Prevalence and calf health outcomes for enteric pathogens on Ohio dairy farms

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Introduction

- Calf diarrhea remains one of the main reasons for productivity and economic losses on U.S. dairy operations .[1]
- Five enteric pathogens are commonly associated with diarrhea in dairy calves, including bovine rotavirus, bovine coronavirus, *Escherichia coli*, *Salmonella spp.*, and *Cryptosporidium parvum*.[2]
- Pathogen-associated differences in health outcomes and case fatality rates have not been well-characterized.
- Zoonotic potential of the pathogens and antimicrobial resistance of *Salmonella* give the study public health relevance.

Objective and Hypothesis

- The objectives of this study were to estimate the prevalence of diarrheal pathogens on Ohio dairy farms, and longitudinally measure the health outcomes for diarrheal illnesses .
- We hypothesized that disease duration and mortality would differ for calves infected with different enteric pathogens.

Materials and Methods

- Fecal samples were taken as part of a clinical trial from 277 pre-weaned calves ≤ 21 d of age diagnosed with diarrhea (fecal score ≥ 2)[3] from 5 Ohio dairy farms.
- Calves were clinically evaluated at enrollment and 1, 2, 3, 7, 14, 21, 28, and 35 d post-enrollment.
  - Rectal temperature (enrollment only), fecal score, dehydration, and depression.
- Fecal samples were homogenized using a Precellys® Homogenizer and total nucleic acid was using the Omega Bio-Tek Mag-Bind Viral DNA/RNA 96 Kit.
- Genomic techniques, including RT-PCR for the viral pathogens and ddPCR for the bacterial and protozoal pathogens, were used to test for the presence of the 5 enteric pathogens.
  - For RT-PCR results, cycle threshold (CT) values ≤ 40 were considered positives and for ddPCR results, gene copy values > 0 were considered positive.

Materials and Methods

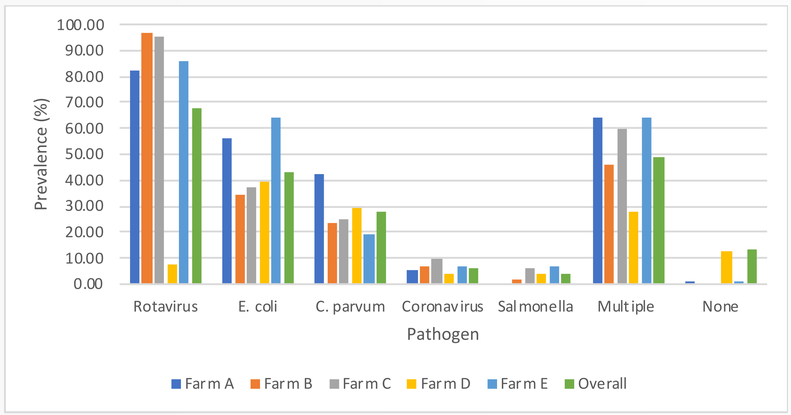
Statistical Analysis

- A survival analysis (PROC LIFETEST, SAS) with a Cox regression model (PROC PHREG, SAS) was used to analyze time to return to a healthy clinical status by pathogen.
- A Poisson regression model (PROC GENMOD, SAS) with robust standard errors was used to test differences in the risk of mortality post-enrollment (d 0 to 35).

Results

- Mean age (± SE) at enrollment: 11.5 ± 4.4 d
- The most prevalent pathogen at enrollment was rotavirus, which was detected in 68.2% (189/277) of samples (**Figure 1**).

Figure 1. Prevalence of gastrointestinal pathogens in diarrheal dairy calves across 5 Ohio dairy farms.



- Risk of mortality was nearly significantly higher for calves infected with *Salmonella* with a risk ratio of 3.83 (95%CI: 0.92, 15.93, p=0.065).
- The pathogens did not have any statistically significant effect on time to return to a healthy clinical status **(Figure 2).**
- Farm was a significantly associated with time to return to health (p=0.0139) (**Figure 3**).

Results

Figure 2. Kaplan-Meier survival plots showing the proportion of calves remaining diseased at different exam days during the study stratified by pathogen.

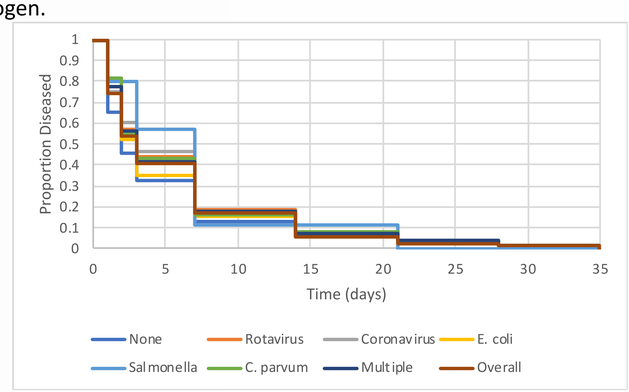
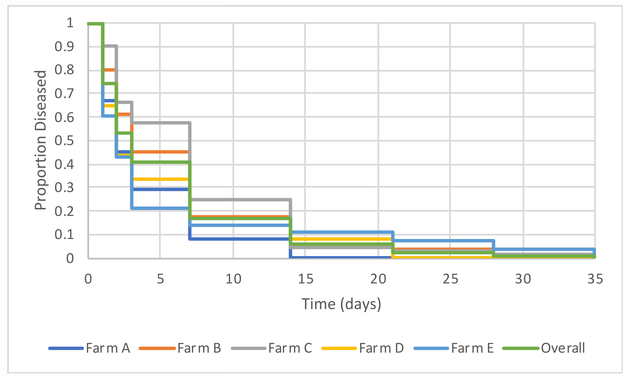


Figure 3. Kaplan-Meier survival plots showing the proportion of calves remaining diseased at different exam days during the study stratified by farm .



Conclusions

- The results suggest that rotaviral infections are prevalent and widely distributed across farms.
- Mortality is more commonly associated with *Salmonella* infections.
- Specific prevention and rapid differentiation of *Salmonella* from other causes of calf diarrhea are important to reduce risk of mortality in pre-weaned calves with diarrhea.

References:

[1]USDA. 2017. Dairy 2014, Heifer Calf Health and Management Practices on U.S. Dairy Operations, 2014 USDA:APHIS:VS, CEAH. Fort Collins, CO.

[2]Foster D.M. 2009. Pathophysiology of Diarrhea in Calves. Vet Clin North Am Food Anim Pract. 25:13–36.

[3]Lago, A., S. M. McGuirk, T. B. Bennett, N. B. Cook, and K. V. Nordlund. 2006. Calf respiratory disease and pen microenviron- ments in naturally ventilated calf barns in winter. J. Dairy Sci. 89: 4014–4025.

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