Manual for Treatment and Control of Lameness in Cattle

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Chapter 1
An introduction to lameness in cattle

Lameness is one of the single most important health problems in cattle. In dairy cattle, there are few conditions as common or as costly as those affecting locomotion. Cows suffering lameness disorders have reduced milk yield, lower reproductive performance, and decreased longevity. In large herds, seriously affected animals must endure extreme pain and discomfort in the simple process of walking to and from the feed bunk, milking parlor, water trough, etc. Consequently, lameness represents an important animal welfare issue. In feedlot cattle, lameness reduces feed conversion and weight gain. In cow–calf operations lameness reduces the cow's ability to forage or graze, thereby decreasing her milk production and body condition, which limits her ability to properly care for her calf or become pregnant. For these and many other reasons, prompt recognition and treatment of lame cows should be a high priority in all cattle operations.

Once lameness has been identified and treatment initiated, the next step is to try to understand its underlying causes. Even a cursory investigation of herd lameness proves that it is a complex multifactorial problem. It may be related to feeding and nutrition, housing conditions, environmental factors, management practices, or a combination of any or all of these. Narrowing it down to the most significant factors or causes in any given situation requires information and an understanding of the relationship of each of these to lameness.

Prevalence of lameness

The determination of prevalence or incidence of lameness is commonly used for the purposes of making comparisons or estimating economic losses. These calculations may also be used for the establishment of benchmarks and for monitoring progress or change that may justify the need for intervention. Throughout this manual, reference to these epidemiologic terms and concepts may be used for any and all of the above. However, our objective in the following is to establish some sense of how common lameness is and what it costs.

A prevalence rate is a snapshot in time evaluation, and therefore has limitations as a precise indicator or predictor of the amount of lameness that may have been experienced previously, or that which may be experienced in the future. However, one study found that a single measure of prevalence was well correlated with mean prevalence over time, and may therefore be useful as a tool to assess the extent of lameness in a herd, or as a means to determine the effect of lameness

intervention strategies. As with incidence, prevalence is also dependent upon the sensitivity or level of detection. In herds where the level of detection is extremely sensitive, prevalence or incidence may be quite high or possibly even overestimated. Where tolerance for lameness is greater, prevalence or incidence may be underestimated. Therefore, some degree of misclassification is unavoidable where there is no standardization of the assessment criteria. Locomotion scoring is the tool most commonly applied when conducting assessments of lameness prevalence. These techniques are described elsewhere in this manual. Readers are advised to review those sections for additional information on detection of lameness in dairy cattle (Chapter 4).

Wells et al. conducted an epidemiologic investigation of the prevalence of lameness in 17 dairy herds in Minnesota and Wisconsin. Cows from 14 herds were housed in stanchions or tie stalls, whereas cows from 3 other herds were housed in either free stalls or dry lot. Two investigators evaluated the locomotion of cows during visits to the farm during the summer and spring. The scoring system proved itself to be reliable with agreement between the two observers at 92.7% and 91.3%. The prevalence of clinical lameness as detected by the trained observers (trial investigators) was 13.7% (117/853) during the summer and 16.7% (134/801) during the spring visits. These prevalence rates were 2.5 times higher than those estimated by the herd managers. A more recent study of 30 Wisconsin herds by Cook found slightly higher prevalence rates. Similar to the study by Wells et al., 15 herds were housed in free stalls, 13 herds in stanchions and tie stalls and the remaining 2 herds had access to free stalls or tie stalls. In this study, the trial investigator assumed responsibility for locomotion scoring during both the summer and winter visits. A locomotion scoring system of 1–4 was used whereby cows scoring either 3 or 4 were considered clinically lame. Cows with a locomotion score of 1 (no gait abnormality) were 54.9% and 55.9% during the summer and winter visits, respectively. Overall herd prevalence for lameness was 21.1% during the summer compared with 23.9% during the winter. Prevalence of lameness was also significantly related to type of housing and stall surface in this study. Free stall herds had an elevated prevalence of lameness during the winter months, whereas there were no seasonal differences observed for tie-stall herds. Further, within the herds housed in free stalls, there were no seasonal differences in lameness prevalence rate for cows in sand-bedded stalls. Free-stall-housed cows bedded with materials other than sand had higher lameness prevalence rate.

Whay et al. began conducting a prevalence study of lameness in the United Kingdom in late 2000. After short time into the study, it was interrupted by an outbreak of foot and mouth disease. Despite this unfortunate circumstance, investigators had collected data from 53 farm visits. Forty-nine of these herds were housed in free stalls, whereas four herds were housed in straw yard loose housing systems. At the beginning of each visit the dairyman was asked to estimate the number of cows lame in the herd on that particular day. Once this and other information was collected, investigators began a series of observations including an assessment of the prevalence of lameness. A four-point scoring system was used by trained observers in which cows that were scored as lame or severely lame were

those classified as a clinically lame for the purposes of calculating the prevalence of lameness. Results indicated that the mean prevalence of lameness as identified by trained observers was 22.11% (range 0–50%). The mean prevalence of lameness as estimated by the dairymen was 5.73% (range 0–35%), indicating that dairymen usually underestimate the prevalence of lameness. Similar prevalence rates of 37 farms in England and Wales were observed in a study by Clarkson et al. Researchers used a five-point scale and found a mean annual prevalence of lameness of 20.6% (range 2.0%–53.9%) for the entire study period . The mean prevalence of lameness during the summer and winter was 18.6% and 25%, respectively.

Incidence of lameness

Incidence rates are usually calculated on an annual basis from herd records of individual animal treatments. These data must be scrutinized carefully when used for determining the true or actual incidence of lameness. For example, in some operations records are kept only on those cases requiring antibiotic treatment for the purposes of residue avoidance. Others report only those lameness conditions that may require treatment by a veterinarian. These studies invariably underestimate the incidence of lameness. Information reported by claw trimmers may be a better source of data for a calculation of lameness incidence. But, these data are often not recorded because they do not conform to the farm's record-keeping system, or the terminology used may not be consistent or easily interpreted by the dairymen. As a consequence, there is wide variation in the incidence rates reported. Vermunt cites incidence rates for veterinary-treated lameness as low as 2.5% to data collected from farm records that show rates of 55% or more.

A study designed to avoid some of the pitfalls (described above) in conducting epidemiologic investigations was conducted in the United Kingdom during 1989 through 1991. Researchers collected information from 37 farms in four regions of England and Wales. An individual form was used for data entry on all cows, and study participants (dairymen, herdsmen, and veterinarians) were given training in proper use of the forms as well as lesion identification and nomenclature. Claw trimmers were generally accompanied by a member of the research team who completed the forms. Data used to determine the incidence of lameness was obtained from examination records of lame cows and those presented for maintenance trimming procedures. The mean annual incidence was 54.6 (range 10.6–170.1) cases of lameness/100 cows/year. Mean incidence during the winter months of November through April was higher (31.7%) compared to the summer months of May through October (22.9%). Of the lesions associated with lameness, 92% affected hind limbs, with 65% affecting the outside claw, 20% affecting the skin, and 14% affecting the inner claw. Sole ulcers (40%) and white line disease (29%) were the predominant lesions observed in claws. Digital dermatitis (40%) was the most common disorder of the foot skin. In front feet, 46% of lesions occurred on the inside claw, 32% on the outer claw, and 22% on the foot skin. The most severe cases of lameness were associated with vertical wall cracks, puncture of the sole by foreign bodies, and foot rot.

Economic loss associated with lameness

The economic loss incurred as a result of disease arises primarily from the consequences of disease and not the cost of treatment. British researchers estimated that sole ulcers were responsible for the greatest economic loss ($627/case, converted to US dollars assuming the value of the British pound at 1.6 to 1 US dollars), followed by digital diseases such as white line disease and sole abscess which accounted for losses of $257/case. Digital dermatitis and foot rot accounted for smaller, but significant losses at $128/case. Lower milk yields, reduced reproductive performance, higher involuntary culling rates, discarded milk, and the additional management effort required to care for lame cows accounted for the majority of economic loss.

Guard reports similar but slightly lower rates of economic loss based on clinical observation and records of lameness in New York dairy herds. Based on an incidence rate of 30 cases/100 cows/year, a fatality rate of 2%, an increase in days open of 28 days, and costs for treatment and additional labor of $23/case, he estimated a cost of $9000/100 cows/year. Cost per clinical case in Guard's example is $300/lame cow, or $90/cow in the herd. The estimates of loss per cow are similar for both studies. The difference in costs per cow in the herd is largely a function of the incidence. Clearly, lameness is one of the most costly of health problems affecting dairy cattle.

Lameness as a cause for reduced performance and culling

Lameness is reported to be the third most common cause of culling or premature removal from the herd, behind reproduction and mastitis. Depending upon one's definition of culling, this may be a bit confusing. For example, cows that leave the herd by way of sale for dairy purposes or those that leave due to low production are removed for "voluntary" (at the will of the dairymen) reasons. Those that leave the herd due to reproductive failure, disease and injury, death, mastitis, or due to feet and legs problems are involuntarily lost from the herd. Since the loss of animals for such reasons is not at the discretion of the dairymen, they are termed "involuntary." In the strictest sense, culling is a voluntary procedure applied to eliminate cows with low milk-producing ability.

Lameness severely limits milk production and reproductive performance. Lame cows do not go to pasture, spend little time at the feed bunk, and prefer to lie down most of the time. If the cow does not eat, she would not be able to maintain milk production or body weight. Under these conditions she becomes a cull for reasons of low production. A study reported by Warnick et al. observed that lame cows produced less milk 2 weeks before and 3 weeks after the diagnosis of lameness was made. A Florida study found that cows affected with foot rot in the early postpartum period produced 10% less milk during lactation as compared with unaffected controls. And, a recent study reported by Juarez et al. found that milk production decreased as locomotion score increased.

Reproductive performance is similarly reduced. A recent study by Melendez et al. found that cows that became lame within the first 30 days postpartum had lower

conception rates (17.5% versus 42.6%), lower overall pregnancy rates (85.0% versus 92.6%), and a higher incidence of cystic ovarian disease (25.0% versus 11.1%). These researchers also observed that culling rates for lame and nonlame cows before the start of breeding (95 days) were 30.8% and 5.4%, respectively. Another study by Garbarino et al. observed a direct effect of lameness on ovarian activity within the first 60 days postpartum. Lameness resulted in a 3.5 times greater likelihood of delayed cyclicity. Researchers also found that the interval to the first luteal phase was prolonged in lame cows as compared to nonlame cows (36 days versus 29 days).

The direct effects of lameness are estimated to account for 15% of the cows culled in the United States (National Animal Health Monitoring System). However, considering the impact of lameness on milk production and reproductive performance, it has been estimated that indirect effects of lameness could easily account for an additional 49% of culling in US dairy herds. This suggests that the significance of lameness is easily underestimated when considering its effects on culling rate. A greater emphasis on record keeping may help producers better understand the true incidence of lameness and potentially improve their awareness of its effects on performance and profitability.

Finally, British surveys indicate that cattle sold to slaughter as a result of lameness have carcasses worth only one half as much as those sold to slaughter for other reasons. Lame cows spend less time eating, more time lying down and lose weight rapidly. Reduced value of cows culled for beef purposes represents an important cause of economic loss that is often times overlooked. Cows with serious or complicated foot problems need to be evaluated and treated carefully. The objective should be to relieve pain and suffering so that the animal can either be returned to service or prepared for eventual movement to slaughter. Whenever pain cannot be adequately controlled to achieve either of these objectives, euthanasia should be considered.

Animal welfare considerations

Lameness causes significant pain and discomfort for affected animals. Furthermore, despite prompt care and treatment, the recovery period may be quite prolonged. One study found the average duration of lameness to be 27 days. Another study observed that animals were clinically lame on average for about 8 weeks and that gait was affected for as long as 3 months or more. Add to this the fact that lame cows often go undetected until late in the course of the disease, and it is not hard to see why lameness is considered to be one of the most important animal welfare issues.

Lame cows should receive prompt attention, but care is often delayed because dairy operations lack proper facilities and equipment for the examination and care of lameness disorders. For these reasons, some veterinarians refuse to work on lame cows because of concerns for their safety or for economic reasons. When the animal or its foot is not securely fastened for examination and treatment purposes, it is harder to work on and more dangerous for both the animal and the veterinarian.

Also, the treatment of certain lameness disorders can be time-consuming, ultimately requiring the veterinarian to charge a fee that some dairymen find excessive. The combination of these problems results in situations where veterinarians are inclined to avoid working on foot problems, and producers are inclined to avoid seeking their assistance, even when veterinary expertise may be necessary. Complicated foot problems where surgical intervention may be required are not brought to the attention of the veterinarian. Instead, the dairyman may be forced to trust his own experience or that of a trimmer for treatment of these conditions. The result may be ineffective or inappropriate treatment, additional treatment delays, and/or failure to provide veterinary care when necessary, which only increases animal suffering. Complicated foot problems, described elsewhere in this manual, require veterinary examination. In some cases, treatment is not indicated. Movement to slaughter or euthanasia may be the better options from an animal welfare perspective.

The influence of genetic factors in lameness

Genetic factors have a significant influence on feet and leg traits in dairy cattle. Specific traits scored include foot angle, legs–side view, and legs–rear view. Heritability values tend to be low (particularly for legs–rear view and foot angle) as scores can vary significantly depending on the cow's stance at the time of scoring. Simply moving the cow forward a few steps can make major differences in scoring of feet and leg traits. Other factors, which markedly influence posture and stance, are overgrown claws or pain associated with foot disorders.

Heritability estimates for feet and leg traits on Holstein cows range from about 0.08 to 0.16, which means that single scores from an individual cow are not a reliable measure of that cow's genetic merit for a specific trait. However, where scores from multiple offspring are available, the breeding value of a specific bull or cow can be reliably estimated. Successful genetic improvement requires selection based on information from progeny tests of bulls and not on the evaluation of a specific individual animal.

Generally speaking, cow legs should be sturdy with a strong pastern and good flexibility in the hock. Abnormally straight hocks, weak pasterns, sickle hocks, splay toes, or overlapping toes are associated with an increase in the incidence of lameness. The ideal conformation of the cow's foot should be short, steeply angled, high in the heel, and even clawed. Some suggest that the ideal hoof angle is 50°–55° for front feet and 45°–50° for rear feet.

Nutrition and feeding management

Nutrition and feeding management are major considerations whenever a herd begins to experience a high incidence of foot problems, in particular that associated with laminitis. In fact, the association of lameness with feeding and nutrition is so great that some fail to recognize the significance of other factors, such as housing and management, when attempting to find the underlying cause(s) of lameness

disorders. A primary goal in feeding is to maximize dry matter intake, and thus optimize performance yet avoid those conditions, which might lead to rumen acidosis and laminitis. Feedlots emphasize keeping feed available at all times and encourage intake numerous times daily in order to avoid rumen acidosis. Dairies apply similar feeding strategies to encourage consistent feed intake and minimize production losses.

Total mixed rations containing high-quality forages have been one of the strategies used to lower the risk of rumen acidosis and laminitis. Proper formulation and mixing of feed ingredients helps achieve optimal success. It is often recommended that hay and ensiled feeds be chopped as coarse as possible and not mixed excessively to the extent that effective fiber attributes are lost. However, if forages are too coarse, cows may sort or select for concentrates rather than consume a balanced diet containing both feed grains and forage. Because of social hierarchy issues, most recommend housing mature cows separately from heifers. In all cases animals should be introduced to the milking herd ration gradually, preferably through the use of a properly formulated transition ration. Transition is a critical period of adjustment for animals and has important links to the pathogenesis of laminitis.

In the southern United States, the nutritionist's challenge is to maintain feed intake and avoid feeding-related health problems during periods of hot weather. One strategy is to increase the nutrient density of rations and thus maintain an acceptable rate of dry matter intake. This strategy can be troublesome if not monitored carefully, in part because heat-stressed cattle tend to eat less frequently (feeding during cooler times of the day only) but proportionally more at each feeding. The combined effect of these types of rations and feeding patterns increases the risk for rumen acidosis. However, add to this the fact that heat-stressed cattle often have a lowered rumen pH due to decreased salivary buffering, and it is easy to understand how acidosis becomes a major feeding challenge during the summer months.

Housing, environment, behavior, and management

Despite research and clinical observation highlighting its significance in limiting the performance and profitability of dairy cattle, lameness remains a prominent health disorder in dairy farms throughout the world. In countries such as the United States where economic incentives have encouraged producers to expand herd size, there has been a gradual change from pasture-based to confinement-type housing systems. Properly designed confinement systems offer the advantages of improved protection of animals from inclement weather conditions. For example, confinement conditions offer convenience for the implementation of cow cooling measures in hot weather and the provision of wind blocks in cold conditions. It also creates facilities for improved access to feed and water, and a comfortable place for the cow to lie down and rest.

On the down side, confinement conditions require cows to stand and walk on hard flooring surfaces. The unyielding nature of solid surfaces (like concrete) promotes claw horn overgrowth, thereby creating unbalanced weight bearing within and between the claws of the foot. This predisposes to claw disorders, most notably