



Breed Health and Conservation Plan

Bulldog Evidence Base

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INTRODUCTION

The Kennel Club launched a 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 complete 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 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 Co-ordinator and breed health committee or representatives if applicable. Priorities are agreed based on this data and incorporated into a list of actions between the Kennel Club and the breed to tackle these health concerns. These actions are then monitored and reviewed on a regular basis.

DEMOGRAPHICS

The numbers of Bulldogs registered by year of birth between 1990 and 2019 are shown in Figure 1. The trend of registrations over year of birth (1980-2019) was +81.17 per year (with a 95% confidence interval of +69.21 to +93.14), reflecting the increase seen in the breed's popularity.

[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.]

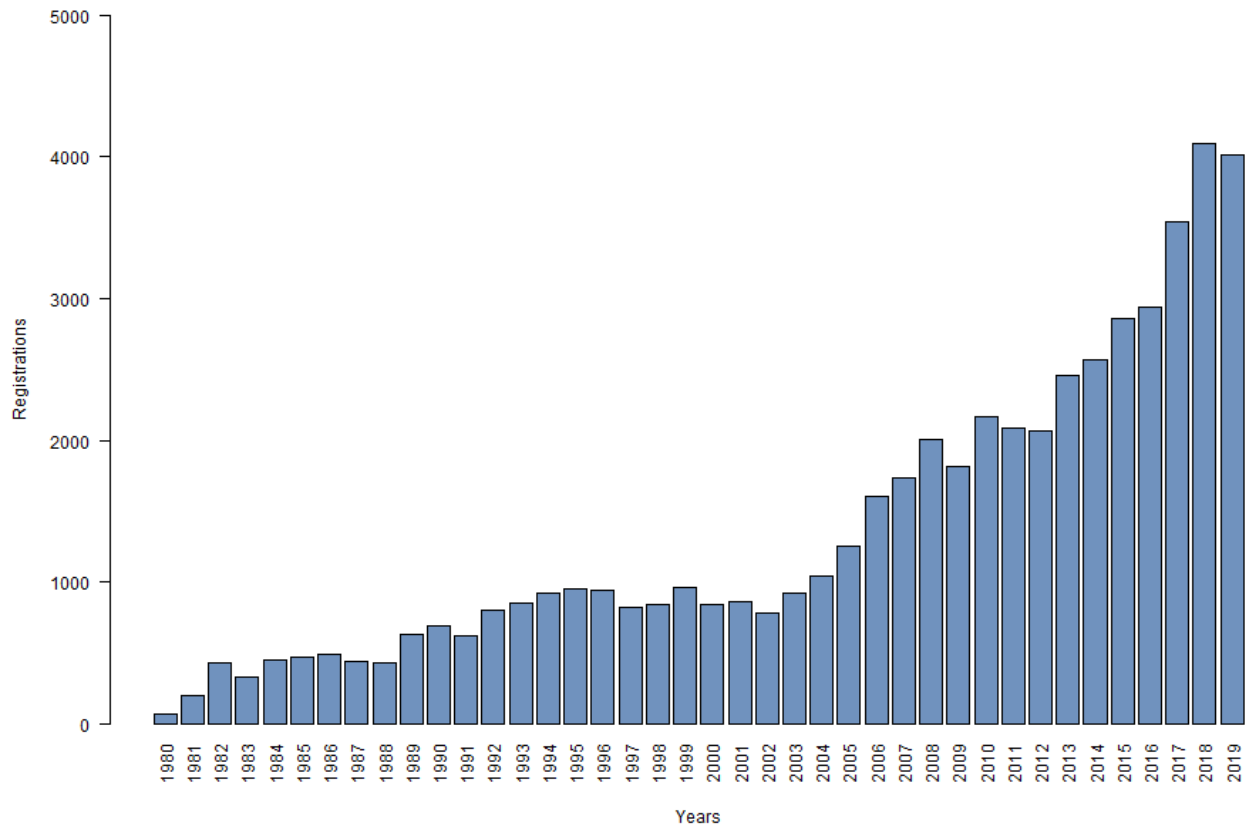


Figure 1: Number of registrations of Bulldog per year of birth, 1990 - 2019

BREED HEALTH CO-ORDINATOR ANNUAL HEALTH REPORT

Breed Health Co-ordinators (BHCs) are volunteers nominated by their breed to act as a vital conduit between the Kennel Club and the breed clubs with all matters relating to health.

The health concerns noted in the Breed Health Coordinators Annual Health Report 2018 for the question '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. BOAS
2. Cherry eye
3. Heart conditions

In terms of what the breed has done in the last year to help tackle these listed health and welfare concerns, the breed has continued to work with the University of Cambridge with regard to the BOAS scheme, continued to monitor and collect information, with advisory information for breeders, and introduced compulsory heart testing under the Gold level of the Bulldog Health Scheme.

The 2019 BHC report received the following for the top three health and welfare concerns:

1. BOAS
2. Eye problems
3. Skin conditions

Actions for 2019 included co-operating and assisting in the launch of the University of Cambridge/ KC Respiratory Function Grading (RFG) Scheme, and encouraging BOAS testing at shows and health days, arranging British Veterinary Association/ European College of Veterinary Ophthalmologist (ECVO) testing at shows and health days, and collecting data on the bronze level of the health scheme.

BREED CLUB HEALTH ACTIVITIES

The breed has a Breed Council, a health sub-committee of the Breed Council and an active Breed Health Coordinator.

A Bulldog health assessment scheme has been running for more than four years, but four years ago the scheme was revised to include Breed Watch points of concern.

The scheme is only open to Kennel Club registered dogs and all dogs must have a microchip. A list of participating vets is provided on the Bulldog Breed Council website, where an agreed fee of £30-35 for the consultation involving the assessment by these vets. As there is a list of 'approved' vets, these are often not the owner's vet.

To order a health assessment form (which comes in triplicate, one for the owner, one for the vet and one to be sent to the health scheme administrator) it costs £5, which if returned is qualification for Bronze level and the only cost incurred by the owner of participation in the scheme apart from veterinary fees. The Council have recently updated the scheme requirements, with the details for obtaining each level shown as below.

BRONZE LEVEL

All Bulldogs to be tested from 12 months.

Purchase a form at a cost of £5.00 from the Bulldog Breed Council

All examinations indicated on the Bulldog Breed Council Health & Conformation form are non-invasive.

All dogs to be assessed by one of the Bulldog Breed Council Approved Vets (can be found on Bulldog Breed Council Website).

One copy to be kept by vet, one copy by the owner and the top copy to be sent back to Health Administrator:

A Bronze Health Certificate will not be awarded if the dog does not meet the following criteria:

- Heart – referred to a cardiologist (if any abnormality found).
- Eyes – with any conditions that are detrimental to the dog's health.
- Any sign of aggression.

- Spine – any palpable abnormality will be referred for further investigation and X-ray. (e.g. spina bifida)

If the information is not clear and is any way questionable, the anonymous form (identified only by certificate number) will be presented to Bulldog Breed Council whose decision is final.

SILVER LEVEL (no additional cost)

The following requirements have to be met:

- To have been awarded a Bronze Level Certificate.
- Clear results on eye examination recorded.
- To have Putnam Test (Grade 0-1)
- To have an HUU DNA test of clear/carrier (certificate copy sent in, which includes microchip/tattoo number)
- No adverse tail problems (inverted or lack of tail will fail silver level)
- Any undesirable characteristics as applied by the breed standard.
- Not to be a monorchid or cryptorchid
- Not to have blue or green eyes
- Not to have non- recognised colours
- Not to be a Dudley
- To have obtained a RFG score (Grade 0,1, or 2)

GOLD LEVEL no additional cost. Dog to be over 24 months (2 years)

- To have been awarded both the Bronze and Silver levels.
- BVA/KC/ISDS Eye Scheme – copy of certificate. Clear results on eye examination recorded.
- BOAS Research Scheme (Grade 0/1). Done with the University of Cambridge, in the chamber.
- Heart screening by qualified auscultation-approved veterinary surgeon.
- RFG scored (Grade 0 or 1)

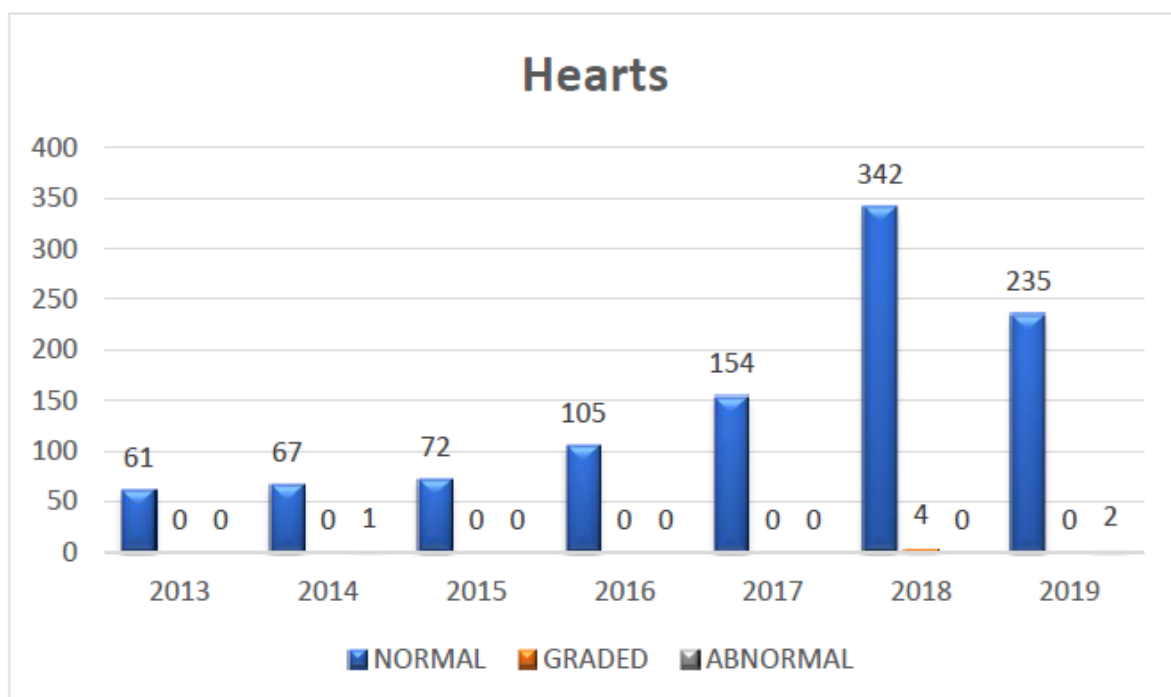
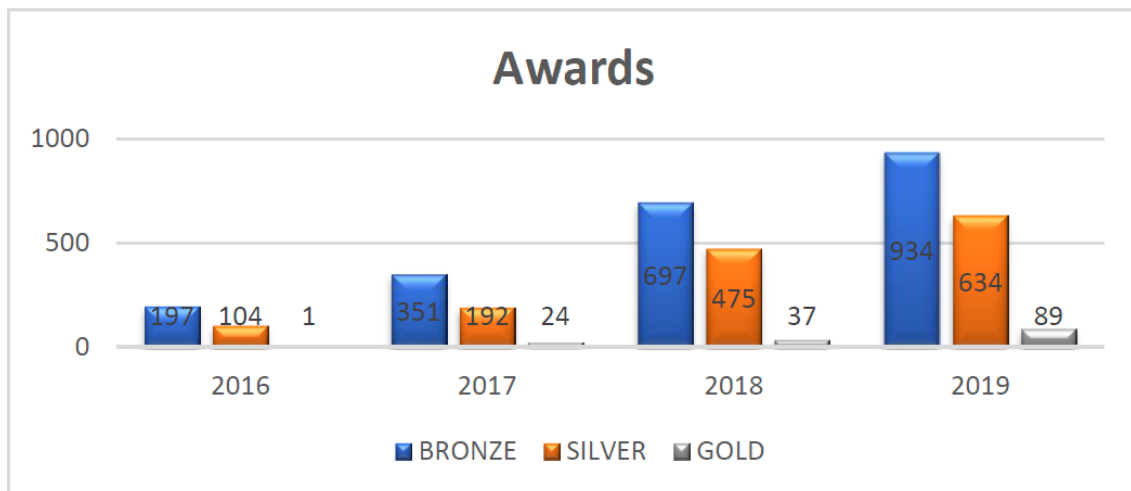
Copies of the certificates which include microchip/tattoo number of all the above tests to be sent in.

Gold stars are also awarded for:

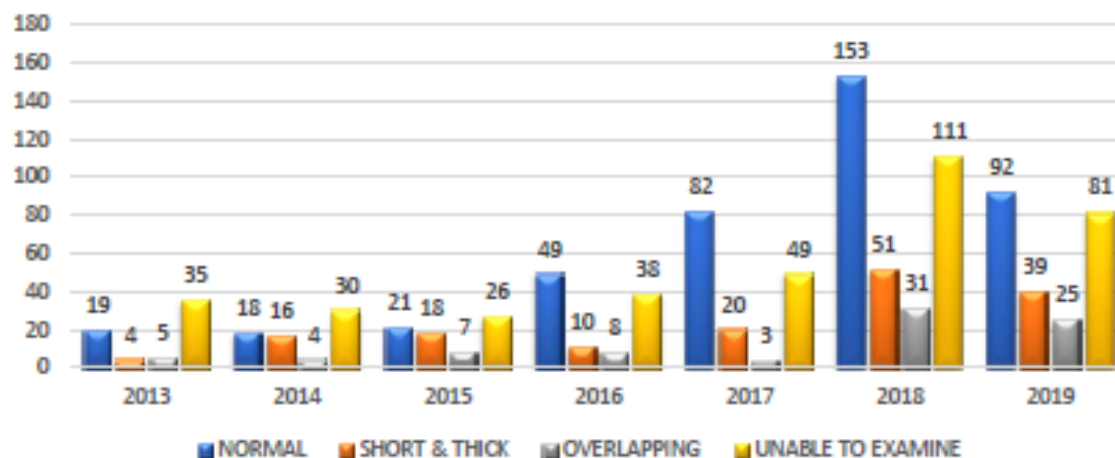
- Trachea measurements
- Spinal X-ray
- Heart Doppler examination
- HUU Clear
- Kennel Club Stud Book number
- UK Champion status
- RFG scheme tested in the Whole-body barometric plethysmography (WBBP) chamber

International participation in this scheme is possible as long as the dog has an Authority to Compete (ATC) number, issued by the Kennel Club.

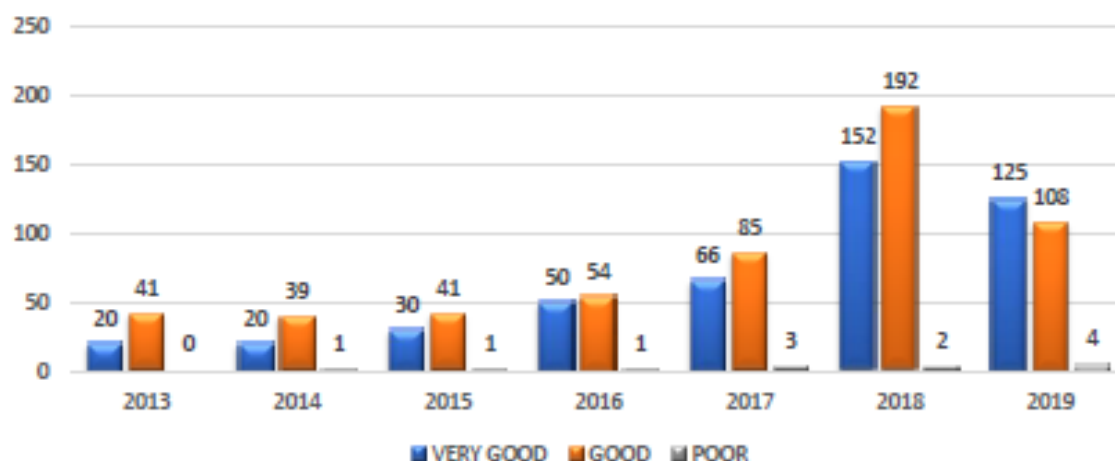
A total of 1,043 forms had been returned between 2013 and the end of 2019, with key findings from the assessments shown below:



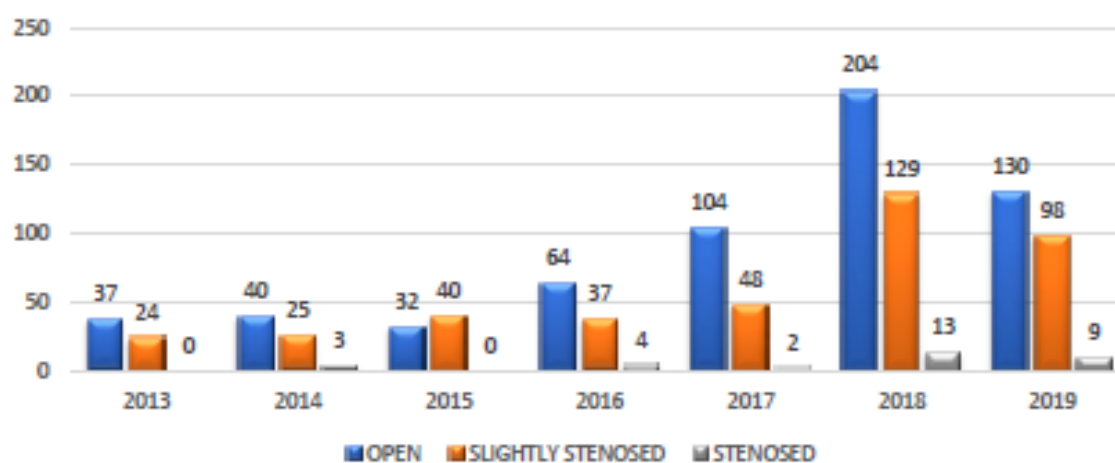
Palate

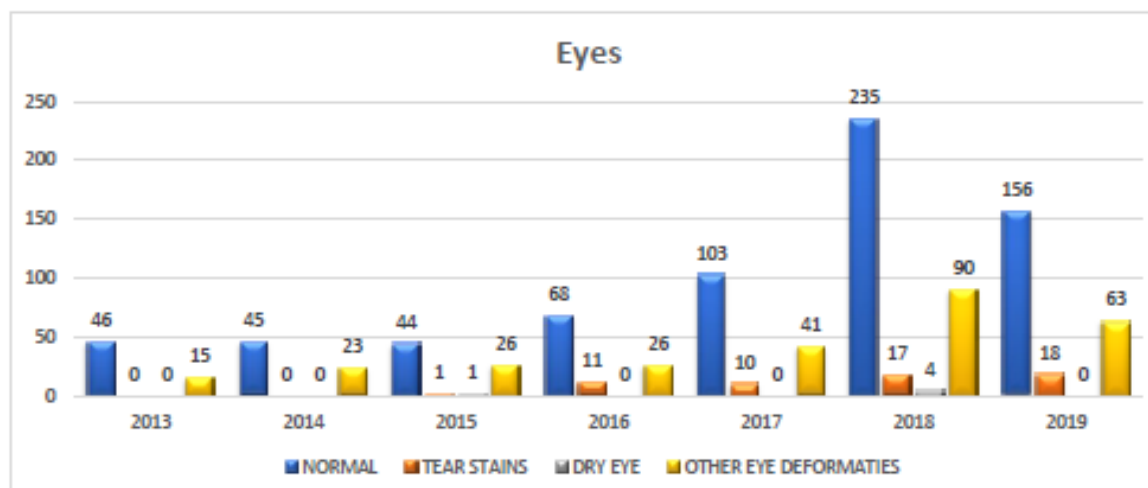
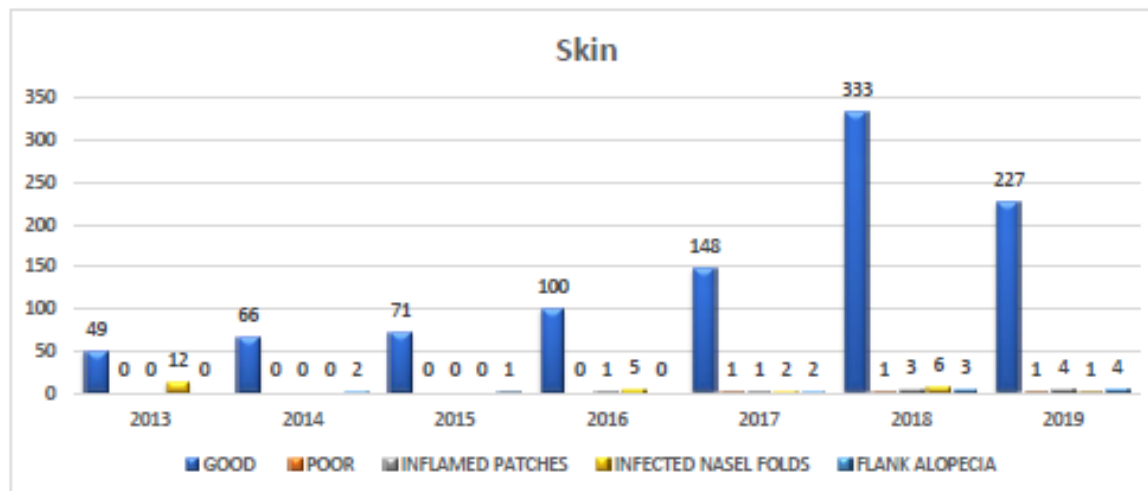
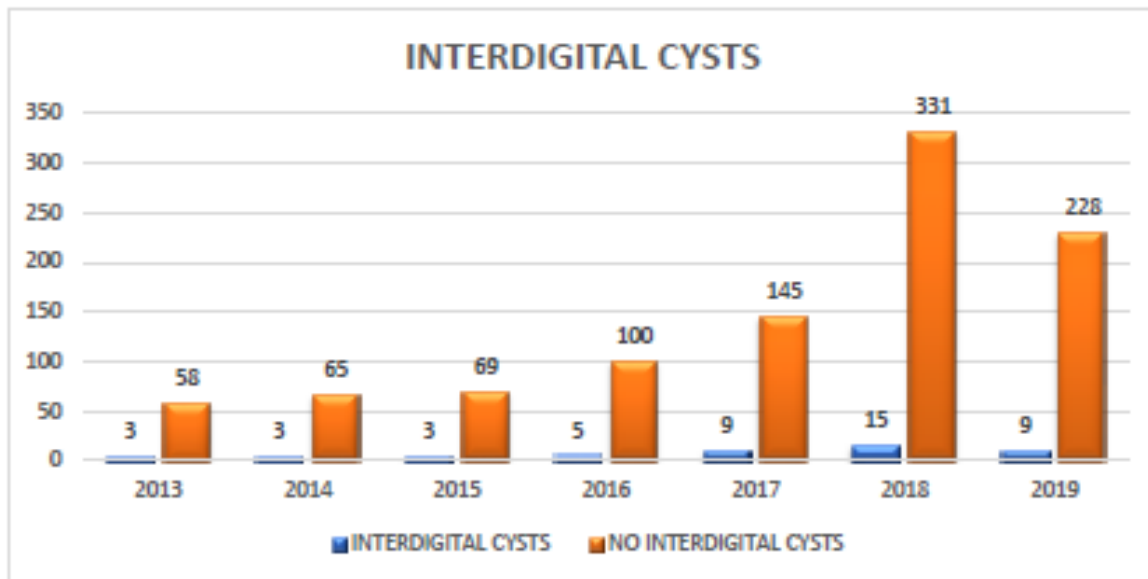


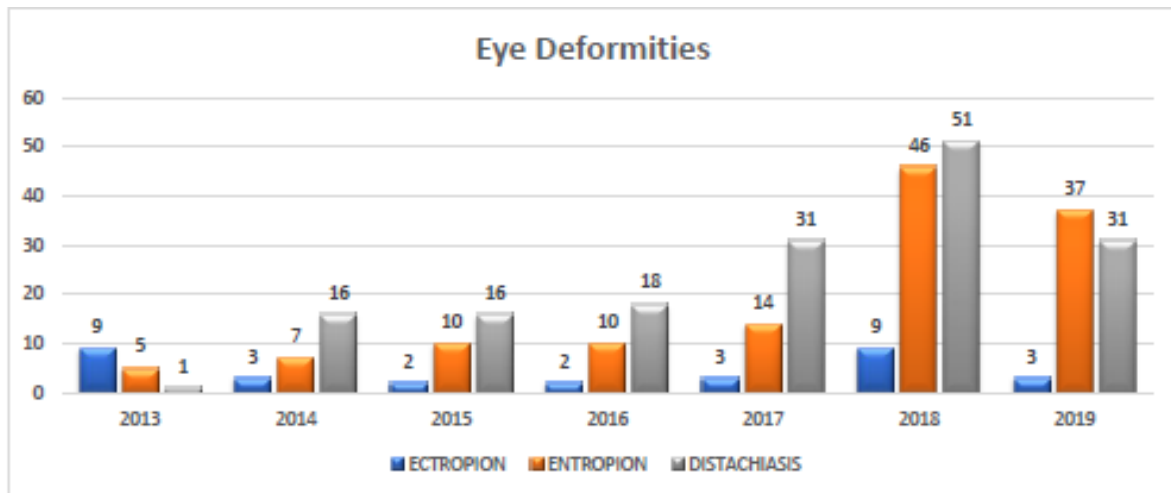
Breathing



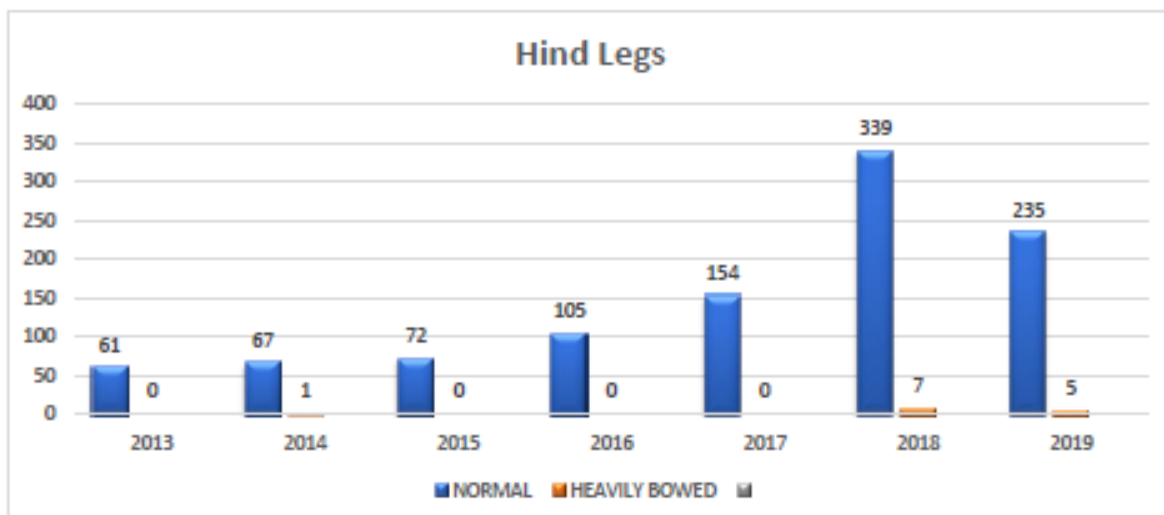
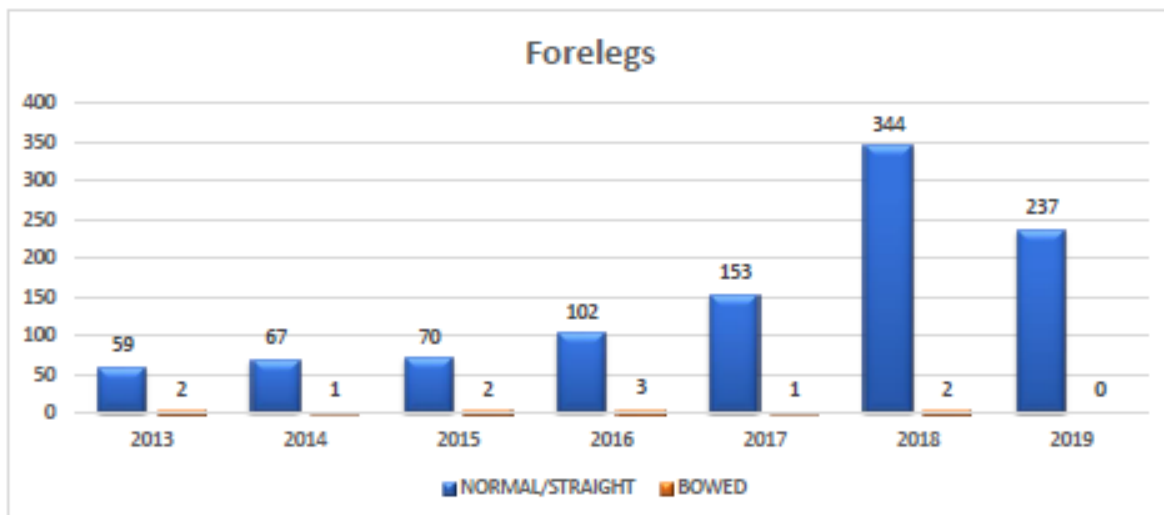
Nostrils

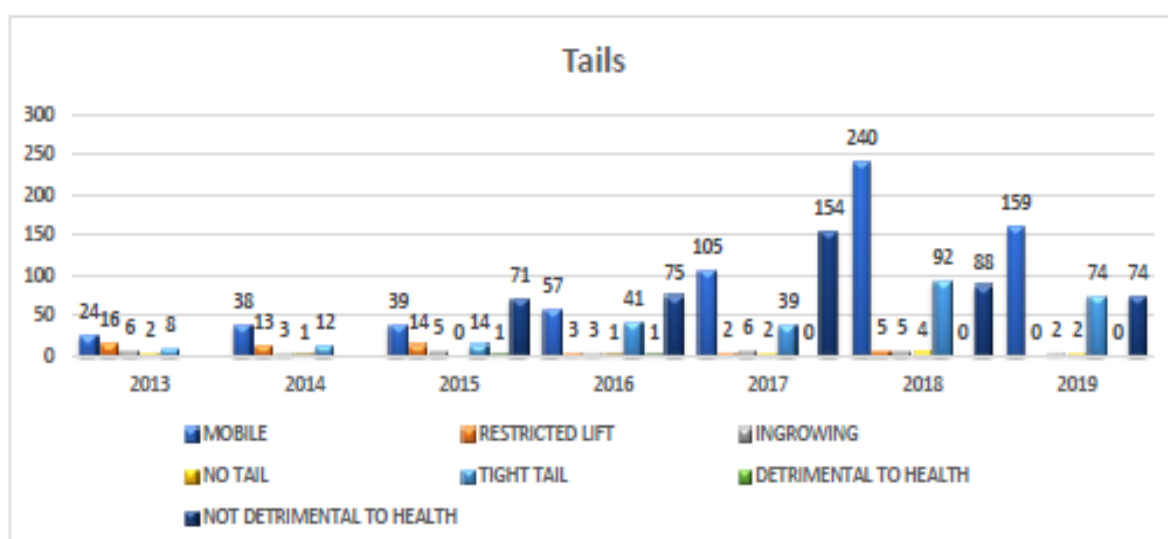
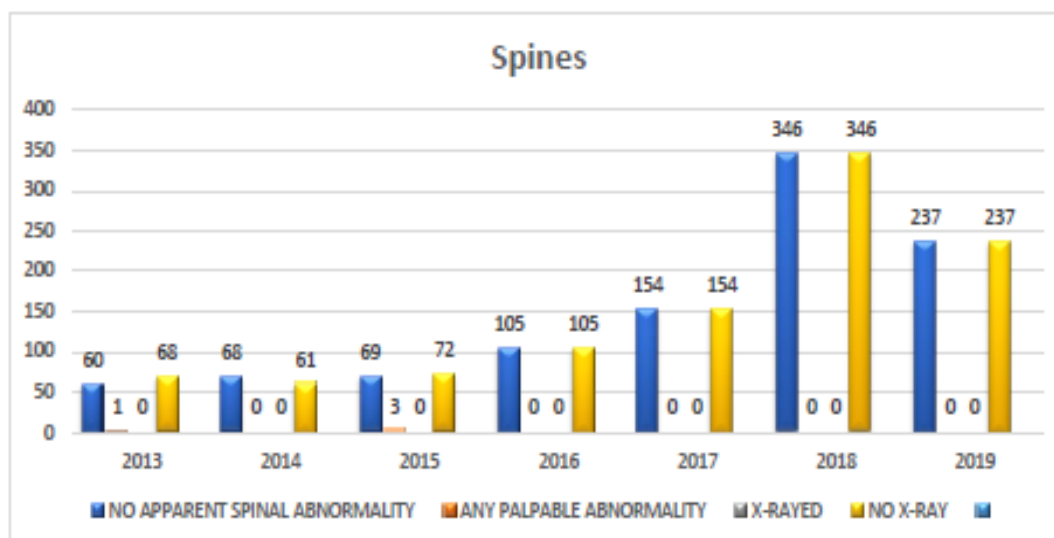
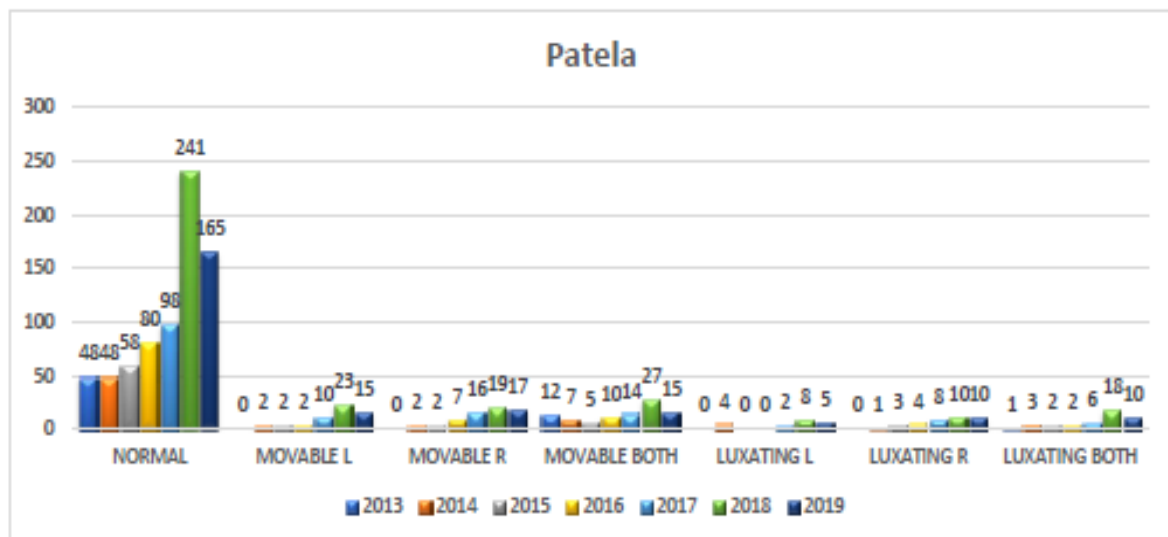


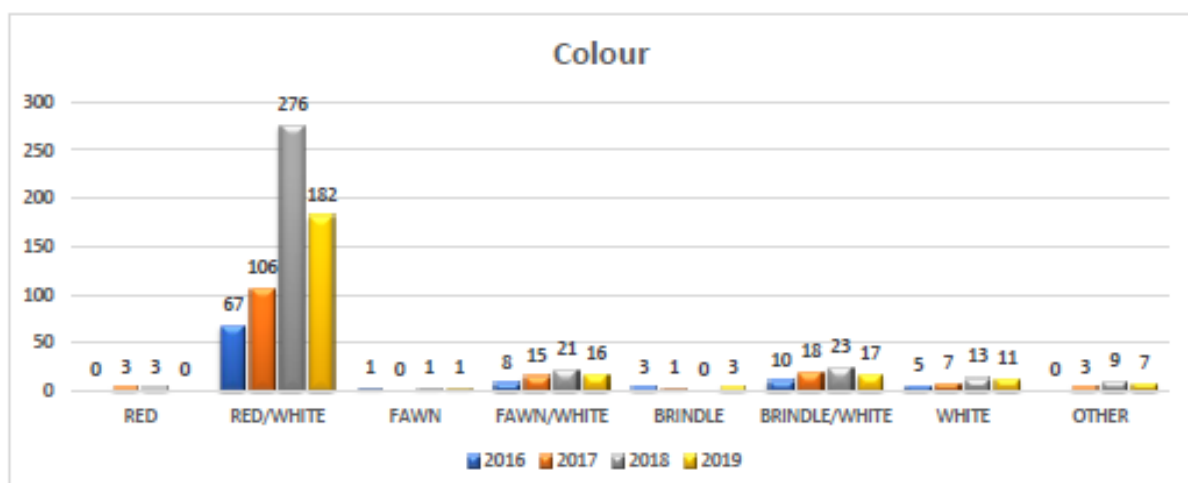
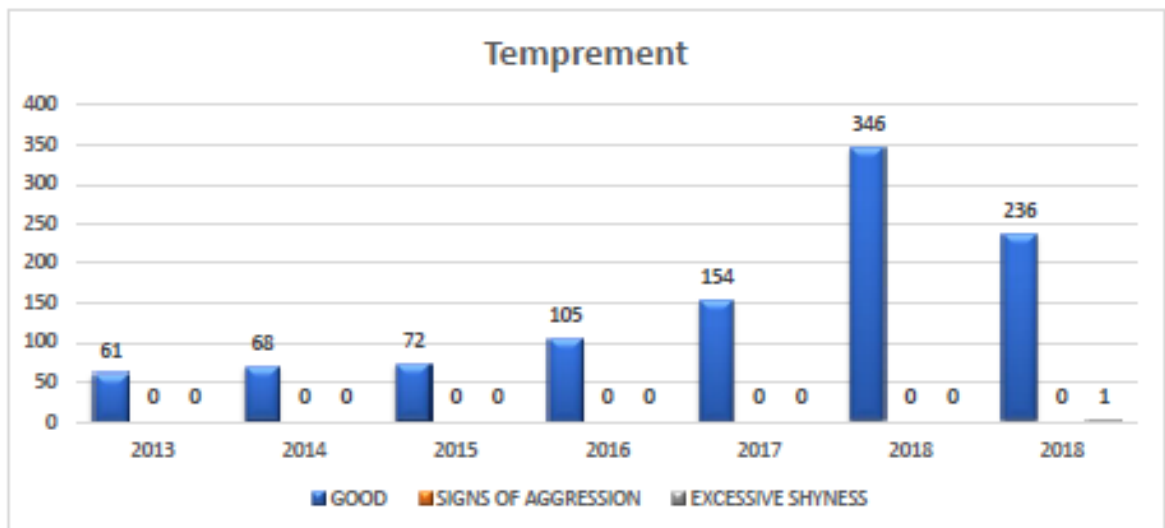
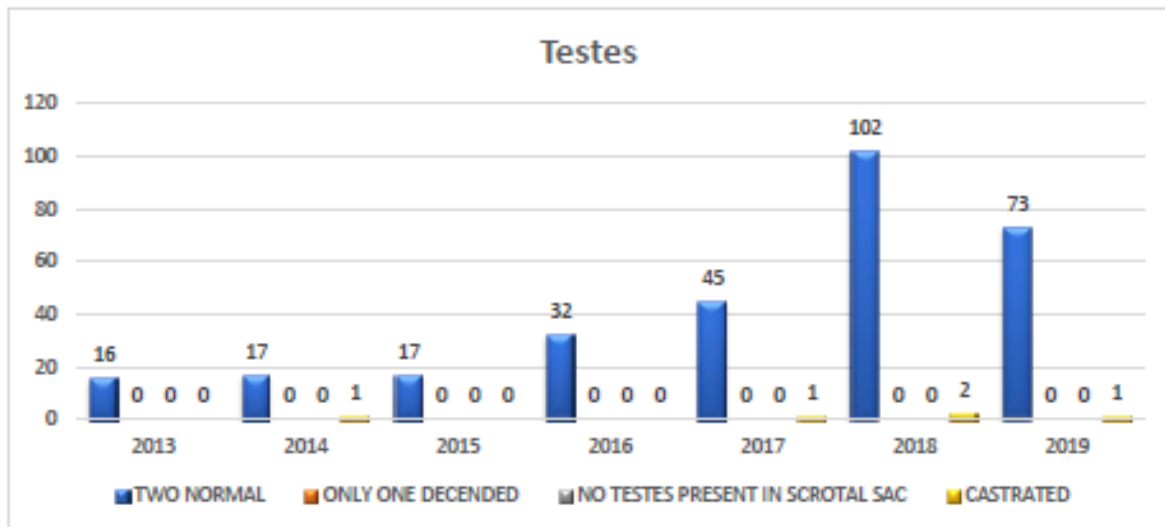


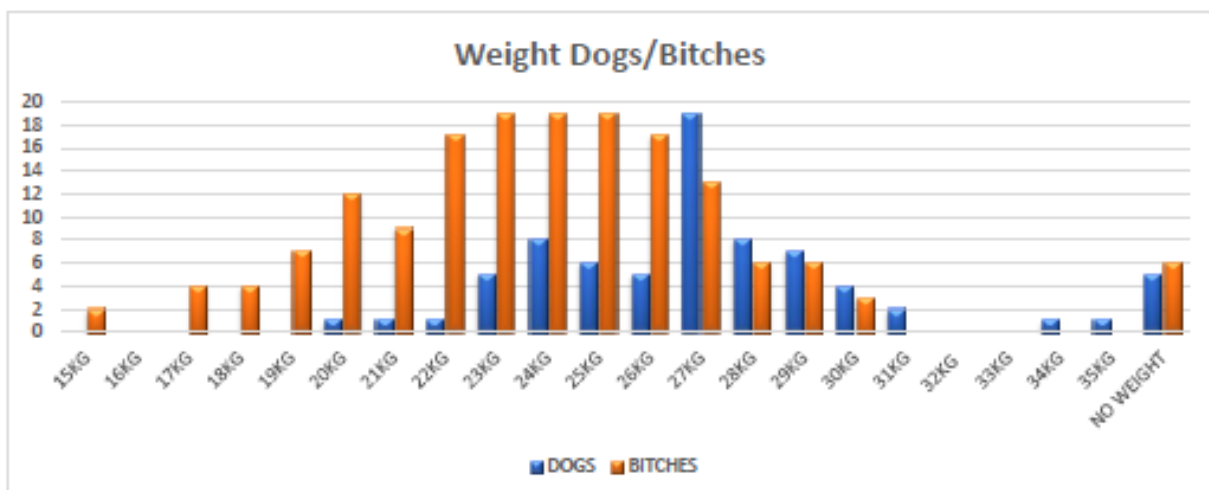
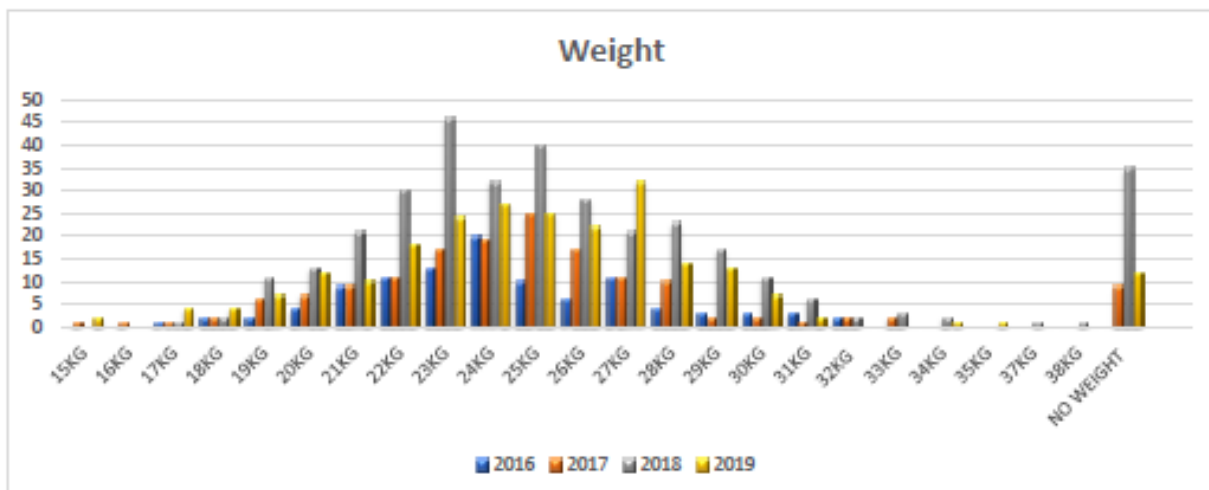
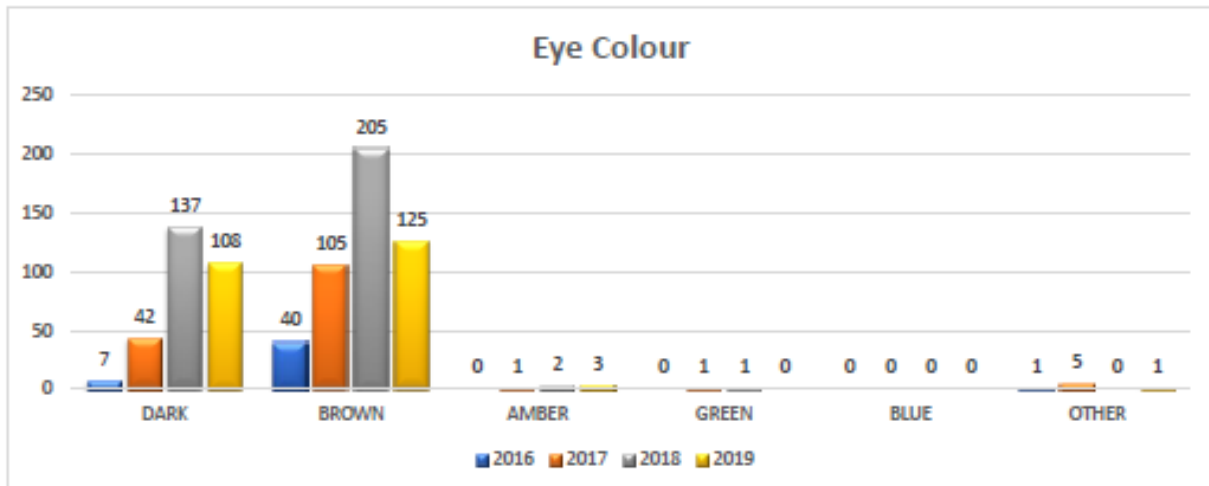


ALL EYE CONDITIONS WERE NOT DETRIMENTAL TO THE DOGS HEALTH IN 2019









There is also a six star scheme, which encompasses physical attributes and health results, which is encouraged but not required under the levels as some parts require anaesthesia. Each star represents one of the following: HUU clear, trachea measurements, spinal x-ray, Doppler of the heart, stud book number and UK Champion status.

BREED SPECIFIC HEALTH SURVEYS

Kennel Club Purebred and Pedigree Dog Health Surveys Results

The Kennel Club Purebred and Pedigree Dog Health Surveys were launched in 2004 and 2014 respectively for all of the recognised breeds at the time, to establish common breed-specific and breed-wide conditions.

2004 Morbidity results: Health information was reported for 403 live Bulldogs of which 217 (54%) were healthy and 186 (46%) had at least one reported health condition, this resulted in a total of 316 reported conditions with a median of one condition/dog (min = 1, max = 6). The top disease conditions by organ system/category for the breed were: ocular (31.6%, 100 of 316 reported conditions), dermatological (15.2%, 48 of 316 reported conditions), reproductive (10.8%, 34 of 316 reported conditions), respiratory (10.4%, 33 of 316 reported conditions) and musculoskeletal (9.2%, 29 of 316 reported conditions). The most frequently reported conditions were cherry eye (61 cases, 15.1% prevalence), entropion (14 cases, 3.5% prevalence) and hair loss or alopecia (13 cases, 3.2% prevalence).

2004 Mortality results: A total of 180 Bulldog deaths were reported. The median age of death was six years and three months (min = 10 months, max = 14 years and 5 months). The top causes of death by organ system/category for the breed were: cardiac conditions (20.0%, 36 deaths), cancer (18.3%, 33 deaths), old age (8.9%, 16 deaths), cerebral/vascular (4.4%, 8 deaths), perioperative (4.4%, 8 deaths) and respiratory (4.4%, 8 deaths). Cancer was the most frequent specific cause of death, accounting for 18.3% per cent of the reported deaths (33 deaths).

2014 Morbidity results: health information was collected for 370 live Bulldogs of which 192 (51.89%) had reported no conditions and 178 (48.11%) reported affected by at least one condition. The most frequently reported specific conditions were prolapsed third eyelid gland (cherry eye) with a prevalence of 14.3%, distichiasis, entropion, hypersensitivity (allergic) skin disorder and dermatitis. Further analysis of the morbidity results suggested that the Bulldog was at increased risk of alopecia/baldness, BOAS, Demodex infestation, distichiasis, entropion, prolapsed gland of the third eyelid ('cherry eye'), pyoderma, rash between skin folds, tracheal disorder compared to the average risk for dogs of all breeds.

2014 Mortality results: 39 deaths were reported. The range of death for Bulldogs was one to 13 years, the mean age at death was 6.36 years. The most frequently reported causes of death were old age, cardiac heart failure, cancer – unspecified, stroke and cardiomyopathy.

Breed-specific health surveys

The Bulldog Breed Council carried out an online survey in early 2016 to gather information on Cherry Eye and Dry Eye in the breed. A total of 302 surveys were completed, with responses from 12 countries.

The results received for the 276 UK Bulldogs are presented here. Some 71% of UK Bulldogs surveyed had developed cherry eye; 5% of those were under eight weeks and a further 20% under 12 weeks with all remaining affected dogs developing the condition in their first year of life. The prevalence of dry eye in the surveyed UK Bulldogs was lower with 17% (51 dogs) being reported as affected. Of these, 14% developed the condition before 12 months of age, and 40% between 12 months and five years of age. A total of 42 UK Bulldogs (14%) were reported to have suffered both cherry eye and dry eye.

UK 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 incorporated literature that includes dogs residing within the UK primarily, and literature that was released relatively recently to try to reflect current publications and research relating to the breed.

Cancers

General cancers: A paper looking into cancer rates across multiple breeds did not specify any particular cancers that the Bulldog is predisposed to, and found that 18.3% of Bulldogs died as a result of cancer (n=180), which was the fifth lowest prevalence out of all breeds considered (Dobson et al, 2013).

Lymphoma: Of 103 dogs diagnosed with lymphoma, the Bulldog was one of three breeds identified as having a possible predisposition, particularly in dogs under the age of three years (Edwards et al, 2003). The authors proposed an incidence rate of 174 per 100,000 dogs (95% CI 35 – 510) and an odds ratio of 4.73 (95% CI 1.42 – 15.83).

Endocrine conditions

Obesity: A study investigating undesirable behaviours in obese dogs included the Bulldog as a breed with a possible predisposition to obesity (German et al, 2017). An odds ratio of 2.44 (95% CI 1.29 – 4.60) was established for obese dogs with regard to undesirable behaviours, implying obese dogs were more likely to exhibit negative behaviours.

General

In a study into the prevalence and impact of conformation-linked inherited defects in pedigree dogs, the total number of such disorders reported in the breed was found to be 42 (Asher et al, 2009). Bulldogs were one of the four breeds with the most conformation-related disorders, along with the Miniature Poodle, Pug and Basset Hound. However, no attempt was made by the authors in that study to consider whether the research included referred to UK dogs or dogs from other countries.

Musculoskeletal conditions

The Bulldog is a chondrodystrophic breed (Martínez et al, 2000). This means that they have abnormal cartilage and bone growth resulting in characteristic disproportionate dwarfism. This is considered to be a breed characteristic in the Bulldog and a number of other breeds (including Basset Hounds, Dachshunds and Corgis) rather than a disease condition.

Neurological conditions

Congenital sensorineural deafness: Congenital sensorineural deafness is usually, but not always, associated with white pigmentation and hereditary components are assumed but not proven for most breeds (Strain, 2004). The condition has been reported in the Bulldog (Strain, 1996; Strain, 2004) but no prevalence estimates were found in the literature.

Idiopathic head tremor: An online survey of UK Bulldog owners was undertaken, assessing the phenotypical characteristics of idiopathic head tremors in the breed to establish any risk factors and compare the condition with other canine and human movement disorders (Guevar et al, 2014). A total of 234 Bulldogs were admitted to the study, with 89 having had reported episodes of head tremors in the past (38% prevalence). The age of onset reported by the owners ranged from six months – nine years (median = 2 years). The frequency range of the tremors was found to be 4.8-6.2 Hz (median = 5.75 Hz), duration seconds up to 3 hours and the episodes per day ranging from 1-11 (median = 2). No contributing risks or causative factors could be established in the study, although stress has been reported as a suspected trigger.

Ocular conditions

Entropion and ectropion: A paper attempted to estimate the impact of different conditions on individual dogs and particular breeds using two measures – the Generic Severity Index for Dogs (GISID) and the welfare impact (Collins et al, 2010). The GISID scores four factors – prognosis, treatment, complications and behaviour; each factor is scored from zero to four, where zero is least and four is most severe. Thus the maximum (worst) possible GISID score for a condition is 16, suggesting that cherry eye has a low to moderate severity. Welfare impact is estimated by multiplying the GISID of a condition by its prevalence. Using these measures, entropion in the Bulldog was estimated to have a GISID of 2-9, and a welfare impact of 7.50-33.75.

Reproductive conditions

Dystocia: In a study to investigate the percentage of litters born by caesarean section, the Bulldog was one of 10 breeds with the highest caesarean section rates. Using data collected during the 2004 Purebred Dog Health Survey, of 248 litters reported in the breed, 86.1% of dams underwent a caesarean section to deliver the puppies (Evans and Adams, 2010a). It was not possible to determine in that study whether the caesarean section was an elective or emergency procedure. Textbooks

refer to a breed predisposition to obstructive dystocia due to disproportion between maternal pelvic canal and foetuses, but no primary literature sources could be found.

Pyometra: A study of dogs attending RSPCA veterinary hospitals found the Bulldog to have the fourth highest prevalence of pyometra, at 4.6% (Gibson et al, 2013). With regard to age at presentation, the median age was 5 years (range 0 – 7.4 years).

Respiratory conditions

Brachycephalic-obstructive airway syndrome (BOAS): A study investigating the impact of facial conformation on severity of BOAS was conducted at the Royal Veterinary College. Brachycephalic dogs were identified through visible examination, determination of 'nares' ratio, feedback from owner questionnaire – with regard to frequency of respiratory difficulties and severity of respiratory sounds, and clinical history (Packer et al, 2015). Of 16 Bulldogs admitted to the study, 63.3% were diagnosed as affected by BOAS, with a median craniofacial ratio of 0.22-0.25 and predicted BOAS risk of 0.38-0.74 (min-max). More recent research at the University of Cambridge has shown that obesity and stenotic nares both have an impact on the severity of BOAS in the breed (Liu et al, 2016, 2017).

Urological conditions

Urolithiasis: A study analysed 6,132 uroliths from UK male dogs which had been submitted to the University of Minnesota Urolith Centre over a 10-year period to identify breed-associated risk factors (Florey et al, 2017). The Bulldog was the third most commonly submitted breed with cystine uroliths (kidney stones), with the authors establishing an odds ratio of 7.82 (95% CI 2.12 – 28.80). Neuter status appeared to correlate with risk in developing stones, with an odds ratio of 4.53 (95% CI 3.22 – 6.37). However, an older study with 14,008 urolith samples submitted to the University of Minnesota established a much higher odds ratio at 60.88 (95% CI 43.51 – 85.18) for the Bulldog and found the breed to be one of three over-represented for this form of stone (Roe et al, 2012).

Another more recent study reported that cystinuria in the Bulldog appears to be a recessive pathology involving the SLC3A1 gene, which has led to the development of a DNA test for the condition – see page 22 (Ruggerone et al, 2016).

VETCOMPASS

The Kennel Club work closely with VetCompass at the Royal Veterinary College. VetCompass is a broad welfare research programme that collects anonymised clinical information from more than 1800 UK veterinary practices and includes over 7.5 million dogs. VetCompass research can be used to identify common breed-specific conditions, or condition-specific concerns which affect a range of breeds. A breed specific VetCompass paper has been published for the Bulldog which is shown below and, in addition, the Bulldog is included in the condition-specific studies also detailed below.

Breed Specific: A recent paper has been released by the VetCompass group which reviewed conditions reported in 1,621 Bulldogs attending veterinary centres in the UK during 2013 (O'Neill et al, 2019). During this time 70.8% of Bulldogs were reported to be affected by at least one condition, with males more likely to be affected by four conditions (pyoderma, interdigital cyst, atopic dermatitis and aggression) and females by two conditions (periodontal disease and obesity). The paper reflects the health status of the general population of Bulldogs, which may include non-pedigree dogs that vets perceive to be Bulldogs.

The median longevity for the breed was established as 7.2 years, with females having a longer longevity of 7.9 years versus 6.7 years in males. It is important to consider that this study will be skewed towards younger dogs as it was undertaken at a time when the breed was undergoing a popularity boom, and therefore longevity values will be biased downwards.

The most commonly reported specific health concerns are shown in Table 1.

Table 1: Prevalence of most common specific disorders in Bulldogs as part of the VetCompass study

Disorder	Count (prevalence)	95% CI	Female prevalence	Male prevalence	P-value between male/female prevalence	Median age at diagnosis
Otitis externa	206 (12.7%)	11.1 – 14.4	11.6%	14.0%	0.143	3.8
Pyoderma	142 (8.8%)	7.4 – 10.2	6.5%	11.1%	0.001	2.4
Overweight/obesity	141 (8.7%)	7.4 – 10.2	10.7%	6.8%	0.006	2.7
Skin fold dermatitis	126 (7.8%)	6.5 – 9.2	7.1%	8.5%	0.275	2.4
Overlong nails	119 (7.3%)	6.1 – 8.7	7.0%	7.8%	0.518	2.8
Cherry eye	110 (6.8%)	5.6 – 8.1	6.2^	7.4%	0.333	1.2
Cryptorchidism	45 (5.6%)	4.1 – 7.4	n/a	n/a	n/a	1.1
Conjunctivitis	88 (5.4%)	4.4 – 6.6	4.8%	6.1%	2.821	n/a
Pododermatitis	88 (5.4%)	4.4 – 6.6	4.5%	6.4%	0.083	4.0
Alopecia	86 (5.3%)	4.3 – 6.5	4.5%	6.2%	0.125	2.2

By organ system the most commonly reported concerns were cutaneous (28.6%, 95% CI 26.4 – 30.8), ophthalmological (18.0%, 95% CI 16.2 – 20.0), aural (13.0%, 95% CI 11.4 – 14.8), enteropathy (11.6%, 95% CI 10.1 – 13.3), and upper respiratory tract (10.5%, 95% CI 9.1 – 12.1).

Musculoskeletal conditions

Patellar luxation: The prevalence of patellar luxation in the Bulldog was reported to be 2.9% out of 1786 Bulldogs seen; this gave an odds ratio of 2.5 (95% C.I. 1.5-4.1) compared to dogs of no recognisable breed (O'Neill et al, 2016).

Neurological conditions

Seizures: The breed was the ninth most commonly affected by seizures, with 39 Bulldogs (out of a breed total of 3374) affected, giving a prevalence of 1.16% (95% CI 0.80-1.52). Overall, the authors concluded that the Bulldog was one of eleven breeds more commonly affected by seizures but as of yet there are no reliable reports on seizure activity in the breed (Erlen et al, 2018).

Ocular conditions

Corneal ulcers: In a recent VetCompass study of dogs affected by corneal ulcers, the Bulldog had the fifth highest prevalence of the condition at 2.41% (19 cases and 768 unaffected dogs); this gave an odds ratio of 6.53 (95% C.I. 3.96-10.78) compared to dogs of no recognisable breed (O'Neill et al, 2017a). The authors postulate that this increased risk of corneal ulceration (seen also in other brachycephalic breeds) could reflect the reduced corneal sensation and fewer numbers of corneal nerves, known to be associated with brachycephalic conformation, which may predispose to corneal ulceration. In addition the large palpebral aperture and relatively shallow eye socket common in many brachycephalic dogs may lead to greater exposure of this less sensitive cornea, increasing the risk of irritation and injury leading to corneal ulceration.

Reproductive conditions

Dystocia: In a recent VetCompass study of 50 first-opinion emergency-care veterinary practices, the Bulldog had a dystocia prevalence of 7.2% based on 15 cases and 194 non-cases, giving an odds ratio of 5.7 (95% C.I. 3.1 to 10.5) compared to dogs of no recognisable breed (O'Neill et al, 2017b).

Respiratory conditions

Brachycephalic obstructive airway syndrome (BOAS): A VetCompass study investigated and compared upper respiratory tract (URT) disorders in three brachycephalic breeds: Bulldogs (n=1416, 0.8% of population), French Bulldogs and Pugs, with three commonly owned breeds: Yorkshire Terriers, Border Terriers and West Highland White Terriers (O'Neill et al, 2015). The study concluded that the brachycephalic breeds were significantly younger at death (8.6 years compared to 12.7 years), 22% of brachycephalic dogs were diagnosed with at least one URT disorder, compared to 9.7% of other breeds. Of all breeds, Bulldogs had the lowest proportion of dogs affected by URT disorders at 19.5% (compared to 20.0% in French Bulldogs and 26.5% in Pugs). The authors found of 200 Bulldogs the proportion of dogs affected by stenotic nares/nasal cavity problems was 7.5%, hard and soft palate 2.5%, pharynx problems 1.0%, larynx disorders 0.5%, trachea 3.5% and BOAS 2.5%. The proportion of Bulldogs affected by multi-site URT disorders was 10.5%. The odds ratio for the breed developing a URT disorder was found to be 4.0 compared to the West Highland White Terrier.

Skin conditions

Demodicosis: This condition is a result of abnormal and excessive numbers of the mite *Demodex canis* which resides in the skin, resulting in skin lesions and

secondary bacterial skin infections. The Bulldog was one of seven breeds found to be at increased odds of developing demodicosis, particularly in younger dogs, with a prevalence of 3.56% (n=1274) in dogs under the age of two years, 0.09% in dogs over the age of four years (n=1149) and an all ages prevalence of 1.51% (n=3374) (O'Neill et al, 2019). The authors proposed an odds ratio of 11.26 (95% CI 7.94 – 15.97) with this being the highest odds ratio across all breeds.

Urological conditions

Urinary incontinence: Of 109,428 male dogs attending 119 clinics throughout England, the Bulldog was established as one of five breeds considered to be predisposed to this condition, with an odds ratio of 5.72 (95% CI 2.24-14.59) and prevalence of 1.39% (Hall et al, 2018). A subsequent study of 72,971 female dogs also suggested that Bulldogs have a predisposition to urinary incontinence, with an odds ratio of 2.24 (95% CI 1.09 – 4.60) (Pegram et al, 2019).

INSURANCE DATA

There are some important limitations to consider for insurance data:

- Accuracy of diagnosis varies between disorders depending on the ease of clinical diagnosis, clinical acumen of the veterinarian and facilities available at the veterinary practice.
- Younger animals tend to be overrepresented in the UK insured population.
- Only clinical events that are not excluded and where the cost exceeds the deductible excess are

However, insurance databases are too useful a resource to ignore as they fill certain gaps left by other types of research; in particular they can highlight common, expensive and severe conditions, especially in breeds of small population sizes, that may not be evident from teaching hospital caseloads.

UK Agria data

Insurance data were available for Bulldogs insured with Agria UK. 'Exposures' are equivalent to one full policy year; in 2017 there were 474 free exposures, 649 full exposures and 1,311 claims, in 2018 (up to July) these figures were 480, 658 and 638 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.

Conditions by number of settlements, for authorised claims where treatments started between August 2017 and July 2018, are shown in Table 2 below.

Table 2: Top 10 conditions and number of settlements for each condition between 1st August 2017 and 31st July 2018 for Bulldogs insured on full policies with Agria UK

Condition	Number of settlements
Third eyelid/nictitating membrane disorder - prolapsed gland (Cherry eye)	184
Brachycephalic airway obstruction syndrome (BAOS)	72
Hypersensitivity (allergic) skin disorder (unspecified)	69
Patellar luxation - medial	38
Entropion	33
Distichiasis	30
Skin (cutaneous) disorder (unspecified)	27
Lameness finding	26
Pneumonia - aspiration	25
Cruciate ligament rupture - caudal and cranial	24

Swedish Agria data

Swedish morbidity insurance data were available from Agria for the Bulldog. Reported rates are based on dog-years-at-risk (DYAR) which take into account the actual time each dog was insured during the period (2011-2016). A year over which a dog was insured with Agria is the equivalent of one DYAR. DYAR for the breed was 1,000 < 2,500, so results should be interpreted cautiously. The full Swedish insurance results are available through <https://dogwellnet.com/>, but key findings are reported below.

The most common specific causes of Veterinary Care Events (VCEs) for Agria-insured Bulldogs in Sweden between 2011 and 2016 are shown in Figure 2. The five most frequently reported specific causes of veterinary treatment were dermatitis/pyoderma/folliculitis, vomiting/diarrhoea/gastroenteritis, otitis, lameness/pain during locomotion, and eyeball trauma, the same top five conditions as listed in the 2006-2011 analysis.

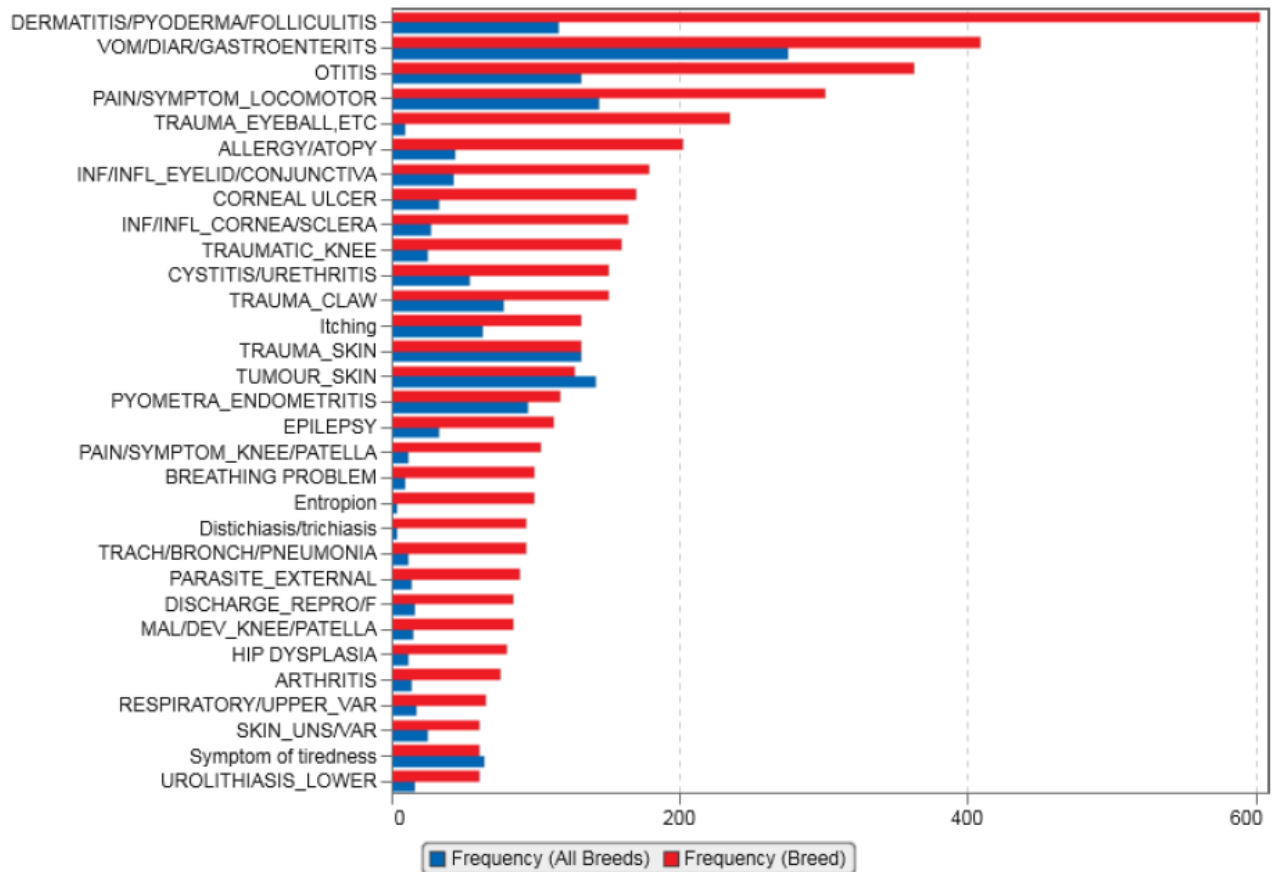


Figure 2: The most common specific causes of VCEs for the Bulldog compared to all breeds in Sweden between 2011 and 2016, from Swedish Agria insurance data.

When relative risk of specific causes of VCEs was compared for the Bulldog to all breeds, the top five specific causes of VCEs ordered by relative risk eyeball trauma, entropion, distichiasis/ trichiasis, breathing problem, and infection/ inflammation of the lower respiratory tract (the 2006-2011 conditions by relative risk were: entropion, distichiasis/ trichiasis, eyeball trauma, upper breathing problems and tracheo/ broncho pneumonia).

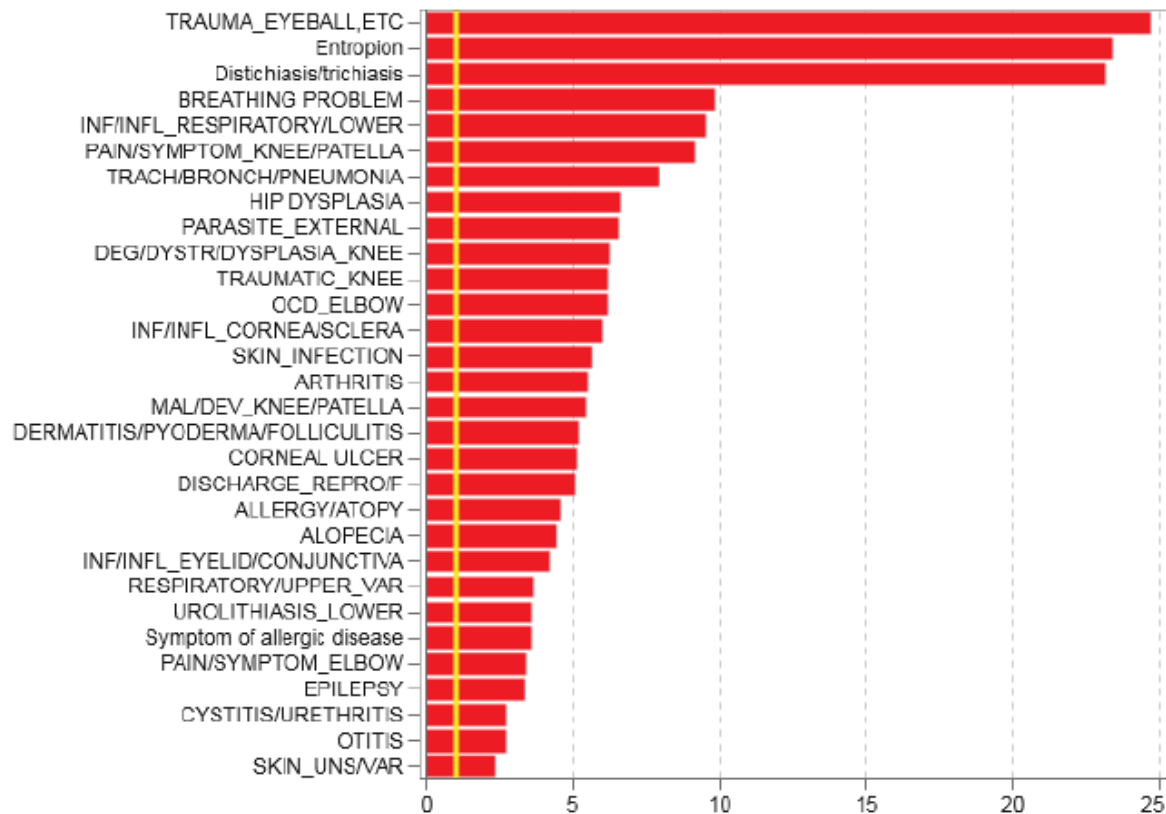


Figure 3: The specific causes of VCEs for the Bulldog ordered by relative risk compared to all breeds in Sweden between 2011 and 2016, from Swedish Agria insurance data.

BREED WATCH

As a category three breed judges' health monitoring forms are mandatory when judging the breed at Championship Certificate level, and Best of Breed winners must undergo a veterinary health check prior to competing for Best in Show. The points of concern reported are shown below in Table 2. Those marked with a * indicate newly reported points of concern.

Table 2: Percentage of Bulldogs exhibited at championship shows with points of concern reported from 2016 to 2019. Those with a * indicate new points of concern.

Point of concern	2016	2017	2018	2019
* Cow hocks	0.0%	0.1%	0.0%	0.0%
* Incorrect bite	0.1%	0.1%	0.0%	0.6%
Excessive facial skin with eyelid defects	0.4%	0.2%	0.5%	0.4%
Hair loss or scarring from previous dermatitis	1.9%	0.9%	0.5%	0.5%
Heavy overnose wrinkle (roll)	0.1%	0.4%	1.8%	2.7%
Inverted tail	0.3%	0.2%	0.6%	0.5%
Lack of tail	1.9%	2.1%	1.0%	1.3%
Pinched nostrils	0.9%	0.4%	3.1%	2.6%
Showing respiratory distress including difficulty breathing or laboured breathing	0.2%	0.0%	0.0%	0.1%
Significantly overweight	0.6%	0.6%	0.5%	0.6%
Sore eyes	1.7%	2.0%	0.5%	0.8%
Tight tail	1.9%	0.6%	2.1%	3.6%
Unsound movement	0.2%	0.0%	1.7%	0.7%
Total	2805	2812	2577	1942

PERMISSION TO SHOW

As of the 1st January 2020 exhibits for which permission to show (PTS) following surgical intervention has been requested will no longer be published in the Breed Record Supplement and instead will be detailed in BHCPs, and a yearly report will be collated for the BHC. PTS cover surgeries that alter the natural conformation of the dog. Exhibitors are expected to seek PTS following surgical alteration should they wish to continue showing their dog. PTS granted to date (excluding neutered/caesarean sections) are shown in Table 3 below.

Table 3: PTS surgeries granted to date for exhibits per year

Surgery	Year				
	2016	2017	2018	2019	2020
Cherry Eye	1				
Removal of lumps/ masses/ tumours/ cysts		1			
Hernia repair					1

ASSURED BREEDER SCHEME

Currently within the Kennel Club (KC)'s Assured Breeders Scheme it is recommended that Assured Breeders:

- Undergo the Bulldog Breed Council Health Scheme to at least Bronze level
- DNA test for HUU
- Undergo the University of Cambridge/ KC RFG Scheme

DNA TEST RESULTS

The following DNA tests are currently available and recognised for the breed:

- Hyperuricosuria (HUU)

A list of laboratories that provide the test can be found through clicking here:

<https://www.thekennelclub.org.uk/worldwide-dna-tests/>

Whilst other DNA tests may be available for the breed results from these will not be accepted by the Kennel Club until the test has been formally recognised; the process involves collaboration between the breed clubs and the Kennel Club in order to validate the test's accuracy.

As a note, as of January 2022 hereditarily clear status will no longer apply after three generations and dogs will need to be retested to confirm the status of that individual. This is to prevent the possibility of misclassification of status and therefore unintentional breeding of affected puppies. Where parentage is confirmed by DNA profile, the major contributor to erroneous status will be removed. Therefore, a less stringent restriction for HC status is applied where parentage is confirmed by DNA test.

Table 4: HUU DNA test results held by the Kennel Club for Bulldogs up to 31/12/2019.

Total Number of Results	CLEAR	CARRIER	AFFECTED	HEREDITARILY CARRIER	HEREDITARILY CLEAR
7888	1789 (22.7%)	689 (8.7%)	52 (0.7%)	88 (1.1%)	5270 (66.8%)

CANINE HEALTH SCHEMES AND ESTIMATED BREEDING VALUES

All of the BVA/KC Canine Health Schemes are open to dogs of any breed with a summary given of dogs tested to date below. Estimated breeding values are not available for the breed at this time due to insufficient numbers of dogs that have participated in the current schemes. It is hoped EBVs may be accessible once a sufficient number of dogs have taken part in the University of Cambridge/ KC RFG Scheme.

HIPS

Thirty-seven Bulldogs have been hip scored as part of the British Veterinary Association (BVA)/Kennel Club (KC) Hip Dysplasia Scheme since the scheme began to 06/02/2019, with a 15-year median hip score of 33 (range 9 – 96).

ELBOWS

Only eight Bulldogs have been elbow scored as part of the BVA/KC Elbow Dysplasia Scheme since the scheme launched in 1998; with three graded as a 0 and two as a grade 2 and three as a grade 3.

EYES

The Bulldog is not currently the Known Inherited Ocular Diseases (KIOD) list for any condition under the BVA/KC/International Sheep Dog Society (ISDS) Eye Scheme. KIOD (formally 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.

However, the BVA still records the results of dogs of other breeds which have participated in the scheme and collates these comments into an annual sightings report, to monitor any existing or emerging eye conditions. The results of Eye Scheme sightings reports of Bulldogs which have taken place since 2010 are shown in Table 5.

Table 5: Sightings reports on Bulldogs which have participated in the Eye Scheme since 2010

Year	Number seen	Comments
2010	1 adult	1 – distichiasis and multifocal retinal dysplasia (MRD)
2011	2 adults	1 – distichiasis right upper lid 1 – no abnormalities recorded
2012	4 adults	1 – left and right minor distichiasis both upper lids left & right anterior hyaloid remnants with minor posterior capsular opacities 1 – lower lid “diamond eye” entropion medially, ectropion centrally nuclear rings both lenses short, scant distichias upper lids 1 – bilateral tendency to lateral lower lid ectropion and very slight medial entropion 1 – ‘cherry eye’ left, surgery advised
2013	3 adults	1 – bilateral tendency to central ectropion and nasal entropion of lower lids 2 – no abnormalities recorded
2014	6 adults	1 – bilateral mild to moderate distichiasis (upper more than lower) bilateral imperforate lower puncta (tear duct openings) bilateral epiphora (tear-staining) 1 – bilateral macropalpebral fissure ectropion 1 – results not available 3 – no abnormalities recorded
2015	6 adults	2 – distichiasis 2 – ectropion 1 – entropion 1 – no abnormalities recorded
2016	7 adults	3 – ectropion 1 – entropion 4 – no abnormalities recorded
2017	41 adults	21 - distichiasis

		10 - entropion 10 - ectropion 1 - combined entropion/ectropion 1 - corneal lipid deposition
2018	46 adults	10 – distichiasis 5 – entropion 2 – ectropion

American College of Veterinary Ophthalmologists (ACVO)

Results of examinations through AVCO are shown in Table 6 below. Between 2015 and 2019, 250 dogs of the breed were examined by the ACVO and prevalence data are shown in Table 7 alongside data from previous years. Overall, 47.9% (206 of 430) of the Bulldogs examined during this time had healthy eye conformation with no conditions diagnosed. It should be noted that the sample of dogs represents American dogs solely.

The following prevalence estimates were reported (Table 6). Overall 50.0% of the dogs examined in 2018 had normal eye conformation and were unaffected by ocular disease. It should be remembered that these were dogs examined in America.

Table 6: ACVO examination results for Bulldogs, 1991 - 2019

Disease Category/Name	Percentage of Dogs Affected	
	1991-2014 (n=1,031)	2015-2019 (n=430)
Eyelids		
Ectopic cilia	0.6%	1.4%
Macropalpebral fissure	1.6%	0.0%
Entropion	14.6%	14.4%
Ectropion	5.6%	4.0%
Distichiasis	21.7% %	27.4%
Nasolacrimal		
Keratoconjunctivitis sicca	0.2%	1.6%
Nictitans		
Prolapsed gland of the third eyelid	1.5%	1.9%
Cornea		
Pigmentary keratitis	2.2%	1.6%
Corneal dystrophy	1.4%	0.6%
Uvea		
Persistent pupillary membranes (iris to iris)	0.6%	1.6%
Uveal cysts	1.0%	0.5%
Lens		
Cataract (significant)	2.5%	1.6%
Retina		
Retinal dysplasia (folds)	6.1%	4.9%

Adapted from: <https://www.ofa.org/diseases/eye-certification/blue-book>

Respiratory Functional Grading Scheme (RFG)

The University of Cambridge/ KC RFG Scheme was launched in February 2019 for the three most popular brachycephalic breeds, Pugs, French Bulldogs and Bulldogs. Breeders can take their dogs to an approved regional assessor who undertakes a simple and non-invasive trot test to establish a dog's airways before and after stress.

Results up to 06/02/2020 for dogs of the breed graded under the scheme are shown in Table 7 below.

Table 7: University of Cambridge/KC RFG Scheme results for Bulldogs to date

Grade	Total Dogs		Male		Female	
0	60 (34.7%)	(89.0%)	14 (26.9%)	(88.5%)	46 (38.0%)	(89.3%)
1	94 (54.3%)		32 (61.5%)		62 (51.2%)	
2	18 (10.4%)	(11.0%)	6 (11.5%)	(11.5%)	12 (9.9%)	13 (10.7%)
3	1 (0.6%)		0 (0.0%)		1 (0.8%)	
Total	173		52		121	

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.
- 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 8.

Table 8: Number of litters of Bulldogs registered per year and number of caesarean sections reported per year, 2009 to 2019.

Year	Number of Litters Registered	Number of C-sections	Percentage of C-sections	Percentage of C-sections out of all KC registered litters (all breeds)
2009	1003	13	1.30%	0.15%
2010	1072	36	3.36%	0.35%
2011	1080	147	13.61%	1.64%
2012	1073	607	56.57%	8.69%
2013	1240	685	55.24%	9.96%
2014	1285	707	55.02%	10.63%
2015	1462	809	55.34%	11.68%
2016	1708	1077	63.06%	13.89%
2017	1684	855	50.77%	15.00%
2018	2127	1207	56.75%	17.21%
2019	1920	1114	58.02%	15.70%

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, an estimated effective population size of 67.9 was reported (estimated using the rate of inbreeding over the period 1980-2014). An effective population size of 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 4. As with most breeds, the rate of inbreeding was at its highest in this breed in the 1980s and 1990s. This represents a 'genetic bottleneck', with genetic variation lost from the population. However, latterly the rate of inbreeding has declined and even been negative, implying a slowdown in the rate of loss, and modest replenishment, of genetic diversity (possibly through the use of imported animals). For full interpretation see Lewis et al, 2015

<https://cgjournal.biomedcentral.com/articles/10.1186/s40575-015-0027-4>

The current breed average inbreeding coefficient is 8.4%.

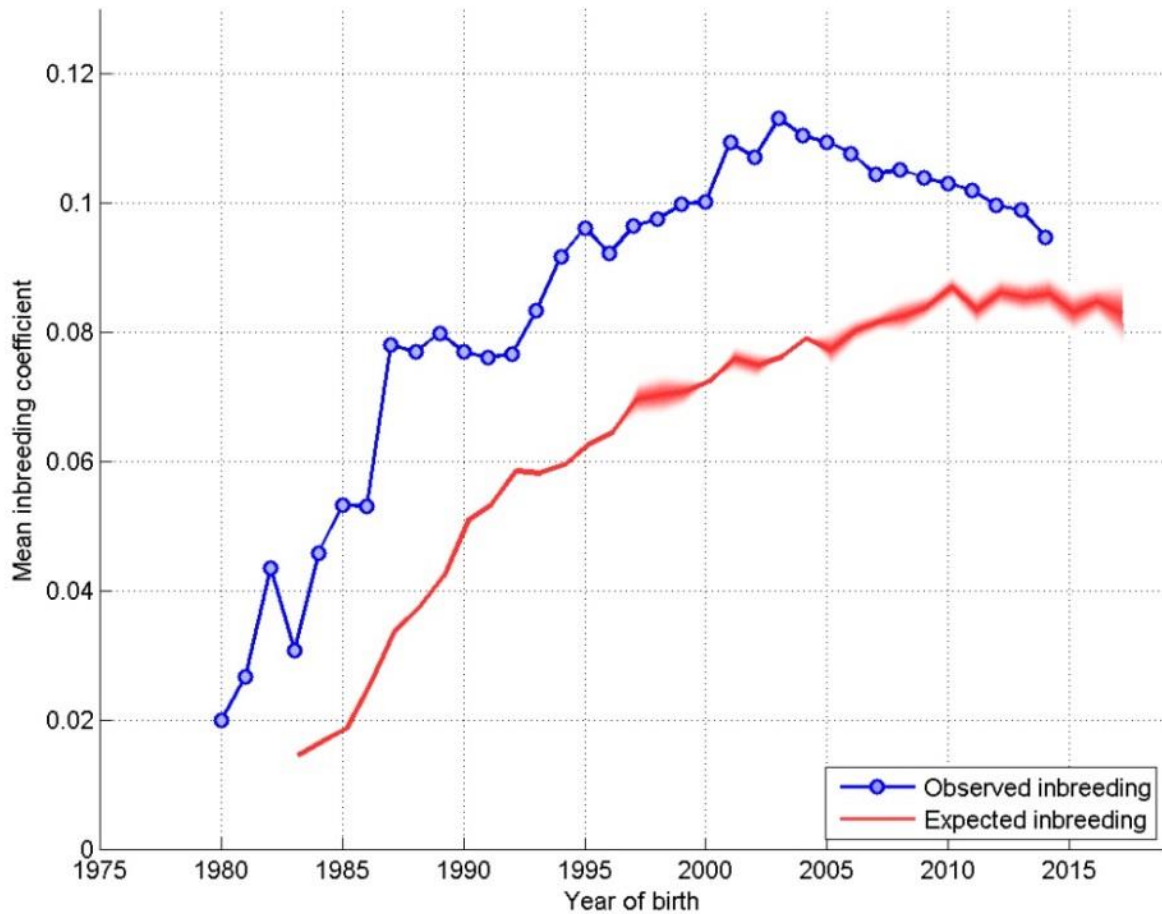


Figure 4: Annual mean observed and expected inbreeding coefficients. [The blurring around the expected inbreeding line indicates an approximate standard deviation around the estimate, in breeds with more than 2000 individuals born in a given year.]

Below is a histogram ('tally' distribution) of number of progeny per sire and dam over each of seven 5-year blocks (Figure 5). 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). It appears that the extensive use of popular dogs as sires has increased (the 'tail' of the blue distribution increasing in Figure 5).

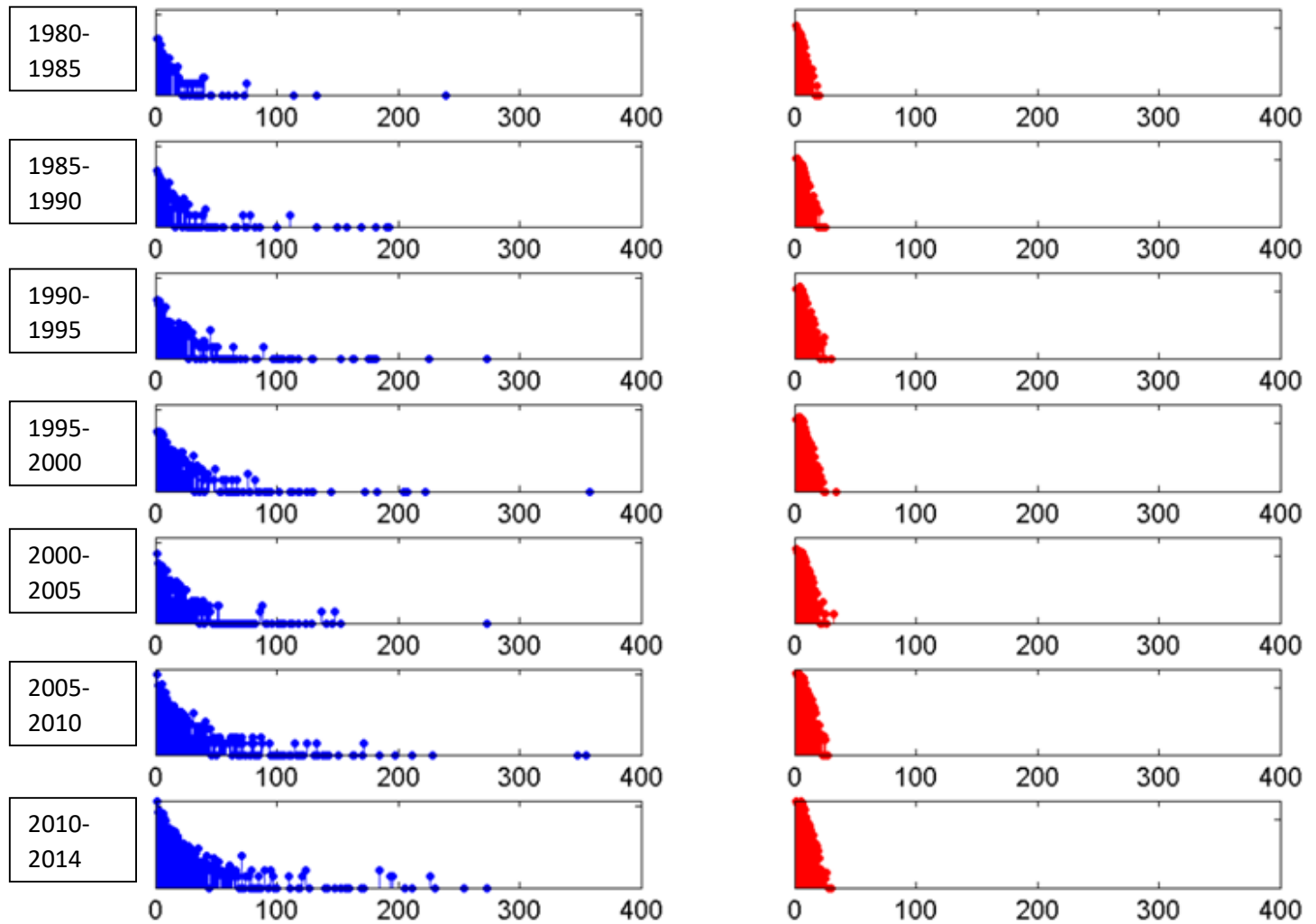


Figure 5: Distribution of progeny per sire (blue) and per dam (red) over 5-year blocks (1980-4 top, 2010-14 bottom). Vertical axis is a logarithmic scale.

CURRENT RESEARCH

The Bulldog is one of the 75 breeds in the AHT's Give a Dog a Genome project; the health conditions given as concerns for the breed was anasarca puppies, BOAS, cardiac, cherry eye, dystocia, ectropion, entropion and patellar luxation. A Bulldog affected with BOAS has been sequenced to assist with the ongoing genetic study of the condition at the University of Cambridge.

The breed have assisted with the launch of the respiratory functional grading scheme in conjunction with the University of Cambridge and the KC, and are continuing to participate in research with the BOAS research group, as well as genome sequencing of dogs affected by Robinow syndrome to try to source a causative mutation.

The breed have also had communications with the Veterinary Cardiologist Society and will be recruiting dogs for pulmonic stenosis testing.

PRIORITIES

A meeting was held with the Bulldog breed representatives on 15th April, following the discussion of the breed's BHCP in 2018. This meeting was to discuss any further health research or developments in the breed's health that had occurred in the interim and to review the action points and priorities confirmed at the previous meeting.

The group agreed from the evidence base and their own experience that the priorities for the Bulldog remain the same as:

- BOAS
- Ocular conditions
- Cardiovascular conditions
- Skin conditions
- Obesity

ACTION PLAN

Following the meeting between the Kennel Club and the breed regarding the evidence base of the Breed Health & Conservation Plans, the following actions were agreed to improve the health of the Bulldog. Both partners are expected to action these points prior to the next review.

Breed Club actions include:

- The Bulldog Breed Council and Breed Clubs to continue to actively encourage uptake of the BVA/KC/ISDS Eye Scheme – **ONGOING**
- The Bulldog Breed Council and Breed Clubs to continue to encourage members to make use of the breed health scheme – **ONGOING**
- The Bulldog Breed Health Representatives to continue to participate in the Brachycephalic Working Group with the Kennel Club's support – **ONGOING**
- The breed clubs to attend Bulldog owner events and share information to pet owners with regard to Bulldog health
- The breed clubs to conduct a survey at shows using the body condition score chart, once available
- The breed clubs to continue to encourage uptake of the RFG Scheme, with a target to increase the number of dogs participating in the scheme throughout 2020, and provide details of health testing sessions to the Kennel Club

Kennel Club actions include:

- The Kennel Club to progress and fund a Bulldog specific body condition score with the University of Cambridge, with the breed clubs to assist in sourcing dogs
- The Kennel Club to report on progress made with the Veterinary Cardiology Society with regard to a heart scheme for Bulldogs/ pulmonic stenosis
- The Kennel Club to investigate the feasibility of developing certification for Bulldogs as part of the BVA/KC/ISDS Eye Scheme, with additional guidance to owners
- The Kennel Club to investigate research avenues for cherry eye with the AHT and KC/BVA eye panel working party
- The Kennel Club to report back on the progress of the neurology development group

- The Kennel Club to assess the impact of current wording under the RFG Scheme for grade 2s – particularly with regard to the phrasing “clinically affected”
- The Kennel Club to develop a health survey, based on the Dachshund health & lifestyle survey, and disseminate to all registered owners of the breed
- The Kennel Club to investigate research avenues for skin conditions that impact the Bulldog

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