# Assessing the utility of leukocyte differential cell counts for predicting mortality risk in neonatal Holstein calves upon arrival and 72 hours post-arrival at calf rearing facilities

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## Introduction

There is growing concern about the level of antimicrobial use and antimicrobial resistance in food producing animals. An area of opportunity to reduce antimicrobial use could be in the treatment of young calves during the first week following arrival at calf rearing facilities. Group metaphylaxis is common due to the unknown age and history of calves that undergo several stressful events prior to arrival, such as transportation, co-mingling and variable periods of fasting. It may be possible to reduce antimicrobial use at this stage in the production cycle without sacrificing animal health and welfare if the calves at highest risk of morbidity and mortality could be identified and treated in a highly selective manner. Recent studies have identified indicators of future risk for morbidity and mortality that can be measured at arrival such as biomarkers and physical exam factors. Bovine haematology, when used in conjunction with clinical examination findings, could be used to improve disease diagnosis. The objective of this study was to assess the utility of leukocyte differential cell counts taken at the time of arrival at a calf rearing facility and 72 hours post arrival for determining mortality risk during the production cycle.

## Materials and Methods

Calves were enrolled in this prospective cohort study at an independent grain-fed veal research facility in Ontario, Canada. All 240 calves that arrived from June to July 2018 into three rooms of 80 were eligible for enrolment. Calves received a risk assessment upon arrival using a standardized screening protocol (adapted from Renaud et al., 2018) and blood samples were collected to measure serum total protein (TP) and machine leukocyte differential cell counts. Of the 240 calves eligible for enrolment, 7 were removed for missing mortality data or machine leukocyte differential cell count data. In total, samples from 233 calves evaluated at arrival and a subset of 158 calves evaluated again at 72 hours post arrival had leukocyte differential cell counts done using the QScout BLD test (Advanced Animal Diagnostic, Morrisville, NC). Calves were fed at the facility for 77 days and calf mortality was reported after calves were shipped from the facility. Cox proportional hazards models were built using Stata 15 (StataCorp LP, College Station, TX) to determine the utility of leukocyte differential cell counts measured at the time of arrival and 72 hours post arrival for predicting mortality risk.

## Results

Over the growing period 39 / 233 calves died, including 30 / 158 calves in the 72 hour post arrival subset. Preliminary univariable survival analysis using Cox proportional hazards models suggest that on the day of arrival every 1 g/dL increase in TP lowers the risk of mortality (Hazard Ratio (HR) = 0.38; P < 0.001). At 72 hours post-arrival, it was found that for every $10^9$ cells/L increase in neutrophils the risk of mortality increased (HR = 1.12; P = 0.007).

## Significance

Preliminary results suggest that machine leukocyte differential cell counts taken on the day of arrival are not a good predictor of mortality but that they may predict an increased risk of mortality when taken 72 hours after transportation. Further studies are required to determine if machine leukocyte differential cell counts have a role in augmenting or refining the risk profile of calves arriving to veal and dairy beef facilities.