Improved breeding values for general health

Emma Carlèn (NAV/Växa Sverige), Terhi Vahlsten (NAV/Faba) and Anders Fogh (NAV/SEGES),

In November 2017 several improvements were implemented in the Nordic Cattle Genetic Evaluation (NAV) for general health. The main improvement in the new evaluation is the change from a sire model to an animal model which implies that cows get breeding values based also on own information. Other improvements includes changes in data, editing and trait definitions as well as new genetic parameters. All together, these changes have an impact on breeding values for sires but a larger effect on breeding values for cows. The changes and results described in this paper refers to effects on breeding values based on phenotypic information (EBVs). However, changes in genomically enhanced breeding values (GEBVs) are of similar size as the changes observed in EBVs.

Upgraded genetic models

The major model improvement is changing from a sire to an animal model which creates more reliable breeding values for bulls and cows since the EBVs for cows are now based also on their own information for general health traits rather than only pedigree information.

Another important feature with an animal model is that cows in the future can be used in the reference population for prediction of GEBVs for general health traits, which is expected to increase the reliability of those.

The evaluation for Jersey now includes data from all three countries and has similar features as the evaluation for the other breeds – earlier it only included Danish data and metabolic diseases. More information used increases the reliability of EBVs.

Valuable information for metabolic diseases

Beta-hydroxybutyrate (BHB) and acetone from milk recording are used as indicator traits in the new evaluation for general health. So far, data is only available from Denmark where it is collected routinely since 2013.

Both BHB and acetone are measures of ketone bodies which indicate (sub)clinical ketosis. These traits have a genetic correlation to ketosis, but also to other metabolic diseases. The genetic correlation between ketosis and BHB/acetone has been estimated to above 0.6 in first lactation and slightly lower in later lactations.

By including this information, the reliability of EBVs for ketosis and other metabolic diseases is considerably improved, especially for Holstein and Jersey animals where most information is available. The effect on EBVs is largest for bulls with many daughters having BHB/acetone information, thus bulls with a majority of their daughters in Denmark, and for Danish cows.

To make better use of the new information, the trait metabolic disorders in the previous general health evaluation has been split into two traits; ketosis and other metabolic diseases. This affects the publication of breeding values and also the weighing of traits into the general health index. The relative weight between ketosis and other metabolic diseases is around 1:2.

Better harmonization across countries

In the previous evaluation, disease diagnoses for feet and leg problems from Denmark included claw trimmer data. This information is already used in the claw health evaluation and has therefore been removed in the new general health evaluation. This implies that around 12% of all the Danish feet and leg records are removed and it has a rather large effect on EBVs for feet and leg problems for Danish sires.

For Sweden, information from herds with incomplete reporting of veterinary treatments (herds with no or unexpectedly few treatments) is no longer used. This implies that data from about 10% of the Swedish lactations have been removed. Denmark and Finland had already similar editing. This has some effect on EBVs for bulls that are progeny tested in Sweden which had been used in the herds with incomplete recording.

More reliable breeding values and changes in breeding values

For all breeds the improved model and changes in data resulted in changes in EBVs for general health traits for both bulls and cows but the effect varies across breed, traits and countries. The effects are largest for Jersey since the new evaluation for Jersey differs considerably from the previous evaluation.

Most important is that reliability of EBVs increases for both bulls and cows. One reason for that is the change from a sire to an animal model where the EBVs for cows are now based also on their own observations for general health traits. Another reason is adding new information in the evaluation. The increase in reliability is highest for Danish cows which has BHB and acetone data, especially for the metabolic traits.

With an increased reliability larger changes in EBVs are expected. For example, results for Swedish cows born between 1995 and 2015 show that the average correlations between EBVs from the new evaluation and pedigree index from the old evaluation for the general health index is around 0.9 for SRB and Holstein cows. The level of the EBV correlations for Finnish and Danish RDC and Holstein cows are at the same level. This results in some re-ranking of cows. For Jersey cows the correlation is as low as 0.5 due to the significant changes in traits involved in the evaluation for Jersey.

The effect on sire EBVs when changing from a sire to an animal model is much less noticeable, however sire EBVs change more than usual due to this, but also because of other data changes in the new evaluation.

The average across country correlations between old and new EBVs for the general health index on AI bulls born after 2009 are around 0.9 for RDC and Holstein. The proportion of bulls that changed less than four units of EBVs for the general health index is around 75% for both breeds. For Jersey sires, the changes are larger but the same comparisons as for the other breeds are difficult to make. As an example, the correlation between metabolic diseases in the old evaluation and other metabolic diseases (excluding ketosis) in the new evaluation is around 0.7 for Jersey sires.

Read more about the new evaluation for general health in NAV newsletter for November 2017 on www.nordicebv.info.