THE KENNEL CLUB
DOG HEALTH

Breed Health and Conservation Plan

BHCP

Boxer

2018

INTRODUCTION

The Kennel Club launched a dynamic new resource for breed clubs and individual breeders – the Breed Health and Conservation Plans (BHCP) project – in September 2016. The purpose of the project is to ensure that all health concerns for a breed are identified through evidence-based criteria, and that breeders are provided with useful information and resources to support them in making balanced breeding decisions that make health a priority.

The Breed Health and Conservation Plans take a holistic view of breed health with consideration to the following issues: known inherited conditions, complex conditions (i.e. those involving many genes and environmental effects such as nutrition or exercise levels, for example hip dysplasia), conformational concerns and population genetics.

Sources of evidence and data have been collated into an evidence base (Section 1 of the BHCP) which gives clear indications of the most significant health conditions in each breed, in terms of prevalence and impact. Once the evidence base document has been produced it is discussed with the relevant Breed Health Coordinator and breed health committee or representatives if applicable. Priorities are agreed and laid out in Section 2. A collaborative action plan for the health of the breed is then agreed and incorporated as Section 3 of the BHCP. This will be monitored and reviewed.

SECTION 1: EVIDENCE BASE

<u>Demographics</u>

The Boxer is a Breed Watch category 1 breed, meaning that there are no current visible points of concern for judges to consider when at a judging appointment. The number of new registrations of the breed per year are shown in Table 1, and have decreased markedly over this time period.

Table 1: Number of Boxers registered per year between 2007 and 2017

Year	Number of new Boxer registrations	Percentage of breed out of total annual registrations
2007	8191	3.03%
2008	7353	2.71%
2009	5947	2.43%
2010	5699	2.22%
2011	5277	2.16%
2012	4622	2.02%
2013	4003	1.79%
2014	4146	1.86%
2015	3479	1.58%
2016	3664	1.61%
2017	3387	1.39%

The number of Boxers registered by year of birth between 1980 and 2017 are shown in Figure 1. The 1980 registrations figure appears depressed for all breeds due to registrations moving across to the electronic system from paper files. The trend of registrations over year of birth (1980-2014) was +71.72 per year (with a 95% confidence interval of -10.10 to +153.54), reflecting the overall increase in registrations. [Put simply, 95% confidence intervals (C.I.s) indicate that we are 95% confident that the true estimate of a parameter lies between the lower and upper number stated.]
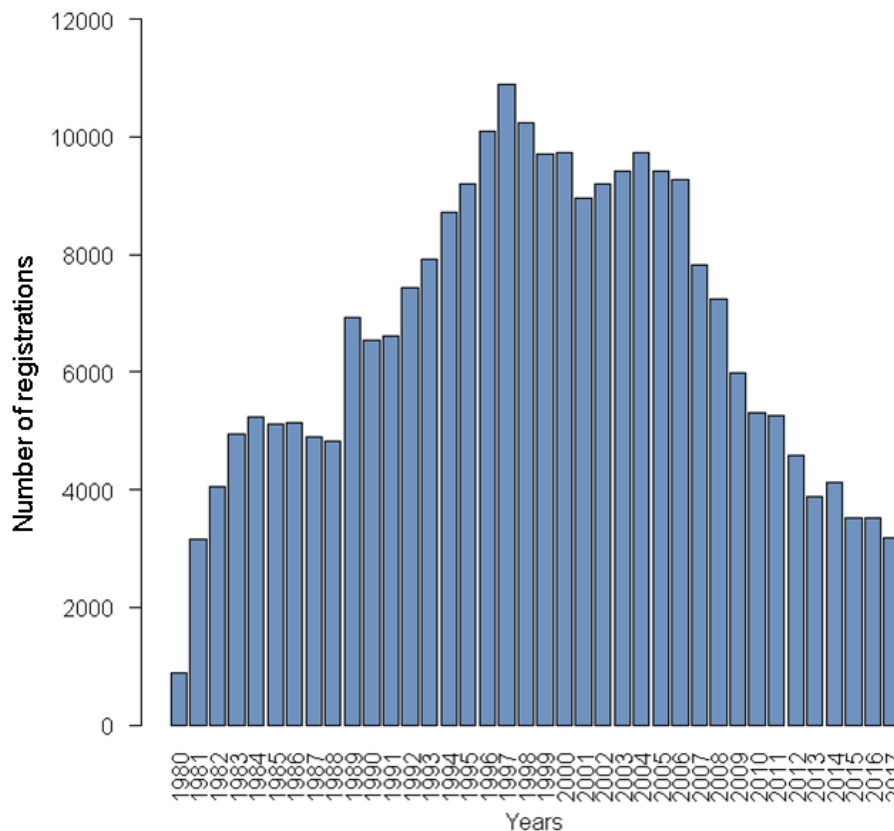

Figure 1: Number of registrations of Boxers per year of birth, 1980 – 2017

Literature review

The literature review lays out the current scientific knowledge relating to the health of the breed. We have attempted to refer primarily to research which has been published in peer-reviewed scientific journals. We have also attempted to acknowledge possible limitations of the studies reported, including when the research involved dogs in other countries. Whilst there are often strong links between populations of a breed in different countries, there are also often differences between the populations and issues seen in one country may not be seen (or may have a different prevalence) in another. However, it may also be useful for United Kingdom (UK) breeders to be aware of conditions occurring in the breed in other countries which have not yet been seen in the UK population, especially given that movement of breeding stock does occur between countries.

Cardiovascular conditions

Aortic stenosis/subaortic stenosis (SAS): In a French study of Boxers which underwent echocardiography at the Cardiology Unit of Alfort University, between January 1998 and May 2005, 105 dogs were diagnosed with one or more congenital heart disease. In total, 46.7% (49 cases) of Boxers with congenital heart disease were found to have subaortic stenosis (Chetboul et al, 2006b). An Italian study of mandatory breed screening results between 1999 and 2004 reported a SAS prevalence of 8.5% (109 of 1283 dogs) (Bussadori et al, 2009). A more recent study of electronic patient records of 90,004 dogs examined at the University of California-Davis Veterinary Medical Teaching Hospital, USA, between 1st January 1995 to 1st January 2010 found the Boxer to be the third most frequently affected breed with aortic stenosis, with a breed-specific prevalence of 4.49% compared to a mixed breed-prevalence of 0.15% (Bellumori et al, 2013).

Arrhythmogenic right ventricular cardiomyopathy (ARVC): This condition was first given this name (which it shares with a human condition) in a study of 239 Boxers with ventricular arrhythmias, including six large families, at Ohio State University, although the breed had long been noted to be predisposed to ventricular arrhythmias and sudden death (Basso et al, 2004). Pedigree analysis of UK cases and unaffected dogs, using Kennel Club records, suggest that the disease in the UK originates from a small number of Boxers imported from the USA (Cattanach et al, 2015). It is suggested to have a single gene autosomal dominant mode of inheritance, with low penetrance. The causative mutation has not yet been identified.

Atrial septal defect (ASD): This congenital heart defect involves a 'hole' in the wall separating the top two chambers of the heart, allowing oxygen-rich blood to leak into the oxygen-poor blood chambers in the heart. The Boxer predominated in a French study of cases of the condition at the Cardiology Unit of Alfort University between January 2001 and March 2005, representing 31.9% (36 of 113 dogs) of cases (Chetboul et al, 2006a). The breed had an odds ratio of 15.28 (95% C.I. 10.24 – 22.84; 36 cases out of 912 dogs admitted to the hospital over that time period) of being diagnosed with the condition compared to dogs of other breeds.

Dilated cardiomyopathy (DCM): This condition is noted as a breed predisposition (Gough, Thomas and O'Neill, 2018), but is considered to be less common in the Boxer than ARVC. A mutation in the striatin gene has been found to be associated with the phenotype in the breed, but is not found in all affected Boxers (Meurs et al, 2001).

Mitral valve dysplasia (MVD): MVD was the second most commonly diagnosed condition in a French study of 105 Boxers with congenital heart disease at the Cardiology Unit of Alfort University, between January 1998 and May 2005. In total, 55.2% (58 cases) of Boxers with congenital heart disease were found to have MVD (Chetboul et al, 2006b).

Pulmonic stenosis: This condition was the fourth most commonly diagnosed condition in a French study of 105 Boxers with congenital heart disease at the Cardiology Unit of Alfort University, between January 1998 and May 2005. Some 4.8% (five cases) of Boxers with congenital heart disease were found to have MVD (Chetboul et al, 2006b).

Dermatological conditions

Atopic dermatitis (atopy): A Swedish study investigating the prevalence of atopic dermatitis in an insured population reported the Boxer as the third most frequently diagnosed breed with the condition, with 53 claims for the condition out of a total of 1,584 Boxers. The breed had an incidence of 8.4 cases per 1000 dog years at risk (DYAR), compared to an overall incidence rate of 1.7 cases per 1000 DYAR (Nødtvedt et al, 2006).

Calcinosis circumscripta: This involves the deposition of inorganic, insoluble calcium salts in the skin. A study of cases seen at the Veterinary Medical Teaching Hospital of the University of California Davis, USA, found that five of 46 cases (10.8%) were in Boxers or Boxer crosses, which was more than would be expected from the overall hospital population (Doerr et al, 2013).

Canine follicular dysplasia (seasonal flank alopecia): This condition involves bilaterally symmetric alopecia and hyperpigmentation, especially over the flanks, and is generally seasonal and recurrent. The cause is unknown in the breed, but it is presumed to have a genetic basis as it is seen so frequently in the Boxer according to North American authors (Rachid et al, 2003). No prevalence estimates could be found in the literature.

Demodicosis (Demodectic mange): A study of 499 dermatology cases between 1998 and 2006 at the Small Animal Hospital in Buenos Aires, Argentina, included 28 cases of juvenile generalised demodicosis. Seven cases were seen in Boxers, and the breed had an odds ratio of 7.52 (95% C.I. 2.86 - 19.74; 7 cases and 20 non-cases) compared to dogs of other breeds suggesting the breed may be at increased risk of the condition.

Idiopathic sterile granuloma and pyogranuloma: The Boxer has been reported to be at risk of these skin conditions (Gough, Thomas and O'Neill, 2018); however, no primary references or prevalence estimates could be found to support this.

Endocrine conditions

Hyperadrenocorticism (Cushing's disease): The Boxer has been reported to be increased risk of this endocrinopathy (Gough, Thomas and O'Neill, 2018). In a study of 85 dogs with the pituitary dependent form of the condition, admitted to the Department of Veterinary Medical Sciences, University of Bologna, Italy, between March 2003 and October 2013, the Boxer was the second most commonly diagnosed breed with the condition (Fracassi et al, 2014). Nine cases (10.65) in the study were Boxers, but the general population of the breed was unknown so the prevalence of the condition in the breed could not be estimated.

Hypothyroidism: The breed has been reported to be at increased risk of hypothyroidism (Gough, Thomas and O'Neill, 2018), but no primary references or prevalence estimates could be found to support this.

Gastrointestinal conditions

Cleft palate: A birth cohort of 2,629 Boxers in the Netherlands had a prevalence of cleft palate of 2.3% (61 cases and 2,561 non-cases), with a probable autosomal recessive mode of inheritance (Nielen, et al, 2001).

Gastric dilatation/ volvulus syndrome (GDV, 'bloat'): Gastric dilatation-volvulus syndrome (GDV) is an acute, life-threatening condition featuring rapid accumulation of air in the stomach, malposition of the stomach to a varying degree and a rise in intragastric pressure, frequently leading to the development of cardiogenic shock (Glickman et al, 2000). The Boxer has been reported to be at increased risk of GDV (Gough, Thomas and O'Neill, 2018): however, no primary references or prevalence estimates could be found to support this.

Histiocytic ulcerative colitis: This condition, causing severe large bowel diarrhoea, is considered almost unique to the Boxer. It was first reported in 1965 in a number of Boxers from a kennel in Northern America, and cases have since been reported in dogs of the breed in many countries including the UK (Churcher and Watson, 1997).

Inflammatory bowel disease (IBD): The Boxer is considered particularly susceptible to IBD. In a study of 546 dogs diagnosed with IBD at the Royal Veterinary College between August 2003 and December 2009, the Boxer was at increased odds of being diagnosed with the condition compared to mixed-breed dogs with an odds ratio of 1.70 (95% C.I. 1.04 - 2.76) based on 31 cases and 1,219 non-cases in the breed (Kathrani et al 2011).

Pancreatitis: The breed has been reported to be at increased risk of chronic pancreatitis. A case series of 200 dogs submitted for post mortem examination at the University of Glasgow Veterinary School; both of the Boxers in the study were found to have chronic pancreatitis giving a risk ratio for the breed of 3.0 (95% C.I. 2.4 – 3.8) compared to other breeds (Watson et al, 2007).

Haematological conditions

Factor I (fibrinogen) and Factor II (prothrombin) deficiencies: The Boxer has been reported to be at risk of these inherited clotting disorders (Brooks, 1999); however, no prevalence estimates were provided.

Haemophilia A (Factor VIII deficiency): The breed has been reported to at risk of a severe, familial form of this inherited clotting disorder (Brooks, 1999); however, no prevalence estimates were provided.

Hepatic conditions

No scientific references to conditions in this category could be found for the breed.

Immunological conditions

No scientific references to conditions in this category could be found for the breed.

Musculoskeletal conditions

Cranial cruciate ligament rupture (CCLR): The Boxer was reported to be at increased risk of cranial cruciate ligament disease, with an odds ratio of 2.14 (95% C.I. 2.00 – 2.30; 836 cases out of 15,962 Boxers) compared to dogs of all breeds, based on dogs which had attended veterinary teaching hospitals in the USA between 1964 and 2003 (Witsberger et al, 2008).

Diffuse idiopathic skeletal hyperostosis (DISH): This condition affects the entire skeleton and results in ossification of soft tissues, including spinal ligaments and sites of attachment of tendons to bone, resulting in stiffness and pain. A retrospective radiographic study of dogs over than one year of age referred to the Utrecht University Veterinary Medical Teaching Hospital between February 2003 and January 2008 revealed an overall prevalence of DISH of 3.8% (78 cases in 2041 dogs). The prevalence of DISH in Boxers was 40.6% (28 cases in 69 dogs of the breed), and the breed had an odds ratio of 51.3 for developing the condition compared to dogs of other breeds (Kranenburg et al, 2011)

Hip dysplasia: In a study of 4,725 Boxers in Italy, the prevalence of hip dysplasia was estimated as 25.2%, and the heritability of the condition was estimated as 0.24±0.047 (Sturaro et al, 2006). UK hip dysplasia data are discussed in the Canine Health Schemes section later in this document.

Metaphyseal osteopathy (hypertrophic osteodystrophy): The Boxer was reported to be at elevated risk of this condition, with a breed-associated odds ratio compared to mixed breeds of 18.4 (95% C.I. 7.1 – 47.5), based on dogs which had attended veterinary teaching hospitals in the USA; however, this result was based on just 7 cases and 7 non-cases in the breed (LaFond et al, 2002).

Osteochondrosis (OCD) of the lumbosacrum: The Boxer was over-represented in a UK case study of 34 cases of the condition, representing 11% (four dogs) of cases (Hanna, 2001). No more recent studies or prevalence estimates could be found in the literature.

OCD of the shoulder: The breed was reported to be at elevated risk of OCD of the shoulder, with a breed-associated odds ratio compared to mixed breeds of 2.2 (95% C.I. 1.1 – 4.5), based on dogs which had attended veterinary teaching hospitals in the USA; however this result was based on just nine cases and 67 non-cases in the breed (LaFond et al, 2002).

OCD of the stifle: The Boxer was reported to be at elevated risk of OCD of the stifle, with a breed-associated odds ratio compared to mixed breeds of 56.3 (95% C.I. 24.8 – 127.8), based on dogs which had attended veterinary teaching hospitals in the USA; however this result was based on just 14 cases and 11 non-cases in the breed (LaFond et al, 2002).

Panosteitis: The Boxer was reported to be at elevated risk of panosteitis, with a breed-associated odds ratio compared to mixed breeds of 1.8 (95% C.I. 1.4 – 2.3), based on dogs which had attended veterinary teaching hospitals in the USA; this result was based on 90 cases and 340 non-cases in the breed (LaFond et al, 2002).

Perineal hernia: The breed has been reported to be at increased risk of perineal hernia, in which the pelvic floor ruptures allowing abdominal contents to protrude into the space between the anus and the scrotum (Gough, Thomas and O'Neill, 2018); however, no primary references or prevalence estimates could be found.

Spondylosis deformans: This degenerative spinal disease is often clinically insignificant, but severe forms cause stiffness, lameness and pain. A radiographic screening study of 851 Boxer dogs in Italy between 1997 and 2001, with a mean age of 20 months (range 10 to 84 months), reported that 84% of dogs had spondylosis lesions (Carnier et al, 2004).

Neoplastic conditions

Canine cutaneous histiocytoma: A survey of veterinary surgeons who had submitted samples for histopathological analysis by Nationwide Laboratories in the UK between 1st November 2007 and 30th April 2008 found that the Boxer was the sixth most commonly affected breed with cutaneous histiocytoma, a benign skin tumour, representing 7.4% (18 of 242) of cases (Killick et al, 2011).

Fibroadnexal hamartoma: These benign tumours involve hair follicles and glandular structures. A study of 5,864 pathology samples submitted to two diagnostic services in Brazil between 2001 and 2008 included 53 cases of fibroadnexal hamartoma. The Boxer was the most frequently affected breed, with six cases (11.3%) in the breed (Loures and Conceição, 2009) suggesting the breed may be at increased risk of the condition.

Lymphoma: The Boxer was reported to be at increased risk of lymphoma based on UK insurance data; there were 103 cases of the condition out of 130,684 insured dogs, and 10 cases out of 5,628 insured Boxers (Edwards et al, 2003). The breed had an odds ratio of 3.26 (95% C.I. 1.57 – 6.76) compared to dogs of other breeds.

Mammary tumours: Analysis of Swedish Agria insurance data, considering female dogs enrolled for both veterinary care and life insurance during 1995 to 2006, estimated the disease incidence of pyometra in 260,000 female dogs. Each full year a dog was insured contributed to one dog-year at risk (DYAR). The overall incidence rate for mammary tumours was 112 cases per 10,000 DYAR (95% C.I. 110-114). The prevalence of mammary tumours in Boxer bitches in this study was 35.0% (236 cases in 2,198 bitches), ranking the breed seventh out of 110 breeds in terms of breed-specific prevalence (Jitpean et al, 2012).

Mast cell tumour (MCT): In a study of dogs treated for MCTs at the University Veterinary Centre, Sydney, Australia between 1989 and 2001, the Boxer represented 21.4% (12 of 56 cases) of cases suggesting a possible breed predisposition (Baker-Gabb et al, 2003). A recent study assessing the prevalence and risk factors for MCTs in UK based dogs found the Boxer to be at increased odds of MCTs compared to crossbreed dogs (Shoop et al, 2015). The study used VetCompass data consisting of 168,636 dogs attending 94 veterinary practices in England between 2007 and 2013, of which 453 dogs met the case inclusion criteria. Overall MCT prevalence was estimated at 0.27%. The Boxer was one of the breeds that exceeded this with MCT prevalence of 1.95% (95% C.I. 1.40% - 2.51%). The breed was reported to have an odds ratio of 12.9 (95% C.I. 7.3 - 22.7) compared to dogs of no recognisable breed.

Osteosarcoma: The breed was found to be at increased risk of malignant bone tumours in a study of Swedish Agria insurance data, with an overall incidence of 13 cases (95% C.I. 7 - 19) per 10,000 DYAR compared to the risk in all breeds combined of 5.5 cases per 10,000 DYAR (Egenvall et al, 2007).

Primary brain tumour: An American study of 9,574 post mortem examinations undertaken at the University of Pennsylvania Veterinary Hospital between1986 and 2010 found the Boxer had an apparent increased risk of primary intracranial neoplasms with a breed-specific prevalence of 13.3% (28 cases in 212 dogs of the breed) compared to an overall prevalence of 2.3% (227 cases in 9,574 dogs of all breeds) (Song et al, 2013).

Vascular tumours: The Boxer was reported to be at increased risk of vascular tumours in a Norwegian study, with an annual incidence rate of 1.5 cases per 1000 dogs of the breed (Moe et al, 2008). This was the highest incidence rate of all breeds.

Other tumours: The breed has been reported to be at increased risk of chemodectoma of the aortic and carotid bodies, gingival and oropharyngeal neoplasia (especially epuli), haemangioendothelioma, skeletal chondrosarcoma, testicular tumours, thyroid tumours and vaginal/vulval neoplasia (Gough, Thomas and O'Neill, 2019); however, no primary references or prevalence estimates could be found to support these possible predispositions.

Neurological conditions

Central vestibular disease: The Boxer has been reported to be at increased risk of this condition, which presents with signs including loss of balance and disorientation (Gough, Thomas and O'Neill, 2018); however, no primary references or prevalence estimates could be found.

Congenital deafness: Congenital sensorineural deafness has been reported in an American paper to occur in the Boxer, and is suspected to be inherited, but no prevalence estimate was provided (Strain, 2004). Dogs with white pigmentation are most frequently affected.

Degenerative myelopathy (DM): DM is a progressive neurodegenerative condition in dogs, with clinical signs usually not manifesting until eight years of age or older. Affected dogs initially show signs of ataxia of the pelvic limbs and a definitive diagnosis can only be by made post mortem. A mutation associated with the condition was first described in 2009; a missense mutation in the superoxide dismutase 1 gene (*SOD1*) on chromosome 31, *SOD1:c.118G>A*, with homozygosity for the A allele being strongly associated with the DM phenotype (Awano et al, 2009). The mutation appears to be autosomal recessive with incomplete penetrance, suggesting the involvement of modifier loci and/or environmental factors, and has been found to be widespread and common in many breeds. When all 33,746 DNA samples which had been submitted to the University of Missouri up to 5th April 2013, the *SOD1:c.118G>A* mutation was reported to have an allele frequency of 72% in the Boxer (Zeng et al, 2014). A DNA test is available for the mutation.

Discospondylitis: Infection of the cartilaginous vertebral endplates of the spine with secondary involvement of the intervertebral disc is termed discospondylitis. A study of 513 dogs with the condition from 12 veterinary teaching hospitals in the USA, and 236,109 dogs without the condition (controls), reported that the Boxer was at increased risk of discospondylitis, with an odds ratio of 3.5 (95% C.I. 1.8 – 6.9; 10 cases, 1,017 controls) compared to mixed-breed dogs (Burkert et al, 2005).

Epilepsy: A birth cohort of 2,629 Boxers in the Netherlands had a prevalence of epilepsy of 2.4% (49 cases and 1,984 non-cases) (Nielen, et al, 2001). In a subsequent study of 655,249 Swedish dogs insured with Agria between 1995 and 2006, the Boxer had the highest incidence rate of epilepsy at 60.3 cases per 10,000 DYAR (95% C.I. 49.3 – 71.3; 115 cases in 19,070 DYAR for the breed) compared to an overall incidence rate of 18 cases per 10,000 DYAR (Heske et al, 2014). The Boxer also appeared to be at increased risk of mortality due to the condition, with a mortality rate of 46.7 deaths per 10,000 DYAR (955 C.I. 35.8 – 57.7; 70 deaths in 14,979 DYAR for the breed) compared to an overall incidence rate of 11 deaths per 10,000 DYAR.

Idiopathic head tremor syndrome: The Boxer was the second most frequently affected breed, representing 13% of cases (37 of 291 dogs), in a multinational survey of veterinary surgeons (Shell et al, 2015).

Sensory neuropathy (progressive axonopathy): A case series reported this condition in the breed, with an autosomal recessive mode of inheritance, more than 30 years ago (Griffiths, 1985). No more recent reports, nor prevalence estimates, could be found in the literature.

Steroid-responsive meningitis-arteritis (SRMA): A study of dogs with the acute form of SRMA presented to Langford Veterinary Services between 1st January 2003 and 31st December 2012 reported that the Boxer was at increased risk of developing this condition, with an odds ratio of 4.60 (95% C.I. 1.20-17.67) compared to dogs of other breeds (Rose et al, 2014). However, this result was based on just four cases and six non-cases in the breed.

Ocular conditions

Corneal ulceration: In a VetCompass study of 104,233 dogs attending 110 first opinion veterinary practices in England, the Boxer had a breed-specific prevalence of 4.98% (69 cases out of 1386 dogs of the breed) compared to an all-breed prevalence of 0.80% (O'Neill et al, 2017). The Boxer had an odds ratio for corneal ulceration of 13.84 (95% C.I. 10.05 – 19.06) compared with dogs of no recognisable breed.

Other ocular conditions: The American College of Veterinary Ophthalmologists (ACVO) consider the Boxer to be predisposed to distichiasis, ectopic cilia, ectropion, macroblepharon, corneal dystrophy, persistent pupillary membranes, cataract and vitreous degeneration (Genetics Committee of the ACVO, 2015). In 2015, 46 dogs of the breed were examined by the ACVO and prevalence data are shown in Table 2 alongside data from previous years.   Overall, 71.7% (33 of 734) of dogs of the breed examined in 2015 had healthy eyes unaffected by any disease conditions. However, it is important to consider that the dogs were from America and this was a small sample size.

Table 2: ACVO examination results for the Boxer, 2000 - 2015

Disease Category/Name	Percentage of Dogs Affected		
	2000-2009 (n=702)	2010-2014 (n=227)	2015 (n=46)
Eyelids			
Entropion	0.1%	0.4%	4.3%
Ectropion	4.3%	2.6%	2.2%
Distichiasis	13.8%	14.1%	19.6%
Cornea			
Corneal dystrophy	8.8%	8.4%	13.0%
Uvea			
Persistent pupillary membranes	0.8%	2.1%	4.3%
Lens			
Cataract, significance unknown	3.0%	0.9%	4.3%
Vitreous			
Vitreous degeneration syneresis	0.7%	1.8%	2.2%

Reproductive conditions

Cryptorchidism: A birth cohort of 2,629 Boxers in the Netherlands had a prevalence of cryptorchidism of 10.7% (80 cases and 667 non-cases in the males), with a heritability estimate of 0.23 (Nielen et al, 2001).

Dystocia: A survey of Boxer breeders in Sweden between 1994 and 1997 included data from 253 whelpings, constituting 56.5% of all Boxer litters registered with the Swedish Kennel Club during this time. Dystocia occurred in 32.0% of bitches and in 27.7% of whelpings (Linde Forsberg and Persson, 2007). Subsequently, in a recent VetCompass study of 50 first-opinion emergency-care veterinary practices, the Boxer had a dystocia prevalence of 3.3% based on 12 cases and 355 non-cases, giving an odds ratio of 2.5 (95% C.I. 1.3 to 4.8) compared to dogs of no recognisable breed (O'Neill et al, 2017b).

Pyometra: The prevalence of pyometra in different breeds was assessed through patient admittance to RSPCA animal hospitals between 2006 and 2011 (Gibson et al., 2013). The Boxer was the tenth most frequent breed affected, with a prevalence of 2.7% compared to an all-breed prevalence of 2.2%. Numbers of affected and unaffected bitches of the breed were not reported.

Vaginal hyperplasia/ vaginal prolapse: The Boxer was reported to be the breed most frequently reported to be affected with vaginal hyperplasia (Post et al, 1991), but no prevalence estimates were found in the literature.

Respiratory conditions

No scientific references to conditions in this category could be found for the breed.

Urological conditions

Renal disease: Juvenile nephropathy has been reported in the Boxer, with a case series of 37 dogs of breed diagnosed with the condition in the UK being published eleven years ago (Chandler et al, 2007). The authors were unable to estimate the prevalence of the condition.

A recent study of Swedish insurance claim records from 1995-2006 reported an overall incidence of kidney disease of 15.8 (95% C.I. 15.3-16.2) cases per 10,000 dog years at risk (DYAR) for a population of 665,245 dogs; for Boxers the kidney disease incidence was 36 (95% C.I. 27 - 44) cases per 10,000 DYAR, based on 69 cases in 19,190 DYAR, suggesting that the breed is at increased risk of kidney disease compared with dogs of other breeds. Considering 548,346 life insurance policies, the total kidney-related mortality was 9.7 (95% C.I. 9.3-10.2) deaths per 10,000 DYAR; for Boxers the kidney-related mortality was 23 (95% C.I. 16 - 31) per 10,000 DYAR, based on 35 deaths in 14,914 DYAR, suggesting the breed is also at increased risk of mortality due to kidney disease compared to dogs of other breeds (Pelander et al, 2015).

Urethral sphincter mechanism incompetence: Boxer bitches have been reported to be at increased risk of this form of urinary incontinence (Gough, Thomas and O'Neill, 2018). A VetCompass study of 100,397 bitches attending 119 veterinary clinics between 1st September 2009 and 7th July 2013 reported that the Boxer had a prevalence of 7.3% (95% C.I. 5.9 – 8.8) for urinary incontinence, compared to an all-breed prevalence of 3.14% (95% C.I. 2.97 - 3.33). The Boxer had an odds ratio for urinary incontinence of 2.31 (95% C.I. 1.50 – 3.55; 24 cases and 1,272 non-cases) compared with dogs of no recognisable breed (O'Neill et al, 2017c).

Purebred/pedigree dog health survey results

2004 Morbidity results: Health information was collected for 249 live Boxers of which 144 (58%) were healthy and 105 (42%) had at least one reported health condition. The top categories of diagnosis were reproductive (13.3%, 29 of 218 reported conditions), cardiac (11.9%, 26 of 218 reported conditions), dermatologic (10.6%, 23 of 218 reported conditions) and ocular (9.2%, 20 of 218 reported conditions). The most frequently reported specific conditions were kennel cough (7.2% prevalence, 18 cases), hypothyroidism (6.4% prevalence, 16 cases), corneal ulcer (6.0%, 15 cases) and false pregnancy (5.4% prevalence, 8 cases in the 147 female Boxers in the dataset).

2004 Mortality results: A total of 130 deaths were reported for the breed. The median age at death for Boxers was 10 years and 3 months (min = 4 months, max = 15 years and 3 months). The most frequently reported causes of death by organ system or category were cancer (38.5%, 50 of 130 deaths), old age (21.5%, 28 deaths), cardiac (6.9%, 9 deaths) and gastrointestinal (6.9%, 9 deaths).   Apart from cancer and old age, the most frequently reported specific cause of death was GDV (5.4%, 7 deaths).

2014 Morbidity results: Health information was collected for 724 live Boxers of which 333 (46.0%) had no reported conditions and 391 (54.0%) were reported to be affected by at least one condition. The most frequently reported specific conditions were skin (cutaneous) cyst (5.4% prevalence, 49 cases), skin cancer/tumour (5.3%, 48cases), hypersensitivity (allergic) skin disorder (4.6%, 42 cases), lipoma (4.3%, 39 cases) and skin lump (4.1%, 37 cases). Further analysis of the morbidity results suggested that the Boxer was at increased risk of alopecia/baldness, arthritis, DCM, colitis, corneal ulcer, cruciate disease, cruciate ligament injury, cryptorchidism, ear lump, epulis, food allergy, heart (cardiac) murmur, hypersensitivity (allergic) skin disorder, hypothyroidism, irregular heartbeat, kennel cough, oral (mouth) lump, pancreatitis, skin (cutaneous) cyst, skin cancer/tumour, skin lump, spondylosis, steroid responsive meningitis/arteritis, unspecified tumour/cancer and urinary incontinence compared to the average risk for dogs of all breeds (Wiles et al, 2017).

2014 Mortality results: A total of 172 deaths were reported for the breed. The median age at death for Boxers was 9 years (min = 0 year, max = 14 years). The most frequently reported causes of death were brain tumour (15.1%, 26 deaths), cancer - unspecified (12.2%, 21 deaths), cardiac (heart) failure (7.0%, 12 deaths) and lymphoma (6.4%, 11 deaths).

VetCompass results

Whilst a breed-specific VetCompass study has not yet been completed, some condition-specific studies have yielded findings relevant to the Boxer. These results are summarised under the respective conditions above.

Insurance data

UK Agria data

Insurance data were available for Boxers insured with Agria UK. 'Exposures' are equivalent to one full policy year; in 2016 there were 2,737 free exposures, 1,163 full exposures and 2,078 claims, in 2017 these figures were 2,667, 1,086 and 1,910 respectively. Full policies are available to dogs of any age. Free policies are available to breeders of Kennel Club registered puppies and cover starts from the time the puppy is collected by the new owner; cover under free policies lasts for five weeks from this time. It is possible that one dog could have more than one settlement for a condition within the 12-month period shown. The top 10 conditions by number of settlements, for authorised claims where treatments started between 1st October 2016 and 31st September 2017, are shown in Table 3 below.

Table 3: Top 10 conditions and number of settlements for each condition between 1st October 2016 and 31st September 2017 for Boxers insured with Agria UK

Condition	Number of settlements
Skin allergy[$]	134
Atopy[$]	96
Corneal ulcer (non-traumatic)	83
Osteoarthritis/degenerative joint disease	80
Cruciate ligament disorders	59
Hypothyroidism	58
Pruritus	56
Cardiomyopathy	48
Chronic pancreatitis	38
Disease of the kidneys/ureter	38

[$] N.B. - Allergy is any exaggerated immune response to a foreign antigen regardless of mechanism. A dog can be allergic without being atopic. Atopy is a genetic predisposition to an exaggerated Immunoglobulin E (IgE)-mediated immune response to allergens in the environment. The treatment of atopy will be different to the treatment of non-atopic allergy.

Swedish morbidity and mortality insurance data were also available from Agria for the Boxer. Reported rates are based on dog-years-at-risk (DYAR) which take into account the actual time each dog was insured during the period (2006-2011). The number of DYAR for the Boxer in Sweden during this period was between 500 and 1,000.

Swedish Agria insurance morbidity data

The most common specific causes of veterinary care episodes (VCEs) for Agria-insured Boxers in Sweden between 2006 and 2011 are shown in Figure 2. The top specific causes of VCEs were vomiting/diarrhoea/gastroenteritis, skin tumour, epulis, otitis, pain/locomotor signs and dermatitis/pyoderma/folliculitis.
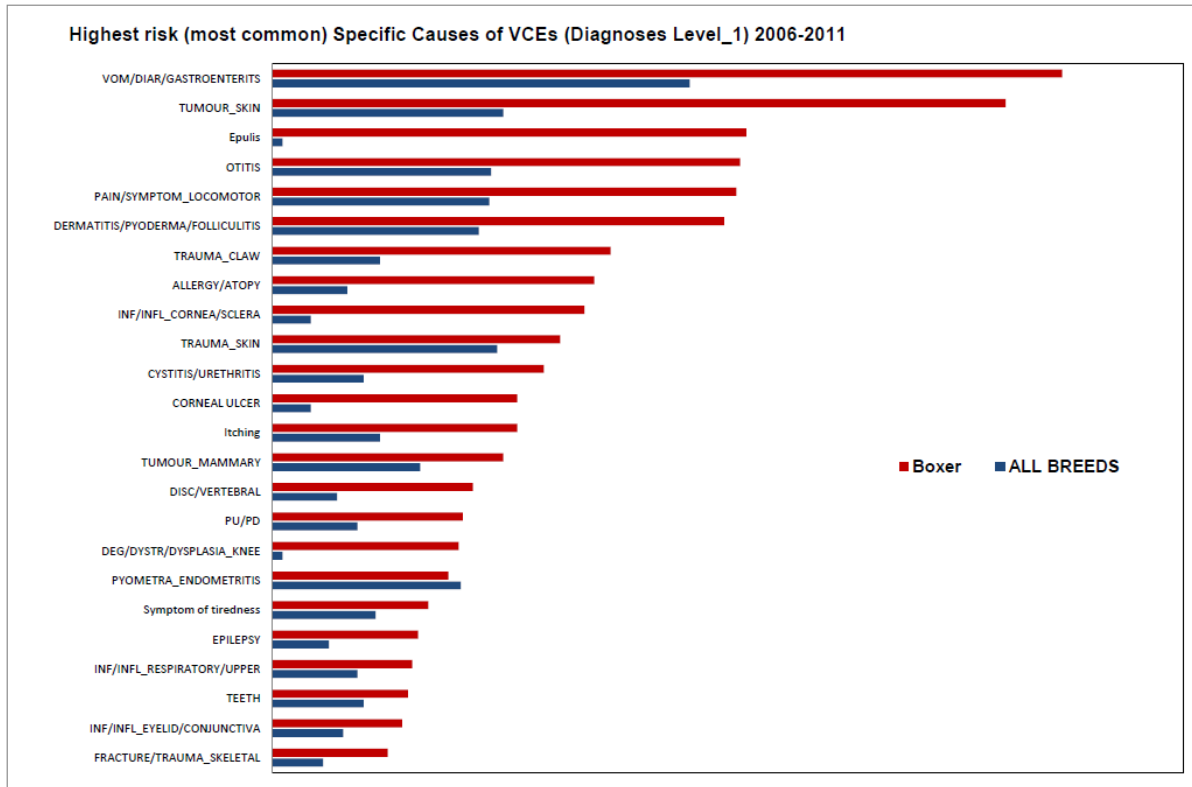
Highest risk (most common) Specific Causes of VCEs (Diagnoses Level_1) 2006-2011

(Legend: ■ Boxer ■ ALL BREEDS)

Categories (top to bottom): VOM/DIAR/GASTROENTERITS, TUMOUR_SKIN, Epulis, OTITIS, PAIN/SYMPTOM_LOCOMOTOR, DERMATITIS/PYODERMA/FOLLICULITIS, TRAUMA_CLAW, ALLERGY/ATOPY, INF/INFL_CORNEA/SCLERA, TRAUMA_SKIN, CYSTITIS/URETHRITIS, CORNEAL ULCER, Itching, TUMOUR_MAMMARY, DISC/VERTEBRAL, PU/PD, DEG/DYSTR/DYSPLASIA_KNEE, PYOMETRA_ENDOMETRITIS, Symptom of tiredness, EPILEPSY, INF/INFL_RESPIRATORY/UPPER, TEETH, INF/INFL_EYELID/CONJUNCTIVA, FRACTURE/TRAUMA_SKELETAL

Figure 2: The most common specific causes of VCEs for the Boxer compared to all breeds in Sweden between 2006 and 2011, from Swedish Agria insurance data.

When relative risk of specific causes of VCEs was compared for the Boxer to all breeds, a few interesting findings were reported. The specific causes of VCEs ordered by relative risk are shown in Figure 3. In this analysis, the top specific causes of VCEs ordered by relative risk were epulis, heart vessel defect, degeneration/dystrophy/dysplasia of the knee, degeneration or dystrophy of the upper urinary tract and OCD.

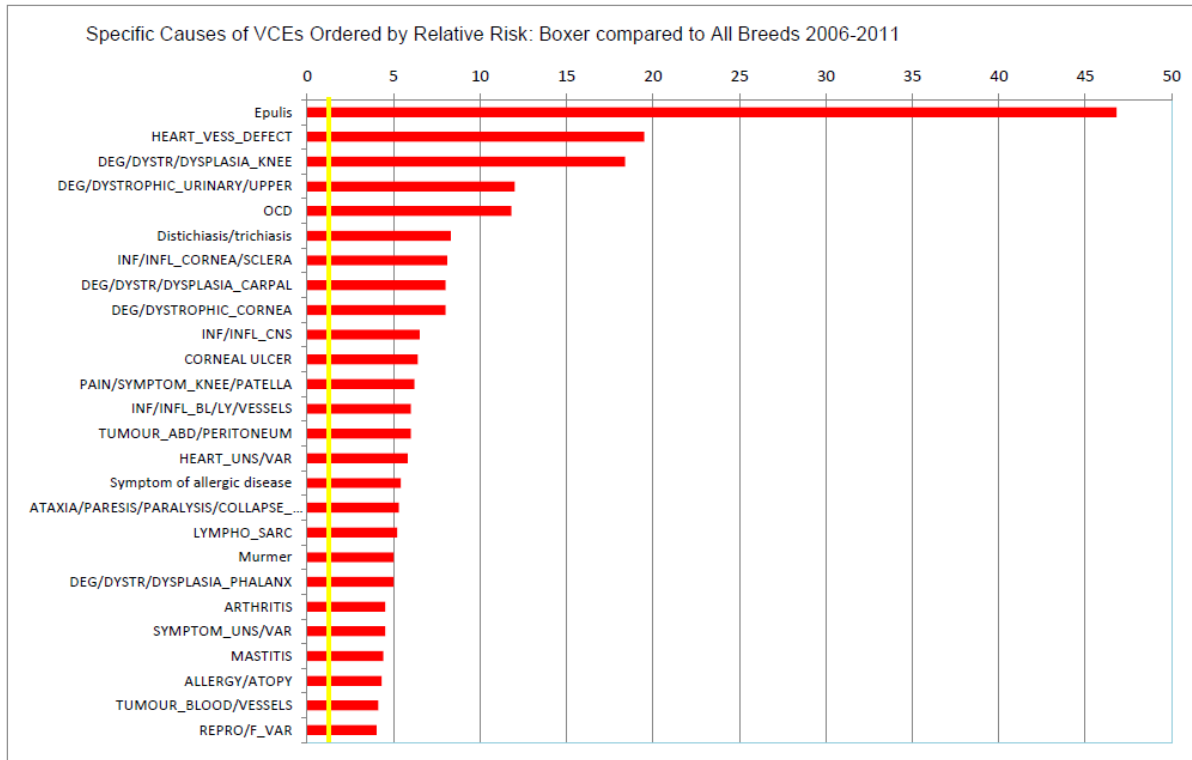Specific Causes of VCEs Ordered by Relative Risk: Boxer compared to All Breeds 2006-2011

Figure 3: The specific causes of VCEs for the Boxer ordered by relative risk compared to all breeds in Sweden between 2006 and 2011, from Swedish Agria insurance data. The yellow line indicates the baseline risk for all breeds.

Swedish Agria insurance mortality data

Median age at death for the Boxer from Swedish Agria insurance data was 6.4 years for males and 6.9 years for females. Agria have a maximum age to which a dog can be life insured, which varies somewhat across breeds and years. Many owners also choose not to insure their dogs after a certain age, as the cost of the premiums become more expensive. For these reasons the median age at death from the Swedish Agria insurance data is artificially depressed for all breeds compared to that reported from surveys or other sources. The most common specific causes of death or euthanasia for Agria-insured Boxers in Sweden between 2006 and 2011 are shown in Figure 4.   The most common specific causes of death were 'dead/euthanized', lymphoma/lymphosarcoma, epilepsy, disc/vertebral and vomiting/diarrhoea/gastroenteritis.
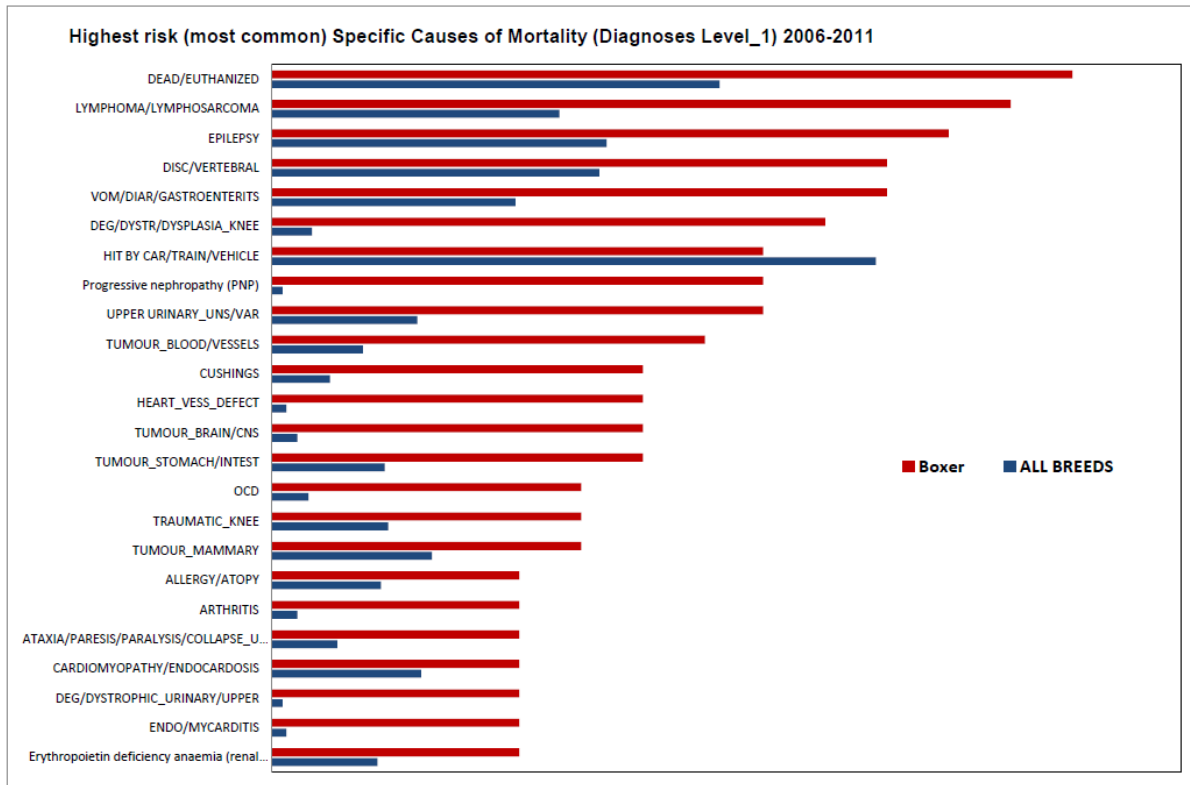
Figure 4: The most common specific causes of death for the Boxer compared to all breeds in Sweden between 2006 and 2011, from Swedish Agria insurance data.

Again, when relative risk of specific causes of death was compared for the Boxer to all breeds, a few interesting findings were reported. The specific causes of VCEs ordered by relative risk are shown in Figure 5. In this analysis, the top specific causes of VCEs ordered by relative risk were progressive nephropathy, heart vessel defect, degeneration or dystrophy of the upper urinary tract, endocarditis/myocarditis and tumour of the brain or central nervous system.

Specific Causes of Mortality Ordered by Relative Risk: Boxer compared to All Breeds 2006-2011
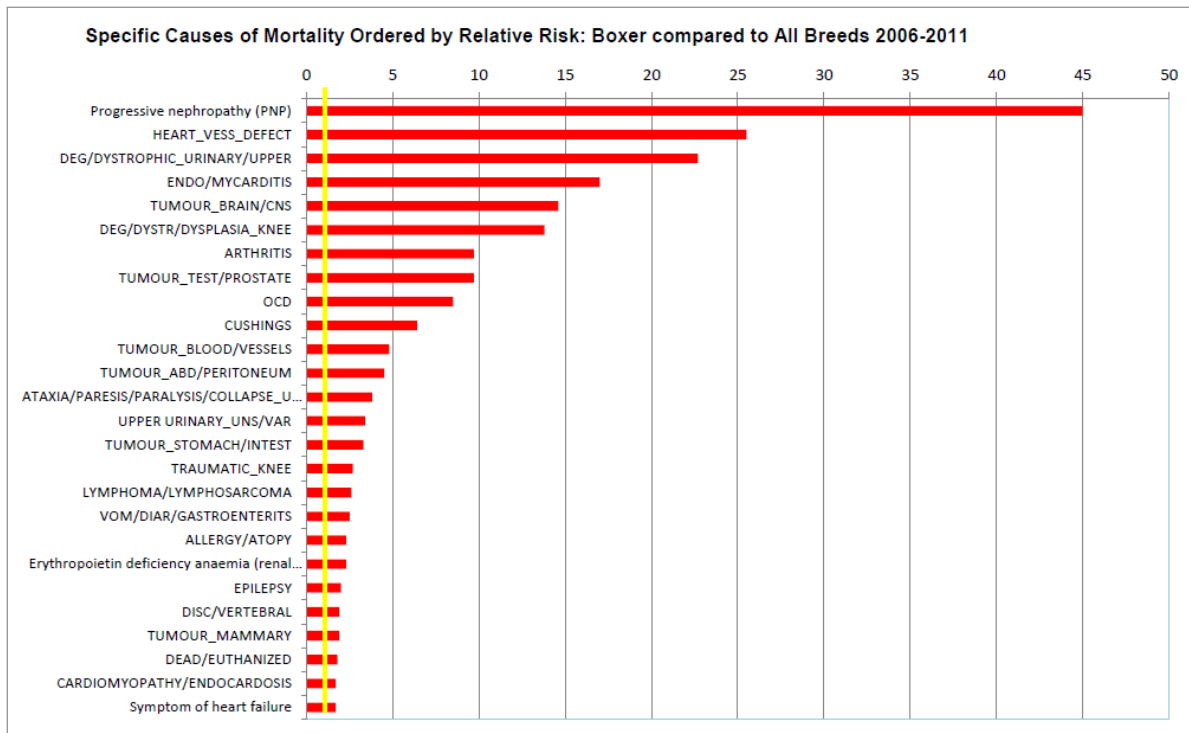
Figure 5: The specific causes of death for the Boxer ordered by relative risk compared to all breeds in Sweden between 2006 and 2011, from Swedish Agria insurance data. The yellow line indicates the baseline risk for all breeds.

Breed-specific health surveys

No breed-specific health survey results were currently available.

Visual health check reports/clinical reports/judges' health monitoring

These are not mandatory for this breed, as they are not on Breed Watch category 2 or 3, and no optional forms have been received.

Breed Club health activities

The breed has an active Breed Health Coordinator and a dedicated health page on the Boxer Breed Council's website: http://www.boxerbreedcouncil.co.uk/health.html .

The Boxer Breed Council requests that all cases of aortic stenosis or ARVC are reported to the health committee; this can be done via the website.

The Breed Health Coordinators Annual Health Report 2016 yielded the following response to 'please list and rank the three health and welfare conditions that the breed considers to be currently the most important to deal with in your breed': 1 cancer, 2 juvenile kidney disease and 3 aortic stenosis. In terms of what the breed has done in the last year to help address these listed health and welfare concerns the following responses were given: 1 Collected information; 2 Set Animal Health Trust (AHT) trial to find gene/genes location; and 3 Heart testing for aortic stenosis and reporting of cardiomyopathy.

In the 2017 Annual Health Report the BHC listed the three health and welfare conditions as 1 cancer, 2 heart conditions (aortic stenosis and cardiomyopathy) and 3 juvenile kidney disease. New actions listed were collecting data from cases of JKD and sending DNA swabs to AHT.

DNA test results

DNA tests are available for the Boxer for arrhythmogenic right ventricular cardiomyopathy (ARVC), haemophilia A, Factor VII deficiency and for a mutation which increases risk of degenerative myelopathy (DM). However, results of these tests are not currently recorded by the Kennel Club. DNA test results are only recorded for Official Kennel Club DNA Testing Schemes which involve collaboration between the Kennel Club, the breed clubs and the DNA testing facilities.

Canine Health Scheme results and EBVs

Under the Kennel Club's Assured Breed Scheme (ABS), participation in the British Veterinary Association (BVA)/Kennel Club (KC) Hip Dysplasia Scheme is strongly recommended. All the BVA/KC Health Schemes are open to dogs of any breed, and the results for Boxers which have been presented for assessment under the BVA/KC Elbow Dysplasia Scheme and BVA/KC/International Sheep Dog Society (ISDS) Eye Scheme are also shown below.

HIPS

Some 172 Boxers were hip scored between 1st January 2001 and 31st December 2016. Hip scores for the breed ranged from 0-75 and the 15 year and 5 year median were the same at 12.

Hip score categories received by Boxers which participated in the BVA/KC Hip Dysplasia Scheme between 1990 and 2016 are shown in five year blocks (which can be considered to approximate to a generation) in Figure 6 below.   The categories correspond to those assigned under the FCI (Europe)'s hip grading scheme; for one hip, a 'normal' hip scores 0-3, borderline scores 4-8, mild HD scores 9-18, moderate HD scores 19-30 and severe HD represents a score greater than 30. Further information on these categories can be found here: https://www.bva.co.uk/uploadedFiles/Content/Canine_Health_Schemes/chs-comparison-of-hd-schemes.pdf . The number of dogs being scored, and hence the number in each five year block, is low and there is no evidence of progress being made in terms of hip score.
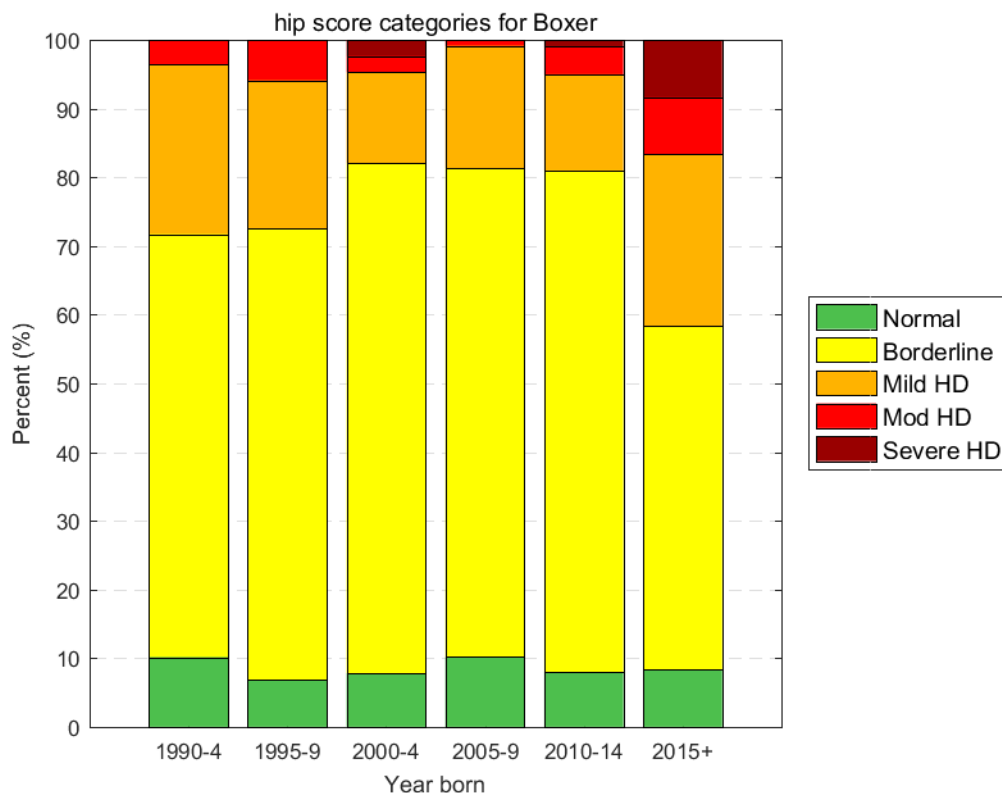

Figure 6 – Hip score categories for Boxers which participated in the BVA/KC Hip Dysplasia Scheme between 1990 and 2016, in 5-year blocks.

ELBOWS

Just eight Boxers had been elbow scored up to 31st December 2016; scores received are shown in Table 4. Only one dog of the breed was diagnosed with a mild degree of elbow dysplasia.

Table 4: Elbow scores and number of dogs receiving those scores since 1998 for the eight Boxers which have participated in the BVA/KC Elbow Dysplasia Scheme.

Elbow score	Number of dogs	Proportion
0	7	87.5%
1	1	12.5%
2	0	0.0%
3	0	0.0%

EYES

The Boxer is not currently on Schedule A or B of the BVA/KC/ ISDS Eye Scheme for any condition. Schedule A lists the known inherited eye conditions in the breeds where there is enough scientific information to show that the condition is inherited in the breed, often including the actual mode of inheritance and in some cases even a DNA test. Schedule B lists those breeds in which the conditions are, at this stage, only suspected of being inherited. However, the BVA also record the results of dogs of other breeds which have participated in the scheme. The results of Eye Scheme examinations of the breed which have taken place since 2012 are shown in Table 5.

Table 5: Reports on Boxers which have participated in the BVA/KC/ISDS Eye Scheme since 2012

Year	Number seen	Comments
2012	10 adults 0 litters	5 – distichiasis 5 – ectropion 2 – entropion 1 – corneal lipid deposition 1 – abnormal pigment deposition
2013	12 adults 0 litters	7 – distichiasis 4 – ectropion 4 – entropion 3 – corneal lipid deposition 3 – abnormal pigment deposition 1 – iris cyst
2014	10 adults 0 litters	5 – distichiasis 5 – ectropion 3 – corneal lipid deposition 1 – persistent hyperplastic primary vitreous (PHPV)
2015	9 adults 0 litters	4 – distichiasis 2 – entropion 1 – ectropion 1 – multifocal retinal dysplasia (MRD)
2016	4 adults 0 litters	2 – distichiasis 1 – corneal lipid deposition

Breed Club Recommendations

Breed Club heart testing for aortic stenosis is strongly recommended for Boxers which are to be used for breeding.

Reported caesarean sections

When breeders register a litter of puppies, they are asked to indicate whether the litter was delivered (in whole or in part) by caesarean section. In addition, veterinary surgeons are asked to report caesarean sections they perform on Kennel Club registered bitches.   The consent of the Kennel Club registered dog owner releases the veterinary surgeon from the professional obligation to maintain confidentiality (vide the Kennel Club General Code of Ethics (2)).   There are some caveats to the associated data; it is doubtful that all caesarean sections are reported, so the number reported each year may not represent the true proportion of caesarean sections undertaken in each breed. In addition, these data do not indicate whether the caesarean sections were emergency or elective. The number of litters registered per year for the breed and the number and percentage of reported caesarean sections in the breed for the past 10 years are shown in Table 6.

Table 6: Number and percentage of litters of Boxers registered per year and number of caesarean sections reported per year, 2007 to 2017.

Year	Number of Litters Registered	Number of C-sections	Percentage of C-sections
2007	1453	0	0.00%
2008	1316	1	0.08%
2009	1108	2	0.18%
2010	971	7	0.72%
2011	950	15	1.58%
2012	817	86	10.53%
2013	679	68	10.01%
2014	708	79	11.16%
2015	606	71	11.72%
2016	608	81	13.32%
2017	573	88	15.36%

Genetic diversity measures

The effective population size is the number of breeding animals in an idealised, hypothetical population that would be expected to show the same rate of loss of genetic diversity (rate of inbreeding) as the population in question; it can be thought of as the size of the 'gene pool' of the breed. In the population analysis undertaken by the Kennel Club in 2015, the estimated effective population size was reported as 80.9 (estimated using the rate of inbreeding over the period 1980-2014). An effective population size of less than 100 (inbreeding rate of 0.50% per generation) leads to a dramatic increase in the rate of loss of genetic diversity in a breed/population (Food & Agriculture Organisation of the United Nations, "Monitoring animal genetic resources and criteria for prioritization of breeds", 1992).

Annual mean observed inbreeding coefficient (showing loss of genetic diversity) and mean expected inbreeding coefficient (from simulated 'random mating') over the period 1980-2014 are shown in Figure 7. As with most breeds, the rate of inbreeding was at its highest in this breed in the 1980s. This represents a 'genetic bottleneck', with genetic variation lost from the population. However, since then the rate of inbreeding has slowed and even declined slightly, implying maintenance and even some replenishment of genetic diversity (possibly through the use of imported animals). It should be noted that, while animals imported from overseas may appear completely unrelated, this is not always the case. Often the pedigree available to the Kennel Club is limited in the number of generations, hampering the ability to detect true, albeit distant, relationships. For full interpretation see Lewis et al, 2015 https://cgejournal.biomedcentral.com/articles/10.1186/s40575-015-0027-4.
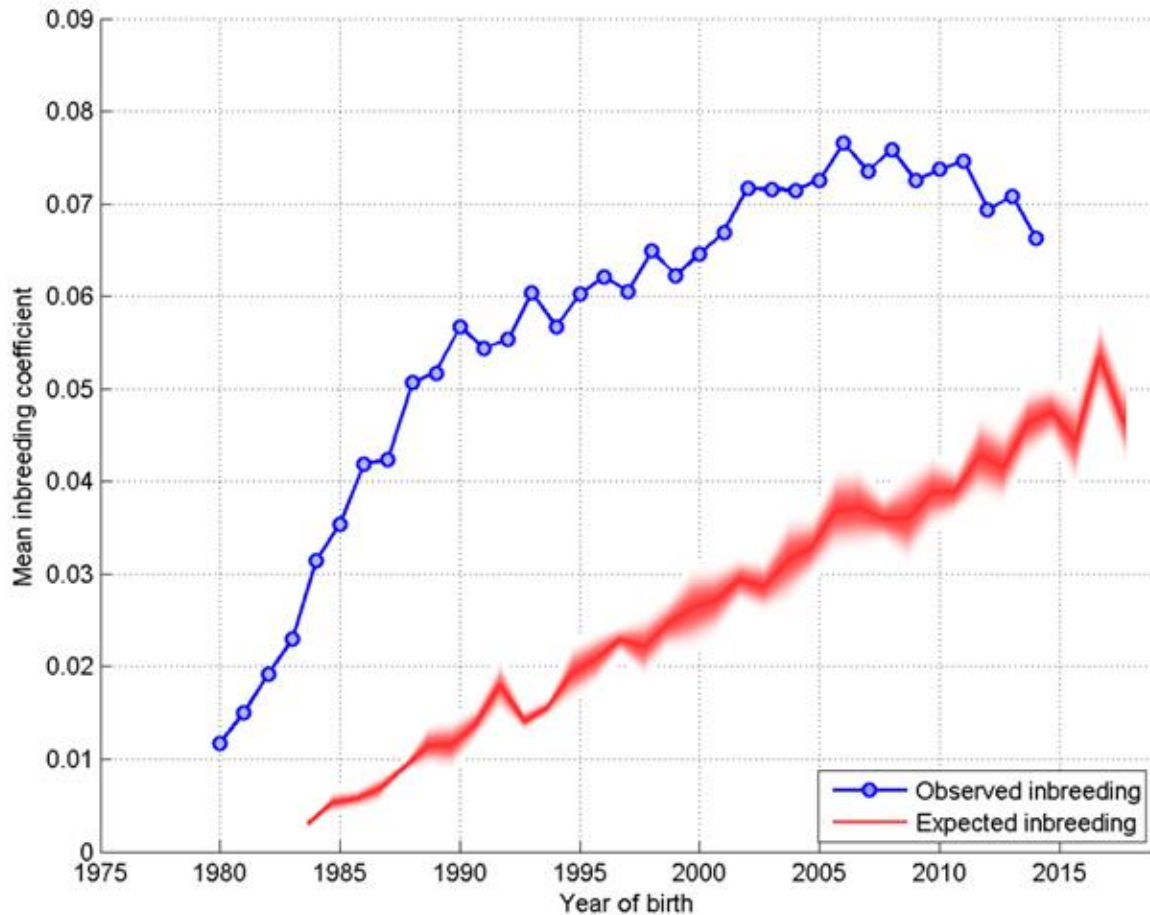
Figure 7: Annual mean observed and expected inbreeding coefficients. [The blurring around the expected inbreeding line indicates an approximate standard deviation around the estimate, in breeds with more than 2000 individuals born in a given year.]

The current annual breed average inbreeding coefficient is 6.3%. This value is calculated each June and represents the average inbreeding coefficient of all Boxers registered between January and December of the previous year i.e. in 2016.

Below is a histogram ('tally' distribution) of number of progeny per sire and dam over each of seven five-year blocks (Figure 8). A longer 'tail' on the distribution of progeny per sire is indicative of 'popular sires' (few sires with a very large number of offspring, known to be a major contributor to a high rate of inbreeding). There appears to be extensive use of popular dogs as sires in this breed (the 'tail' of the blue distribution in Figure 8).
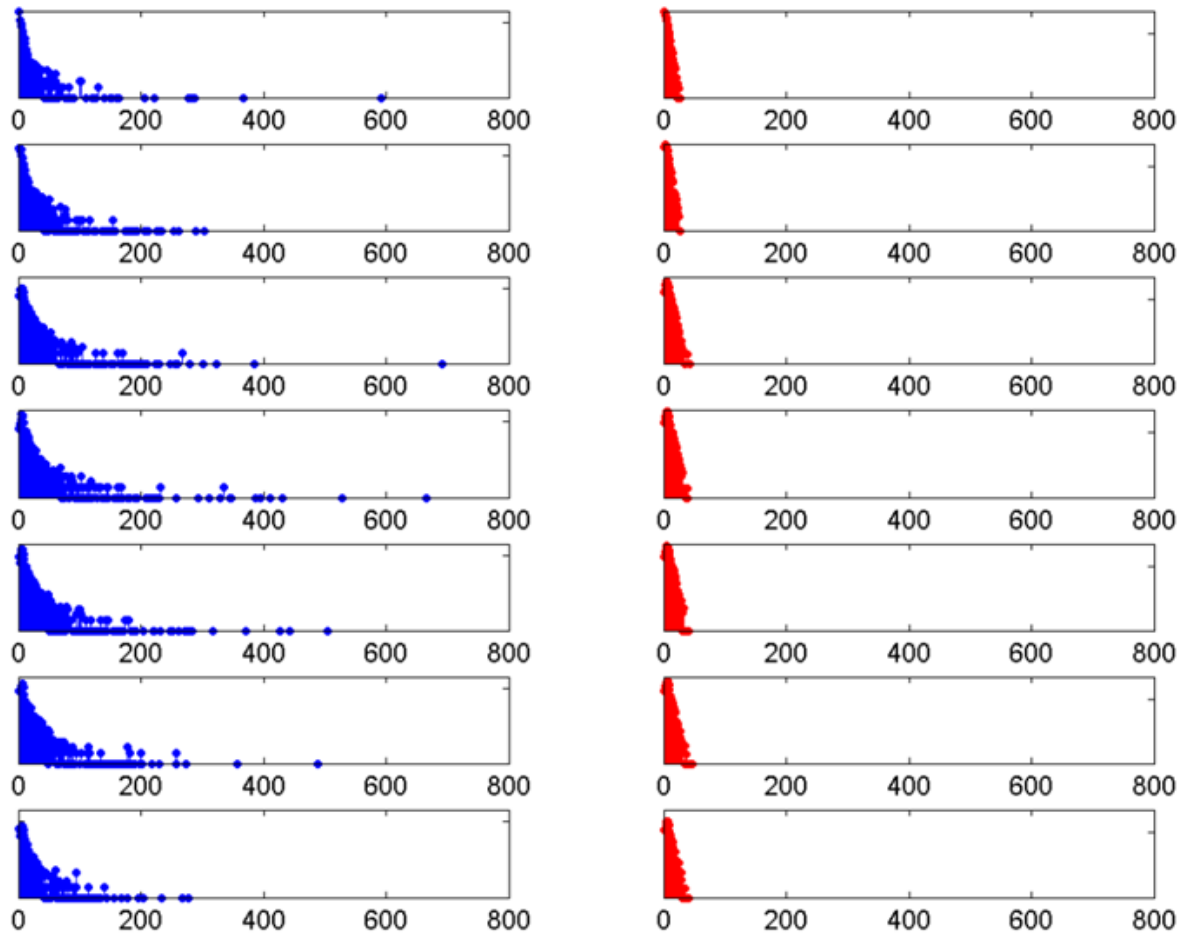
Figure 8: Distribution of progeny per sire (blue) and per dam (red) over 5-year blocks (1980-4 top, 2010-14 bottom). Vertical axis is a logarithmic scale.

Current research projects

There is research into the genetics of juvenile kidney disease ongoing at the AHT, in collaboration with researchers in Sweden.

Professor Amos at the University of Cambridge and Professor Syme at the Royal Veterinary College are also undertaking research into the genetics of juvenile kidney disease in the breed.

SECTION 2: PRIORITIES

A meeting was held with Boxer health representatives on 18th June 2018 to discuss Section 1 of the BHCP and agree the priority issues for the health of the breed.

There were five cardiovascular conditions noted, of which subaortic stenosis (SAS) was thought to be a particular concern in the UK population. Arrhythmogenic right ventricular cardiomyopathy (ARVC) is being monitored, particularly from lines imported from the US, where it appears to be a larger concern; however, it appears to be in relatively small numbers. There is a breed club recommendation for heart testing for subaortic stenosis and the breed clubs do encourage this; the breed appear to be active and engaged with the issue.

The dermatological category included five conditions in the literature review, of which four had been seen in the breed in the UK. Atopy had anecdotally been on the increase in the breed. Calcinosis circumscripta has been seen primarily in dogs under treatment for Cushing's disease; however, there have been few cases to date. Canine follicular dysplasia appears more common now and is often misdiagnosed as a thyroid issue. Demodicosis again appears to be more common recently.

Endocrine conditions listed in the literature review were Cushing's disease and hypothyroidism. The group discussed both conditions suggesting that they appeared to be more common, with the latter anecdotally seeming linked to neutering. It was also noted that treatment of low thyroid hormone levels seems to prevent recurrence of corneal ulcers. The group also noted Addison's thought to be seen in the breed, however, no papers to support this at present.

Gastrointestinal conditions found in the literature review were cleft palate, gastric dilatation/ volvulus syndrome (GDV/bloat), histiocytic ulcerative colitis, inflammatory bowel disease (IBD) and pancreatitis. Of these the group considered GDV and histiocytic ulcerative colitis to be particular concerns within the Boxer population, with the latter thought to be on the rise. It was suggested that IBD may appear as a misdiagnosis, or perhaps a mild form, of histiocytic ulcerative colitis.

Some haematological conditions noted had been seen, but there was no evidence that these are occurring in a significant number of cases anecdotally amongst the breed.

Considering the ten musculoskeletal conditions listed (three being different forms of osteochondrosis (OCD)), two were seen in the UK most frequently (cranial cruciate ligament rupture and spondylosis deformans). Whilst metaphyseal osteopathy used to be an issue in the breed, it is now not seen commonly and the OCDs are also not common in the breed, although it was noted that the shoulder is the most frequently affected joint in the breed. Panosteitis is listed across many large breeds and considered to be self-limiting usually.

The BVA/KC Hip Dysplasia scheme is currently a recommendation under the Assured Breeder Scheme (ABS) and from 2001 to 2016 just 172 Boxers have been through the scheme; due to the low numbers tested there is no evidence of progress with regards to hip score, however it was agreed there are other concerns that should be considered to be more of a priority for the breed currently. When reviewing the elbow scores, 8 Boxers had been scored through the BVA/KC scheme, 7 of which had a score of 0 and a dog had a score of 1.

The neoplastic or cancer category had seven specific conditions listed. Three of these were particular concerns for the breed: lymphoma, mammary tumours and mast cell tumours, with epuli also a concern. It is generally accepted that epuli are particularly common in the Boxer, and the survey and insurance data support this, but no papers relating to the condition in the breed were found in the literature review.

Neurological conditions of interest were congenital deafness, epilepsy and sensory neuropathy. All have been issues in the breed, and were thought to have reduced prevalence in recent years, with sensory neuropathy thought to have been selectively bred out. The ocular condition listed was corneal ulcers, which as discussed earlier are thought to be linked to low thyroid hormone levels, and appear to improve with thyroid treatment. Discussion was held regarding the American College of Veterinary Ophthalmologists (ACVO) and BVA/KC/ISDS Eye scheme results. Adnexal conditions were thought to be more of a concern for the UK population than the other conditions listed by the ACVO, supported through the BVA/KC/ISDS Eye scheme results.

There were four reproductive conditions seen in the literature review. Cryptorchidism and dystocia had anecdotally been seen in the UK population.

Although no respiratory papers found, there was discussion over research in Sweden which was thought to mention Boxers in relation to Brachycephalic Obstructive Airway Syndrome (BOAS), however this was not thought to be a significant concern for the breed currently. Renal conditions were juvenile kidney disease (JKD), and urethral sphincter mechanism incompetence, both known in the breed, the latter in spayed bitches. It was surprising not to find more papers relating to JKD in the breed, but it was thought that some may be in preparation.

The 2004 and 2014 Purebred and Pedigree Breed Health Survey results were reviewed, with the results supporting the concerns discussed, with cancers, heart conditions, skin conditions and corneal ulcers mentioned. It was noted that there is no breed specific VetCompass study for the Boxer yet, and it is hoped that this will become available in due course.

Genetic diversity measures were discussed, the breed has an estimated effective population size of 80.9, which is below the threshold at which there is concern. The use of popular sires in the 80's and 90's correlates with this and it is positive to see that there are now fewer popular sires used. It is hoped that the population analyses will be repeated in 2020. With the full report the effective population size is seen in 5 year blocks, giving a more positive picture for recent years, as the graph plateaus.

The group agreed from the information provided and their own experience that heart conditions (particularly aortic stenosis and ARVC), cancers, JKD and skin conditions were the priorities for the Boxer.

SECTION 3: ACTION PLAN

- The Kennel Club and Boxer breed clubs to monitor research from the AHT, the University of Cambridge and Sweden into JKD.

- The breed clubs to continue to encourage participation in breed club heart testing.

- The Kennel Club and the breed clubs to approach the Veterinary Cardiovascular Society with regards to producing heart scheme evidence.

- The Kennel Club to monitor the AHT's research into cancers.

- The Kennel Club to monitor the University of Nottingham research into atopy.

- The Kennel Club to assist with a breed health survey.

- The Kennel Club to enquire about the possibility of a Boxer VetCompass study.

- The Kennel Club will review progress with the Boxer health representatives in June 2019.

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