

Dairy cow mortality: A review to evaluate the potential for meta-analysis

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Introduction

Mortality among dairy cows constitutes a problem both in terms of financial losses (value of dead cow, decreased production and extra labour) and compromised animal welfare (suffering before death or euthanasia). A rise in the mortality among a group of cows may indicate sub-optimal health and inadequate welfare. Mortality among dairy cows may therefore be a relevant measure of animal welfare. Nevertheless, surprisingly few studies focusing on cow mortality exist. To our knowledge, no review of these studies has been published until now. Therefore, no overview over what might be considered as the 'natural' or 'normal' level of mortality in a dairy cow population exists.

Meta-analysis can be defined as a quantitative synthesis of a number of study results. Meta-analysis might be a useful technique to give an overview over the results from many different studies. However, in order to get 'reliable' results it is important that information about a number of variables is available for each study, and that the information is gathered according to certain guidelines.

Objectives

Our objective was to review the literature on dairy cow mortality to give an overview over the mortality among dairy cows in different countries. Additionally, we wanted to evaluate the potential for meta-analysis of the prevalence or incidence of cow mortality and its associated risk factors based on an evaluation of the quality of information from these studies.

Materials and methods

All studies on mortality among dairy cows published internationally were identified using a number of different literature databases. Only studies published in English, German or French were included. No restrictions regarding year of publication were imposed.

We identified a number of variables that was considered important in relation to the ability to use the results from a given study for a meta-analysis. Ideally, the publication of the results from each study should include information about all these variables. The variables were measure of mortality (mortality rate, mortality risk or other), place and year of study, study design, sampling method, sample size (number of cows/lactations and/or herds included), information about causes of death and information about whether the dead cows were euthanized or died unassisted.

Results

We found 13 studies focusing on dairy cow mortality. These studies are presented in Table 1. Mortality are traditionally calculated as either mortality rate (e.g. per cow year) or mortality risk (e.g. per lactation). In some of the studies presented in Table 1, the exact measure was not specified. Milian-Suazo et al. (1989), Faye and Perochon (1995), Menzies et al. (1995), Stevenson and Lean (1998) and Thomsen et al. (2004) were the only authors who had included information about the distribution of deaths in relation to time after calving. Harris (1988), Faye and Perochon (1995) and Thomsen et al. (2004) included information about the effect of age or parity on mortality. Only one study included information about whether the dead cows were euthanized or died unassisted (Thomsen et al., 2004).

Table 1 Summary of 13 studies on dairy cow mortality.

Study	Measure of mortality	Country	Year of study	Number of cows/lactations and herds included	Sampling method/study design	Information about causes of death
Nørgaard et al. (1999)	Crude death rate 3 – 4 %	Denmark	1974-1993	Calculated on the basis of data from incineration plants and annual counts of the Danish cattle population	Calculated on the basis of data from incineration plants and annual counts of the Danish cattle population	No
Harris (1989)	1.09 – 1.40 % of cows depending on age	New Zealand	1985-1986	66,663 cows from 384 herds	Random sample of 1000 herds, herds with extreme values of survival were not included	Yes
Karuppanan et al. (1997)	Annual mortality rate 0.008 – 0.064 depending on herd	USA	1987-1992	19,482 cows from 9 herds	Prospective, observational study, convenience sampling of herds	No
Milian-Suazo et al. (1989)	1.2 % of lactations studied ended in death	USA	1981-1985	7,763 lactations from 34 herds	Prospective, observational study, convenience sampling of herds	Yes
Esslemont and Kossaibati (1997)	Annual mortality rate 0.016	England	1990-1992	26,644 lactations from 50 herds	50 out of 150 herds with data recording selected, sampling method not further specified	Yes
Faye and Perochon (1995)	Annual mortality rate 0.0096	France	1986-1990	4,129 cows (8,945 lactations) from 47 herds	Not specified	Yes
Stevenson and Lean (1998)	4.3 % of cows in the study	Australia	1992-1994	1,642 cows from 8 herds	Convenience sampling of herds	Yes
Gartner (1983)	Mortality risk 0.011 – 0.018	England, Wales, Scotland	1973-1976	11,352 lactations from 18 herds	Not specified	No
Menzies et al. (1995)	Annual mortality rate 0.0155	North Ireland	1992	1,306 herds	Stratified random sample of herds, questionnaire survey (response rate 29.7 %)	Yes
Gardner et al. (1990)	Mortality rate 0.02	USA	1986-1987	16,039 cows from 43 herds	Stratified random sample	Yes
Thomsen et al. (2004)	Mortality risk 0.014 – 0.041 depending on year and breed	Denmark	1990-2001	7,206,629 lactations (from all Danish herds)	All Danish dairy cows calving 1990 – 2001 included (data from central database)	Yes
Smith et al. (2000)	Mortality rate 0.051 – 0.088 depending on herd size, region and production level	USA	1998	11,259 herds	Holstein herds from the eastern part of the USA, sampling method not further specified	No
Batra et al. (1971)	1.56 – 2.35 % of cows in the herds depending on changes in herd size	Canada	1967-1968	2,534 herds	Not specified	No

Discussion

In relation to the relatively large impact of dairy cow mortality on ethics, animal welfare and the farmer's economy, the number of published studies is surprisingly low. Most of the studies give some information about the causes of death. However, the degree of details reported varies considerably. Only one study discriminate among euthanized and unassisted dead cows (Thomsen et al., 2004) even though this might be of interest in several ways (e.g. animal welfare, economy, and bias due to control programs with stamping out of cows or herds). Many studies are relatively old. There is some evidence indicating that the mortality among dairy cows increases (Thomsen et al., 2004). Therefore, up-to-date figures on dairy cow mortality might be desirable.

In relation to meta-analysis is it important to be able to evaluate the methodological quality of the studies included (Sutton et al., 2000). Study design and sampling methods are of major importance in this context. In many of the studies in Table 1, the study design and sampling methods are not specified. Therefore, it is difficult to evaluate the 'quality' of these studies and the ability to generalise the results to a larger population.

Meta-analysis aimed at evaluating the relationship between mortality and a number of risk factors in addition are dependent on the availability of reliable information on the relevant risk factors. Furthermore, these risk factors need to relate to the same population as the mortality measures, which, in turn, require information about study design and sampling methods in the original studies on mortality.

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