

The changing impact of economics on managing bovine respiratory disease complex in feedlot cattle

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Abstract

The cattle market has set year-over-year record high prices since 2009. The increasing value of cattle has substantially increased the financial risk of feeding cattle, and has commensurately increased the economic losses from disease. As cattle feeding profitability continues to be challenged by the low margin between selling prices and operating costs, all facets of cattle feeding are being evaluated to improve efficiency. Better disease management is an area where economic efficiencies can be gained. Bovine respiratory disease complex (BRDC) is widely cited as the most costly disease of beef cattle in North America. Management tools and efforts need to be reexamined, and new tools developed, to reduce BRDC economic losses. This paper reviews cattle feeding financial risk and recent economic implications from the Integrated Program for Reducing Bovine Respiratory Disease Complex in Beef and Dairy Cattle Coordinated Agricultural Project.

Key words: bovine, cattle, BRD, economics, genomics

Résumé

Le marché des bovins s'est fixé d'année en année des prix records depuis 2009. La valeur croissante des bovins a augmenté substantiellement le risque financier de nourrir les bovins, et a augmenté les pertes économiques en proportion de la maladie. Comme l'engraissement de bovins la rentabilité continue d'être menacé par la faible marge entre les prix de vente et coûts d'exploitation, toutes les facettes de l'engraissement de bovins sont évalués afin d'améliorer l'efficacité. Une meilleure gestion de la maladie est un domaine où l'efficacité économique peut être acquise. Le complexe respiratoire bovin complexe (BRDC) est largement cité comme les plus coûteuses des maladies des bovins en Amérique du Nord. Outils de gestion et les efforts doivent être réexaminés, et de nouveaux outils ont été élaborés, à réduire les pertes économiques BRDC. Le présent document examine l'engraissement de bovins risque financier et incidences économiques récentes du Programme intégré pour la réduction du complexe respiratoire bovin complexe dans le boeuf et les bovins laitiers COORDONNÉ Projet agricole.

Introduction

Bovine respiratory disease complex (BRDC) is widely cited as the most costly disease affecting feedlot cattle.^{1,22} Work on identifying management approaches to reduce the large economic losses from BRDC as a result of shipping and comingling cattle lots dates back to the 1960s, as feedlots were established and expanded in the 1950s and 1960s and hybrid grains, irrigation technology, and transportation efficiencies made concentrated animal feeding operations economically feasible.⁶ The prevalence of BRDC detected in feedlot cattle varies by year with a 15-year range from 5% to 44%, and also by season, with higher prevalence rates in the fall and winter.^{12,21} The average prevalence rate of BRDC was 16.2%, with virtually all feedlots (96.9%) reporting 1 or more cases between July 1, 2010 and June 30, 2011. Recent reports have indicated that greater than 60% of all cattle in the feedlot have lung lesions resulting from BRDC, and many of these animals were undetected as suffering from an illness.¹⁸ Of animals that exhibited noticeable symptoms of illness, BRDC was the most common cause (67% to 82%) of illness detected in feedlot cattle.³ Data from 1,000 lots of cattle representing 182,918 head over 2012 and 2013, reported mortality rates ranging from 0% to 36%, with an average of 1.4%. Although this data did not scientifically identify cause of death, the large majority of mortalities were attributed to BRDC. The high prevalence of BRDC in feedlot cattle has not fallen in spite of best management practices and vaccination programs.^{5,12}

Economic estimates of the impact of BRDC are dated and time-sensitive. BRDC economic losses are directly related to the market values of fed cattle sold and feeder cattle purchased, as well as feed cost and other feedlot operating and ownership costs. The purpose of this article is to review how changing economic conditions might impact BRDC management in cattle feedlots.

Cattle Feeder Financial Risk

Financial risk is defined as the variance in profitability and cash flow. Most risk management efforts ultimately target mitigating profitability losses. The financial risk to cattle feeders has increased dramatically over the past several years as the economics of the cattle market has changed. The

reported supply of cows and heifers that calved for 2015 is 39 million head.¹⁰ This supply level is comparable to cattle numbers in the early 1940s. Low supply and strong beef demand from both national and international export markets has pushed cattle prices to record high levels. Cattle prices have reached year over year record high prices since 2009. As feeder and fed cattle price increases, the cash flow a cattle feeder has at risk increases accordingly. Figure 1 highlights the increase in financial risk to cattle feeders. The solid blue line is the monthly fed steer value using USDA-reported steer weights and the 5-area average steer price (Texas-Oklahoma, Kansas, Nebraska, Colorado and Iowa-Minnesota) from 2009 to April 2015. The per-head steer value has increased more than double from \$1,162 in 2009 to a high of \$2,462 in November 2014, to some seasonal market softening to \$2,262 as of April 2015. The increase in value has a direct impact on BRDC management, because mortality losses are direct losses of increasingly higher-valued animals that result in higher losses in cash flow and expected profitability. Morbidity losses represent loss in efficiency of higher-valued animals. Morbidity losses attributed to BRDC include lower carcass quality grade, an increase in the number of railers, disease treatment costs, and decreased feed efficiency.¹⁶

Compounding the financial risk is the low margin in feeding cattle. The dashed red line in Figure 1 is the estimated per-head margin. The estimated margin reflects the average return to cattle feeders purchasing a 725-pound (330-kg) feeder steer and the feed cost needed to finish the steer to market weight.⁹ The margin does not include a disease loss factor. It only accounts for the direct cost of purchasing the feeder steer and its feed cost. As compared to the fed-steer value which has definitive upward trend, the estimated margin has no trend and is largely estimated to be

negative. The prevalence of BRDC greatly compounds cattle feeding financial risk, because BRDC mortality and morbidity losses have higher cash flow and expected profit losses due to the increasing trend in market value, but the estimated feeding cattle margin has not increased commensurately. This indicates that BRDC economic losses have to be offset by an increasing number of non-infected cattle to maintain profitability.

Further and more importantly to BRDC management is that the return to an investment cost that mitigates BRDC prevalence is high and is increasing in value. BRDC prevalence mitigating management actions such as sourcing low-disease-risk cattle, developing preconditioning programs, processing practices for arriving feedlot cattle, disease treatment practices, and use of emerging technologies such as genetic selection for reduced BRDC susceptibility all need to be evaluated for their economic return relative to the record high value of cattle at risk for disease loss.

Managing Feedlot Risk

Market risk is the variation in selling and purchasing prices. Cattle feedlots face significant market risk. Research on midwest feedlots has indicated that approximately 74% of the variation in cattle feeding returns is due to changes in the prices of fed cattle, feeder cattle and corn.^{8,19} Cattle feedlots are widely recognized for using futures market contracts and options to hedge their market risk on cattle and feed prices. Given the large value at risk that feedlots have in cattle and feed, it well justifies having personnel on staff and paid consultants that specialize in executing hedging transactions that mitigate market risk. Several studies have identified that hedging reduces market risk to cattle feeders.^{17,14,4,19} It is widely assumed that the low and negative cattle feeding

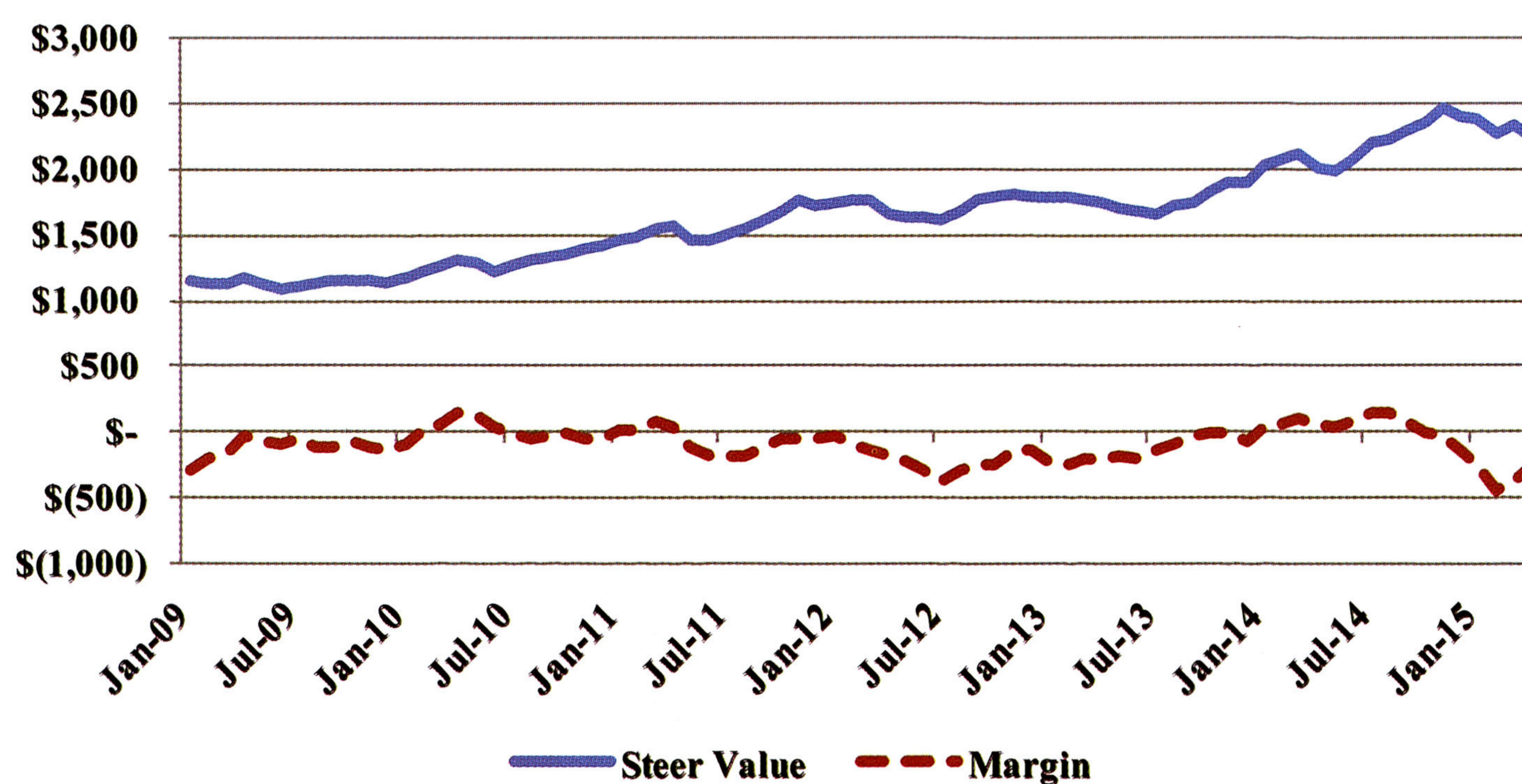


Figure 1. Fed steer value and estimated margin per head. (Data from www.LMIC.info).

margin shown in Figure 1 is offset by hedging transactions that make cattle feeding profitable in the long run. Additionally, cattle feedlots can use USDA risk management insurance products such as Livestock Gross Margin – Cattle to insure the margin between selling price and feeder purchase price and corn price, or Livestock Revenue Protection to insure a minimum selling price. Both insurance products are subject to maximum number of head limitations. Even though hedging and insurance can effectively reduce market risk, substantial production risk remains in feeding cattle.

Cattle feedlot production risks include feed conversion to gain, i.e. feed efficiency and disease incidence. Maintaining feed efficiency is critical to profitability as feed cost is about 70% of cattle feeding total operating cost. Feed efficiency and conversion to weight gain is typically measured by average daily gain, and most commonly measured on a pen or lot basis. The variation in feed efficiency of pens and lots of cattle over the feedyard and over time is typically within an expected range of performance, and is not an uncertain performance factor over time. By averaging average daily gain over the number of cattle in a pen, the variation in individual steer or heifer feed efficiency is not easily accounted for. Individual steer or heifer feed efficiency in a feedlot has not been researched widely in the past because of the difficulty in measuring individual animal feed intake. Research on feed efficiency variability between individual animals is expanding as the number of Grow Safe type systems expands research capacity in this area. Feed efficiency becomes more of a concern as feedlots change their ration to respond to feedstuff availability and cost. Presently there is not information for feedlots to selectively offer premiums or discounts on feeder cattle based on variable feed efficiency except through preconditioning programs that transition cattle onto feed.

Market risk is largely managed through hedging and insurance. Feed efficiency is largely managed through a feedlot's nutrition program and efforts to maintain a consistent ration. Disease risk, however, is receiving increased attention as a management factor because disease economic losses are increasing in significance and disease losses can be traced to individual animals through treatment records and performance measures such as quality grade. As financial risk increases and profit margins continue to be small, there is an increasing need to improve production efficiency to maintain profitability. Decreasing disease risk is viewed by many as an area where substantial gains in production efficiency could occur.

Source risk

Clearly, 1 way feedlot producers could manage disease risk and reduce the prevalence of BRCD is to purchase feeders that are more likely to remain healthy during the feeding period. These feeders are often called low-source-risk cattle. Feeders that come from preconditioning programs, backgrounding programs or are purchased privately without the need to comingle cattle from different sources, and have

low transportation stress, are referred to as low-source-risk. Cattle marketed as low-source-risk are often sold at a premium price. Cattle purchased through auctions that have a high amount of comingling, that have an unknown vaccination program and have high transportation stress are referred to as high-source-risk.

The important question is, what is the actual disease risk of low-source-risk cattle? Figure 2 presents the mortality percent from a feedlot that rated the source risk of their cattle purchased with arrival dates from 3/29/2012 to 8/31/2013. The data represents 954 lots and 177,304 head of cattle classified as low-source-risk. The cause of mortality is not known, but as the mortality percent increases it is highly likely due to disease.

Most feedlot-associated deaths resulted from BRDC, and averaged over time the mortality ratio of cattle entering feedlots was 1.26%.¹⁰ Figure 2 shows that the mortality rate ranges from 0 to 36% and shows a large number of lots above 1.26% mortality. Table 1 presents the source risk mortality data in detail.

If less than 2% is used as a normal mortality rate, the source risk data show that 171 lots or 17.9% of the lots, which corresponds to 16% of the number of cattle, have a mortality

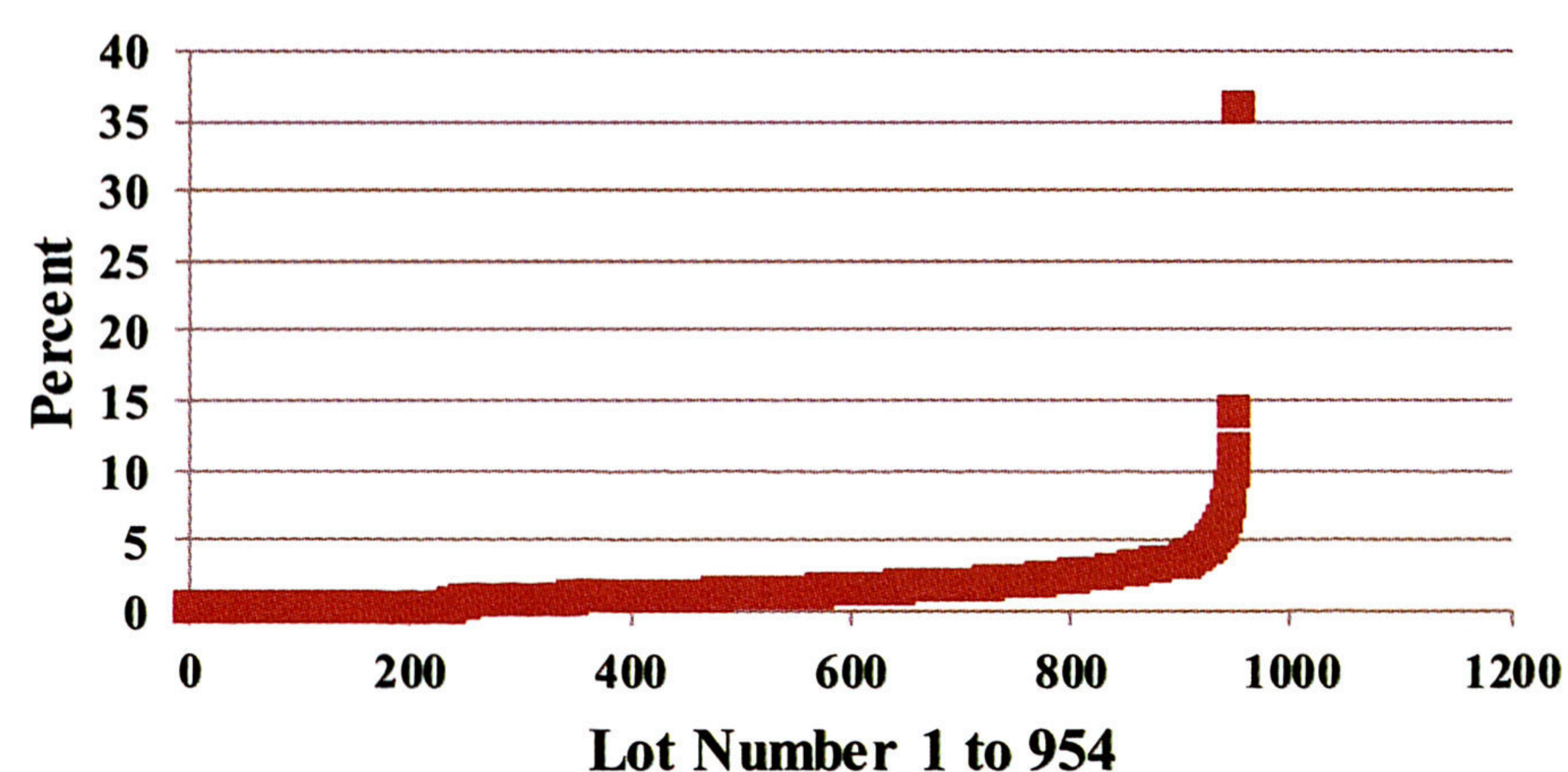


Figure 2. Low-source-risk and mortality percent (n=954 lots).

Table 1. Mortality Analysis of Low Source Risk Lots

Mortality Percent	Number of Lots	Percent of Lots	Number of Cattle	Percent of Cattle
0	240	25.2%	31,779	17.9%
0-0.9%	280	29.4%	65,087	36.7%
1-1.9%	263	27.6%	52,025	29.3%
2-2.9%	96	10.1%	16,760	9.5%
3-3.9%	43	4.5%	7,267	4.1%
4-4.9%	12	1.3%	1,853	1.0%
5-5.9%	7	0.7%	1,057	0.6%
6-6.9%	4	0.4%	636	0.4%
>= 7%	9	0.9%	840	0.5%
Total	954	100.0%	177,304	100.0%

rate of 2% or more. This indicates that disease risk remains in cattle classified as low source risk and in some cases substantial disease risk occurred. This indicates that work is needed to provide tools that better classify low source risk, and to determine the cases where cattle expected to have low disease risk have high disease incidence.

Preconditioning Programs

Preconditioning programs are a tool to source and verify low-source-risk cattle. Preconditioning programs are designed to reduce BRDC incidence by increasing the immunity of the calf in preparation for the stress of weaning and shipping as calves move through the beef cattle production system. Preconditioning activities include: implementation of an animal health protocol for vaccinations and parasite control, dehorning, castration, weaning, and transitioning calves to a roughage and grain ration fed in feed bunks for a specified feeding period. Preconditioning program costs incurred by the cow-calf producer are recovered through price premiums from selling low-source-risk, value-added preconditioned calves, calf weight gain over the preconditioning feeding period, and potential seasonal price improvement. In some cases, producers recapture preconditioning costs through the improved efficiency of their calves in a retained ownership venture.

Preconditioning programs have variable definitions regarding days-on-feed after weaning and health program protocols. There can be substantial differences in costs and effectiveness of the various programs. Preconditioning typically refers to a minimum of 45 days on feed post-weaning. Preconditioning periods less than 30 days generally do not produce enough weight gain to offset production costs, immunological response to vaccinations may not be complete, and calves may not have fully recovered from the stress of weaning.²⁵ Some preconditioning value-added programs require a minimum of 60 days-on-feed; see for example the Superior Livestock VAC PRECON program, <http://www.superiorlivestock.com/value-added-programs/superior-vaccination-programs> and the Western Video Market Feeder Vac program, <http://www.wvmcattle.com/site/index2.htm>. In addition to variable feeding periods, calf health protocols differ in the specific vaccinations required and when they have to be administered. Typically, documentation of the preconditioning program is an affidavit provided at the time of sale.

Sourcing preconditioned calves is receiving increased interest as a tool to better manage disease risk and improve cattle production efficiency post-weaning. Evaluative reviews of most preconditioning programs indicated production advantages for preconditioning calves. Preconditioning programs reduced disease morbidity and mortality and improved average daily gain when preconditioned animals were placed into the feedlot.^{2,23}

Days to BRDC Diagnosis

Several studies have reported that most BRDC incidence and mortality occur within the first 45 days after cattle arrive at the feedlot.^{3,10} However, recent data from the Integrated Program for Reducing Bovine Respiratory Disease Complex in Beef and Dairy Cattle Coordinated Agricultural Project (<http://brdcomplex.org/>), which has stringent case diagnostic and pathogen identification protocols, has found that a significant number of BRDC-positive cases occur later in the feeding period. Figure 3 presents a histogram of days from arrival to case pull-date or being diagnosed as BRDC-positive from 2 participating feedlot project collaborators. One feedlot was located in Colorado and the second in Washington. The Colorado feedlot collected data from 2012 to 2013, and the Washington feedlot collected data from 2013 to 2014. A condition for an animal to be included in this study was they could not have received a metaphylaxis antibiotic treatment upon arrival at the feedlot. The number of BRDC cases in each feedlot was 407 in Colorado and 452 in Washington. The bars represent the number of animals diagnosed with BRDC relative to the number of days from arrival at the feedlot. In the Colorado feedlot, 183 steers or 45% of the case population were diagnosed with BRDC at 51 or more days after arrival, with 95 animals being diagnosed at 126 days or more after arrival. In the Washington feedlot, 161 heifers or 36% of the case population were diagnosed with BRDC at 51 or more days after arrival, but the Washington feedlot did not have the spike in the number of cases at 126 or more days after arrival.

These data present an interesting finding relative to the literature that notes that most BRDC incidence occurs early after arrival. BRDC incidence that occurs later in the feeding period has higher economic losses because if mortality occurs the animal loses the value of the feed fed, treatment costs are higher because the animal weighs more, and the value of any animal lost to mortality increases as the number of days after arrival that BRDC occurs increases. Work is ongoing to analyze if there are any differences in pathogens, mortality rates, and carcass quality parameters between early and late BRDC occurrence.

Genetic Selection

Genomic technology has the potential to improve profitability in the beef industry by improving management and selection decisions. As genomic technology continues to advance, the potential for declining costs of genetic testing and the development of markers for important feedlot profit drivers, such as disease resistance and feed efficiency, may lead to cost-effective marker-assisted management in the feedlot sector.²⁷ Using genetic markers for multiple-trait selection for feedlot performance characteristics has been estimated to be economically efficient.²⁵

There is evidence that susceptibility to BRDC is at least partially under direct genetic control. Differences in BRDC

susceptibility have been found between cattle breeds and sire lines, and heritability estimates in the low-to-moderate range (0.04 to 0.21) have been reported for BRDC susceptibility in beef and dairy cattle.^{7,11,13,15,18,20,21} This suggests that selecting for BRDC-resistant cattle could have a substantial impact on reducing BRDC prevalence.^{16,22} An estimate of the cost of BRDC to the feedlot for treatment cost, loss in carcass quality value, and mortality was estimated to be \$204 using data from the Colorado feedlot described in the discussion of Figure 3. Using the rate of genetic gain that could be achieved through selection for cattle that were less susceptible to BRDC, the feedlot industry could realize gains between \$8.3 to \$16.6 million/year based on 2013 costs and market prices by selection for cattle that are less susceptible to BRDC.¹⁶

In the beef industry, genetic selection for reduced BRDC incidence will likely occur first in vertically integrated operations and cow-calf producers that retain ownership through the feedlot. These operators will benefit directly through reduced disease incidence and are the most likely to use genomic technologies as they make bull and heifer retention decisions. Adding disease resistance to a marker-assisted selection index represents a new cost-efficient approach to reduce BRDC incidence. The development of genomic breeding values for sires that are less susceptible to BRDC is underway as part the ongoing USDA-funded multi-institutional research project “Integrated Program for Reducing BRDC in Beef and Dairy Cattle” (www.brdcomplex.org).

Conclusions

The prevalence of BRDC has remained high despite efforts to suppress the disease through vaccination and

metaphylaxis antibiotic prevention programs. As cattle values have reached year-over-year record high values the impact of BRDC disease losses have commensurately increased. As the financial risk of feeding cattle increases, managers are critically evaluating strategies to improve profitability. Reducing disease losses is becoming more important because this represents a management area that can be improved with substantial profitability effects. Market risk and feed efficiency have larger total cost effects, but economic efficiency in these areas has been largely obtained through hedging and insurance, and maintaining a planned nutrition program with a consistent ration.

Sourcing low-risk cattle is seen as an effective practice to reduce BRDC incidence, but cattle feedlots need to determine the net economic return from paying price premiums for low-risk cattle and their effective disease resistance and improved early feed-to-gain efficiency. In data on classifying source risk, about 16% of the lots classified as low risk had higher than the industry average mortality rates and in some lots the mortality rates were substantially higher. Recent data from a large BRDC coordinated agricultural project shows a substantial number of BRDC-diagnosed cases occurred after 50 days from arrival in the feedlot. BRDC incidence that occurs later in the feeding period has higher economic losses. Research on using genomic technologies to select for BRDC resistance offers promise in developing a new tool to reduce economic losses from BRDC incidence.

Acknowledgement

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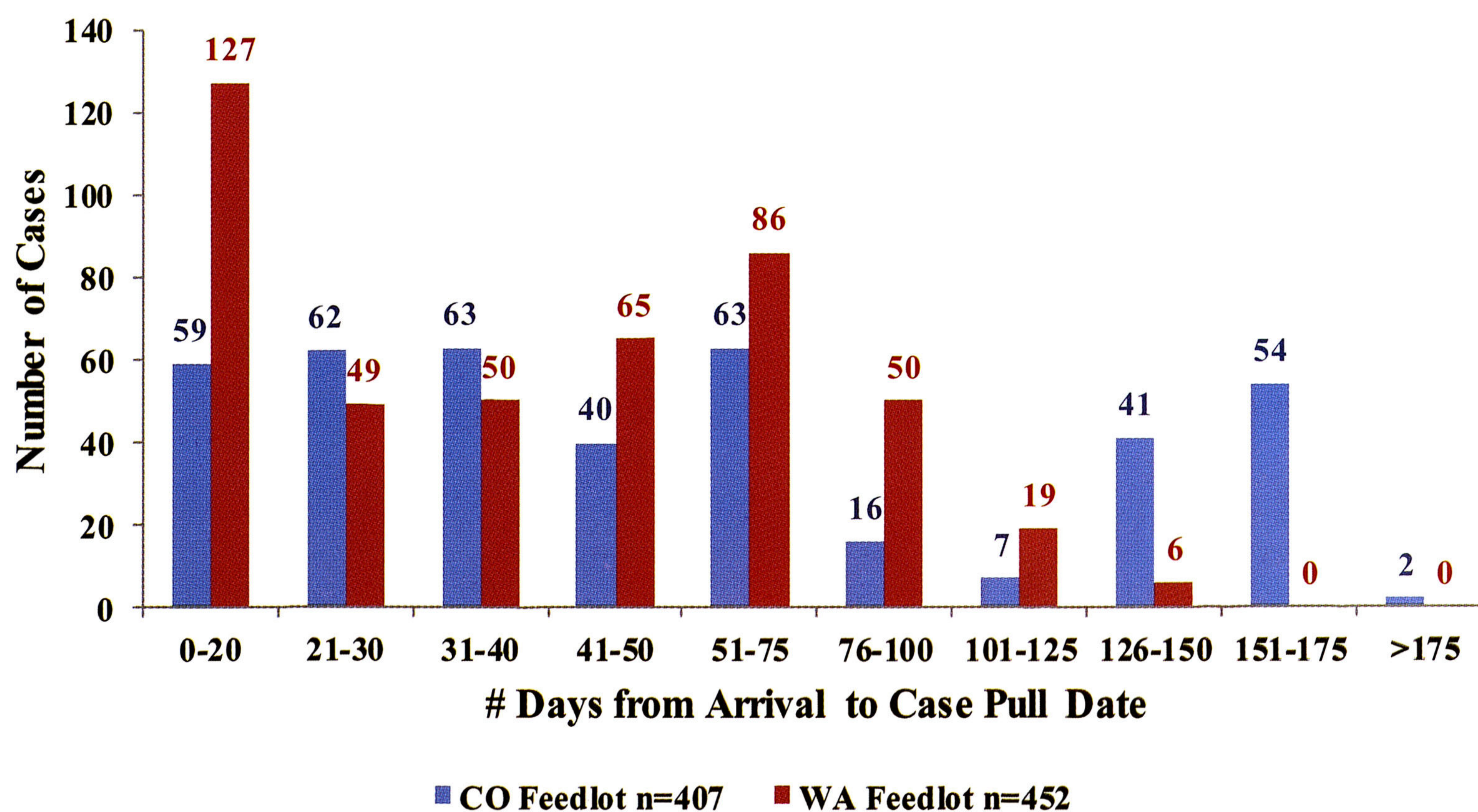


Figure 3. Days post arrival to BRDC case diagnosis.

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