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Risk factors associated with mortality at a milk-fed veal calf facility: A prospective cohort study

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ABSTRACT

The veal industry experiences calf losses during the growing period, which represents a challenge to animal welfare and profitability. Health status at arrival may be an important predictor of calf mortality. The objectives of this prospective cohort study were to describe the health status of calves arriving at a veal farm and determine the risk factors associated with early and late mortality. Using a standardized health scoring system, calves were evaluated immediately at arrival to a commercial milk-fed veal facility in Ontario, Canada. Weight at arrival and supplier of the calf were recorded. The calves were followed until death or the end of their production cycle. Two Cox proportional hazard models were built to explore factors associated with early ($\leq$21 d following arrival) and late mortality (>21 d following arrival). A total of 4,825 calves were evaluated from November 2015 to September 2016. The overall mortality risk was 7%, with 42% of the deaths occurring in the first 21 d after arrival. An abnormal navel, dehydration, housing location within the farm, arriving in the summer, and the presence of a sunken flank were associated with increased hazard of early mortality. Drover-derived calves and calves with a greater body weight at arrival had lower hazard of early mortality. Housing location within the farm, being derived from auction facilities, and an abnormal navel were associated with higher hazard of late mortality. These results demonstrate that risk factors for mortality can be identified at arrival, which represents a potential opportunity to selectively intervene on these calves to reduce mortality. However, methods of preventing the development of these conditions before arrival need to be explored and encouraged to improve the welfare of the calves entering the veal industry.

Key words: veal industry, mortality, animal welfare, health status

INTRODUCTION

Mortality in dairy calves, whether female or male, represents a significant welfare issue (Ortiz-Pelaez et al., 2008) and a major source of economic loss to livestock industries. High levels of antimicrobial use (Bos et al., 2013) and resistance (Catry et al., 2016) are also among the challenges faced with the rearing of dairy calves. With public concern about animal welfare on the rise (Vanhonacker et al., 2008; Spooner et al., 2014), improvements in animal health are needed to reduce the levels of morbidity and mortality.

There is a lack of published information on male calf mortality in North America; however, estimates from the veal and dairy beef industries suggest that mortality is high. Winder et al. (2016) reported a mortality risk of 8% over the entire production period at a single milk-fed facility in Ontario. Pardon et al. (2012a) reported a mortality risk of 5% on 15 Belgium milk-fed veal farms, whereas Bähler et al. (2012) reported a mortality risk of 4% in calves housed on 15 veal farms with high animal welfare standards in Switzerland. As the majority of mortality occurs within the first 3 wk following arrival at veal calf raising facilities (Bähler et al., 2012; Pardon et al., 2012a; Winder et al., 2016), initial management at the veal facility, but also management at the dairy farm of origin, may be critical in the health and welfare of calves.

Management of newborn calves on dairy farms affects their survival and productivity, with calving management (Wells et al., 1996), colostrum management (Postema and Mol, 1984; Pardon et al., 2015), early life nutrition (Ollivett et al., 2012; Todd et al., 2017), and housing (Waltner-Toews et al., 1986; Lago et al., 2006; Windeyer et al., 2014) all playing critical roles in disease risk. Commingling, crowding, and transportation (Mormede et al., 1982; van der Fels-Klerx et al., 2000) are additional challenges faced by calves before their arrival at veal facilities.

Similarly, management practices on veal operations have been identified as risk factors affecting calf health. Purchasing practices, type of breed reared, housing, ventilation, herd size, and nutrition (Brscic et al., 2012;

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Lava et al., 2016; Todd et al., 2017) have been associated with elevated mortality, morbidity, and antimicrobial use at veal operations. Hence, management of calves on the veal operation plays an equally critical role in their health and welfare.

A management practice that is commonly used upon arrival at veal facilities is to provide group oral antibiotics (Pardon et al., 2012b), likely because of the large number of calves that enter the veal industry with health challenges (Wilson et al., 2000). However, it is unclear whether health abnormalities identified at arrival affect mortality, as the sole studies (Wilson et al., 2000; Bähler et al., 2012) evaluating individual calves at arrival yielded few associations between reduced general condition at arrival and increased risk of morbidity or mortality. If calves at high risk for mortality could be identified, it may provide an opportunity to intervene selectively with antibiotics or supportive therapy while reducing overall antibiotic use (Pardon et al., 2015).

The objectives of this study were to describe the health status of calves at arrival to a veal facility and to associate characteristics of the arriving calf with early and late mortality.

MATERIALS AND METHODS

This prospective cohort study was conducted in cooperation with a milk-fed veal producer and in accordance with the University of Guelph Animal Care Committee requirements (Animal Use Protocol: #3453). The producer had 5 barns in different geographical locations within the southwestern region of the province of Ontario, Canada. In barns 1, 2, and 4, the calves were fed manually, whereas in barns 3 and 5, automatic calf feeders were used. Calves were housed individually in barns 1 and 4 and in groups of 60 calves in barns 3 and 5. Calves in barn 2 were housed in individual pens in early life, transitioning to groups of 8 calves 5 to 6 wk following arrival.

Data Collection

When calves arrived at the barns, they were immediately evaluated according to a standardized health scoring system and weighed using a digital weigh-scale (Cardinal Scale Manufacturing Co., Webb City, MO). The supplier of the calf and receiving date were recorded. In total, there were 233 different recorded suppliers. These suppliers were divided into 7 categories (5 drovers, local, and auction). "Local" refers to dairy farmers who delivered their calves directly to the veal facility. The term "drover" was used for calves that were transported directly from multiple dairy farms to the veal facility by a third party, and "auction" was used to classify calves purchased by the veal farm from auction markets. Season was categorized as winter (December to February), spring (March to May), summer (June to August), and fall (September to November). Calves were identified at arrival based on their Canadian Cattle Identification Agency (CCIA) eartag. Trax-IT software (Merit-Trax Technologies, Mount Royal, Quebec, Canada) was used to record all mortalities occurring during the production period.

Standard Health Scoring System

An iPad (Apple Inc., Cupertino, CA) with the Calf Health Scorer app (University of Wisconsin-Madison, Madison, WI) and Qualtrics software (http://www.qualtrics.com/) was used to record the health scoring. The app provided images and descriptions to evaluate the respiratory system (nose, eye, ear, cough; McGuirk and Peek, 2014), fecal consistency (McGuirk, 2008), navel inflammation (adapted from Fecteau et al., 1997), joint swelling, and rectal temperature. A second recording form developed in Qualtrics was used to evaluate and record dehydration (adapted from Wilson et al., 2000), BCS (Wilson et al., 2000), and sunken flank (Table 1). Sunken flank (Bähler et al., 2012) was scored based on the appearance and palpation of the abdomen. A flank was not considered sunken if the calf had a convex appearance to the lower portion of the paralumbar fossa and fluid could be balloted. The health scores were not provided to the barn staff to ensure that the screening of the calves did not influence treatment decisions.

All calves were examined by 1 of 3 observers. Observer 1, a veterinary practitioner, provided training to observers 2 and 3, who were veterinary students. Using scores gathered from all calves arriving at the facility on June 17, 2016, inter- and intraobserver agreement were calculated for observers 1 and 2 using percentage agreement (McHugh, 2012) and weighted kappa (κ; Cohen, 1968). A Fleiss-Cohen weight type was applied when calculating the weighted κ (Fleiss and Cohen, 1973). Observer 3 relocated to pursue another position and could not be assessed for observer agreement.

Sample Size Calculation

A proportion estimation sample size calculation was used to determine the required number of calves. Based on previous work by Winder et al. (2016) and a review of available records, we estimated that calves identified with a health abnormality at arrival would have a mortality risk of 10%, whereas those without an abnormality would have a mortality risk of 7.5%. Using