

# An economic analysis of subclinical ketosis testing and propylene glycol treatment strategies in early lactation dairy cattle

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## Introduction

The negative associations of subclinical ketosis (SCK) with downstream health events and production have been well described in dairy cattle during early lactation. Cows with SCK have an increased risk of developing additional postpartum diseases such as displaced abomasum (DA), are at an increased risk of leaving the herd, and have decreased milk yield during early lactation. Thus, the cost per case of SCK depends on a variety of factors including increased occurrence of postpartum diseases, cost of herd replacements, and loss of milk production. The intensity and accuracy of diagnostic testing used to define a case of SCK then affects the reliability of the cost estimate. Additionally, overall herd costs of SCK vary based on herd SCK incidence, and a cost-to-treatment benefit ratio depends on the frequency and accuracy with which cows are tested. Although a higher testing frequency improves accuracy, it may not improve the cost-to-treatment benefit. Following accurate identification of SCK-positive cows, individual cow treatment with propylene glycol (PG) is an effective means of reducing the risks associated with SCK. The purpose of this study was to develop stochastic economic models which address variation in disease risks and costs in order to evaluate different simulated on-farm testing and PG treatment strategies based on herd SCK incidence.

## Materials and Methods

Data used in model development were from a large field trial conducted on 4 free-stall dairy herds (2 in New York and 2 in Wisconsin) in which cows from 3 to 16 days-in-milk (DIM) were each tested 6 times for SCK with the Precision Xtra meter. Subclinical ketosis was defined as a  $\beta$ -hydroxybutyrate concentration of 1.2 to 2.9 mmol/L. Data from 741 SCK-positive cows and 976 nonketotic cows were used in model development. Four simulated on-farm testing and treatment strategies were analyzed at herd SCK incidences ranging from 5% to 80%, and included 1) treating all cows with 5 days of PG starting at 5 DIM (TREAT ALL); 2) testing all cows for SCK 1 day per week (e.g. Mondays) from 3 through

16 DIM and treating all positive cows with 5 days of oral PG (TEST1); 3) testing all cows for SCK 2 days per week (e.g. Mondays and Thursdays) from 3 through 9 DIM and treating all positive cows with 5 days of oral PG (TEST2); and 4) testing all cows for SCK 3 days per week (e.g. Mondays, Wednesdays, and Fridays) from 3 through 16 DIM and treating all positive cows with 5 days of oral PG (TEST3).

Cost-benefit analyses included the costs associated with labor to test cows,  $\beta$ -hydroxybutyrate test strips, labor to treat cows, PG, and the associated gain in milk production and decrease in DA and early removal risks of PG-treated SCK cows compared with those for non-treated SCK cows. Stochastic models were developed using @Risk. Probability densities and tornado sensitivity analyses were run with 10,000 iterations to account for variability in the distribution of input variables.

## Results

Per 100 fresh cows in a herd with an SCK incidence of 40%, the mean economic benefits were \$1,079 (TREAT ALL), \$715 (TEST1), \$1,111 (TEST2), and \$730 (TEST3). The 95% cost-benefit range for the TEST2 strategy was \$258 to \$2214. Correlation coefficients showed a herd's underlying DA and early removal risks during the first 30 DIM had the highest impact on the cost-benefit of SCK testing, and treatment had a larger benefit in herds with higher DA and early removal risks. The TEST2 strategy was the most cost-effective strategy for herds with SCK incidences between 15 and 50%; for herds with SCK incidence > 50%, TREAT ALL was the most cost-effective strategy.

## Significance

Results indicated that when herd SCK incidence is > 25%, almost any SCK testing and treatment protocol will be economically beneficial for the farm. Repeated incidence or prevalence testing is recommended in order to determine which approach to testing and treatment is optimal for an individual herd, and to evaluate changes in transition cow management that could justify adjustments in these protocols.