

## **Management and use of genetic information for improvement of health in pedigree dogs**

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### **Summary**

To reduce the incidence of inherited disorders and their impact on welfare in pedigree dogs, national kennel clubs (KCs) can play a very important role in the governance and regulation of dog breeding. In this study, we sent questionnaire to 30 European KCs with more than 2,000 puppies registered in 2015 and investigated the differences existing between KCs regarding the management and use of genetic information related to dog breeding, health and welfare. Preliminary results provided by 11 European KCs and the results showed the health information of pedigree dogs is being widely collected in Europe and those information are possibly available through pedigree document or website online. Results from our survey also showed recommendation of genetic testing was given and health requirement for reproduction was set for a large proportion of breeds in the surveyed countries.

### **Introduction**

According to Online Mendelian Inheritance in Animals (OMIA, 2017), more than 303 Mendelian trait/disorders have been reported in dogs, with various prevalence and consequences for canine health. The number of those disorders for which the key mutation has been identified has more than doubled since 2010, reaching 231 in 2017. To reduce the incidence of inherited disorders and their impact on welfare in pedigree dogs, national kennel clubs (KCs) can play a very important role in the governance and regulation of dog breeding. Meanwhile, genetic information (e.g., pedigree databases, records of inherited disorders, genetic test results) is important for KCs to analyse and to provide recommendations or even requirements for the implementation of breeding programmes. However, the breeding context and breeding rules differ between countries (Hedhammar et al. 2011). Hence, we investigated differences that exist between KCs regarding the management and use of genetic information related to dog breeding, health, and welfare.

### **Materials and method**

We designed a questionnaire and sent it in April 2017 by email to 30 European national KCs (one national KC in one country) with more than 2,000 puppies registered in 2015. Preliminary results provided by 11 European KCs regarding 9 specific questions were analysed, considering the three following topics: 'information registered', 'information provided' and 'recommendation and rules implemented' for pedigree dogs. For each question, the KCs were asked to check one box from several alternatives (0%, 1-50%, 51-99% and 100% of breeds covered in their countries for certain information was collected or used).

## Results

11 European countries (Austria, France, Belgium, UK, the Netherlands, Ireland, Germany, Denmark, Latvia, Sweden, and Norway) provided answers to the questionnaire with respondents being either a staff member, head, or person responsible for health or breeding commissions within the KCs.

Figure 1a shows, what type of information was recorded by KCs and for what approximate proportion of breeds the information was collected. ‘Health examination’ was done for more than 50% of their breeds in 10/11 countries. The recording of ‘genetic tests results’ appeared less common, with 2/11 countries indicating that they did not register genetic information on any breed, while 4/11 countries reported that such tests were done for more than 50% of their breeds.

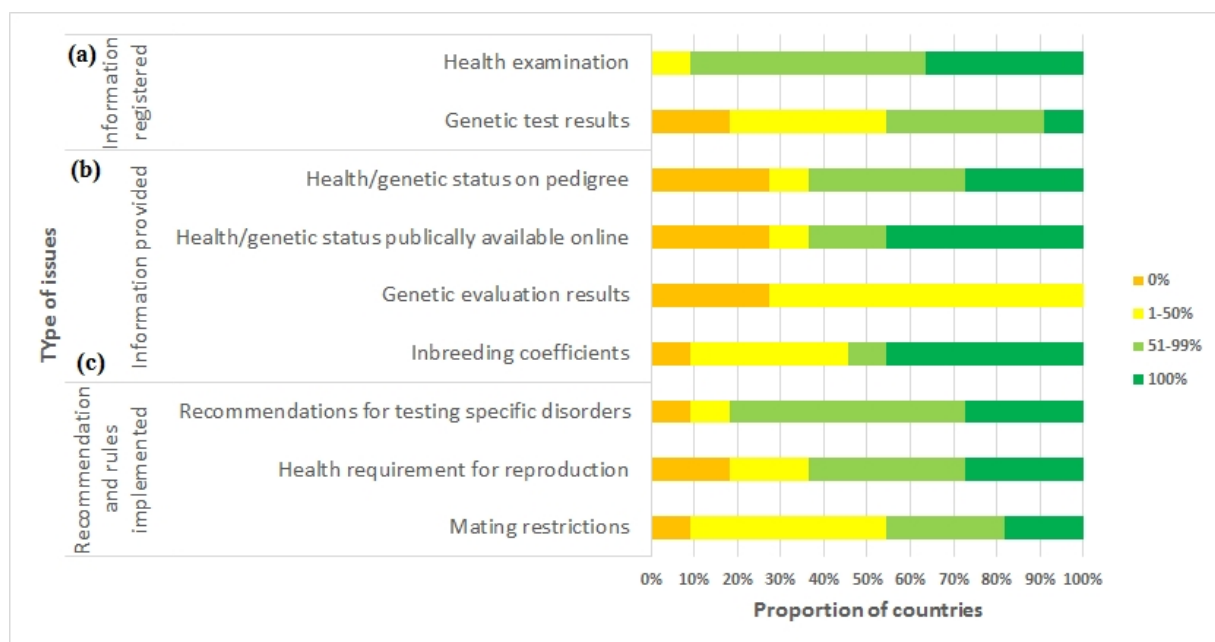


Figure 1. Type of information registered, information provided to breeders and owners, and breeding recommendations and requirements for pedigree dogs, as reported by eleven kennel clubs, and the proportions of breeds covered (four options: 0%, 1-50%, 51-99% and 100% )

Figure 1b shows that a majority of KCs reported that health/genetic status were provided to breeders, owners and the public for more than 50% of their breeds by pedigree document (7/11 KCs) and by online information (7/11 KCs). Computation and provision of genetic evaluations (essentially for hip dysplasia) was less common and only done for a limited number of breeds. For some countries, e.g. France and Belgium, estimation of breeding values for hip dysplasia was either imminent or in development. Besides, 5/11 KCs indicated that they provided inbreeding coefficients for all the breeds in their countries, in general through online database. Besides, inbreeding coefficients were provided only for some breeds by 5/11 KCs in their countries.

Figure 1c presented breeding recommendations and requirements were in place (for at least some breeds) in most countries of the surveyed KCs (9-10/11). However, those actions were reported to be generalized for all breeds for a minority of countries of the surveyed KCs (2-3/11).

## **Discussion**

### **Health and genetic data in Europe**

The survey answers show a good representation of European countries, at least in Western and Northern Europe. The results show that health information of pedigree dogs, is widely collected in Europe and this information is possibly available through pedigree documents or on-line. To a lesser extent, information of clinical screening of hip dysplasia and genetic tests are also collected and available. There are however large diversity in genetic information collection and provision between countries. Some tools (e.g., online pedigree, genetic evaluation on hip dysplasia) have been developed since more than ten years in countries such as the Nordic ones (Hedhammar et al. 2011), while other countries, such as Belgium and France, have also began to develop equivalent tools more recently (Wijnrocx 2017; Wang et al. 2017a).

However, even within a country, there is variation in the collection and provision of genetic information across breed clubs. Considering genetic evaluation of hip and elbow dysplasia for instance, estimated breeding values are provided in the UK and Sweden only for a subset of 28 and 40 breeds respectively, which are selected based on the prevalence of the disorder, the amount of data available and breed club willingness to use EBVs.

Also, in some countries, such as Germany, breeding and data management are in general under the authority of breed clubs, resulting in heterogeneity in the implementation of genetic evaluation.

### **Breeding management**

Simulation studies in recent years have confirmed that breeding management (e.g., avoiding mating close relatives, equally using sires, and limiting litter numbers) can reduce the increase in inbreeding in dog populations and decrease the expression of inherited recessive disorders (Leroy and Baumung, 2011; Windig and Oldenbroek 2015). Therefore, beyond collecting and providing information, KCs have further opportunities to promote the health welfare through breeding management. Results from our survey also show that recommendations on genetic testing are given and health for reproduction is required for a large proportion of breeds in the surveyed countries. On the other hand, setting mating restriction could be very challenging and risky that driving breeders away from their KCs (O'Neil et al., 2017). Therefore health requirements and mating restrictions may be more difficult to implement in countries which do not have a culture of regulations and compliance with breeding rules.

### **Implications for international collaboration**

On the one hand, differences between countries in information collection and breeding management may restrict collaboration and data exchanges between countries. On the other hand, it is important to build on experiences from the different countries. Sharing of breeding related information between KCs (e.g., prevalence of inherited disorders by breeds, breed-specific breeding strategies, ongoing breeding programs etc.) can assist decision-making within their countries and facilitate and harmonise health assessment and screening

programmes. For instance, the online database of the French Kennel Club has largely benefited from the experience of the mate select tool that being implemented in the UK (<https://www.thekennelclub.org.uk/services/public/mateselect/>). International collaboration, by sharing pedigree information, as well as screening and generic evaluation results, can also improve the management of inherited disorders (Wang et al. 2017a) and genetic variability (Wang et al. 2017b) in pedigree dogs.

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