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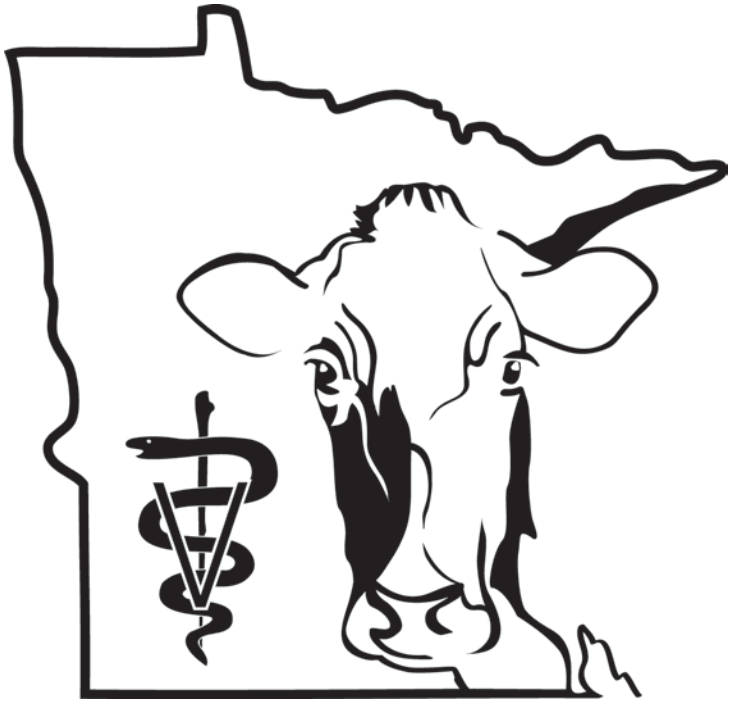

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Managing Cattle Lameness
Lessons from Prevalence and Incidence Data

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All dairy herds have lame cows. At least every published report of surveys based on locomotion scoring has found lame cows(1,3,5,6,8,18,19,21,23). Recent data from North America involving about 140 herds in 4 studies found mean prevalence of clinical lameness between 16 and 28%(1,5,6,8). Surveys relying on observations at trimming always find almost half of cows examined have lesions (6,12,17,18). For example, in an Ontario study (6) using a 4-category locomotion score the proportion of cows with normal locomotion with lesions was 44%. For locomotion judged as mildly, moderately, or severely lame, the frequency of lesions was 52, 63, and 95% respectively. There is less data available on the incidence of lameness than the prevalence. Why have researchers focused so heavily on prevalence? I believe the answer is because prevalence measures are easy to acquire compared to incidence measures. You can visit the herd for a short period and use the method that will be standardized across your study and collect data on the current circumstances. For broader referability the same methods can be transported to several or many other herds within a short period of time. It is efficient to gather enough data to convince editors, reviewers, and funding agencies that some real work has been done. However, without an understanding of the relationship between new occurrences of lameness or lesions and the more common snapshot data widely available, steps to reduce the problem of lameness for a given herd may be misguided.

Some investigators have used locomotion scoring repeated at frequent intervals for determining the incidence of lameness (2,3,11). All of these projects were conducted in New York dairies with different objectives and found incidences of undifferentiated lameness between 20 and 70% for the intervals evaluated, including one study with observations only between calving and 70 days in milk. Other studies have used treatment records to estimate incidence for specific lameness conditions (4,8,18). This approach has clear value since different disorders have markedly different consequences and ultimately different interventions to minimize their occurrence. As noted by this author and others, there are 2 main problems with this approach to studying incidence. Relying on farmer, hoof trimmer or even veterinary diagnosis is fraught with misclassification. Furthermore, only those cows selected by the farmer or herd manager for attention are counted. In two independent evaluations, lameness prevalence was determined by locomotion scoring and the farmers were asked to estimate the level of lameness in their herds(21,22). In both examples the farmers tremendously underestimated the proportion of cows found lame by researchers. This discrepancy probably contributes to the final conclusions of this paper

Modern dairy management has realized the necessity of recording health disorders for effective management. The recording by many herds of mastitis, ketosis, displaced abomasum and other problems has become routine and accurate. Some records are usually maintained for foot health.

As such, the incidence should be easily determined from treatment records for lame cows. Unfortunately, many herds do not readily distinguish between routine trims and treatment for lameness. Professional hoof trimmers usually leave a paper record of their work as part of their routine. This report usually includes treatments because they result in a higher fee than routine trimming. A potential shortcoming of trimmer records is the likelihood of over counting lameness. Not all visible lesions result in pain, discomfort, or abnormal locomotion. This is particularly true for digital dermatitis. In the absence of other data, the use of lameness treatment supplies may be a surrogate for the incidence of lameness. There are other questions about incidence for us to grapple with. Cows that are retreated may be counted twice. Cows that have a white line abscess one month and a sole ulcer the next might be considered a single case. No one has developed commonly accepted rules for including or excluding these events in determining the incidence of lameness. Computerized records usually have the disease events in the current lactation or lactation plus dry period in the active data file. With all cows that have calved as the denominator (lactating plus dry cows) and either the first treatment for each cow, or all treatments, the proportion affected can be calculated. The incidence thus calculated for some convenient interval is derived from treatment records. Herein lies the disconnect. Before treatment can be initiated someone must determine that a cow is lame. What proportion of lameness is detected and treated? Can we estimate this from available data?

Published values for incidence of lameness are usually highest from Great Britain at about 60% (10) with other publications in the range of 5 to 50%. These reports are not uniform in their definition of incidence. In my opinion, the data used for the studies giving low values were probably incomplete. In reviewing some farm records only cows receiving drug treatments were recorded and in others only those treated by veterinarians were recorded. At almost any level of lameness incidence our goal is to reduce the occurrence and thus reduce suffering and financial losses. Within a herd, the recording system employed should probably only be used to evaluate changes in that herd. Attempts at benchmarking or to look across herds or to combine data from several herds unless collected in identical fashion as by a single hoof trimmer are probably invalid.

Separating the incidence of lame cows from the prevalence of lame cows in a herd might lead to different conclusions about both the magnitude and the nature of a problem within a herd. Prevalence is very important. It is the current state of the locomotory health of the herd. The prevalence is used in assessing welfare by comparing current conditions to a fixed goal. The New York State Cattle Health Assurance Program states that 85% of cows should have a locomotion score of 1 (based on the Sprecher/Zinpro 1 to 4 scale)(19) to pass. I suggest that this goal will be difficult for most herds to achieve based on the published results of many cross-sectional studies of multiple herds. In a complete herd evaluation that we performed (3 experienced locomotion scorers simultaneously but independently scoring all cows as they exited the parlor) the proportion with a score of 1 and 2 was 79% (based on the Guard/Janssen 1 to 5 scale)(11) (407 of 518 cows). In this study all cows were trimmed in the following 2 days and 20 of 407 non-lame cows had serious, painful digital lesions. Of 88 cows with a locomotion score of 3, 26 (30%) had a painful digital lesion. For cows with a score of 4, 13 of 21 (62%) and with a score of 5, 2 of 2 (100%) had painful digital lesions. There is always the chance of errors in classification by locomotion scoring or by evaluating the feet when the cow is being trimmed. Nevertheless, the assessment of this herd was that lameness was a minor problem and yet by

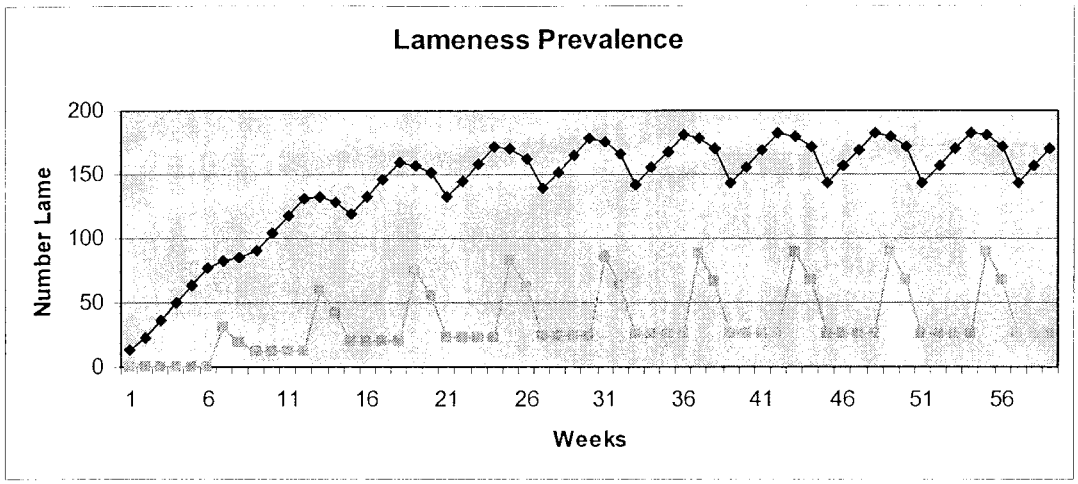
locomotion score it would not have passed the NY welfare audit. Cows that walk normally have serious lesions and cows that limp may not have detectable lesions.

Our goals in developing locomotion scoring systems have been both to serve as research tools to study the biology of lameness and to aid producers in identifying cows that will benefit from treatment. Imperfection might be corrected by objective, mechanical measures. The only system in commercial application in the USA is StepMetrix from Boumatic, Inc. This system was used by the herd described in the previous paragraph and its performance evaluated. The manufacturer recommends a cutoff of 38 in the 1 to 99 machine generated score for lameness. With this threshold the sensitivity was 24% and the specificity 94% for detection of cows with painful lesions found at trimming. I do not believe a system that identifies 1 in 4 cows with lesions as adequately sensitive for successful management of lame cows.

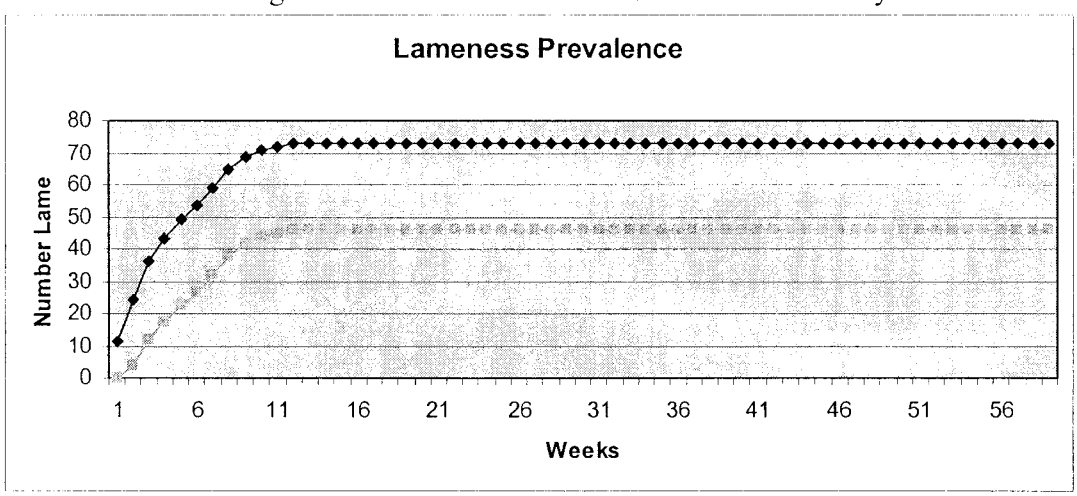
Prevalence of lameness is greatly affected by the disorders present in the herd and the management approach to their treatment. At one extreme, lame cows could be identified by observation every day and treated the same day. Treatment of some conditions results in return to normal locomotion in a few days and for others the recovery period may be weeks. If the herd with daily observation and treatment had mostly infectious digital diseases that respond rapidly to treatment the prevalence would be very low. Following are some hypothetical herd scenarios to illustrate the effects of detection and action on apparent prevalence. With a 50% incidence of digital dermatitis and 4 days of abnormal locomotion (1 day before and 3 days after treatment) there would be 200 lame cow days per year in a 100 cow herd. With a uniform rate of occurrence and treatment the prevalence of lame cows would 200/365 or 0.5%. At the other extreme of detection and action, for example a hoof trimmer visits every 4 weeks to treat lame cows, there would be 10 days of abnormal locomotion for every case (an average of 14 days before treatment and 3 afterwards). The prevalence of lameness would be 850/365 or 2.3% or 5 times higher due to delayed treatment. If the detection in a herd is imperfect, as it always will be, the prevalence judged by an outside observer will be higher than either of these simple examples. Additionally, the longer recovery periods of hoof horn lesions such as white line abscesses and sole ulcers will add to the prevalence more than a higher incidence of rapidly treated infectious diseases. Sole ulcers require up to 2 months for healing and even with hoof blocks cows usually display abnormal locomotion. Consider the situation with an incidence of sole ulcer of 15% and the duration of abnormal walking is 2 months with immediate treatment. There will be 900 lame cow days or a prevalence of 2.5%. Recovery from a minor white line abscess takes about 7 days. With daily observation and treatment and an incidence of 15% there will be 105 lame cow days or a prevalence of 0.3%. Waiting for the trimmer's monthly visit will increase lame cow days to 315 and triple the apparent prevalence to 0.9%. Added to all these considerations are the cows with chronic hoof problems that never recover to perfect soundness. Perhaps 3 to 5% of many herds fall into this category and add to the prevalence regardless of other detection and intervention activities.

The following figures illustrate the prevalence of lame cows in a herd of 1000 with the following characteristics: 4 disorders considered- 1) sole ulcer with incidence of 20% per year and 8 weeks of lameness during recovery, 2) white line abscess with incidence of 20% per year and 2 weeks of lameness during recovery, 3) foot rot with incidence of 5% and 1 week of lameness during recovery, and 4) digital dermatitis with incidence of 50% per year and 0.5 week of lameness

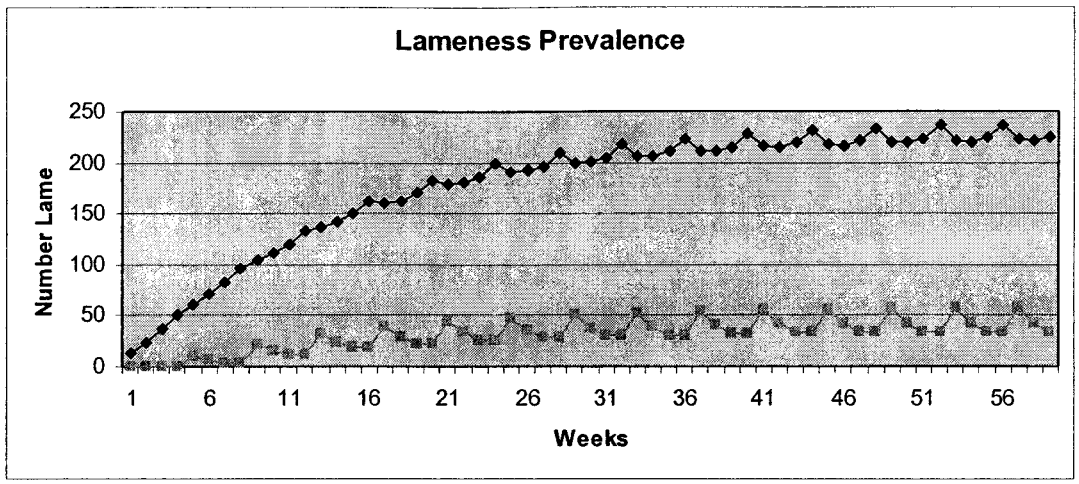
during recovery. The upper line is all clinically lame cows and the lower line are treated and convalescing cows. All diseases are independent and may occur simultaneously. The figures illustrate the effects of different intervals between treatment days and the efficiency of detection of lame cows. The timeline begins with no lame cows in the herd. No chronically lame cows are included in the model.



Detection and trimming at 6 week intervals with 50% detection efficiency.



Detection and trimming at weekly intervals with 50% detection efficiency



Detection and treatment at monthly intervals with 25% detection efficiency.

These figures show that with the same underlying rates of disease very different prevalence will result. Increasing the frequency of detection/action and the efficiency of detection can reasonably lower the prevalence to 5% or less. Doing both less efficient detection and less frequent intervention can result in a prevalence of 30%.

What can be done to reduce the incidence of lameness? The risk factors are well characterized. Infectious disease control requires a combination of hygiene to reduce the infection pressure and preventive foot bathing to control the health of interdigital skin. Hoof horn lesions are reduced by minimizing standing time by providing stall comfort, not overcrowding, separating first from greater parity cows, and controlling the daily time budget for milking and management activities. Excessive hoof wear can be reduced by rubber flooring. Feeds and feeding management should be rumen-friendly. The list is simple. Finding the right thing to fix in any given problem herd may be less obvious.

What can be done to reduce the prevalence of lameness? First, reduce incidence of new lameness cases. Second, find and fix lame cows. As with many of the health problems of dairy cattle, the actions of the people responsible for their care have a large impact on the apparent magnitude of problems and on the welfare and financial consequences of abnormal health.

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