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Risk factors associated with on-farm mortality in Swedish dairy cows

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ABSTRACT

Dairy cow mortality (unassisted death and euthanasia) has increased, worldwide and in Sweden. On-farm mortality indicates suboptimal herd health or welfare and causes financial loss for the dairy producer. The objective of this study was to identify cow-level risk factors associated with on-farm cow mortality. Cows with at least one calving between 1 July 2008 and 30 June 2009 from herds enrolled in the Swedish official milk recording scheme with >40 cow-years were included. Each cow was followed from the day of calving until she calved again or left the herd (died, slaughtered or sold). The effects of potential risk factors on on-farm cow mortality were analysed using a Weibull proportional hazard model with a gamma distributed frailty effect common to cows within herd. The event of interest (failure) was euthanasia or unassisted death. An observation was right censored if the cow was slaughtered, sold, calved again or had an on-going lactation at 500 days after calving. The lactations were split into seasons (January to April, May to August and September to December) and at 30 and 100 days in milk in order to evaluate seasonal effects and the effect of disease in different lactation stages. Primiparous and multiparous cows were analysed separately. The highest hazards for both primiparous and multiparous cows were found for traumatic events and diseases, both in the lactation stage in which the cow died and in the preceding stage. The hazard was higher in early lactation and lower in 2nd parity compared to higher parities. Increased age at first calving (for primiparous cows), calving between January and April, dystocia and stillbirth also increased the mortality hazard. Differences were also found between breeds, between milk production parameters at first test milking and between management types. The results from this study show the importance of good management and preventive health actions, especially around calving, to avoid mortality in dairy cows.

1. Introduction

High on-farm cow mortality (i.e. euthanasia and unassisted death) is a concern on dairy farms from both an animal well-being and an economic point of view. Increasing mortality has been reported in several

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countries. Thomsen et al. (2004) showed that the mortality risk among Danish dairy cows increased from 2% in 1990 to 3.5% in 1999. In the USA, lactational death frequency increased from 2% in 1995 to 4.6% in 2005 (Miller et al., 2008), and was found to be 5.7% in 2007 (USDA, 2007). Alvåsen et al. (2012) reported that mortality rates in Swedish dairy herds increased from 5.1 to 6.6 deaths/100 cow-years between 2002 and 2010. This is of great concern for the dairy industry and explanations for the increase and possibilities to reduce the mortality rate are sought.

Several risk factors for on-farm cow mortality at herd level have been identified. A recent Swedish study found that larger herd size, Holstein breed, and lower herd mean annual milk yield are all factors associated with increased mortality rates (Alvåsen et al., 2012). This is in concordance with results from other countries (Thomsen et al., 2006; McConnel et al., 2008; Raboisson et al., 2011). Furthermore, no summer grazing (Thomsen et al., 2006; Burow et al., 2011), conventional (compared with organic) herds (Thomsen et al., 2006; Alvåsen et al., 2012), increased mean herd somatic cell count (Thomsen et al., 2006), increased proportion of purchased cows (Thomsen et al., 2006; Raboisson et al., 2011) and longer herd average calving interval (Raboisson et al., 2011; Alvåsen et al., 2012) are also factors that have been associated with higher mortality rates.

There are only a few studies on risk factors for mortality at the cow level and this has not been studied under Swedish production conditions. Previous studies have reported greater mortality risk in early lactation (Milian-Suazo et al., 1988; Stevenson and Lean, 1998; Thomsen et al., 2004; Dechow and Goodling, 2008). McConnel et al. (2009) showed that 40% and 50% of deaths occurred by 30 days after calving for younger cows (parities 1 and 2) and for older cows (parities 3 and greater), respectively. Their result also showed that the risk for mortality increase with parity which is in line with results from Denmark and the USA (Thomsen et al., 2004; Dechow and Goodling, 2008; Miller et al., 2008). Parity and stage of lactation are not modifiable for the dairy farmer, but some other factors may be. It is therefore important to identify other risk factors for mortality at cow level to be able to reverse the negative trend.

The objective of this observational study was to assess associations between cow-level data from the Swedish official milk recording scheme and on-farm mortality in dairy cows.

2. Material and methods

2.1. Study population and study design

Data from herds enrolled in the Swedish official milk recording scheme were used. All cows with at least one calving between 1 July 2008 and 30 June 2009 from herds with a herd size of >40 cows were included in the study. In 2008/2009, 85% of the dairy cows (80% of the dairy herds) were enrolled in the Swedish official milk recording scheme, which comprise information on animal entrance and removal dates, monthly test milkings, calvings, artificial inseminations, fertility treatments, claw trimmings, disease diagnoses and treatments (Swedish Dairy Association, 2010).

Table 1
Farmers' stated main reasons for on-farm mortality and slaughterin a study of cow-level risk factors for mortality in 206,752 cows with a calving between 1 July 2008 and 30 June 2009.

Main reason for disposal	Mortality		Slaughter	
	n	%	*n*	%
Fertility disorders	782	6.1	13,625	25.2
Udder disorders	1211	9.5	16,587	30.6
Metabolic disorders	1363	10.6	340	0.6
Claw/leg disorders	2047	16.0	3569	6.6
Low milk yield	8	0.1	6887	12.7
Trauma	1126	8.8	352	0.7
Other/unknown reasons[a]	6276	49.0	12,777	23.6
Total	12,813	100.0	54,137	100.0

[a] Other/unknown reasons = includes reasons such as old age and bad temperament, unknown reasons and not registered reasons.

Cows were followed from the day they calved until they calved again. The event of interest (failure) was on-farm euthanasia or unassisted death in the on-going lactation. Cows that were slaughtered or sold during the lactation and cows with an on-going lactation at 500 days after calving were right censored. For each cow, the observation period was calculated as the time period between calving and the time of failure or right censoring.

2.2. Data editing

Observations were excluded when a reported entry into the same or into another herd happened on a date after the reported date for mortality (four lactations, four cows) or slaughter (173 lactations, 169 cows) was found, and when the date of entry into a herd was inconsistent in relation to the date of calving (four lactations, four cows). In total, 209,236 lactations (206,752 cows from 2084 herds) were included in the analysis.

Farmers' stated reasons for mortality and slaughter were categorised into 'Low milk yield', 'Fertility disorders', 'Udder disorders', 'Metabolic disorders', 'Claw/leg disorders', 'Trauma' and 'Other/unknown reasons' (Table 1). The category 'Other/unknown reasons' included both other reasons such as old age and bad temperament and also cases where the reason for mortality or slaughter was unknown or not registered.

All potential risk factor variables for which there were some missing data (calving interval, production data from the previous lactation, production data from the first test milking after calving and genetic merits of the dam and sire, respectively) were categorised in order to also include such observations as a separate category within these variables. This was done to avoid losing a large proportion of the data (n = 24,714 and n = 48,818 for primiparous and multiparous cows, respectively) from the analyses. For disease variables missing data was considered as synonymous to absence of disease and a missing category was therefore not created.

Data from the first test milking post calving in the on-going lactation were used to evaluate the associations with production, udder health, and energy balance. Only data from the first 30 days post calving were used, and cows