An evaluation of early intervention protocols based on camera-based autonomous mobility score trends

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Introduction

Lameness is a major animal welfare issue in the dairy industry and its measurement is a component of both industry- and processor-led animal welfare audits. Although lameness is highly prevalent on dairy farms, farm personnel have difficulties identifying mild cases of lameness. Reasons for this difficulty include the time, human resources and training required to detect lameness, along with the lack of belief that early intervention works. Automatizing the process of lameness detection through the implementation of autonomous camera-based deep learning will provide dairy farms with an effective and easy-to-implement tool to reduce lameness duration. Combining early and accurate lameness detection with appropriate treatment protocols will result in lower levels of lameness. The objective of this project was to determine if changes in camera-based autonomous mobility scores could be used to reduce the duration of lameness.

Materials and methods

Starting in July 2021, a 2,300-cow herd was scored continuously using camera-based autonomous mobility scoring (CattleEye). The camera-based mobility scoring (CMS) outputs a score of 0 to 100, where 0 indicates no mobility abnormalities and 100 indicates severe mobility abnormalities. A score above 49 is considered lame. At the same time, the herd's hoof trimmers were trained in nomenclature for the recording of lesions and their hoof trimming technique was standardized. Starting in December 2021, cows with an increasing CMS trend over the previous 14-day period were enrolled in the study on a weekly basis. This increasing trend was determined based on a linear model of the CMS that gave each cow a trend score. Cows with trend scores above 20 were eligible for enrollment. To ensure only new cases of lameness were enrolled, only cows with a CMS below 50 in 14-28 days before enrollment were eligible for enrollment. Additional enrollment criteria included cows being greater than 14 days in milk, not being coded as "do not breed", and not having a concurrent illness. These data were retrieved from on-farm management software. Eligible cows were scored by trend score from highest to lowest and odd-numbered cows were placed on the hoof trimming list (TEST) to be trimmed in the following week. Even-numbered cows were enrolled in the study but not placed on the hoof trimming list and were considered our CONTROL group. Due to hoof trimming capacity, between 5-12 cows with the highest trend scores were placed on the farm's hoof trimming list and an equal number of CONTROL cows were enrolled. Our outcome of interest was the percentage of days cows spent above their maximum CMS pre-enrollment score. For this study, CMS was measured for 56 days post enrollment. Data were analyzed by comparing means and using a linear model that included, treatment, lactation group, days in milk, trend score, and max score category at enrollment as confounders. Models were stratified by lactation group and pre-enrollment score quartile to explore the impact of chronicity.

Results

A total of 132 cows were enrolled in the study with 68 cows in the CONTROL group and 64 cows in the TEST group. In the CONTROL group 22, 18 and 28 cows were in the 1st, 2nd or 3+ lactation categories respectively. In the TEST group 22, 12 and 30 cows were in the 1st, 2nd or 3+ lactation categories respectively. Average days in milk at enrollment were 127 (95% CI 103-150) and 144 (95% CI 120-167) for the CONTROL and TEST group. Overall, in the 56 days, post-enrollment CONTROL cows had on average 13% of their scores above their max pre-enrollment score whereas TEST cows had 11% of their scores above their maximum pre-enrollment score. Results from our model indicate that first lactation TEST cows had 10.2% fewer days above their pre-enrollment max score (95%: -25.5% to +5%). Additionally, TEST cows in the lowest pre-enrollment score quartile (scores 22-39) had 18.8% fewer days above their pre-enrollment max score (95% CI: -37.8 to 0).

Significance

Our results support that early intervention based on increasing CMS trends improves the mobility in the 56 days past enrollment for cows with low initial scores or if they are in their first lactation.

