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Validation of Nordic dairy cattle disease recording databases—Completeness for locomotor disorders

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ABSTRACT

The Nordic countries Denmark (DK), Finland (FIN), Norway (NO) and Sweden (SE) all have unique national databases holding the disease records of dairy cows. The objective of this study was to estimate and compare completeness for locomotor disorders in the four Nordic national databases. Completeness figures for farmer-recorded disease events were calculated on two different levels: the first refers to disease events that were observed on the farm regardless of whether a veterinarian had been involved (FARMER); the second refers to farmer records of cases attended by a veterinarian, i.e. to veterinarian-treated disease events (VET). A sample of herds with 15 or more cows was obtained from a simple random sample of dairy farms in FIN, NO and SE, and from a systematic random sample in DK. There were 105, 167, 179 and 129 participating farmers in DK, FIN, NO and SE, respectively, and during two 2-month periods in 2008 these farmers recorded the disease events they observed on the farm. Data from the four national databases were extracted in May 2009. The two data sources, farmer recordings and national databases, were managed in a comparable way in all four countries, and common diagnostic codes were created and added to match recordings appearing in both datasets. In all 555 farmers completed data records in the first data-recording period, and 515 farmers did so in the second period. In DK, FIN, NO and SE, 55%, 77%, 82% and 75%, participating farmers completed the recordings during the first recording period, respectively; the corresponding figures for the second recording period were 71%, 82%, 83% and 91%.

To calculate completeness, disease cases recorded in the national databases were compared with the farmer recordings using an exact match for the locomotor complex defined as same country, herd identification number (id), cow id, and event date at the levels of FARMER and VET. Completeness at FARMER level were 0.22, 0.21, 0.23 and 0.12 in DK, FIN, NO and SE, respectively. At VET level they were 0.37, 0.27, 0.34 and 0.17. To compare differences in completeness between countries exact 95% confidence intervals were calculated. There were significant differences in completeness between DK and SE at both FARMER and VET level. The completeness indicate that the ability to estimate true disease occurrences in the four national databases varies and is in general poor. Completeness should be taken into account when disease occurrences in different countries are compared.

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1. Introduction

Cattle databases in the Nordic countries, Denmark (DK), Finland (FIN), Norway (NO) and Sweden (SE) have long been recognized as comprehensive recording systems of production and disease at the level of the individual animal and the herd. This is reflected in the substantial volume of publications reporting and analyzing data from those databases (e.g. Lindberg et al., 2003; Østerås et al., 2003; Egenvall et al., 2011). The disease recording systems rely on reports of veterinarian-treated disease events (Gröhn et al., 1984; Olsson et al., 2001; Sviland and Waage, 2002). Primary databases often refer to databases that were constructed for a specific research project. Secondary databases were originally constructed for other purposes (Sørensen et al., 1996). The secondary sources are of great value in research. Data from secondary databases need to be studied with considerable care. Nevertheless, the secondary databases can save time and resources (Egenvall et al., 2011; Houe et al., 2011). Although information from secondary databases is used in many studies, few studies have evaluated the quality of the data as such (Egenvall et al., 1998; Penell et al., 2007; Mörk et al., 2009; Penell et al., 2009). Several published papers discuss this problem and identify the need for data in databases used for secondary purposes to be validated (Bartlett et al., 1986; Olsson et al., 2001). Only a few validation studies have been carried out looking at disease databases in the Nordic countries (Bennedsgaard, 2003; Gulliksen et al., 2009; Mörk et al., 2009, 2010). Obviously, the successful validation of such the databases would help to demonstrate that their data can be used safely in future research, assuming the validity remains constant over time for each diagnosis (Houe et al., 2011).

Detailed data recording in the Nordic countries permits the incidence of disease in countries in the region to be compared. The first attempt to compare disease occurrences in different Nordic countries was made in 1993 (Plym-Forshell et al., 1995). In 2003 a pilot project was established with the aim of comparing disease incidences (Østerås et al., 2002), and in particular comparing the incidence of bovine mastitis in Denmark (DK), Finland (FIN), Norway (NO) and Sweden (SE) (Valde et al., 2004). Results from these studies showed that the comparison of data from these countries is far from straightforward, even if one has unimpeded access to database records in all four countries. In connection with human medical records, differences between countries with implications for the comparison of database data have been addressed. The difficulties combining studies from different countries are largely due to contrasts in coding practice and computer systems (Jordan et al., 2004). The comparison of data raises many questions. For example, issues arise concerning such matters as raw data management, the dangers in different databases of data loss and data errors that are not properly taken into account, and the possibility that the sampling criteria may differ between the countries' databases.

In 2007, a Nordic research collaboration project called the Dairy Health Recording Validity Assessment (DAHREVA) was set up with the aim of validating disease records in the national databases for dairy cows in DK, FIN, NO and SE. The project aims to validate dairy cow databases simultaneously, in a comparable way. The specific objectives of the work presented in this paper were to estimate and compare completeness (e.g. how well the occurrence of locomotor disorders on the farm is captured) in the Nordic countries' cattle disease databases.

2. Materials and methods

2.1. Selection of herds and cows

The target population in this study was dairy cows that were from herds of at least 15 cows at the time of data sampling in DK, FIN, NO and SE. The herds in DK, NO and SE participated in the milk yield control, and the herds in FIN participated in the health surveillance system. To emphasize, the purpose of the database is the same. "ND" is one part of the milk yield control or health surveillance system and that in all countries the database is designed to capture all medically treated animals and not all sick animal. Initially a number of herds were selected at random. After selection, all cows were observed for 4 months. Finally, herds that reported any disease events on the farm were selected for the study.

Sample size was calculated based on national disease incidences from the previous years, the herd size, and assuming a sensitivity/completeness of 80% and the ability to detect this level of data loss with 95% confidence. For further explanations, see Espetvedt et al. (2012).

In January 2008 random samples of 1000, 900, 800, and 400 farmers in DK, FIN, NO and SE, respectively, received an invitation to participate in the project by standard mail. The number of invited herds was different for each country. FIN, NO and SE sent invitation letters earlier than DK. Following a low initial response rate, FIN and NO sent another invitation, telephoned the farmers not responding to the invitation letter in the first batch, and just accepted the 'yes'-answers in the second batch. SE sent one invitation and then telephoned non-responders until a sufficient number of herds had been recruited. DK sent their first invitations at the same time as FIN and NO sent their second invitations. Aware of the low response rates in other countries, DK contacted more farmers initially and telephoned farmers who replied that they might want to participate. The sampling frame involving herds of at least 15 cows from the four national databases. In DK 3980 were in the sample frame of a total of 4002 herds in the control year 2007/2008. In FIN the sampling frame consisted of 8725 herds in the Finnish Agricultural Data Processing Centre out of a total of 12,455 herds in 2008. The sampling frame for NO was 7489 herds in the Norwegian Dairy Herd Recording System out of a total of 14,182 herds in 2006. In SE the sampling frame was 5094 herds out of a total of 6573 dairy herds in 2008.