

# Development of a risk assessment tool for prevention of bovine respiratory disease in pre-weaned calves on California dairies

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## Introduction

Bovine respiratory disease (BRD) has been estimated as the cause of death in 22.5 % of pre-weaned and 46.5 % in post-weaned heifers. In 2010, 18.1 % of pre-weaned heifers on dairy heifer raising operations were reportedly affected by pneumonia, the second most common illness after diarrhea. Despite the availability of numerous vaccines and antibiotics specifically approved for the prevention and treatment of BRD, morbidity and mortality in dairy calves have remained static over the past 25 years. The objective of this cross-sectional study was to determine how management practices on California dairies are associated with BRD in pre-weaned calves.

## Materials and Methods

A convenience sample of 100 grade A dairies across California were enrolled, which resulted in a study population of 4599 pre-weaned calves housed individually or in groups. Dairies were visited between May 2014 and April 2016, and in-person interviews were conducted with owners or herd managers. The questionnaire collected information about demographics, maternity pen, colostrum, and calf management, vaccinations and dust abatement. Following the interview, a simple random sample of calves was evaluated for the presence of BRD using the standardized and validated California BRD scoring system for pre-weaned calves. Demographic information on the scored calves as well as housing conditions were recorded. A generalized linear mixed model with a logit link was fitted with calf as the unit of analysis and weighted with the inverse of the dairy-specific sampling fractions. The outcome of the model was presence or absence of BRD with dairy as the random effect and adjusted for breed, herd size, organic status, age and season.

## Results

The median herd size of the study dairies was 1100 milking cows (mean herd size was 1718 ( $\pm$  189.9 SE) with an overall survey adjusted BRD prevalence of 6.91% ( $\pm$ 0.69

% SE). Of the 4599 calves enrolled on the study dairies, 3131 (70%) were Holstein, 1042 (23%) were Jersey and the remaining 306 (7%) were crossbred or other purebred breeds, while 3796 (86%) were female and 621 (14%) were male. Odds ratios (ORs)  $>1.0$  represent a potentially increased risk, while ORs  $<1.0$  are potentially protective. Season was significantly associated with BRD in the summer compared to the spring (OR: 5.53; 95% CI: 1.12 - 27.28) and in the fall compared to the spring (OR: 6.66; 95% CI: 1.22 - 36.34). For calves fed pooled colostrum, the OR for the association between heat-treating colostrum compared to not heat-treating it and BRD was 0.46. The odds ratios for the different hutch materials and BRD were the highest for non-wooden hutches. Specifically, the OR for the association between metal hutch compared to wood and BRD was 4.26 (95% CI: 1.47 - 12.3). In contrast, a positive association between housing calves in plastic hutches compared to wood and BRD was only significant for calves between the ages of 40 and 75 days (OR:1.79). Furthermore, the OR comparing housing calves in hutches under a roofed structure without walls in addition to the hutch roof, to hutches without the additional roof was 0.11 (0.03 - 0.44) adjusted for age and season. The odds of calf-to-calf contact in BRD calves older than 75 days were 14.81 times that in non-BRD calves of the same age.

## Significance

Results of this study provide estimates for the magnitude of association between key management practices. Such results contribute insights into calf management strategies that may mitigate the burden of BRD in pre-weaned calves on California dairies. Due to the cross-sectional nature of the study, causal inferences cannot be made. However, the findings of this study provide the basis for hypothesizing potentially causal factors and promote the design of further studies to directly examine housing and management factors found to be associated with BRD.