

Factors associated with morbidity, mortality and lung consolidation in preweaned dairy calves

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Introduction

Over one-third of dairy calves will experience a preweaning illness, with diarrhea and respiratory disease accounting for the majority of recorded morbidities and mortalities. Moreover, these calfhood illnesses have enduring repercussions including reduced average daily gain, delayed first conception and reduced first lactation milk yield. The objective of this retrospective cohort study was to explore factors associated with the occurrence of diarrhea, respiratory disease (BRD), lung consolidation (LC) and mortality in preweaned dairy calves.

Materials and methods

Complete calf health records from birth to 56 d of age were available from 2,361 female Holstein calves from 11 dairy farms in Ontario, Canada. Thoracic ultrasound was performed at 30 d (+/- 7 d) using a linear probe set at 8 cm and 8.5 MHz. Lung tissue was considered consolidated if hypoechoic areas eliminated the bright white band at the pleural interface and reverberation aspect found in normal lung. The extent of LC was determined by summing the affected areas of all lobes. Calves were considered LC positive at ≥ 1 cm² of consolidation. Variables screened in univariable analyses for each morbidity model included season of birth, birth bodyweight, calving ease, first colostrum feeding volume, colostrum Brix, number of colostrum feedings, time of birth and transfer of passive immunity (TPI) among total protein categories of poor (PR; < 5.1 g/dL), fair (FR; 5.1-5.7 g/dL), good (GD; 5.8-6.1 g/dL) and excellent (EX; ≥ 6.2 g/dL). Season of birth was categorized as winter (Dec-Feb), spring (Mar-May), summer (Jun-Aug) and fall (Sept-Nov). Variables screened in the LC model included the aforementioned variables as well as incidence of diarrhea. Lastly, the mortality model also screened the same variables as the morbidity models but included 2 additional potential predictors: any health event and presence of LC. Multivariable mixed-effects logistic regression models with a random effect for farm were built using a manual backward stepwise elimination process until all variables had a $P \leq 0.05$ or were identified as confounders.

Results

Overall, 22.8% (538/2,360) of calves were treated for diarrhea. Only season was associated with its occurrence, where calves born in the summer had greater odds of diarrhea (OR = 1.54; 95% CI: 1.08-2.20; $P = 0.02$) compared to winter. With respect to BRD, 47.4% (1,118/2,360) of calves were treated, with calves born in summer (OR = 0.67; 95% CI: 0.51-0.88; $P = 0.005$) having lower odds of BRD and calves born in fall (OR = 1.51; 95% CI: 1.12-2.04; $P = 0.007$) having greater odds for BRD compared to winter. Further, EX TPI calves had lower odds for BRD (OR = 0.71; 95% CI: 0.52-0.98; $P = 0.04$) compared to PR TPI.

Over half of the calves subjected to thoracic ultrasound had LC (1,156/2,276; 50.8%) and the odds of LC were lower if TPI was GD (OR = 0.56; 95% CI: 0.38-0.82; $P = 0.003$) or EX (OR = 0.41; 95% CI: 0.28-0.61; $P < 0.001$) compared to PR. Additionally, calves born in the summer had lower odds of LC than calves born in the winter (OR = 0.72; 95% CI: 0.51-1.00; $P = 0.05$). Birth weight was also associated with LC, where every 1 kg increase reduced the odds for LC (OR = 0.96; 95% CI: 0.94-0.98; $P < 0.001$).

Last, 3.2% (75/2,361) of calves died. The odds for mortality were lower in calves born in fall (OR = 0.23; 95% CI: 0.05-0.97; $P = 0.05$) compared to winter and if TPI was GD (OR = 0.13; 95% CI: 0.07-0.78; $P = 0.042$) or EX (OR = 0.34; 95% CI: 0.12-1.00; $P = 0.05$) compared to PR. Moreover, the odds of mortality were higher for calves with a health event compared to those with no health events (OR = 20.18; 95% CI: 4.24-96.13; $P < 0.001$) and if calves had LC compared to no LC (OR = 2.65; 95% CI: 1.02-6.88; $P = 0.05$).

Significance

These results highlight the importance of improving TPI to reduce preweaning morbidity, mortality and LC. Moreover, they demonstrate the effect of season on the incidence of morbidity and respiratory damage. The seasonal effects are likely associated with temperature, ventilation and air quality oscillation.

