

# Effect of lameness during early lactation on subsequent fertility and survival of Holstein cows across multiple geographic areas in the US

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## Introduction

Due to pain and discomfort associated with lameness, this disorder represents a significant animal-welfare challenge for the dairy industry. In addition, the high incidence of this condition results in substantial economic losses that include treatment and control costs, premature culling, decreased milk yield, and impaired reproductive performance. Although previous studies established an association between lameness and reproduction, large multi-state prospective studies using standardized definitions and procedures can provide new insights on the magnitude of the effects of lameness on fertility of dairy cows. Therefore, our objective was to test the effect of lameness at early stages of lactation on fertility and survival of a large population of Holstein cows in dairies across multiple states.

## Materials and Methods

A total of 11,733 cows calving in 16 farms located in 4 regions (Northeast [4 herds], Midwest [6 herds], Southeast [1 herd], and the Southwest [5 herds]) were enrolled at parturition and monitored weekly for multiple reproductive events and survival. Cows were scored for lameness (score 1 [normal] to 5 [severe]) at 35±3 days-in-milk (DIM). Subsequently, cows were categorized as normal (NOR) or lame (LAM; score ≥3). Resumption of ovarian cyclicity (ROC) was assessed via trans-rectal ultrasonography at 40±3 and 54±3 d postpartum and pregnancy diagnosed by ultrasonography on d 32±3 d after AI, and reconfirmed at d 60±3 of gestation. Pregnancy loss between d 32 and d 60 after AI was calculated. Multivariate logistic regression was used for testing potential associations between LAM and multiple reproductive and survival variables including ROC, pregnancy and pregnancy

loss at first and second AI, and survival before and after 50 DIM. Parity and season were included as fixed effects, and farm and region as random effects in the models.

## Results

Frequencies of lameness scores were 64%, 24.1%, 9.65%, 2.1%, and 0.15% for categories 1, 2, 3, 4, and 5, respectively. Overall, mean (range) farm incidence of LAM was 11.9% (2.18 - 33.8). Average LAM incidence was greater in cows calving in winter (13.7%) than in summer (9.99%;  $P<0.0001$ ) and in pluriparous (15.2%) compared to primiparous (6.1%;  $P<0.0001$ ) cows. The incidence of LAM varied by region ( $P<0.0001$ ) 10.7% (Northeast), 13.9% (Midwest), 10.3% (Southeast), and 9.3 (Southwest). Lameness affected ROC; the odds (95% CI) of ROC multiplied by 0.65 (0.57-0.75) in affected cows, such that the odds of cyclicity were reduced by 35% by LAM. The odds of pregnancy at first and second AI in LAM cows were 0.81 (0.70-0.93) and 0.81 (0.68-0.95) times the odds of pregnancy of NOR cows, respectively, indicating that the odds of pregnancy were reduced by 19% in both cases. The odds of pregnancy loss at first and second AI were not affected by LAM. Lame cows had lower survival than NOR cows; the odds of leaving the herd (death and live culling combined) before 50 DIM and after 50 DIM were 3.39 (2.10-5.47) and 1.74 (1.51-2.00), respectively.

## Significance

The incidence of lameness (score ≥3) was affected by farm, season of calving, parity, and region. Lameness occurring during early lactation had a lasting detrimental effect on both fertility and survival of Holstein cows.