Health and Management of Confined Cows and Calves

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Introduction

The methods employed to produce beef calves differ widely because of dissimilarity in the characteristics and availability of natural resources, human resources, and capital. Natural resources include land and cattle. Cow-calf production systems are inherently tied to the land by the availability of feed and forage, weather conditions, and geography. Human resources include the availability and skill of labor and management. In many regions of the Unites States it has become a challenge to hire and retain skilled ranch employees. Capital includes the availability of money, credit, and facilities.

Collectively, the practices and procedures used on a cow-calf ranch to produce calves can be considered a complex adaptive system. A ranching system is complex because of the many external and internal factors that change, sometimes rapidly and unpredictably. A ranching system is adaptive because learning takes place, by both people and cattle, in response to the changing factors and conditions. In practice, we often investigate small portions of the system at a time to learn how to resolve problems or become more efficient. However, ultimately it becomes important to look at how actions in one sector affect the entire production system including financial outcomes as well as the health and well-being of the people, the cattle, and the environment.

The subject of this report is to discuss how confined cow-calf production systems might affect the health and well-being of cows and calves, and how we might adapt the system to avoid important foreseeable hazards. Recognizing and understanding potential problems allows the cattle producer to make long-term and near-term plans to minimize risk. Managing risks requires greater understanding of the factors associated with those hazards, how to mitigate those factors, and the associated costs (Moore, 1977). Economics should not be the sole basis for making decisions about the care of animals. However, the cost of health care remains an important financial constraint to most cattle producers, and therefore, an important consideration. The relative costs of disease prevention and control practices are relevant to risk management decisions.Cattle producers might enlist the help of a veterinarian to identify potential hazards and make recommendations to prevent problems; for example, the veterinarian may conduct a herd-specific risk assessment.Risk assessment is a process of:

1) evaluating the likelihood and costs (or benefits) of potential hazards (or opportunities) — termed **risk analysis**
2) determining what actions, at what relative cost, can be taken to mitigate those hazards — termed **risk management**
3) sharing the action plan with all members of the team, as well as keeping records to show what was done and whether the actions were successful — termed **risk communication.**

During the risk analysis phase, it may be useful to supplement published data with herd-specific data from health records (Rae, 2006), outbreak investigation (Smith, 2012), or clinical trials (Sanderson, 2006). It may be possible to recognize important hazards and estimate their costs without ranch data, but it is more difficult to evaluate progress or compliance in the risk management stage without using records. Unfortunately, few cow-calf operations collect animal health data in a format that is easily analyzed (National Animal Health Monitoring System (U.S.), 2008). The lack of a simple record keeping system on many farms hinders the process of recognizing important hazards and their costs, makes it difficult to document that risk management actions were implemented, and to evaluate if those actions were effective.

A risk assessment evaluates the reasons hazards occur, their likelihood, and their cost. In the absence of farm-specific information, risk assessments are often based on published information and expert opinion. For example, a national survey of beef cattle herds (National Animal Health Monitoring System (U.S.), 2008), reported that 2.9

percent of calves were born dead and another 3.5 percent died or were lost prior to weaning. These rates were similar regardless of the herd size. In this survey, the reasons for beef calves to die in the first three weeks of life, in order of frequency, were:

1) birth related (25.7 percent of deaths)
2) weather related (25.6 percent)
3) unknown causes (18.6 percent)
4) digestive system related (14 percent)
5) respiratory disease (8.2 percent); and
6) predation or injury (6.2 percent).

Not every beef herd experiences these losses, or at these frequencies. However, in the absence of herd-specific information, these data tell us that, on average, the important hazards to the survival of neonatal calves are 1) problems occurring during and around the time of calving; 2) dangers from the environment, and 3) contagious diseases. In fact, if we exclude reproductive problems, the subject of another paper, these three categories probably represent the major health risks associated with confinement cow-calf production systems to cows and their calves.

Health Problems at Calving

Successful calving occurs when a live calf is born without complications to the calf or the dam. Problems with the birthing process are called dystocia. Dystocia may be due to factors of the calf or factors of the dam (Rice, 1994). Of the factors associated with the calf, large birth weight is the most common cause of dystocia for most beef cattle herds, and the factor most preventable, through genetic selection (8). Factors of dystocia attributable to the dam are age, pelvic size, and metabolic health (Rice, 1994). Dystocia is more likely to occur with heifers, and also cows with small pelvic dimensions. Common metabolic problems at calving are from muscle weakness due to protein-energy malnutrition, exhaustion during prolonged muscular contractions, and low blood levels of calcium or magnesium.The consequences of dystocia to the calf are metabolic or physical injury which may result in death during or following calving. Lack of oxygen in the blood causes injury to cells and results in acidosis and low blood sugar. Physical injuries include congestion and swelling of the head and tongue which may prevent nursing, or broken bones due to excessive force during calving assistance. The dam may experience metabolic or physical injury during or following the birthing process. The most common problems for the dam are exhaustion from muscular contractions, pressure injury to leg muscles while being down, and bruises or tears to the uterus and vagina. The consequences of these problems include failure of the dam to get up after calving, prolapse of the uterus, excessive bleeding, or infection of the reproductive tract. Each may ultimately be fatal.

In confinement systems, cow nutrition and exercise during gestation are important to dystocia prevention. Another important aspect of managing dystocia risk is to know when veterinary assistance should be sought. Cattle producers should seek veterinary assistance when they:

1) don't know what is wrong

2) know what is wrong, but either don't know what to do, or recognize that the problem is beyond their abilities

3) know what is wrong and what to do about it, but they have been unsuccessful after 30 minutes of trying (Mortimer, 1993).

Dangers from the Environment

Common environmental hazards are weather extremes, crowding, predators, and physical sources of injury. At birth, the calf is limited in its ability to regulate its body temperature so extremely warm or cold environmental conditions present a risk for hyperthermia, or hypothermia, respectively; especially when accompanied by dry and dusty or wet and muddy conditions. The crowded conditions of confinement systems increase the opportunities for injury from being stepped on, butted, or otherwise injured by others in the herd, and increase opportunities for pathogen exposure and transmission. Predators are less likely to be a problem in confinement systems but dogs, wild canids, or other predators might still enter pens and kill or injure newborn calves or calves weakened by illness or injury.Cows are less susceptible to weather stressors compared to their calves, but dystocia or metabolic disease increases their risk for hypothermia or hyperthermia. When cows are heavy with calf they may be more likely to slip and fall, and the likelihood further increases when the floor surface has a steep slope or is slippery from snow, ice, or mud. Cows calving near fences, walls, or low spots are at risk for not being able to rise after lying down. In confinement, cows or calves may become injured from a variety of hazards in the lots including protruding nails, broken posts, loose wire, holes, steep embankments, standing water, and various sources of electricity. Insect pests such as flies can be a problem in confinement systems, but there may be easier opportunities to apply insect control methods compared to pasture systems. Water sources may be compromised by freezing in the winter or because of inadequate flow rates or limited access in the summer.

The risk of injury to cow or calf can be minimized by providing favorable environmental conditions. Long-term strategies include selecting a breeding season so that calving and subsequent production stages occur during optimal weather conditions and designing and using facilities with minimal physical hazards. Near-term strategies for environmental safety include ongoing surveillance of the facilities for potential sources of injury and providing supplemental sources of shade, windbreaks, or water as appropriate.

Contagious Diseases

All things being equal, contagious diseases are more likely to become evident in confinement systems than pasture systems because of greater opportunities for cattle to cattle contact and subsequent pathogen transmission. However, other important risk factors for introduction of contagious diseases are movement of cattle from other operations or from fence-line exposure, independent of degree of confinement.The contagious disease most likely to affect calves in the first weeks of life is neonatal calf diarrhea, commonly called scours (National Animal Health Monitoring System (U.S.), 2008). Calf scours is a detriment to calf health and well-being, and the disease is costly to cattle producers because of reduced calf growth performance, death loss, the expense of labor and medicines to treat sick calves, and the risk for worker injury while treating sick calves (Anderson et al., 2003; Swift et al., 1976). Agent, host, and environmental factors collectively explain the occurrence of clinical signs of diarrhea, and these factors interact dynamically over the course of time (Smith et al., 2008). Cattle producers and their veterinarians have to understand the dynamic relationships occurring between agent, host, and environmental factors within the context of the specific production system to successfully prevent or control scours (Barrington et al., 2002). Even if the scours pathogens existing in the herd are known, it may not be possible to prevent or control disease until the various sources of the agent and the important routes of transmission on the farm are understood and the practices that affect source and transmission are managed.Although the adult cow-herd likely serves as the source of most calf scour pathogens from year to year (Collins et al., 1987; Crouch and Acres, 1984; Crouch et al., 1985; McAllister et al., 2005; Ralston et al., 2003; Watanabe et al., 2005), the average dose-load of pathogen exposure to calves is likely to increase over time within a calving season because calves infected earlier serve as pathogen-multipliers and become the primary source of exposure to younger susceptible calves. This multiplier-effect can result in high prevalence of infective calves and widespread environmental contamination with pathogens (Atwill et al., 1999). Therefore, calves born later in the calving season may receive larger dose-loads of pathogens, and, in turn, may become relatively more infective by growing even greater numbers of agents. Eventually the dose-load of pathogens overwhelms the calf's ability to resist disease. This is likely to be especially true in confinement systems.

In theory there are three approaches to preventing outbreaks of calf scours:

1) eliminate the pathogens from the population
2) increase calf immunity against the pathogens
3) alter the production system to reduce opportunities for pathogen exposure and transmission (Sanderson and Smith, 2005).

However, the pathogens that cause diarrhea are found in most beef cattle herds and it is difficult or impossible to eliminate these agents from cattle herds. Colostral immunity is critical to protect neonatal calves from disease, but this passive immunity against diarrhea pathogens decreases with time (Cortese, 2009), and managers of beef cattle herds have limited ability to improve calf ingestion and absorption of colostral antibodies beyond not interfering with maternal bonding. Also, unfortunately, vaccines are not available against all pathogens associated with calf diarrhea. That leaves the third option as the most viable approach to control calf scours in most cattle herds.

One example of a beef cattle management system for controlling neonatal calf diarrhea is the Sandhills Calving System (Smith, 2009; Smith et al., 2004). The management actions defined as the Sandhills Calving System prevent effective contacts among beef calves by segregating calves by week of age. This is achieved through scheduled weekly movement of pregnant cows to clean calving lots or pastures. The objective of the system is to re-create, during each subsequent week of the season, the more ideal conditions that exist at the start of the calving season. These more ideal conditions are that cows are calving on ground that has been previously unoccupied by cattle (for at least some months) in the absence of older, infective calves. Key components of the systems are age-segregation of calves, the frequent movement of pregnant cows to clean calving areas, and opportunity for maternal bonding and colostrum ingestion with little management interruption. Age segregation prevents the serial passage of pathogens from older calves to younger calves. The routine movement of pregnant cows to new calving pastures prevents the build-up of pathogens in the calving environment over the course of the calving season, and helps to prevent exposure of the latest born calves to an overwhelming dose-load of pathogens. The system is adaptable to confinement housing.

Pneumonia (bovine respiratory disease or BRD) is a leading cause of sickness and death in beef calves after the first few weeks of life. As with scours, the occurrence of BRD is affected by factors of host immunity, presence of specific pathogens, and opportunity for transmission. In confinement systems the opportunity for pathogen transmission is high. Although the bacterial pathogens of pneumonia are commonly found in the upper respiratory tract of cattle, the inciting damage is often due to viral infections that may not be present in all herds. Maternal immunity against respiratory pathogens wanes with time. Every 16 to 20 days after ingestion, the amount of maternal antibodies left in the blood stream is halved, so that by 96 to 120 days of age, a calf retains less than 2 percent of the antibodies it absorbed from colostrum. The immune system is functional but unprimed at birth. Prior to 5 to 8 months of age the immune response of calves is weak, slow, and easy to overcome (Cortese, 2009). Therefore, even in the absence of additional stressors, calves 3 to 4 months of age may be particularly susceptible to infectious diseases. Herd immunity is the protection afforded to susceptible individuals because the majority of the individuals in the population are immune. In herds with a narrow calving window, calves are of similar age and herd immunity is lost as most calves approach 3 to 4 months of age. Weaning and severe weather can be powerful stressors that further reduce a calf's ability to resist disease. Management practices that provide opportunity for pathogen introduction, such as commingling, or that increase stress, such as weaning, may have less impact on health if they are completed prior to or after calves are 3 to 4 months of age (Smith, unpublished). Vaccines against respiratory pathogens have been important for reducing the incidence of BRD in feedlot calves. However, the optimum vaccination protocol to prevent BRD in calves less than 5 months of age remains an important subject of investigation.

Other important contagious diseases that might have greater likelihood of occurrence in beef confinement systems are pinkeye and coccidiosis. Pinkeye is a bacterial infection of the eye that is exacerbated by irritants or injury to the cornea. Protecting calves from blowing dust, irritating feedstuffs, and controlling flies is helpful for preventing pinkeye. Coccidiosis is a diarrheal disease caused by a protozoa and spread by fecal-oral transmission. Prevention of coccidiosis includes general environmental hygiene, including preventing calves from climbing in feed bunks or defecating on feed, and reducing the fecal shedding of oocysts by feeding cows and calves coccidiostatic medications, such as an ionophore.

Health Outcomes in the First Year of UNL Cow-Calf Confinement Trials

The objectives of this study were to observe health outcomes in a cow-calf confinement study, test for potential risk factors associated with disease, and evaluate the effect of disease on growth performance. Pregnant cows (n=84) were allocated to confinement at the UNL Feedlot at Mitchell, NE (n=42) or the UNL Feedlot near Mead, NE (n=42). Cows calved at both locations between May 1 and July 30 (*Figure 1*) using the Sandhills Calving System to segregate calves by age. During the calving phase, one calf at Mitchell was treated for pneumonia at two days of age and one cow was euthanized after a uterine prolapse. At Mead, two calves were born premature and died, and one calf died due to injury. No calves at either location experienced neonatal calf diarrhea.

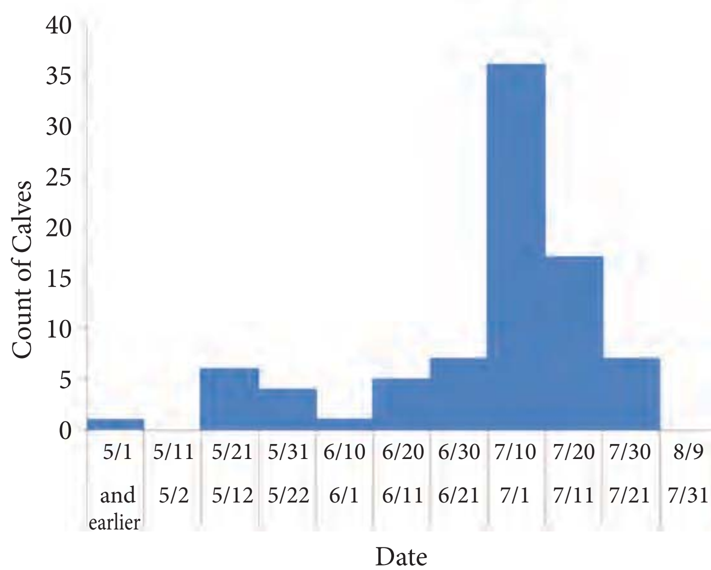

Figure 1. Calving distribution for 84 cows fed in confinement at UNL facilities in Mead and Mitchell, NE.

Calves at both locations (n= 80) were randomized into early-weaning and normal-weaning groups. Early-weaned calves were sorted according to the dam's body weight category into 3 pens of 5 to 7 calves at each location. This occurred on September 25, 2012 at Mitchell and September

27 at Mead. The calves in the normal-weaning group remained in confinement with their dams in 3 pens of 5-7 pairs corresponding to the same body weight categories of the dam. The average age of calves at the beginning of the weaning trial phase was 86.6 days (range 59 to 149 days). The weaning trial phase ended when the normal-weaning group was weaned on January 22, 2013 at Mead and January 24 at Mitchell. The average age of the calves at the end of the weaning trial phase was 205.6 days (range 176 to 270 days). No calves were removed from the study during the weaning trial phase.

No morbidity or mortality was reported from Mitchell during the weaning trial phase. At Mead, 10 of 39 calves (26%) were treated for BRD during the weaning trial phase. Of the BRD cases, seven were in the early-weaned treatment group (cumulative incidence = 35%) and three were in the normal-weaned group (cumulative incidence = 19%). Cases of BRD clustered in time with initial cases began to occur 15 days after initiation of the weaning trial phase and secondary cases, occurring approximately 30 days after initiation of the study (*Figure 2*). The average age that calves were pulled for BRD was 109.6 days (range 89 to 155 days, *Figure 3*). Even though there were meaningful differences in BRD incidence between weaning treatments, the difference could have been due to chance. The incidence of BRD was not significantly associated with birthdate of the calves, gender, or age of the dam.

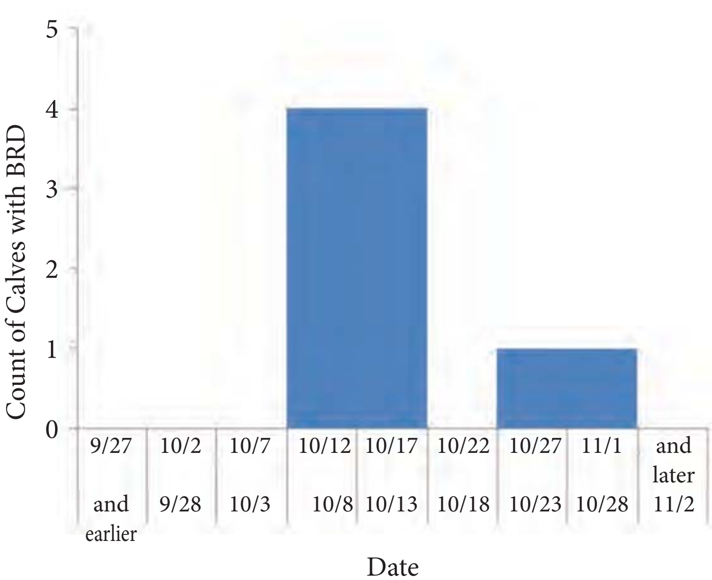

Figure 2. Epidemic curve for 10 calves diagnosed with BRD at the Mead facility. The weaning phase was initiated on September 27.

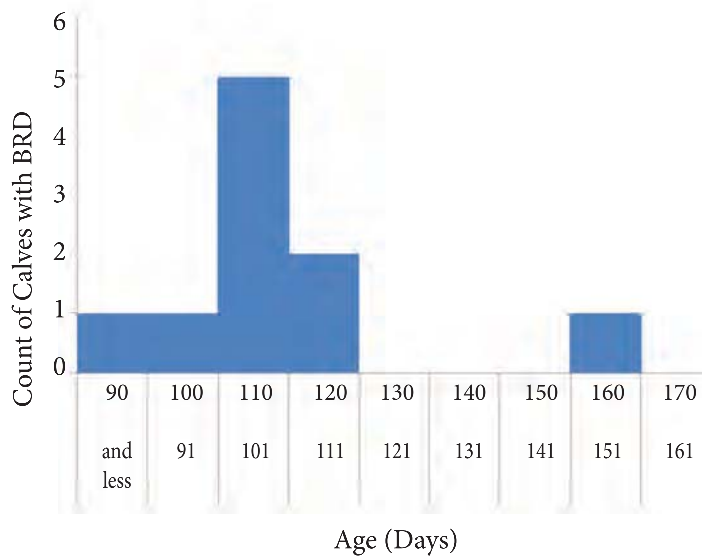

Figure 3. Distribution of age, in days, when 10 calves at the Mead facility were diagnosed with BRD. Seven of the cases occurred in early-weaned calves. Nine of the 10 cases occurred in calves 3 to 4 months of age.

Conclusions

Few cattle producers have experience managing confined cows and calves. However, confinement systems may have economic advantages under some conditions. Economics should not be the sole basis for making decisions about the care of animals. However, the cost of health care remains an important financial constraint to most cattle producers, and therefore, an important consideration in the development of confinement systems. Recognizing and understanding potential health problems in advance allows the cattle producer to make long-term and near-term plans to minimize risk. The hazards to cows and calves in confinement cow-calf systems include health problems at calving, dangers from the environment, and contagious diseases, as exemplified in the UNL cow-calf confinement study. To some extent health risks can be mitigated, though not eliminated, by anticipating their occurrence, managing known risk factors, and assuring that everyone on the team understands what is being done and why.

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