Age Patterns of Disease and Death in Insured Swedish Dogs, Cats and Horses

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Summary
From 1995 to the present Agria Animal Insurance, Sweden (Agria Djurförsäkring, Stockholm, Sweden) has provided data on both health care and life insurance claims for descriptive and analytical research. From these data we have published extensively on insured dogs and horses and have recently submitted a study on cat mortality. Over the periods studied most extensively (1995–2002 for dogs, 1997–2004 for horses and 1999–2006 for cats), Agria has insured approximately 200,000 dogs, 100,000 horses and up to 200,000 cats per year. Estimates based on formal research or market surveys suggest that Agria insures approximately 40% of both the Swedish dog and horse populations and 50% of the purebred cat population. Where animal insurance is so widely embraced, the Agria-insured populations are likely to be representative of the national population. This paper focuses on age patterns of disease, differences between breeds and genders, body system and disease process and changes over time. An increase in survival over the years for dogs and cats is undoubtedly affected by owner, societal and veterinary factors relative to the availability of, and willingness and ability to access, and continue, veterinary care. In addition, marked differences in survival across breeds suggest that comparisons between people and companion animals in terms of health, disease and longevity must consider these complexities.

Keywords: cat; dog; horse; insurance database; mortality

Introduction
Understanding patterns of disease in animal populations is a necessary underpinning of health promotion and disease prevention strategies. The distribution of mortality and morbidity by age, both in general, for specific diseases and compared across breeds, is important information for individual owners, veterinarians and researchers. 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). Comparing similarities and differences in the pattern of disease across species, breeds, ages, genders, etc. can suggest theories about aetiology and inform causal reasoning about contributions of, for example, genotype, phenotype or physiology, conformation, use or temperament to disease occurrence. Unfortunately, sources of population-based information on incidence of disease and death in companion animals have historically been rather scarce.

For many years now we have had access to data from an animal insurance company in Sweden (Agria Djurförsäkring, Stockholm, Sweden). We have published extensively on insured dogs and horses and have recently submitted a study on cat mortality (e.g. Egenvall et al., 2000, 2005a, 2006; Bonnett et al., 2005). Over the periods studied most extensively (1995–2002 for dogs, 1997–2004 for horses and 1999–2006 for cats), Agria has insured approximately 200,000 dogs, 100,000 horses and up to 200,000 cats per year. Estimates based on formal research or market surveys suggest that Agria insures approximately 40% of both the Swedish dog and horse populations and 50% of the purebred cat population. Where animal insurance is so widely embraced, the Agria-insured populations are likely representative of the national population.
Swedish animal populations may or may not be reflective of other populations. For specific breeds of, for example, purebred dogs, it is likely that the insured animals have many similarities to the same breeds in other locations. At the population level, however, it must be noted that Sweden, in general, has extremely high standards for responsible animal ownership and almost no stray dogs. It has not been the culture to perform elective surgeries on pets. In Sweden, in 1995, it was estimated, for example, that only 7% of Swedish bitches were spayed, and many of those would have been ovario-hysterectomized because of experiencing pyometra (Egenvall et al., 1999).

The insurance data provide an excellent opportunity for describing patterns of disease with a clear base population (all insured animals) as well as case data (those that get sick or die). For mortality, even if an animal died for a reason not covered by the life insurance, the company would be informed of the animal’s death when the owner cancelled the policy. During the period of research, the company has had relatively few exclusions for specific or general causes of disease or death, but there have always been certain limitations of the data, which must be borne in mind when interpreting the statistics. Behavioural problems in general, are not reimbursable as a cause of disease or death in dogs unless it is related to a biophysical problem. We are unable to differentiate death per se from humane destruction. Although dogs could have health insurance to any age, relatively few are insured after the age of 12 years. In most of the years of analysis dogs could only be life-insured to 10 years of age, which includes most of the lifespan for some breeds and less for others. For veterinary care insurance, the owner is reimbursed only for problems for which the deductible cost is exceeded. Thus, very minor problems are not reflected in the database.

All diagnoses are submitted by veterinarians based on a hierarchically designed registry that has been in use for many years in Sweden (Swedish Animal Hospital Organisation, 1993). In general, only one diagnosis is assigned to each death or veterinary care event. Studies on the validity of the data indicate high correctness of demographic data and adequate validity of diagnostic information, accepting that there are likely more problems than are captured in the data (Egenvall et al., 1998; Penell et al., 2007). However, knowing that the estimates from the analyses are likely conservative allows interpretation to proceed effectively. Even considering the limitations, the statistics from the Swedish insurance data represent a wealth of population-level data on morbidity and mortality in companion animals that is not readily available elsewhere. The findings from these
studies should be used in conjunction with other evidence and knowledge to examine health issues.

Dogs

For many disease conditions the risk of death increases with age. This can be seen in the overall pattern of death with age for males and females (Fig. 1). An important consideration when considering age effects in dogs is the extreme differences between breeds. The average yearly mortality among life-insured dogs (10 years of age and younger) was approximately 4% yearly. However, among the 100 most common breeds of dogs (those with at least 250 dogs at risk yearly) the risk ranged from 0.6% per year to over 18%.

One way of looking at the age pattern is to examine survival analysis of the proportion of animals surviving to various ages. Overall in the insured population, we found a small but statistically significant increase from 64% to 68% of dogs surviving to 10 years of age in the period 1999—2002 compared with 1995—1998 (unpublished data; see ‘Agria Dog Breed Profiles’ [http://www.agria.se]). This rather unexpected result coincided with an increase in the risk of dogs having at least one veterinary care event (a veterinary visit that exceeded the deductible). Similar differences were seen in many, but not all, breeds.

![Veterinary care average risk (%) by process: all breeds](image1)

Fig. 3. Risk (%) for veterinary care claims by disease process, all breeds of dogs, from Agria Dog Breed Profiles.

![Veterinary care average risk (%) by age for higher risk process](image2)

Fig. 4. Risk (%) for veterinary care claims for most frequent disease process by age, all breeds of dogs, from Agria Dog Breed Profiles.
One could hypothesize that as more dogs receive veterinary care, the longer they live. It is likely that the statistics reflect a societal shift to accessing more care and/or instituting or continuing treatment for older dogs. Interestingly, pain management pharmaceuticals (e.g. non-steroidal anti-inflammatory drugs; NSAIDS) specifically for dogs became available in Sweden in 1998–1999. It is possible that improved quality of life in ageing animals had an influence on the survival statistics. Fig. 2 presents a graph of survival that highlights the marked difference in the pattern of survival across breeds and that at least one small breed (Cavalier King Charles spaniel) has a relative low survival to 10 years of age.

Another way of examining survival is to look at conditional survival. For example, in these data, a Bernese mountain dog that was alive at 8 years of age had a 50% chance of being dead by 10 years of age, whereas for border collies the risk was less than 10%. It is clear that, regardless of calendar age, the biological age across breeds is very different and health control programs with age-based recommendations that target all dogs without reference to specific breeds are likely unsupported.

As opposed to mortality, where we saw an overall decrease in deaths before 10 years of age, there was an increase in the percentage of dogs with at least one veterinary care event in 1999–2002 compared with 1995–1998. How much this reflects owner/societal attitudes about accessing care can only be hypothesized. One can see that there is an increase within each process-category of disease (Fig. 3). In Fig. 3, the category ‘inflammatory’ includes all infectious and inflammatory diseases, regardless of system.

The overall pattern of an increased risk of disease/death with age does not hold for all categories of age.
Fig. 4 shows the age patterns for several process categories of disease (veterinary care events). As can be seen, deaths due to traumatic causes decrease with age. Inflammatory problems are high in the very young, lower in dogs 2–4 years of age and then increase with age. In the Swedish dog population, pyometra is the most common cause of disease in female dogs and accounts for some of this pattern. However, diseases such as outer ear infection and pyoderma have rather similar patterns. The decrease at the highest ages is likely due, at least partly, to owner decisions about care. Patterns of disease also vary by body system. Dogs display a similar U-shaped pattern for respiratory disease as is seen in man and other species (Fig. 5).

Horses

In horses, the age pattern for morbidity reflects a high risk of disease in the very young and in middle age (i.e. during the ages of most intense use/activity; Fig. 6). It should be noted that these statistics are for riding horses and do not include race horses. Many further details on patterns of morbidity and mortality in these horses have been studied (Egenvall et al., 2005b; Egenvall et al., 2006).

Cats

Preliminary findings for mortality in cats (Egenvall et al., 2009) suggest that there was both an increased survival over recent years, as was seen in dogs, and marked differences between breeds in age patterns of death (Fig. 7). In the Birman breed, in the period 1999–2002, 58% of cats survived to 12.5 years of age, whereas in 2003–2006 survival increased to 68%. For Siamese cats, survival in the two periods was 33% and 42%, respectively.

Conclusion

It is clear from these insurance data that for age patterns of disease in companion animals there are marked differences across species, breeds, body systems and disease processes. The data have the benefit of being reflective of the veterinary practice situation, at least in Sweden, with certain limitations. However, when using these data to inform our understanding of the influence of genotype, phenotype or physiology on, for example, the age distribution of disease, it must be remembered that it is impossible to quantify the impact of owner attitudes and decisions that lead to seeking or continuing veterinary care or that influence the risk for death/humane destruction. Thus we must proceed cautiously, with full respect for the complexity of health and disease in companion animals.

Conflict of Interest

The first author was an invited speaker at the Merial European Comparative Vaccinology Symposium and received travel expenses and an honorarium for this presentation.

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References

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