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INTRODUCTION

This paper is aimed to review studies on breed, sex and age as risk factors for various diseases and to outline how such information can be used in every day practice as well as for research on aetiology. Understanding patterns of disease in animal populations is a necessary underpinning of health promotion and disease prevention strategies (1). The presentation will review information from the literature with a focus on population based studies from an insurance data base at Agria Animal Insurance which has been used for a series of published papers (1-5) as well as for development of a resource for breed clubs and breeders (Agria Dog Breed Profiles) in their work on breed specific strategies to handle health issues within their breed.

Daily, in small animal practice we see breed predilections for many diagnoses in almost all organ systems, presumably indicating a genetic predisposition. Also gender differences in disease occurrence are common, for obvious reasons related to hormonal effects and differences in reproductive organs. Age predilections by aetiology (congenital and developmental versus degenerative and neoplastic) are well-accepted, although not necessarily well-quantified in small animal practice. Understanding the risk of disease based on host factors such as age, gender and breed is an integral part of generating diagnostic hypotheses. However, if our risk assessments aren’t based on valid evidence, there is a possibility that we are misled in our clinical duties by impressions based on popular theories, personal experience and/or special circumstances. In the human medical field research has shown that anecdotal evidence and clinician memory often result in biased estimates. Unfortunately, sources of population-based information on incidence of disease and death in companion animals have historically been rather scarce.

In addition to the need for well-quantified information to support evidence-based practice, understanding risk factors can inform research elucidating the aetiology of specific conditions. Comparing similarities and differences in the pattern of disease across species, breeds, ages, genders, etc. can suggest theories about aetiologies and inform causal reasoning about contributions of - for example, genotype, phenotype or physiology, conformation, use or temperament - to disease occurrence (1).

BREED PREDISPOSITION

Health problems in pedigree dogs, recently highlighted in media world wide have been extensively reviewed (http://www.rspca.org.uk/in-action/issuesindepth/pedigreedogs, http://www.apgaw.org/userimages/, http://www.dogbreedinginquiry.com) and have prompted an increased focus by veterinarians, geneticists and ethicists on several issues related to breed predispositions for canine diseases (6-8). As a complement to listing and classification of disorders known to/accepted as affecting dogs of various breeds, valid estimates of their occurrence have been requested by those trying to elucidate the extent of problems in purebred dogs. The need for statistically significant and robust prevalence data of inherited disorders was listed as the key research need by everyone who addressed the topic. The lack of quantification of the occurrence of disease over time precludes our knowing whether and to what extent breed specific diseases are increasing in the population.

Despite excellent sources on reported breed predispositions and the proven, indicated or presumed inheritance for canine disease by organ system and by breed (9) http://www.vet.cam.ac.uk/idid/, and http://ormia.angis.org.au/a.angis.org.au/, www.upei.ca/~cidd/intro.htm, it is only recently that population-based estimates of the prevalences of various canine disorders have been compiled. The veterinary profession is strongly involved in screening programs for only a fraction of those listed and if statistics are not linked to the population-at-risk the true occurrence/commonness of even these entities is difficult to estimate.

The most obvious breed predispositions are those more or less formally named accordingly, for example, Bedlington terrier hepatitis, Collie eye anomaly, Dalmatian leucodystrophy, German shepherd dog pyoderma, Pug encephalitis, Schnauzer comedo syndrome, Scotty cramp, Shar pei fever, and Westie armadillo syndrome. Only for the two first mentioned do we have indications of the prevalence, based on reports from molecular genetics laboratories and national registries of ophthalmology screening programs, respectively. Dermatomyositis in collies, canine leucocyte adhesion deficiency in Irish setters and lethal...
acrodermatitis in bull terriers, as well as many metabolic and storage diseases, have been strongly linked to one or a few related breeds, but, again, evidence is lacking on the true prevalence. In clinical practice these conditions are recognised by their more or less pathognomic clinical features.

For clinical entities like cataracts, dwarfism, diabetes mellitus, epilepsy, familial nephropathies and PRA, several breeds either are affected by the same specific aetiology or different variants with similar clinical and diagnostic features. It is the responsibility of the profession to assist in quantification of specific diseases, making it possible to formulate breed specific advice on how to handle health problems. However, it can be a challenge for veterinarians in practice to sort out and differentiate sub-classifications of, for example, some of the conditions listed above. Whereas research on molecular genetics and disease mechanisms demand valid, well-specified diagnoses, it may not always be in the best interest of the client or the pet to perform the level of diagnostic work-up required to confirm a specific diagnosis. In addition, diagnostic validity may suffer if we are heavily influenced by presumed predilection and apply specific diagnoses in the absence of diagnostic confirmation.

Another challenge for the profession is to further reveal and quantify breed predispositions related to conformation, constitution or usage; for example respiratory problems in brachycephalic breeds, dystocia in various breeds and some conditions of the locomotor system. Although case reports and series as well as registries at laboratories and from national screening programs may indicate a breed predisposition, it is only by population-based studies accurate estimates of any prevalence or incidence are obtained. Published estimates of disease frequency and breed predilection of diseases in companion animals are commonly based on hospital records from teaching hospitals, which lack information from primary care units and about the healthy population at risk. Since the mid 1990’s population-based morbidity and mortality information based on insurance populations for various diseases by breed, sex and age, have been presented (1-5).

Health programs for purebred dogs including recent recommendations, i.e. http://www.dogbreedinginquiry.com, have tended to place an overemphasis on genetic testing of breeding animals. However, if we wish to address the full scope of disease and welfare, we must consider all problems where we see an increased risk in specific breeds, not only those for which a genetic test or screening program is in place. By presentation of relative as well as true prevalence data by breed and comparison to all breeds, breed specific pattern of the disease burden is clearly featured in the Agria breed profiles. Estimates of prevalence and breed risks for complex diseases in the insurance data base at Agria have also been utilized to select high risk populations for molecular genetic studies. In the accompanying presentation on Breed related diseases as a resource for comparative studies (ibid) breed predisposition for complex diseases such as atopic dermatitis, diabetes mellitus and mammary tumour will be further discussed.

GENDER EFFECTS
Besides the effects due to differences in organ systems and hormonal influences gender effects are seen on specific entities as well as on broader diagnostic classifications from which only few are well characterized in small animal medicine. For example, both mitral valve diseases in small size breeds and cardiomyopathies in large breeds are noticed at a younger age, to a greater extent and in more severe forms in males than in females. There is also a male predominance in most developmental and degenerative orthopaedic conditions including osteosarcoma, possibly due to larger rate of growth. It is less well understood why males also are over-represented with specific infections as well as pyoderma. It may be that behavioural factors influence the former predilections as well as the higher risk of males for traumatic deaths and injuries. For hypoadrenocorticism and for immune-mediated haemolytic anaemia, a female predominance has been reported. A difference between intact and neutered animals has been proven for various diseases in both males and females. Progesterone-related diabetes mellitus is found to greater extent in some breeds and indicates effects of both sex and neutered/intact status.

AGE AS A RISK FACTOR
Understanding the age pattern of risk can support appropriate anticipatory guidance (i.e. adjusting the care and management of animals relative to the likelihood of specific diseases or categories of problems affecting various body systems). For instance, the risks for traumatic injuries and acute poisonings tend to be higher at younger ages, whereas the occurrences of degenerative and neoplastic conditions increase with age. The risk for respiratory disorders displays a U shaped pattern in pets which is also seen in humans and several other species and a male preponderance (1). However, the aetiology...
of such differences may be a complex interaction of, for example, immune system changes, and environmental and behavioural influences. Comparison of findings from various studies/sources must consider these issues.

CONCLUSION

Evidence of breed, sex and age effects from population based studies on e.g. insurance claim data serve not only as a basis for genetic studies and breeding advice but also for informed decisions in clinical practice.

REFERENCES