Disease predispositions in dogs and cats: the fuller story

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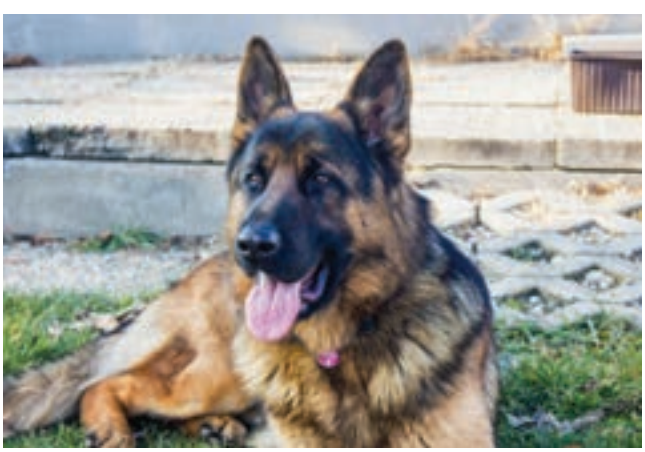
Companion animals are often bred according to the whims and needs of mankind rather than following the harsh survival rules of natural selection. It is widely accepted that almost all dog and cat breeds have specific diseases to which they are particularly prone (ie. predisposed). Consequently, breed-related disease has become an important anthropogenic-welfare issue and it behoves everyone with an interest in companion animals to strive to reduce these welfare costs.

Domestic dogs and cats have become integral parts of modern human family life. Dog and cat populations in the UK are each estimated at around eight to 10 million animals (Murray et al, 2010; Asher et al, 2011; PFMA, 2012), with 24-31% of UK households estimated to own at least one dog (Asher et al, 2011; Murray et al, 2010). Humans have expressed their 'love' of these species by selecting for specific favoured characteristics that have led to over 400 unique dog breeds and 70 cat breeds. In the UK, 80% of dogs and 10% of cats are now purebreds (O'Neill et al, 2014b; O'Neill et al, 2014a). The benefits of dog and cat ownership are well known, and include both physical (Ownby et al, 2002; Friedmann and Son, 2009) and psychological gains (Virués-Ortega and Buela-Casal, 2006; Walsh, 2009). However, man has progressively played with the shape of the modern dog such that the dog is now the most phenotypically diverse mammal at a species level (Wayne et al, 2006) and it is increasingly questioned whether modern-breed selection towards extremes of conformation have allowed dog health and welfare to derive comparable benefits (McGreevy and Nicholas, 1999; Rooney, 2009). Each of the 50 most popular breeds in the UK has at least one reported conformational predisposition to disease (Asher et al, 2009) and almost 400 non-conformational inherited disorders have been identified (Summers et al, 2010).



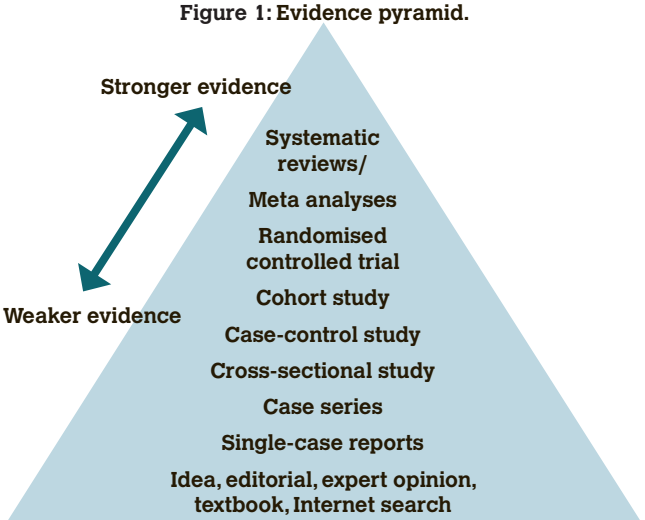
The debate over the health impacts from man's manipulation with dog breeds came to a head in 2008 when the BBC aired a documentary called *Pedigree Dogs Exposed* that claimed purebred dog health was deteriorating to an unacceptable level because of man's desire for the 'perfect' dog (BBC, 2008). Three major reports followed that all concurred that pedigree-breeding practices did impose welfare costs on dogs but, more crucially, concluded that critical data gaps existed on disorder prevalence and that these gaps were constraining effective reforms (Bateson, 2010, Rooney and Sargan, 2008; APGAW, 2009). At that time, prevalence data had been published on only 1% of inherited disorders affecting popular UK dog breeds (Collins et al, 2011). Essentially, 'believing' that a problem exists and having 'evidence' for what that problem may be, are two very different things; and optimal progress to resolve any issue should be based on evidence rather than opinion.

VETCOMPASS PROGRAMME

Over the past decade, things have changed a lot and substantial efforts have been put into generating the information needed on dog-and-cat breed health to fill these data gaps. The key opportunity identified by the three major reports was to collect and merge the vast quantities of high-quality health data held by first-opinion veterinary practices into a single national surveillance system that could generate reliable disorder-prevalence values (McGreevy, 2007). This concept led to the creation of the VetCompass Programme that collects de-identified electronic health records from first-opinion, charity and referral practices, and has received universal support from welfare, scientific and veterinary bodies (VetCompass, 2018). From an initial PhD project at the Royal Veterinary College in the UK, VetCompass has grown to become the largest database of veterinary clinical records used for research in the world. In the UK, 1,000 practices (over 20% of all UK practices) are sharing data on over 10 million companion animals and the project has now been extended to equine clinical data as well. In addition, the project also holds anonymised data on over 17 million US animals from over 1,000 US practices. VetCompass has been developed in Australia as an initiative that covers all eight Australian Vet Schools (VetCompass Australia, 2018)

and assistance is being given to sister projects in Sweden, Denmark and Spain. To date, VetCompass research has supported 35 peer-reviewed publications with many more studies in progress. In addition, many other bodies such as universities (Packer et al, 2015; Sandøe et al, 2017), the Kennel Club (Wiles et al, 2017) and Agria Insurance (Öhlund et al, 2015, Vilson et al, 2013) have continued to contribute novel insights. Consequently, the 'evidence' world on breed health that exists today is very much richer than in 2008.

Figure 1: Evidence pyramid.



BREED DISPOSITION IDENTIFICATION

However, as important as the generation of new health data on dog and cat breeds is, this can only begin to have a positive effect on breed health once it is collated into a single resource that is easy to interpret and disseminate. This was the task that the authors set themselves for the new 3rd edition of This *Breed Predispositions to Disease in Dogs and Cats* that has just been published (Gough et al, 2018).

The critical first was to clearly define which breed-disease combinations (ie. predispositions) had strong supporting evidence. Previous editions of the book had included weak evidence from conference proceedings and textbooks. While such weak evidence may make for interesting general reading, this does not necessarily mean that they are correct or tell an unbiased story. Expert opinion (sometimes called eminence-based veterinary medicine) relies on the personal opinion of recognised experts or self-appointed commentators and is often problematic for general practitioners to challenge. Although expert opinion may be presented as highly persuasive and personal evidence, it is almost certainly the weakest type of evidence available unless it is underpinned by a solid and stated evidential platform (Holmes and Ramey, 2007). This is because many cognitive biases are inevitably inherent within the belief systems of any individual expert and it explains why experts so often vehemently disagree on specific questions.

The 3rd edition aimed to place stronger emphasis on the modern principles of evidence based veterinary medicine (EBVM; [Cockcroft and Holmes, 2003]). EBVM aims to identify the most reliable sources of evidence from the ever-increasing volume of information that is available in the modern era of electronic publication. The evidence pyramid narrows progressively from the wider volume of low-quality at the base to a smaller volume of higher-quality evidence at the tip (see Figure 1). Higher quality of evidence tends to be original pieces of research that have been through the peer-review process and were designed to reduce selection or information biases, be large enough to reduce random error and to have adequate statistical analytic

Breeds	Count of disease predispositions
German Shepherd Dog	77
Boxer	76
Labrador Retriever	70
Golden Retriever	66
Cocker Spaniel	63
Rottweiler	58
Miniature Schnauzer	50
Dachshund (unspecified)	47
Yorkshire Terrier	47
West Highland White Terrier	42
Dobermann Pinscher	41
Pug	41
Springer Spaniel	40
English Bulldog	39
Shih Tzu	39
Collie	34
Greyhound	34
Great Dane	33
Miniature Poodle	33
Pointer (unspecified)	33

Table 1: Breeds with the most reported disease predispositions.

Disease	Count	Percentage of all breeds affected
Cataract	63	30.6%
Hip dysplasia	46	22.3%
Patellar luxation	43	20.9%
Progressive retinal atrophy	34	16.5%
Atopic dermatitis	33	16.0%
Dystocia	30	14.6%
Idiopathic epilepsy	30	14.6%
Panosteitis	30	14.6%
Congenital portosystemic shunt	29	14.1%
Diabetes mellitus	28	13.6%
Elbow dysplasia	28	13.6%
Mast cell tumour	27	13.1%
Aggression	25	12.1%
Osteochondrosis – shoulder	24	11.7%
Pyometra	24	11.7%
Intervertebral disc disease	23	11.2%
Glaucoma – primary	22	10.7%
Mammary neoplasia	22	10.7%
Gastric dilatation/volvulus	21	10.2%
Hypothyroidism	21	10.2%

Table 2: Most commonly reported disease predispositions.

methods (Vandeweerd et al, 2012). Where possible, the 3rd edition of the book aimed to reference only original peer-reviewed scientific publications and to avoid the inclusion of conference proceedings, review articles, editorials, websites or veterinary textbooks.

So, what have we learned from the exhaustive search of the published literature. Firstly, there is now substantial good evidence on breed-related health in dogs and cats. There were 2,467 breed-disease predispositions identified across 739 diseases and 200 breeds of dogs. Predispositions were also identified in 45 cat breeds. The most common predispositions in dogs were cataract (2.6% of all reports, 30.6% of breeds affected), hip dysplasia (1.9%, 22.3%) and patellar luxation (1.7%, 20.9% [see Table 1]).

The dog breeds with the highest predisposition counts were German Shepherd Dog (77 predispositions; 10.4% of 739 disease terms), Boxer (76; 10.3%) and Labrador Retriever (70; 9.5%; [see Table 2]).

These findings can assist veterinary organisations and breed clubs to target breeding reforms towards the most prevalent conditions affecting dog and cat welfare. Assuming that the political will exists to make changes to the way pets are bred and that these changes are informed by the available and growing evidence base to reduce the incidence of inherited disease, then it is possible to improve breed welfare significantly.

However, can we now say that we have all the answers; or does a word of caution need to be added? Do these comprehensive results truly mean that cataract is the most important welfare issue in dogs or that the GSD is the sickest dog breed? Or do they just mean that these commonly reported disorders and breeds are where we are focussing our research? For example, popular breeds are likely to be biased towards having more predispositions reported just because they have enough dogs in many studies to achieve statistical significance, Additionally, being the most reported predisposition does not mean that cataract is the most prevalent, severe or important disease of dogs. As always, the value of data resides not just in having the information but also in good interpretation.

All said though, this solid evidence base in a single resource can be an effective springboard from which other companion animal stakeholders can develop effective strategies to improve animal welfare. Breeders and breeding organisations can identify priorities when considering the genetic health of their breeds. The show community, both those showing and those judging, can refine their opinions on optimal conformations and temperaments within individual breeds. Owners can use breed health information when deciding on breed selection or considering on how best to care for their current dog or cat. Awareness of breed-related disease can help veterinary students and veterinarians with diagnosis and when advising owners and the book could be a useful resource for vet practices either in their internal library or in their waiting rooms.

REFERENCES ON REQUEST

READER QUESTIONS AND ANSWERS

1: WHICH DOG BREED HAS THE HIGHEST COUNT OF REPORTED PREDISPOSITIONS?

A Boxer
B Cocker Spaniel
C German Shepherd Dog
D West Highland White Terrier
E Rottweiler

2: WHAT IS THE LARGEST DATABASE OF VETERINARY CLINICAL RECORDS USED FOR RESEARCH IN THE WORLD?

A Agria
B RCVS
C Kennel Club
D BSAVA
E VetCompass

3: WHICH DISEASE HAS THE HIGHEST COUNT OF REPORTED PREDISPOSITIONS?

A Hip dysplasia
B Cataract
C Patellar luxation
D Diabetes mellitus
E Hypothyroidism

4: ROUGHLY HOW MANY UNIQUE DOG BREEDS HAVE BEEN CREATED?

A 40
B 140
C 240
D 400
E 4,000

5: HOW MANY UNIQUE DISEASE TYPES HAVE BEEN IDENTIFIED AS BREED-RELATED IN DOGS?

A 45
B 200
C 400
D 739
E 2,467

ANSWERS: 1: C; 2: E; 3: B; 4: D; 5: D