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Perinatal, neonatal, and rearing period mortality of dairy calves and replacement heifers in France

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ABSTRACT

Dairy calf and replacement heifer mortality in France was assessed by calculating mortality rates at 0 to 2 d (calves), 3 d to 1 mo (calves and heifers), 1 to 6 mo of age, and 6 mo of age to first calving (heifers) using the national identification database. Between birth and 2-d-old, 261,000 and 251,000 of the 3.56 and 3.43 million calves born in 2005 and 2006, respectively, died. The overall 0- to 2-d-old calf mortality rate was around 6.7%, which is similar to the low range of values reported in the literature. Among the 2.38 and 2.39 million calf-month, 139,000 and 133,000 died between 3 d and 1 mo of age in 2005 and 2006, respectively. Among the 3 d to 1 m of age group, dairy calf mortality rate was around 5.7%. Such a rate has not been reported previously because of the great differences in age classes between studies. For the 0- to 2-d-old and 3-d- to 1-mo-old calves, annual mortality was zero on 26 and 44% of the farms, respectively. Calf mortality during the first month of life increased in winter (to 12–17%) and decreased in summer (to 8–12%), with a small peak in June or July. Mortality during the first month of life is higher in males than in females, with a mortality odds ratio of 1.20 (and 95% confidence interval of 1.19–1.21). Such a difference is also found within the noncrossed or beef-crossed calf subpopulations. Disregarding the sex, the mortality of beef-crossed calves is slightly less than that of noncrossed dairy calves, with a mortality odds ratio of 0.98 (and 95% confidence interval of 0.98–0.99) before 1 mo of age. In heifers, around 51,000, 35,000, and 40,900 out of the 1.2 million 3-d- to 1-mo-old, 1.1 million 1- to 6-mo-old, and 950,000 6-mo-old to first calving heifers died, respectively. The respective mortality rates were 4.5, 3.1, and 4.1%; these rates are similar to the low range of values previously published. The proportions of farms with no heifer mortality during a year were higher than for calves, between 60 and 70%. The mortality probability for heifers was very high for the first day of life (95% survival between 2–30 d of age), then decreased during the first year of life and became constant up to around 3 yr of age (88% survival at 36 mo of age). The risk of mortality is higher in Montbéliarde and Normande heifers compared with Holstein. In conclusion, and beyond the average mortality rates, farmers and farm advisors should keep in mind the broad range of mortality values, which shows that very low mortality (1–2%) can be achieved, even in animals with a known high risk of mortality, such as beef-crossed dairy calves.
Key word: dairy calf mortality, dairy heifer mortality, sex, breed

INTRODUCTION

Calf mortality represents economic losses to the dairy industry due to delayed genetic progress, fewer replacements available for voluntary culling of the lactating herd, and increased cost of replacement. In the United States, the annual economic damage resulting from stillborn and loss of calves is reported to be about $125 million (Meyer et al., 2001). The total costs of calf and heifer mortality are probably underestimated; for instance, the total costs of stillbirth far exceed the value of the calves and must include the higher risk of death and reproductive complications in the dams (Ortiz-Pelaez et al., 2008). Because of the decrease in dairy cow numbers and the increase in calf mortality, the availability of male dairy calves for the fattening industry has tended to decrease. This represents a future danger for that sector, particularly in countries with an important veal calf industry, such as France (Sarzeaud et al., 2008).

Moreover, calf and heifer mortality is considered a welfare issue, and calf mortality has been identified as one of the most important indicators of dairy farm health status (Ortiz-Pelaez et al., 2008). The continuous increase in calf and heifer mortality reported in many countries during the last decade suggests that the economic and welfare stakes related to the mortality of young cattle are also increasing (Meyer et al., 2001; Berglund et al., 2003; Steinbock et al., 2003).

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An accurate estimation of calf and heifer mortality is important to define the political and financial priorities for the value chain and cattle health programs. Numerous observational studies have been carried out to document mortality rates in calves and heifers (Meyer et al., 2001; Bicalho et al., 2007; Lombard et al., 2007; Johanson et al., 2011), to define the causes of the deaths (Agerholm et al., 1993; Menzies et al., 1996; Svensson et al., 2006), and to identify some risk factors of young cattle mortality (Chassagne et al., 1999; Svensson et al., 2006; Stull et al., 2008; Gundelach et al., 2009). Except for stillbirth, the classes of age used in the mortality studies differ considerably between studies, although 1 or 2 main causes of mortality can be determined when precise and narrow classes are built (Svensson et al., 2006; Gulliksen et al., 2009). The use of exhaustive databases allows an accurate estimation of mortality according to classes of age. It also prevents selection bias linked to the exclusion of nonmember farms (when using Milk Control Program databases for instance) or restricted to some geographical areas.

The aim of this study was to describe dairy calf and replacement heifer mortality using a data set which included all French herds for 2 years. The relative risk of mortality for some characteristics of the animals was also quantified.

MATERIALS AND METHODS

Data Sets

Data concerning all cattle and herds were extracted using MySQL-software (MySQL, version 5.0, Redwood City, CA). All data were geo-located at the municipal level. The municipalities were gathered into dairy production areas as previously described (Raboisson et al., 2011). The detailed characteristics of the National Bovine Identification Database have already been described (Raboisson et al., 2011). Briefly, it contains routine records of individual data for farms and animals. Animals were sorted and associated with a dairy, beef (cow-calf), or fattening (bulls, steers, or veal calves) herd within each farm.

Mortality Rates

The mortality rates were calculated yearly (for 2005 and 2006) for each class of animals and within each herd. The 0 to 2 d mortality rate (i.e., the number of deaths between birth and 2 d of age divided by the number of born calves) was calculated for the pure breed (noncrossed) and the beef-crossed (dairy dam and beef sire or beef AI) dairy calves. The 3-d- to 1-mo-old calf, the 3-d- to 1-mo-old heifer, the 1- to 6-mo-old heifer, and the 6-mo-old to first calving heifer mortality rates were the number of deaths during the respective period divided by the number of calf-month, heifer-month, heifer-5 month, and heifer-year, respectively. The number of animal-period was calculated with the time at risk for each class of animals. For instance, one calf staying alive for one month accounted for 1 calf-mo, but if it stayed alive for 2 wk it only accounted for 0.5 calf-mo. For the 3 d to 1 mo calf mortality, noncrossed and beef-crossed calves were also distinguished and the mortality rates were also calculated with the number of calves present at 2 d of age, in addition to calculations made with the number of calf-mo. Because of the small to moderate average herd size of French dairy cattle farms (Raboisson et al., 2011), the mortality rates were deleted from the database (no value) when the denominator was under 5 units (the unit of the denominator was dependent on the class of animal). This prevented overestimation of the mortality rates related to a small herd or to a herd with a low number of animals in one class (a large herd with few beef-crossed dairy calves, for instance).

Statistical Analysis

Data were analyzed using R (version 2.10.1, The R Foundation for Statistical Computing, Vienna, Austria). The descriptive statistics for the numbers of deaths, animals at risk (animals at a given age or animal-period), and farms with and without mortality were performed. The mean French mortality rate per class of animals was calculated including and excluding mortality rates equal to zero by averaging the herd-level mortality rates. The need for inclusion or exclusion of the zero values was suggested by the high proportion of farms with no mortality (for one class of animals) in France. The overall national number of deaths over the overall national number of animals at risk was also calculated.

A survival analysis was then performed for all animals born in 2005 and 2006, distinguishing the age classes of the animals, the characteristics of the calves (sex and breed) and the dairy production areas. The survival probability was obtained by calculating the Kaplan-Meier estimator (package survival of R), disregarding the fact that a dependence on herd might exist. For all calves except heifers, the Kaplan-Meier estimator was calculated from birth to exit, or to 30 d of age if exit occurred after that. For heifers, the survival estimator was calculated from the age of 2 d and up to 30 d of age or the first calving, disregarding the movements between farms during this period. The dairy production area used for the survival analysis was the birth place for calves and heifers between birth and 30 d of age. It