Completeness of metabolic disease recordings in Nordic national databases for dairy cows

M.N. Espetvedt [a,*], C. Wolff [b], S. Rintakoski [c], A. Lind [d], O. Østerås [a]

[a] Norwegian School of Veterinary Science, Department of Production Animal Clinical Science, P.O. Box 8146 Dep., NO-0033 Oslo, Norway
[b] Department of Clinical Sciences, Swedish University of Agricultural Sciences, P.O. Box 7054, SE-750 07 Uppsala, Sweden
[c] University of Helsinki, Department of Veterinary Biosciences, P.O. Box 66, FI-00014 Helsinki, Finland
[d] Department of Large Animal Sciences, Faculty of Life Sciences, University of Copenhagen, Grønnegårdsvej 8, 1870 Fredriksberg C, Denmark

ARTICLE INFO

ABSTRACT

The four Nordic countries Denmark (DK), Finland (FI), Norway (NO) and Sweden (SE) all have national databases where diagnostic events in dairy cows are recorded. Comparing and looking at differences in disease occurrence between countries may give information on factors that influence disease occurrence, optimal diseases control and treatment strategies. For such comparisons to be valid, the data in these databases should be standardised and of good quality.

The objective of the study presented here was to assess the quality of metabolic disease recordings, primarily milk fever and ketosis, in four Nordic national databases. Completeness of recording figures of database registrations at two different levels was chosen as a measure of data quality. Firstly, completeness of recording of all disease events on a farm regardless of veterinary involvement, called 'Farmer observed completeness', was determined. Secondly, completeness of recording of veterinary treated disease events only, called 'Veterinary treated completeness', was determined. To collect data for calculating these completeness levels a simple random sample of herds was obtained in each country. Farmers who were willing to participate, recorded for 4 months in 2008, on a purpose made registration form, any observed illness in cows, regardless of veterinary involvement. The number of participating herds was 105, 167, 179 and 129 in DK, FI, NO and SE respectively. In total these herds registered 247, 248, 177 and 218 metabolic events for analysis in DK, FI, NO and SE, respectively. Data from national databases were subsequently extracted, and the two sources of data were matched to find the proportion, or completeness, of diagnostic events registered by farmers that also existed in national databases. Matching was done using a common diagnostic code system and allowed for a discrepancy of 7 days for registered date of the event. For milk fever, the Farmer observed completeness was 77%, 67%, 79% and 79%, and for Veterinary treated completeness 88%, 71%, 80% and 82%, in DK, FI, NO and SE, respectively. For ketosis, the Farmer observed completeness was 77%, 55%, 70% and 46%, and for Veterinary treated completeness 84%, 75%, 79% and 56%, in DK, FI, NO and SE, respectively. The differences observed in some of these completeness figures indicate that metabolic disease frequency measures when calculated from these four national databases do not accurately reflect the true difference in metabolic disease occurrence in dairy cows between countries. Further standardisation of disease registrations is necessary for valid between-country assessments.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

During the 1960s and 1970s herd health programmes for dairy herds that had a particular focus on productive efficiency started to develop (Noordhuizen and Wentink, 2001). With this development followed the use of computers to record, organise and analyse data on production and disease for the individual animal, the herd, and if possible at regional and national levels. Today, the Nordic countries Denmark (DK), Finland (FI), Norway (NO) and Sweden (SE) all have national centralised databases that contain information from the majority of dairy herds in the countries, including animal identification, production parameters, milk and carcass quality, culling reasons, and disease and treatment data. The traditional dominant positions of farmer cooperatives in the Nordic countries, especially dairy and breeding associations, have played a central role in the development of these national databases. The recording of diseases and design of the health schemes associated with these four systems are described by Olsson et al. (2001). Researchers' access to data in these centralised databases has given unique opportunities for epidemiologic research and there are several examples of published studies (Gröhn and Bruss, 1990; Nyman et al., 2007; Thomsen and Sørensen, 2009; Andersen et al., 2010). In 1993, the first attempt at comparing disease frequencies based on the Nordic databases was made (Plym Forshell et al., 1995). In 2003 results from a Nordic pilot project were reported (Østerås et al., 2003) and a comparison of the cumulative risk of bovine mastitis in DK, FI, NO and SE was later published (Valde et al., 2004). From this comparative work it has become apparent that it is not straightforward to compare disease occurrence in dairy cows between countries, despite the existence of national health databases. Questions are raised when marked differences are found after calculating disease occurrences in the same manner from raw data in Nordic national databases. This applies to the design of the system, how well it functions, including influence of behaviour of veterinarians regarding disease treatment and recording, and if Nordic farmers vary in how they handle disease in their herd and what threshold they have for contacting a veterinarian. These questions are related to the validity or more precisely, the accuracy of recorded data in these databases, accuracy being defined as the combined effect of completeness and correctness (Hogan and Wagner, 1997). The term accuracy is here used differently from when assessing a measurement system or diagnostic test. When data from these databases are used for research they become secondary data, i.e. data that are originally collected for another reason than the specific research in question, and the need for describing their accuracy or performing a formal validation may be crucial, depending on the study design and aims. Likewise, data quality when using data from these databases in breeding programs and herd health advisory work should be of concern. There has been little formal validation of these Nordic health databases apart from some recent work in SE (Mörk et al., 2009, 2010), as part of a PhD thesis in DK (Bennedsgaard, 2003) and on recordings of calf diseases in NO (Gulliksen et al., 2009). Examples of published validation studies of cattle disease

recordings outside the Nordic countries are scarce. Mulder et al. (1994) assessed data from general practice records, while Salman et al. (1988) validated diagnoses in a surveillance system for beef cattle. Some studies of disease data validation have been published in other areas of veterinary medicine (Pollari et al., 1996; Egenvall et al., 1998; Nødtvedt et al., 2006; Penell et al., 2007, 2009), but examples are more numerous in the human medical field (Gerber et al., 1988; Barrie and Marsh, 1992; Pringle et al., 1995; Arts et al., 2002; Jordan et al., 2004; Hommel et al., 2010).

In 2007, a collaborative Nordic research project was implemented with the aim of validating the disease recordings in national databases for dairy cows in a uniform and comparable manner. The project was concerned with both the transfer of data from farm to national database and the influence of human behaviour on disease recording, aiming to identify strengths and weaknesses of the various national systems. The chain of events thus encompassed and which was expected to influence data quality in national databases was, (1) the detection of an ill cow by the farmer, (2) the probability that the farmer contacts a veterinarian for a visit or treatment of this cow, (3) the probability that the veterinarian makes a record after visiting or treating this cow, and (4) that the record made by the veterinarian is successfully transferred to the national database. This means that the actual occurrence of diseases on farm was not determined, but the validation was based on the occurrence of diseases on farm as detected by the farmer.

To our knowledge this is the first attempt at validating several centralised dairy cow disease databases simultaneously. Work presented here is concerned with validating recordings of metabolic diseases, primarily milk fever and ketosis. Due to different methods and challenges of analysing, presenting and discussing results for other diseases and reproduction problems, these are aimed to be published elsewhere. Completeness of recording has been chosen as the measure of data quality, this being defined as the proportion of recorded disease events in national databases of those events that were observed on farm. In validating metabolic disease recordings, the objectives have thus been to find the completeness of all farmer detected disease events in the herd regardless of veterinary involvement, the completeness of recording of veterinary treated disease events only, and comparing these completeness figures within and between the Nordic countries: DK, FI, NO and SE.

2. Materials and methods

2.1. Cow populations

The target population, and eligible herds, included dairy herds with a herd size of a minimum of 15 cows, participating in the national dairy herd milk recording system in DK, FI, NO and SE. Data flow for disease recordings into each of the four countries' databases are represented schematically in Figs. 1–4. For the majority of disease events that end up as a recording in the database a veterinarian has been involved. Further information about the four national schemes can be found in other