
Metaphylaxis – low risk cattle	2 (8.7%)	21 (91.3%)	NA
Feedgrade antibiotics –high risk cattle	12 (52.2%)	6 (26.1%)	5 (21.7%)
Feedgrade antibiotics – low risk cattle	4 (17.4%)	16 (69.6%)	3 (13.0%)

Table 2-5 Ranking of seven factors utilized by consulting feedlot veterinarians to predict morbidity and mortality in feeder cattle in commercial feedyards (These items are listed in order of importance by mean and mode with 1 (most predictive) to 7 (least predictive)).

	Mean	Mode
Cattle health risk	1.3	1
Weather patterns	3.2	2
Amount and quality of labor	3.4	4
Receiving nutrition program	3.9	3
Class of antibiotic use for metaphylaxis	4.4	5
Class of Antibiotic use of treatment	5.6	6
Brand of Vaccine	6.2	7

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