



Breed Health and Conservation Plan

French 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 number of French Bulldogs registered per year has increased dramatically over the past decade. This marked increase is illustrated graphically in Figure 1 which shows the number of French Bulldogs registered per year between 1980 and 2019. Numbers were low and stable between 1980 and around 2005. The trend of registrations over year of birth (1980-2014) is +530.11 per year (with a 95% confidence interval of +332.01 to +728.21), reflecting the sharp increase in popularity of the breed.

[A '95% confidence interval' is a tool used in statistics which shows that we are 95% certain that an estimated number is between the lowest number and the highest number provided.]

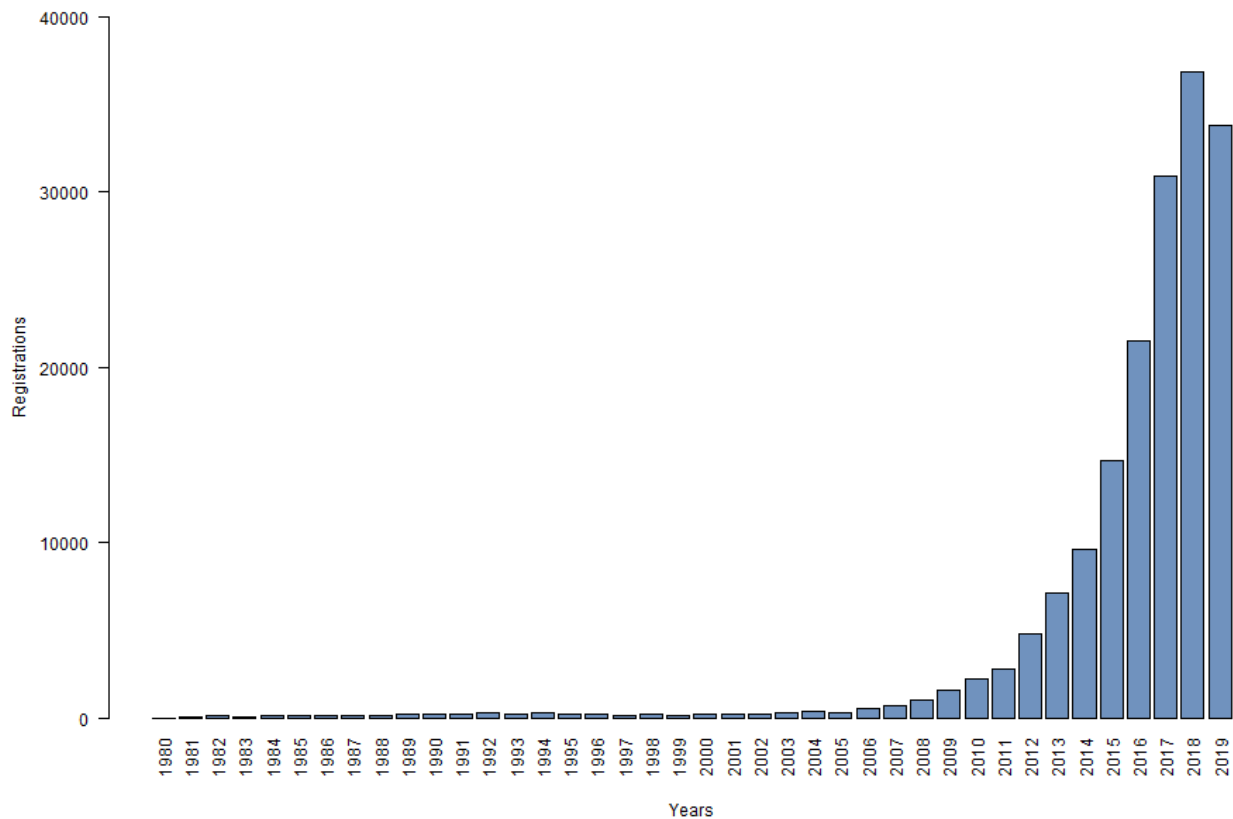


Figure 1: Number of registrations of French Bulldogs per year of birth from 1980 to 2019.

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. Spinal problems
3. Allergies

With regard to these concerns the breed have continued to collaborate with the University of Cambridge and assist in the Respiratory Function Grading (RFG) scheme launch, and collecting data on health concerns in the breed.

The 2019 report received the same top three health concerns as the previous year, with actions including encouraging the use of the University of Cambridge/ KC Respiratory Function Grading (RFG) Scheme and holding four sessions at club shows, continuing to collect data on spinal problems in the breed through the use of spine screening and collecting data on allergies in the breed.

BREED CLUB HEALTH ACTIVITIES

French Bulldog Health Scheme

The French Bulldog Club of England also run their own health scheme consisting of three levels.

Bronze:

Completion of the visual health assessment by a veterinary surgeon which includes:

- a) Heart auscultation
- b) BOAS assessment
- c) Nostril grading
- d) Eye examination (for signs of excessive tearing, entropion, ectropion, distichiasis, pannus, enlarged third eyelid, eyes of unequal size, dry eye, and corneal scarring)
- e) Any narrowing of the ear canal and signs of hearing loss
- f) Any skin affliction
- g) Patella score
- h) Spinal palpation
- i) Tail examination
- j) Temperament evaluation

Silver:

To have obtained the Certificate of Participation in Bronze Level with the following results:

- a) Participation in the RFG Scheme (Grade 0 or 1)
- b) Nostrils Grade 1 or 2 (depending on vet's comments exceptions can be made if nostrils are grade 3 but BOAS must be a grade of 0 or 1)
- c) Heart test, either:
 - a. Normal results within the previous 12 months
 - b. Repeat heart test with normal results
- d) Patellar score (Grade 0 or 1)
- e) DNA tested for HC-HSF4 (Clear result)
- f) Nostril grade 1 or 2 (exception can be made depending on veterinarian comments and BOAS grade of 0 or 1)

Optional under silver:

- a) Participation in the BVA/KC/ISDS Eye Scheme
- b) DNA test – cystinuria type 3
- c) DNA test – degenerative myelopathy
- d) DNA test – hyperuricosuria (HUU)

Gold:

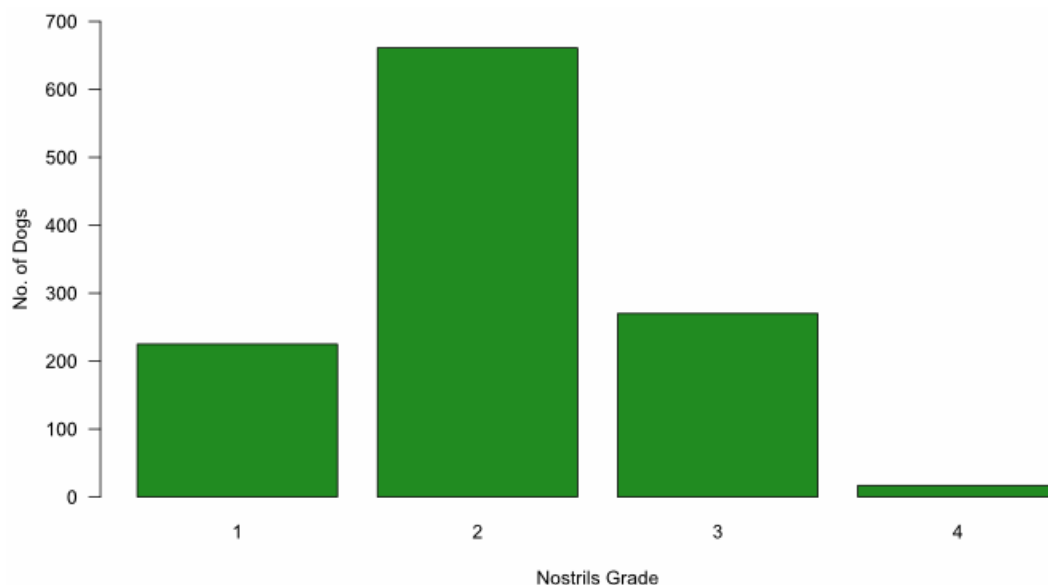
To have obtained the Certification of Participation in Bronze and Silver level with the following:

- a) To be at least two years of age
- b) To have obtained a BOAS grade 0 or 1 under the University of Cambridge/KC RFG
- c) Repeated heart test with a normal reading (dog must be 2 at age of testing)
- d) Spinal X-ray

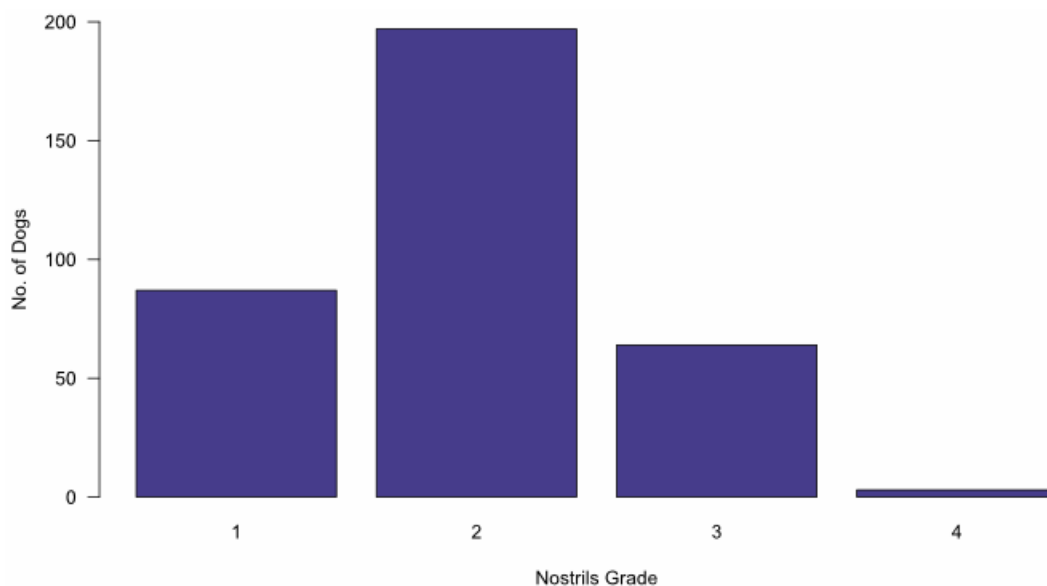
To date, 2151 forms have been received from participants of the scheme, with details of participating dogs given below. The majority of dogs were standard colour (n=1,756) but non-recognised coloured (CNR) dogs have also participated (n=395). Whilst a large number of dogs have participated in the scheme to date, it is important to consider that an element of self-selection may occur, whereby it is not mandatory for owners to submit results following participation.

With regard to body condition scores (1-9 scale) 87.5% of standard colour dogs were scored at an ideal weight (4 or 5), 2.3% underweight and 10.0% overweight. Of the CNR dogs, 88.8% were of ideal weight, 2.9% underweight, and 8.3% overweight.

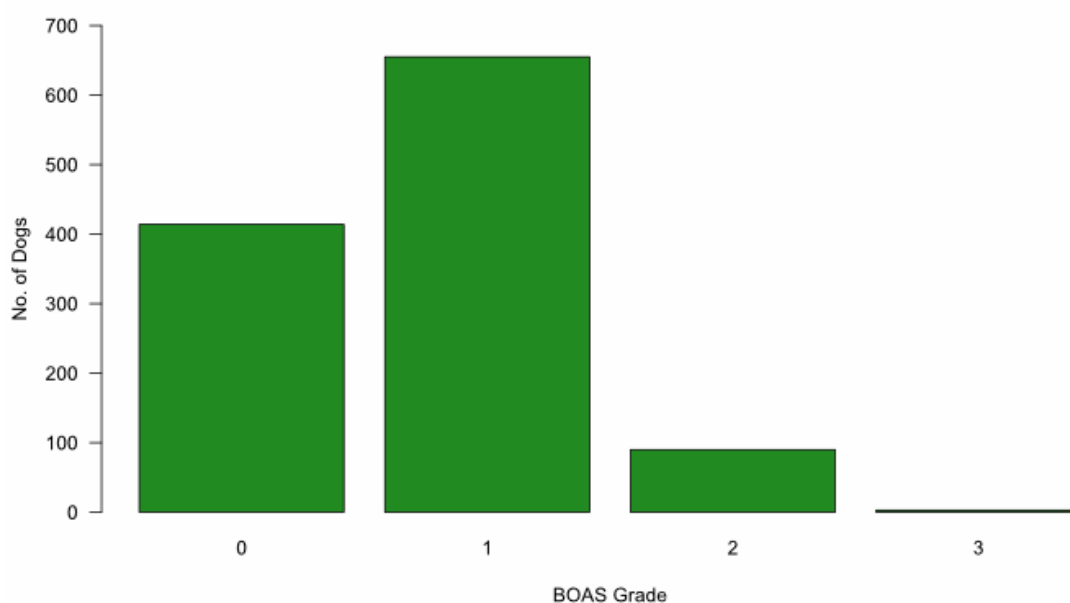
Nostril stenosis grading forms part of the assessment, with the majority of dogs (n=1,173) graded as a 2, or mild stenosis (graph below). Nearly a quarter, 24.5% of dogs had nostrils graded a 3 or 4 (moderate or severe stenosis).



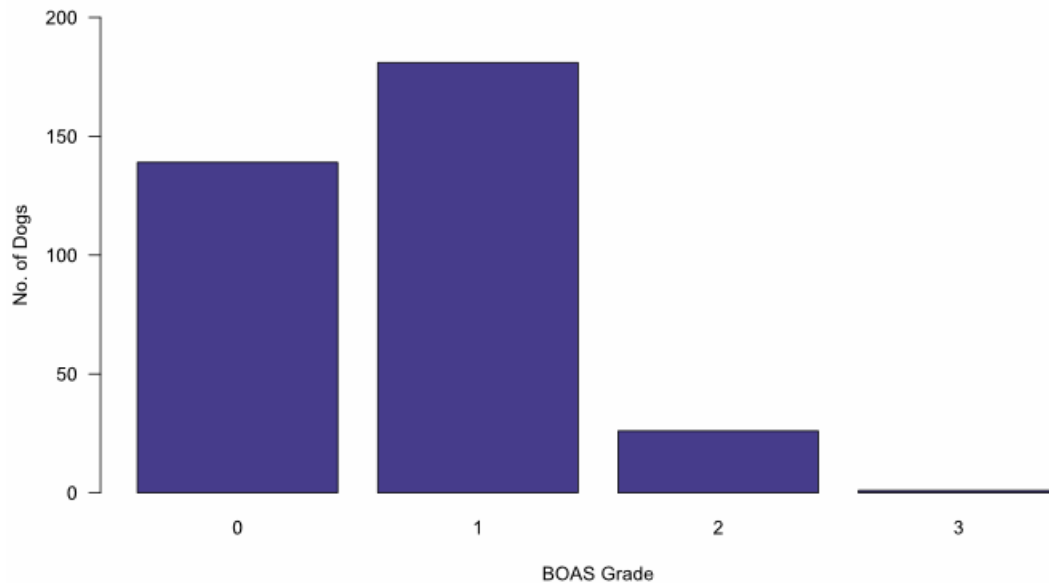
With regard to CNR dogs, again over half of dogs graded as having mildly stenosed nostrils (graph below), and 19.1% having either a grade 3 or 4.



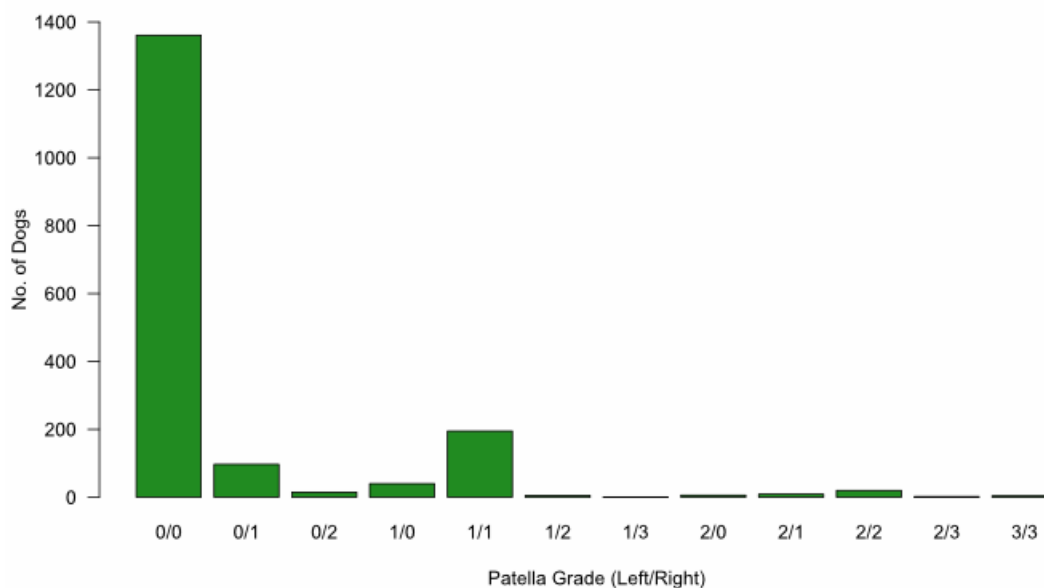
As of 2015, the health scheme incorporated the breathing protocol outlined by the University of Cambridge/ KC RFG Scheme. Of 1,162 standard colour French Bulldogs, the majority of dogs graded a 0 or 1, with just 8.0% graded as a 2 or 3 (graph below).



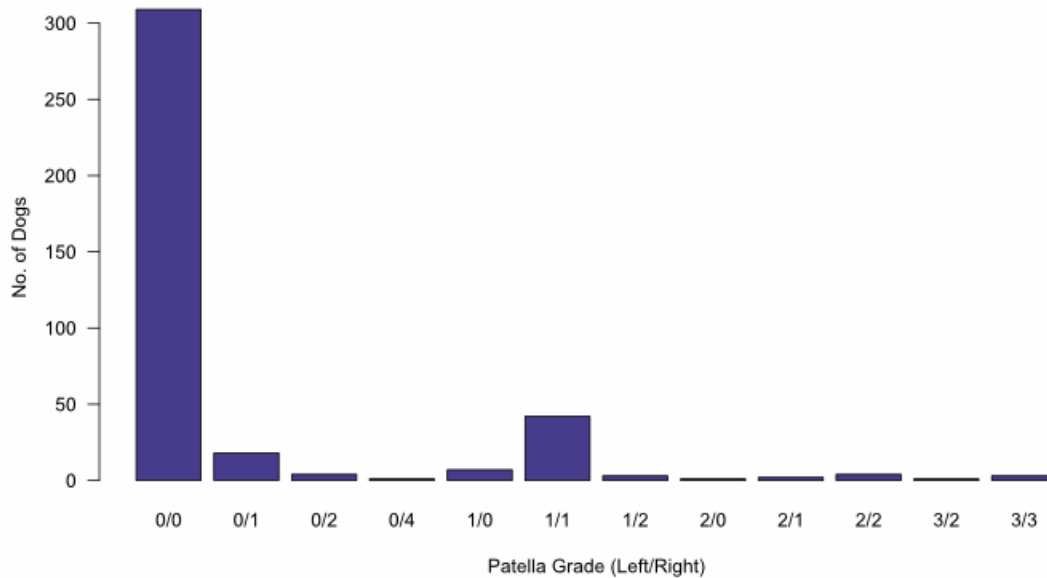
Of the 347 CNR French Bulldogs, again the majority of dogs graded 0 or 1, with 10.7% a grade 2 or 3 (graph below).



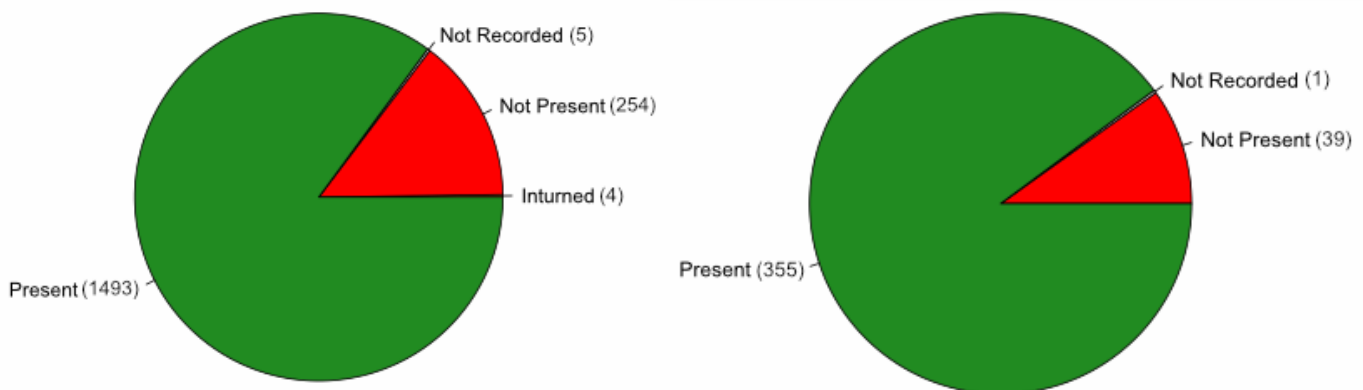
Patellar grading is also incorporated into the scheme, using the Putnam scheme, which grades a dog's degree of luxation on a scale from 0 to 4. Of 1,755 patellar graded under the scheme, 77.5% were graded 0/0 (meaning normal in both limbs), no dog was graded a 4, however there were six incidences of grade 3s in both or one limb (graph below).



Of 395 CNR French Bulldogs, 78.2% had normal (0/0) patellars, however there were four incidences of grade 3s in both or one limb (graph below).



Presence and abnormalities in the tail are another factor of the scheme, with the findings given in the graph below (standard colours on the left, CNR on the right). A total of 14.5% (n=254) standard coloured dogs had no recorded tail, and inturned tail was present in 0.2% of dogs. With regard to the CNR dogs, 9.9% had no recorded tail, with no reports of inturned tails.



Vets are requested to comment on aspects of the eye of the dog undergoing the scheme, including the following: excessive tearing, eyes of unequal size, enlarged third eyelid, entropion, ectropion, dry eye, distichiasis, pannus, and corneal scarring. The findings of eye examinations under the scheme to date are shown in Table 1 below. Overall, 90.8% of standard coloured dogs (n=1,754) had no issues reported, and similarly 86.6% of CNR (n=395) had no reported concerns. Seventeen of the standard colour dogs had multiple issues in the eye, and nine CNR also had multiple issues stated.

Table 1: Eye Examination Results for French Bulldogs that have participated in the Club Health Scheme to date.

Eye Observation	Count of standard coloured dogs	Eye Observation	Count of CNR dogs
Excessive tearing	77	Excessive tearing	30
Entropion	42	Entropion	15
Eyes of unequal size	20	Eyes of unequal size	7
Distichiasis	17	Enlarged third eyelid	5
Other	17	Distichiasis	3
Ectropion	11	Corneal scarring	2
Enlarged third eyelid	6	Dry eye	1
Corneal scarring	4		
Dry eye	1		
Enucleation	1		
Pannus	0		

Examination of the ears and ability to hear are tested, as well as the degree of stenosis of the ear canals. A total of 1,750 standard coloured dogs have been tested, with 95.3% having both ears open and all but 38 having established hearing. With regard to CNR dogs, of the 394 tested, 93.7% had open ear canals and all but seven dogs had established hearing. Recordings of the degree of stenosis in the remaining dogs are shown in Table 2 below.

Table 2: Ear Examination Results for French Bulldogs that have participated in the Club Health Scheme to date.

Ear Observation	Count of standard coloured dogs	Ear Observation	Count of CNR dogs
One ear narrow, one ear open	35	One ear narrow, one ear open	12
Both ears narrow	44	Both ears narrow	12
Both ears closed	2	Both ears closed	0
One ear open, one ear closed	1	One ear open, one ear closed	1

With regard to heart auscultation, 99.5% of 1,754 standard coloured dogs had a normal heart examination, with just three graded with a grade 1 heart murmur, two with sinus arrhythmia and one with a grade 3 heart murmur. Of the 395 CNR dogs, 99.0% had a normal examination, with three dogs affected with a grade 1 heart murmur and one with an ungraded heart murmur.

Finally, skin health was assessed with vets requested to consider whether the skin was good, whether there were areas of inflammation or any patches of hair loss/baldness, or any other comments. Thirteen of the 1,746 standard coloured dogs had

reported inflamed areas, four comments of “skin not good”, one with interdigital dermatitis, and one with seasonal alopecia. The remaining 98.9% had normal and healthy skin. Of the CNR dogs, three had inflamed areas, two “skin not good”, two with atopy, and one for both early skin disease and seasonal allergies. The remaining 97.7% had healthy skin.

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 collected for 154 live French Bulldogs of which 73 (47%) were healthy and 81 (53%) had at least one reported health condition. The top categories of diagnosis were ocular (20.8%, 27 of 130 reported conditions), musculoskeletal (17.7%, 23 of 130 reported conditions), reproductive (13.8%, 18 of 130 reported conditions) and aural (9.2%, 12 of 130 reported conditions). The three most frequently reported specific conditions were corneal ulcers (11.5%, 15 of 130 conditions), otitis externa (7.7%, 10 of 130 conditions) and patellar luxation (6.9%, 9 of 130 conditions).

2004 Mortality results: A total of 71 deaths were reported in the breed. The median age at death for French Bulldogs was 9 years (min = 5 months, max = 14 years and 8 months). The most frequently reported causes of death by organ system or category were cancer (38.0%, 27 of 71 deaths), neurological (16.9%, 12 of 71 deaths), old age (8.5%, 6 of 71 deaths), respiratory (7.0%, 5 of 71 deaths) and musculoskeletal (4.2%, 5 of 71 deaths). The three most frequently reported specific causes of death were cancer – type unspecified (22.5%, 16 of 71 deaths), brain tumour (7.0%, 5 of 71 deaths) and epilepsy (5.6%, 4 of 71 deaths).

2014 Morbidity results: Health information was collected for 330 live French Bulldogs of which 210 (63.6%) had reported no conditions and 120 (36.4%) reported affected by at least one condition. The most frequently reported specific conditions were hypersensitivity (allergic) skin disorder (6.46%, 17 of 263 conditions), Brachycephalic Obstructive Airway Syndrome (BOAS) (6.08%, 16 of 263 conditions), narrowed nostrils (5.70%, 15 of 263 conditions) and otitis media (4.94%, 13 of 263 conditions). Further analysis of the morbidity results suggested that the French Bulldog was at increased risk of BOAS, otitis media, persistent vomiting and rash between skin folds and at a decreased risk of arthritis and lipoma compared to the average risk for dogs of all breeds.

2014 Mortality results: Just 21 deaths were reported in the breed. The median age at death for French Bulldogs was 5.9 years (min = 0 years, max = 14 years). The most frequently reported causes of death were cardiac (heart) failure (19.0%, 4 of 21 deaths), cancer – unspecified (9.52%, 2 of 21 deaths), aggression (4.76%, 1 of 21 deaths), allergies and bone tumour (4.76%, 1 of 21 deaths).

BREED SPECIFIC HEALTH SURVEYS

No breed-specific health surveys are currently available.

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 French Bulldog is predisposed to, but found that 38.0% of French Bulldogs died as a result of cancer (n=71), with a median age at death of 9 years (Dobson et al, 2013).

Neurological conditions

Intervertebral disc disorder (IVDD): A recent study of 178 French Bulldogs which had been treated at the Royal Veterinary College (RVC) between November 2010 and September 2016, 77 of which had IVDD and 101 which were unaffected, found that dogs of the breed with kyphosis (excessive curvature of the spine) were at almost two times increased odds (odds ratio (OR) = 1.98, 95% C.I. 1.04-3.78) of being affected by cervical or thoracolumbar IVDD than those without kyphosis (Inglez de Souza et al, 2018).

Reproductive conditions

Dystocia: In a study to investigate the percentage of litters born by caesarean section, the French Bulldog had the third highest reported caesarean section rates. Using data collected during the 2004 Purebred Dog Health Survey, of 248 litters reported in the breed, 81.3% (65 of 80) of litters were delivered by caesarean section (Evans and Adams, 2010). It was not possible to determine in that study whether the caesarean section was an elective or emergency procedure.

Respiratory conditions

Brachycephalic obstructive airway syndrome (BOAS): A large research project into BOAS has been underway at the Queen's Veterinary School Hospital, University of Cambridge, for several years. A study of 89 French Bulldogs, 19 of which had been referred as BOAS cases and 70 of which were presented to participate in the research by their owners, reported a prevalence of 9 0.54 (95% C.I. 0.43–0.65) across the whole study group and 0.43 (95% C.I. 0.31-0.55) if the clinical cases were excluded (Liu et al., 2015).

A subsequent study of 214 dogs of the breed (17.3% of which were clinical cases and 82.7% were volunteered) found that 10.7% had a BOAS functional grade of 0, 30.4% grade I, 43.5% grade II and 15.4% grade III (Liu et al, 2017). Considering the nares (nostrils), 10.8% had open nares, 13.6% had mild stenosis, 29.0% had moderate stenosis and 45.3% had severely stenotic nares.

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 French Bulldog which is shown below and, in addition, the French Bulldog is included in the condition-specific studies also detailed below.

A breed-specific VetCompass study was published in 2018, with 2228 dogs of the breed represented (out of a total of 445,557 dogs attending veterinary practices during 2013) (O'Neill et al, 2018).

Of the dogs that were included in the study 1612 (72.4%) were reported to be affected by at least one condition. The most prevalent conditions reported are shown in Table 3 below.

Table 3: The most commonly reported disorders of French Bulldogs included in the breed-specific VetCompass study.

Disorder	Count	Prevalence	95% CI
Otitis externa	312	14.0%	12.6 – 15.5
Diarrhoea	167	7.5%	6.4 – 8.7
Conjunctivitis	71	3.2%	2.5 – 4.0
Overlong nails	69	3.1%	2.4 – 3.9
Skin fold dermatitis	66	3.0%	2.3 – 3.8
Anal sac impaction	64	2.9%	2.2 – 3.7
Upper respiratory tract infection	61	2.7%	2.1 – 3.5
Pyoderma	60	2.7%	2.1 – 3.5
Prolapsed nictitans gland	57	2.6%	1.9 – 3.3
Pododermatitis	50	2.5%	1.9 – 3.2

Males were significantly more commonly affected by conjunctivitis, pyoderma, BOAS, aggression, vomiting, upper respiratory tract disorder, claw injury and stenotic nares.

The most common conditions by category were cutaneous (17.9%), enteropathy (16.7%), aural (16.3%), upper respiratory tract (12.7%) and ophthalmological (10.5%).

With regard to mortality the top causes for death in the breed were found to be brain disorder (11.9%, median age at death 2.1 years), spinal cord disorder (9.5%, median age at death 4.0 years), lower respiratory tract disorder (7.1%, 0.9 years), mass lesion (7.1%, 7.0 years) and upper respiratory tract disorder (7.1%, 2.5 years). It is important to consider that due to the breed's sudden rise in popularity the age at death will be artificially depressed.

Musculoskeletal conditions

Patellar luxation: The French Bulldog was one of four breeds proposed as having a possible predisposition to this condition, based on data from 210,824 dogs attending primary-care veterinary practices in the UK between 2009 and 2014 (O'Neill et al, 2016). The breed were proposed an odds ratio of 5.4 (95% CI 3.1 – 9.3) with a prevalence of 4.0% (95% CI 2.1 – 5.8, n=1,280). Neutered dogs were found to be at a higher risk of developing the condition, with an odds ratio of 2.4 (95% CI 1.8 – 3.2), as were females, with an odds ratio of 1.3 (95% CI 1.1 – 1.5) and dogs below the mean breed weight, 1.4 (95% CI 1.2 – 1.6).

Neurological conditions

Seizures: In a study of breed predispositions to seizures, the French Bulldog was identified as one of eleven breeds with a possible susceptibility, based on information from 455,553 dogs (Erlen et al, 2018). Nineteen cases were used in the study, as well as 2,378 non-cases, with an odds ratio of 1.87 (95% CI 1.17 – 2.98). Unfortunately, no reliable history on seizure activity in affected French Bulldogs were available.

Ocular conditions

Corneal ulcerative disease: The French Bulldog had a prevalence of 1.87% (95% CI 0.97 – 3.24) for corneal ulcers, based on 12 cases and 643 non-cases (O'Neill et al, 2017). From this, an odds ratio of 7.25 was established (95% CI 3.92 – 13.42) for the breed. The authors noted that brachycephalic breeds were at a higher odds, with this being 11.18 (95% CI 8.72 – 14.32) across these breeds.

Respiratory conditions

Brachycephalic obstructive airway syndrome (BOAS): A VetCompass study of upper respiratory tract disorders, which included 1,503 dogs of the breed, found a random sample of the French Bulldogs in the dataset had a 20.0% prevalence of upper respiratory tract disorders, of which 12% were nares/nasal cavity disorders and 6.0% tracheal disorders, 10.5% were multi-site disorders and 1.5% were categorised as BOAS (O'Neill et al, 2015).

Reproductive conditions

Dystocia: The French Bulldog was established as the breed with the highest odds ratio for this condition, based on 701 cases among 18,758 bitches (O'Neill et al, 2017). The authors proposed an odds ratio of 15.9 (95% CI 9.3 – 27.2) and found a prevalence of 20.6% (95% CI 13.1 – 28.4) for dystocia in the breed.

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 (O'Neill et al, 2019). The French Bulldog was one of seven breeds found to be at increased odds of developing demodicosis, particularly in younger dogs (aged <2 years), with a prevalence of 1.88% (95% CI 2.40 – 2.73). An all age breed prevalence of 1.29% was established (95% CI 0.88 – 1.83). An odds ratio of 5.07 (95% CI 3.37 – 7.63) was set for the breed. However, no cases were identified in dogs over the age of four years implying this affects dogs of a younger age in the breed.

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 included

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 dogs insured with Agria UK. 'Exposures' are equivalent to one full policy year; in 2017 there were 1,183 free exposures, 1,566 full exposures and 1,963 claims, in 2018 (up to July) these figures were 1,449, 1,604 and 2,238 respectively.

Data relating to two different types of policies were supplied. 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.

Table 4: Conditions and number of settlements for each condition between 1st July 2017 and 31st June 2018 for French Bulldogs insured with Agria UK shown.

Condition	Number of settlements
Hypersensitivity (allergic) skin disorder (unspecified)	225
Brachycephalic airway obstruction syndrome (BAOS)	124
Atopy finding	119
Ulcerative keratitis (Corneal ulceration)(unspecified)	65
Skin (cutaneous) disorder (unspecified)	63
Fracture of thoracic limb - humerus (site unspecified)	54
Epilepsy - idiopathic generalised	53
Patellar luxation - medial	48
Vomiting - presumed self-limiting	48
Gastroenteritis	47

\$ 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 Agria data

Swedish morbidity and mortality insurance data were also available from Agria for the. 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). The number of DYAR for the French Bulldog in Sweden during this period was 15,000 <25,000. 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 French Bulldogs in Sweden between 2011 and 2016 are shown in Figure 2. The top five specific causes of VCEs were vomiting/diarrhoea/enteritis, otitis, dermatitis/pyoderma/folliculitis, corneal ulcer, and allergy/atopy.

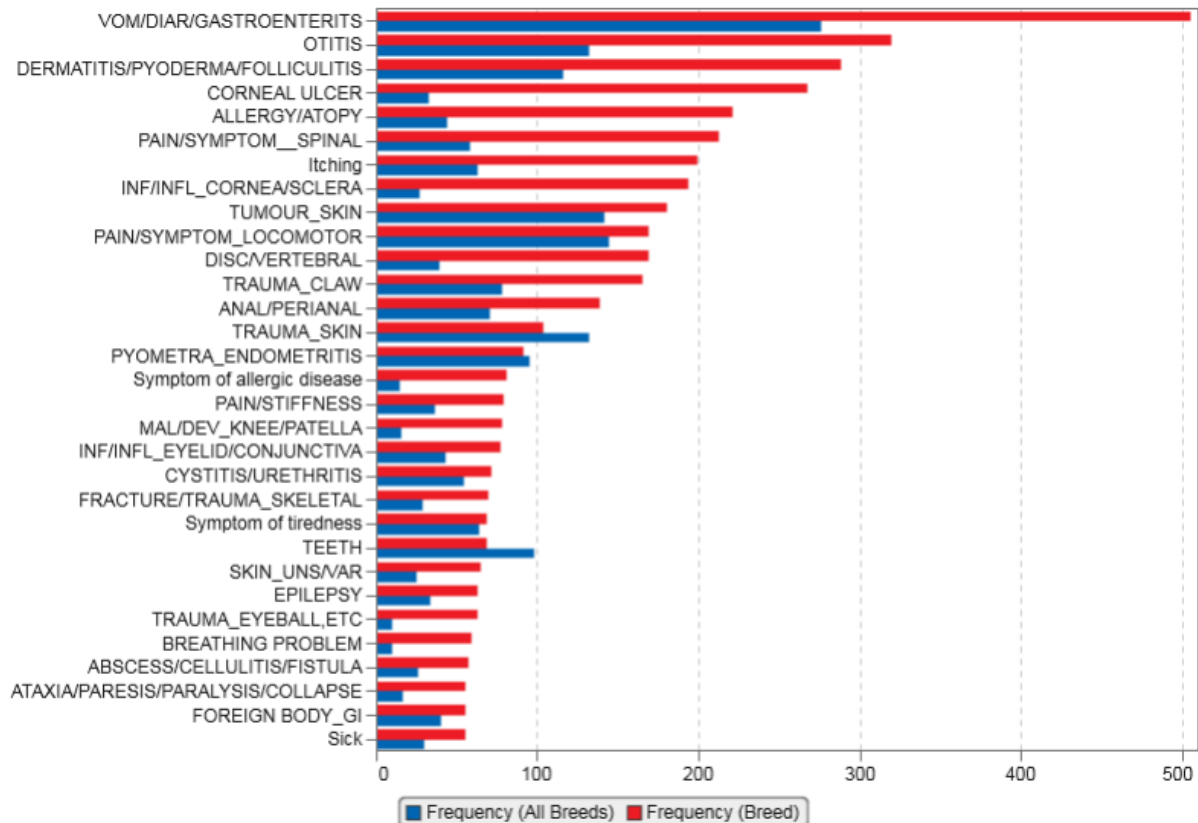


Figure 2: The most common specific causes of VCEs for the French Bulldog compared to all breeds in Sweden 2011 - 2016, from Swedish Agria insurance data.

When relative risk of specific causes of VCEs was compared for the French Bulldogs to all breeds, some interesting findings were reported. The specific causes of VCEs ordered by relative risk are shown in Figure 3. In this analysis, the top five specific causes of VCEs ordered by relative risk were malformation or developmental abnormalities of the respiratory tract, malformation/ developmental abnormalities of the spine, corneal ulcer, tremor/ shaking, infection/ inflammation of the cornea/ sclera and trauma to the eyeball.

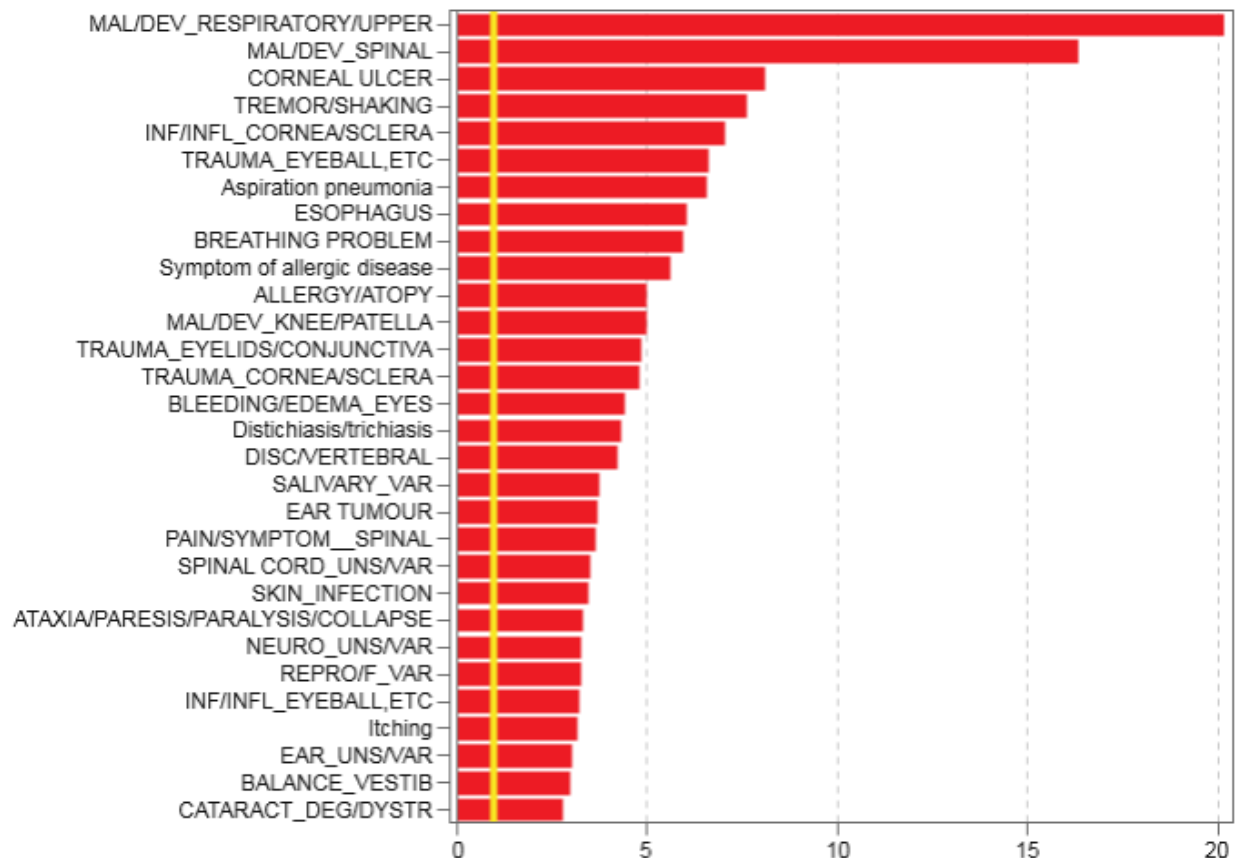


Figure 3: The specific causes of VCEs for the French Bulldog ordered by relative risk compared to all breeds in Sweden 2011 - 2016, from Swedish Agria insurance data.

Further analysis was undertaken on locomotor disorders with French Bulldogs having a higher relative risk of spinal, knee/ patellar, hock, unspecified/ various and hip/ femur/ pelvic problems (Figure 4).

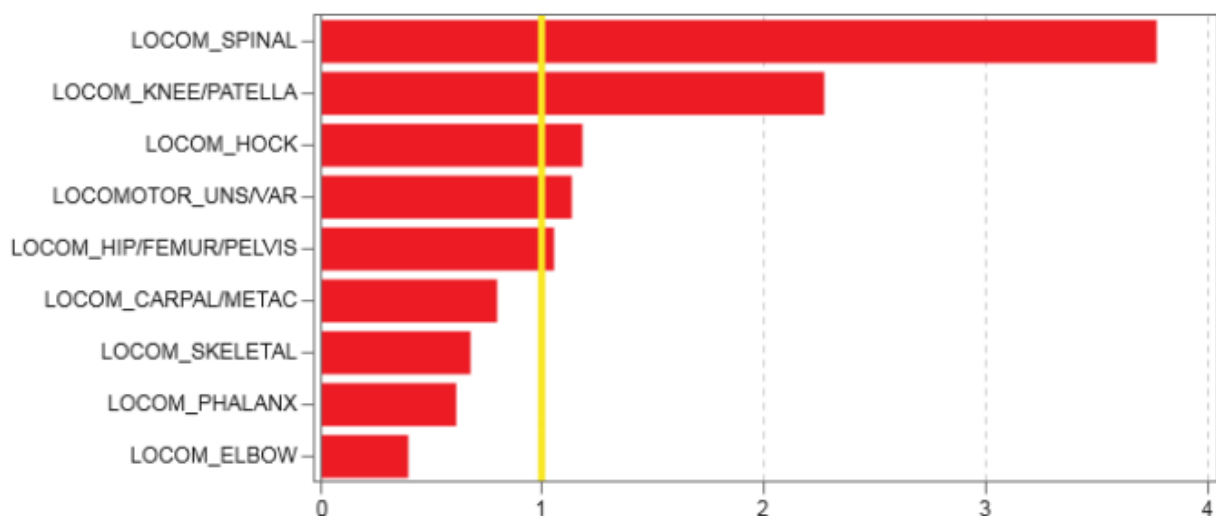


Figure 4: Relative risk morbidity for locomotor disorders compared to all breeds in Sweden 2011 – 2016, from Swedish Agria insurance data.

Swedish Agria insurance mortality data

The most common specific causes of death were disc/vertebral, epilepsy, dead/ euthanised, breathing problem and ataxia/ paresis/ paralysis/ collapse (Figure 5).

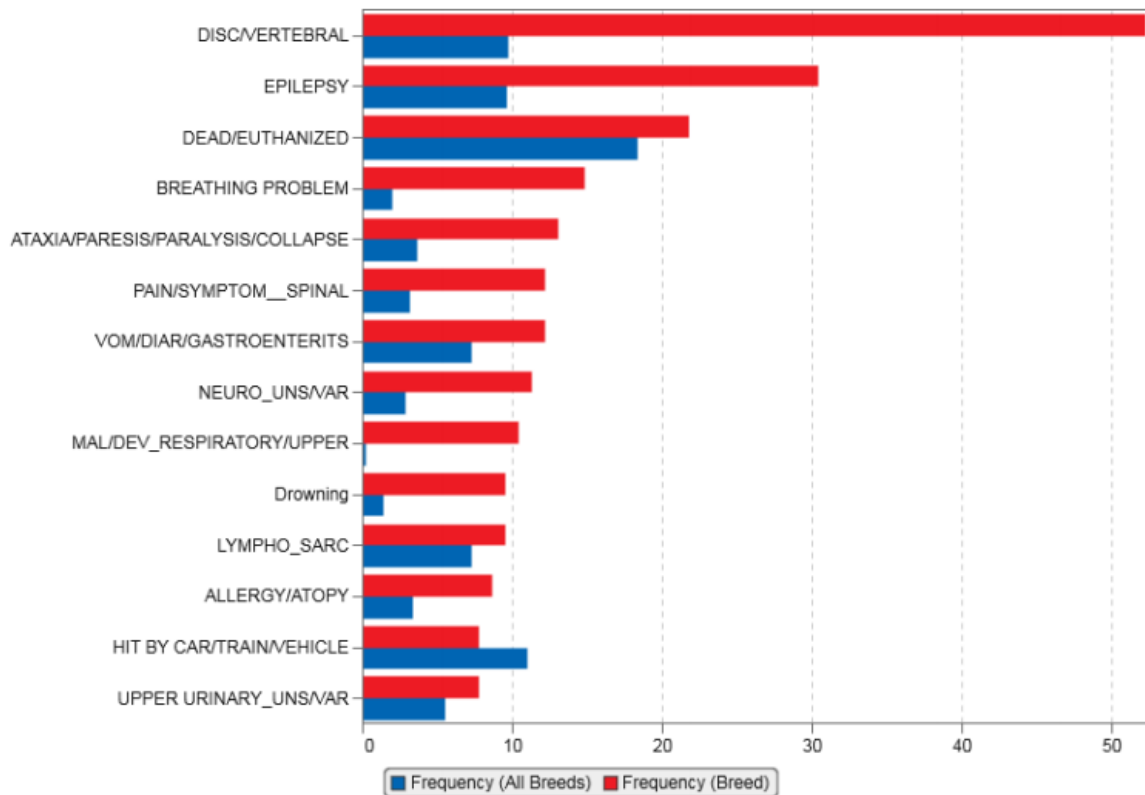


Figure 5: The most common specific causes of death for the French Bulldog compared to all breeds in Sweden between 2011 and 2016, from Swedish Agria insurance data.

BREED WATCH

As a category two breed judges' health monitoring forms are mandatory. The points of concern reported are shown below in Table 4. Those marked with a * indicate newly reported points of concern.

Table 4: Percentage of French Bulldogs exhibited at Dog shows with points of concern for 2016 to 2018. Those with a * indicate new points of concern.

Point of concern	2016	2017	2018	2019
Difficulty breathing	0.35%	0.82%	0.00%	0.00%
Dogs showing respiratory distress including difficulty breathing or laboured breathing	0.00%	0.07%	0.61%	0.37%
Exaggerated roach in the top line	2.03%	0.00%	2.17%	1.76%
Excessively prominent eyes	0.73%	0.49%	0.11%	0.00%
Incomplete blink	0.91%	2.10%	0.07%	0.00%
Incorrect bite	1.73%	0.37%	0.68%	1.18%
Inverted tail	0.30%	0.16%	0.39%	0.00%
Lack of tail	4.58%	0.00%	1.60%	0.00%
Lack of tail, screw tail, inverted tail and tight tail	0.00%	2.05%	3.21%	2.99%
Overly short neck	0.91%	2.27%	0.00%	0.00%
Pinched nostrils	7.73%	2.01%	4.99%	3.53%
Prominent eyes	0.00%	0.00%	0.46%	0.00%
Screw tail	0.60%	5.15%	0.04%	0.32%
Short neck	0.00%	0.97%	2.56%	0.75%
Signs of dermatitis in skin folds	0.13%	0.62%	0.11%	0.16%
Tight tail	1.94%	9.07%	0.53%	0.00%
* Excessive wrinkle	0.13%	0.00%	0.00%	0.00%
* Eye/Eyelid abnormalities	0.00%	0.16%	0.00%	0.00%
* Incorrect dentition	0.00%	0.00%	0.00%	0.00%
* Lower lip over incisors (tight lip)	0.00%	0.21%	0.00%	0.16%
*Weak hind movement	0.69%	0.21%	0.18%	0.00%
Total	2482	2686	2808	1870

NB: In 2017 the points 'inverted tail', 'lack of tail', 'screw tail' and 'tight tail' were combined into 'lack of tail, screw tail, inverted tail and tight tail' which explains the sudden uptake of this point of concern and fall in the old points.

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 are required to be granted for exhibitors with a dog that has had surgery that alters its natural conformation. PTS granted to date are shown in Table 5 below.

Table 5: PTS surgeries granted to date for exhibits per year

Surgery	Year				
	2015	2016	2017	2018	2019
An operation to repair a fractured leg				1	
Enucleation (eye removal)			1		1
Prolapsed harderian gland (Cherry eye)	1				
Removal of lumps/ masses/ tumours/ cysts				1	
Shortening of soft palate (following trauma/ injury)		1			
Umbilical hernia			1		

ASSURED BREEDER SCHEME

It is currently required that all Assured Breeders undergo the following on all breeding stock:

- Participation in the University of Cambridge/ KC RFG Scheme

It is also recommended that the following are undertaken:

- Eye testing through the British Veterinary Association (BVA)/ KC Eye Testing Scheme – annual
- DNA test for hereditary cataracts (HC) – HSF4
- Participate in the French Bulldog Health Scheme
- DNA test for degenerative myelopathy (DM)

DNA TEST RESULTS

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

- HC-HSF4
- DM

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.

Results of dogs DNA tested for these conditions to date (03/01/2020) are shown in Table 6 below.

Table 6: HC-HSF4 DNA test results held by the Kennel Club for French Bulldogs up to 03/01/2020.

DNA Test	Total Number of Results	CLEAR	CARRIER	AFFECTED	HEREDITARILY CLEAR	HEREDARILTY CARRIER
HC-HSF4	17,413	3,146 (18.3%)	33 (0.2%)	0	14,234 (81.5%)	0
DM	5,643	1,631 (28.9%)	575 (10.2%)	66 (1.2%)	3,303 (58.5%)	68 (1.2%)

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

In total 43 French Bulldogs have been hip scored as part of the BVA/KC Hip Dysplasia Scheme in the 15 years to the beginning of 2020. The median hip score received was 12 (range 5 – 93).

ELBOWS

Six French Bulldogs have been elbow scored as part of the BVA/KC Elbow Dysplasia Scheme in the past 15 years. Of these, four were graded 0 and two graded as a 1.

EYES

The French Bulldog is currently on the Known Inherited Ocular Diseases List (formally known as Schedule A) for HC (early developing) under the BVA/KC/International Sheep Dog Society (ISDS) Eye Scheme. The KIOD 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. As the changes to

the Schedules of the Eye Scheme are very recent (as of 01/01/2020) no report is available for French Bulldogs examined under the KIOD to date.

Schedule B has been replaced with sightings reports, which are in place to monitor any emerging or existing eye conditions in the breed. The results of Eye Scheme sightings reports of French Bulldogs which have taken place since 2012 are shown in Table 7.

Table 7: Sightings reports on French Bulldogs which have participated in the BVA/KC/ISDS Eye Scheme since 2012.

Year	Number seen	Comments	
2012	10 adults	No sightings reported	
2013	46 adults 5 litters	Adults 1 – entropion 1 – persistent pupillary membranes 1 – other cataract 1 – choroidal hypoplasia 1 – cherry eye 1 – micropunctum	Litter 1 – multifocal retinal dysplasia
2014	30 adults 4 litters	Adults No sightings reported	Litter 1 - distichiasis
2015	46 adults 3 litters	Adults 1 – multifocal retinal dysplasia	
2016	42 adults 1 litter	Adults 2 - distichiasis	
2017	36 adults 1 litter	No comments	
2018	60 adults 3 litters	No comments	

American College of Veterinary Ophthalmologists (ACVO)

Results of examinations through AVCO are shown in Table 8 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 French 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 8). Overall 74.9% of the dogs examined between 2015-2019 had normal eye conformation and were

unaffected by ocular disease. It should be remembered that these were dogs examined in America.

Table 8: ACVO examination results for French Bulldogs, 1991 - 2019

Disease Category/Name	Percentage of Dogs Affected	
	1991-2014 (n=3,491)	2015-2019 (n=1,791)
Eyelids		
Entropion	1.1%	0.7%
Distichiasis	7.0%	5.5%
Nasolacrimal		
Imperforate lower nasolacrimal punctum	0.5%	2.4%
Uvea		
Persistent pupillary membranes (iris to iris)	2.2%	3.3%
Persistent pupillary membranes (iris to cornea)	1.4%	1.2%
Persistent pupillary membranes (endothelial opacity/no strands)	0.9%	1.6%
Lens		
Cataracts (significant)	3.5%	3.5%
Vitreous		
Persistent hyaloid artery/ remnant	2.4%	1.9%
Retina		
Retinal dysplasia	2.4%	1.9%

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 03/01/2020 for dogs of the breed graded under the scheme are shown in Table 9 below.

Table 9: University of Cambridge/KC RFG Scheme results for French Bulldogs, 2016 - 2019

Grade	Total Dogs	Male	Female
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0	60 (53.6%)	105 (93.8%)	14 (36.8%)	36 (94.7%)	46 (62.2%)	69 (93.2%)
1	45 (40.2%)		22 (57.9%)		23 (31.1%)	
2	6 (5.4%)	7 (6.2%)	2 (5.3%)	2 (5.3%)	4 (5.4%)	5 (6.8%)
3	1 (0.9%)		0 (0.0%)		1 (1.4%)	
Total	112		38		74	

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 French Bulldog and the number of reported caesarean sections in the breed for the past 10 years are shown in Table 10.

Table 10: Number of litters of French Bulldogs registered per year and number of caesarean sections reported per year, 2008 to 2018.

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)
2008	245	1	0.41%	0.05%
2009	357	0	0.00%	0.15%
2010	531	9	1.69%	0.35%
2011	667	51	7.65%	1.64%
2012	1021	356	34.87%	8.69%
2013	1485	493	33.20%	9.96%
2014	2089	709	33.94%	10.63%
2015	3155	1066	33.79%	11.68%
2016	4620	1633	35.35%	13.89%
2017	5783	2192	37.90%	15.00%
2018	7047	2972	42.17%	17.21%

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 132.2 was reported (estimated using the rate of inbreeding over the period 1980-2014). The rate of inbreeding has remained relatively steady and is within the level thought to be sustainable. This means that there is a suitable balance between selective breeding and inbreeding, therefore the genetic diversity is being effectively managed (Food & Agriculture Organisation of the United Nations, "Breeding strategies for sustainable management of animal genetic resources", 2010).

Annual mean observed inbreeding coefficient (showing loss of genetic diversity) and mean expected inbreeding coefficient (from 'random mating') over the period 1980-2014 are shown in Figure 5. 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, since the early 2000s the rate of inbreeding has been negative, implying moderate 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>.

The current breed average inbreeding coefficient is 2.5%.

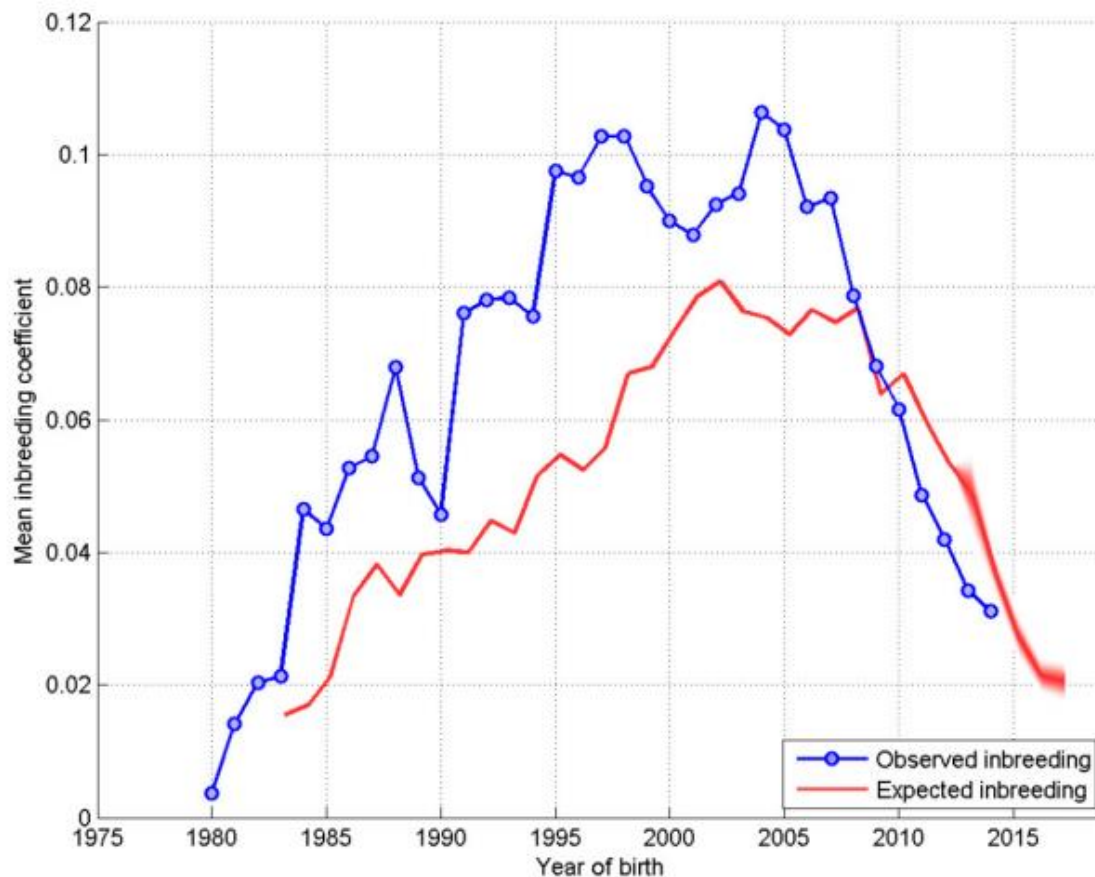


Figure 5: Annual mean observed and expected inbreeding coefficients

Below is a histogram ('tally' distribution) of number of progeny per sire and dam over each of seven 5-year blocks (Figure 6). 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 lengthening in figure 6).

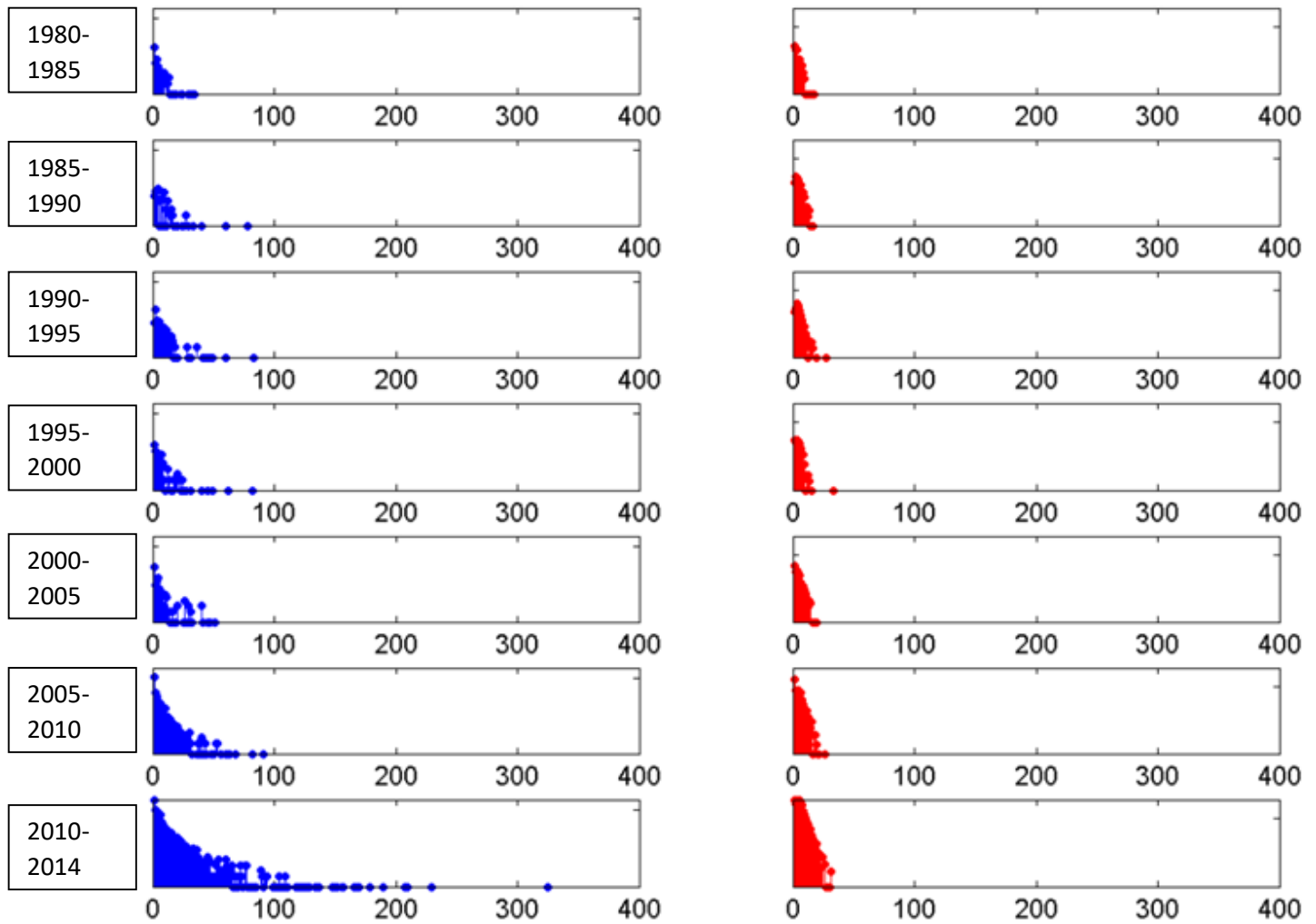


Figure 6: Distribution of progeny per sire (blue) and per dam (red) over 5-year blocks (1980-4 top, 2010-14 bottom). Vertical axis is a logarithmic scale.

CURRENT RESEARCH

The French Bulldog is part of the BOAS research project underway at the University of Cambridge and have also been contributing to research that is being carried out alongside the RVC and AHT into the heritability and progression of DM.

PRIORITIES

A meeting was held with the French Bulldog breed representatives on 8th April 2019, 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 that the breed priorities for the French Bulldog would be:

- BOAS
- Spinal disorders
- Allergies

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 French Bulldog. Both partners are expected to action these points prior to the next review.

Breed Club actions include:

- The breed to continue to support and attend the Brachycephalic Working Group with the additional support of the Kennel Club - **ONGOING**
- The welfare groups to send their collected health data to the Kennel Club for analysis
- The breed clubs to nominate a Breed Health Co-ordinator and form a health committee, with representatives from every club
- The breed clubs to encourage participation in the RFG Scheme, with a target to improve upon the uptake to date, and every breed club to hold a testing session
- The breed clubs to take the amended breed standards to their club's AGM and feedback to the Kennel Club
- The breed clubs to send details for all health testing events to the Kennel Club for inclusion in the 2020 health calendar

Kennel Club actions include:

- The Kennel Club to keep the breed updated with regard to the development of the neurology scheme
- The Kennel Club to monitor outcomes and/or research on allergies, specifically with regard to skin problems, which include the French Bulldog
- The Kennel Club to fund and progress the development of a body condition score chart for the breed, in collaboration with the University of Cambridge
- The Kennel Club to develop a health survey, using the Dachshund health and lifestyle survey as a template, and circulate to registered owners, following the breed's approval
- The Kennel Club to review the breed's status as a Category 2 breed under Breed Watch

REFERENCES

- Dobson, J.M. (2013) Breed-predispositions to cancer in pedigree dogs. *Hindawi* <http://dx.doi.org/10.1155/2013/941275>
- Erlen, A., Potschka, H., Volk, H.A., Sauter-Louis, C., O'Neill, D.G. (2018) Seizure occurrence in dogs under primary veterinary care in the UK: prevalence and risk factors. *Journal of Veterinary Internal Medicine* **32**: 1665-1676
- Evans, K., Adams, V.J. (2010) Proportion of litters of purebred dogs born by caesarean section. *Journal of Small Animal Practice* **51**: 113-118
- Inglez de Souza, M.C.C.M., Ryan, R., ter Haar, G., Packer, R.M.A., Volk, H.A. and De Decker, S. (2018) Evaluation of the influence of kyphosis and scoliosis on intervertebral disc extrusion in French bulldogs. *BMC Veterinary Research* **14**: 5 DOI 10.1186/s12917-017-1316-9
- Liu, N.-C., Sargan, D. R., Adams, V. J., & Ladlow, J. F. (2015). Characterisation of brachycephalic obstructive airway syndrome in french bulldogs using whole-body barometric plethysmography. *PLoS ONE*, **10**(6), e0130741
- Liu, N.-C., Troconis, E.L., Kalmar, L., Price, D.J., Wright, H.E., Adams, V.J., Sargan, D.R. and Ladlow, J.F. (2017) Conformational risk factors of brachycephalic obstructive airway syndrome (BOAS) in pugs, French bulldogs and bulldogs. *PLoS ONE* **12** (8): e018928
- O'Neill, D.G., Jackson, C., Guy, J.H., Church, D.B., McGreevy, P.D., Thomson, P.C., and Brodbelt, D.C. (2015) Epidemiological associations between brachycephaly and upper respiratory tract disorders in dogs attending veterinary practices in England. *Canine Genetics and Epidemiology* **2**:10 doi: 10.1186/s40575-015-0023-8
- O'Neill, D.G., Meeson, R.L., Sheridan, A., Church, D.B., Brodbelt, D.C. (2016) The epidemiology of patellar luxation in dogs attending primary-care veterinary practices in England. *Canine Genetics and Epidemiology* **3**:4 DOI 10.1186/s40575-016-0034-0
- O'Neill, D.G., Lee, M.M., Brodbelt, D.C., Church, D.B., Sanchez, R.F. (2017) Corneal ulcerative disease in dogs under primary veterinary care in England: epidemiology and clinical management. *Canine Genetics and Epidemiology* **4**:5. DOI 10.1186/s40575-017-0045-5
- O'Neill, D.G., O'Sullivan, A.M., Manson, E.A., Church, D.B., Boag, A.K., McGreevy, P.D., Brodbelt, D.C. (2017) Canine dystocia in 50 UL first-opinion emergency-care veterinary practices: prevalence and risk factors. *Veterinary Record* doi: 10.1136/vr.104108
- O'Neill, D.G., Turgoose, E., Church, D.B., Brodbelt, D.C., Hendricks, A. (2019) Juvenile-onset and adult-onset demodicosis in dogs in the UK: prevalence and breed associations. *Journal of Small Animal Practice* DOI: 10.1111/jsap.13067