THE KENNEL CLUB

Breed Health and Conservation Plan

French Bulldog Evidence Base

CONTENTS

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 and 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 1990 and 2022. Numbers were low and stable between 1990 and around 2005. The trend of registrations over year of birth (1990-2022) is +1,275.5 per year (with a 95% confidence interval of +925.2 to +1,625.7), reflecting the sharp increase in popularity of the breed. A drop was seen in 2022, and this trend will be monitored closely.

[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.]

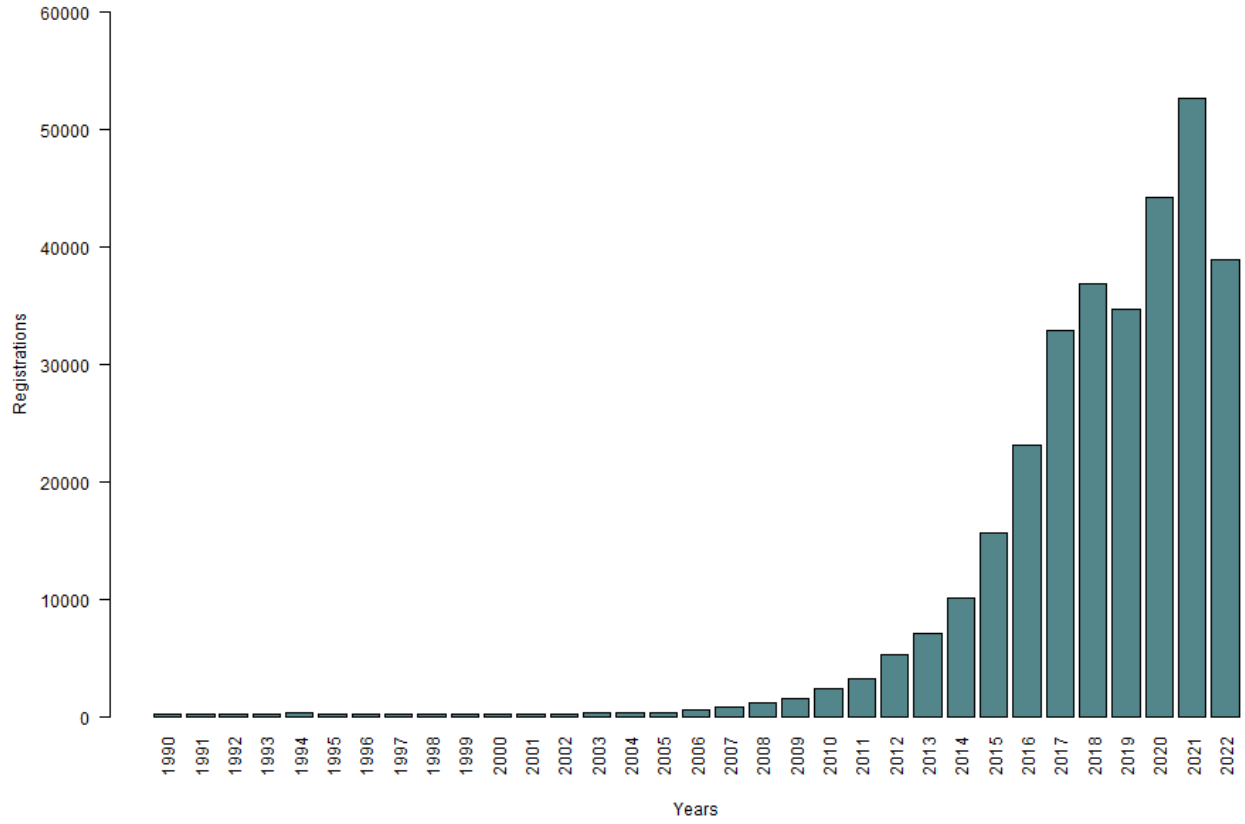


Figure 1: Number of registrations of French Bulldogs per year of birth from 1990 to 2022.

As of 2020 the Kennel Club has amended the way in which dogs are registered with regard to colour, with owners able to register a specific colour, as opposed to CNR (colour not recognised). The proportion of colours registered in 2022 are shown below, with the majority of dogs (74.0%) of non-breed standard colour.

Following recommendations made by the non-breed standard colours working party, the Kennel Club Board has approved several measures. These include the separation of breed standard and non-breed standard (NBS) colours in the Breed Record Supplement; the implementation of a Colour Watch system, similar to Breed Watch, to provide clear guidance on breed standard and NBS colours in every breed; and the introduction of a process whereby the UK owners of imported dogs are asked to record their dog's true colour from The Kennel Club's current full list of both breed standard and NBS colours.

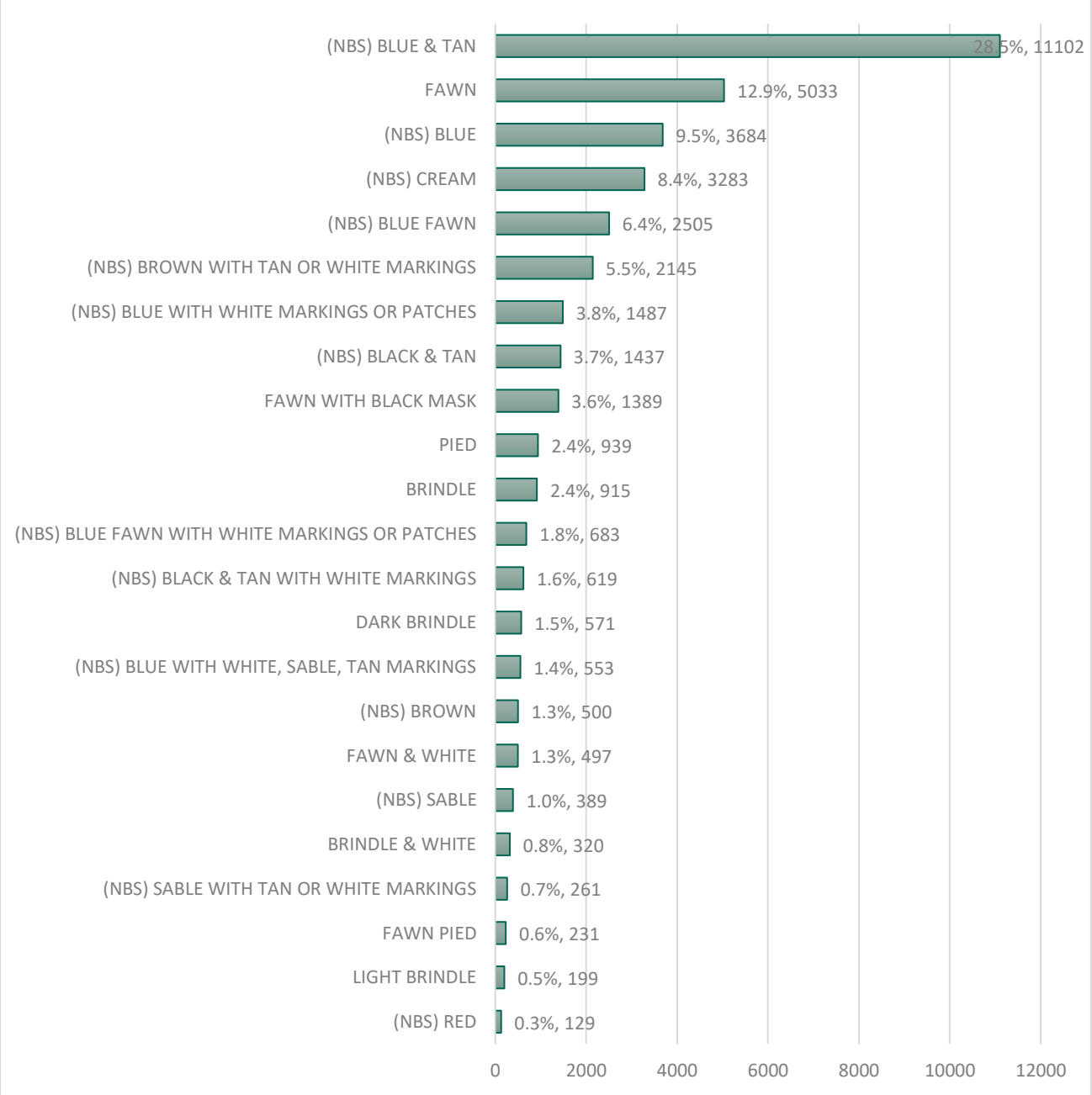


Figure 2: Breakdown of colours registered by the Kennel Club in 2022 (including colours that account for more than 0.0% of the total proportion registered).

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 2022 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 2022 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 a health testing weekend for two clubs, as well as continuing to collect data on spinal problems in the breed through the use of spine screening and collecting data on skin disorders 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 four levels.

Basic health check:

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

Upon submission to scheme a confirmation of participation is issued and the results recorded on the database.

Bronze:

This level is open to standard recognised colours only, and requires:

a) Completion of the visual health assessment as part of the Basic health check

b) Participation in the Kennel Club/ University of Cambridge Respiratory Function Grading Scheme

Silver:

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

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

Gold:

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

a) Be of standard recognised colour
b) To be at least two years of age
c) To have obtained a BOAS grade 0 or 1 under the University of Cambridge/KC RFG, when the dog is over two years of age
d) Repeated heart test with a normal reading (dog must be 2 at age of testing)
e) Spinal X-ray and evaluation

Optional recommended tests for ALL levels
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)

To minimise cost, the FBCE recommends that the basic health check is carried out by RFG assessor.

Scheme statistics – up to July 2023

Seventeen health testing events have been held by the breed clubs between 2021 as 2023.

Up to Jan 2020, 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

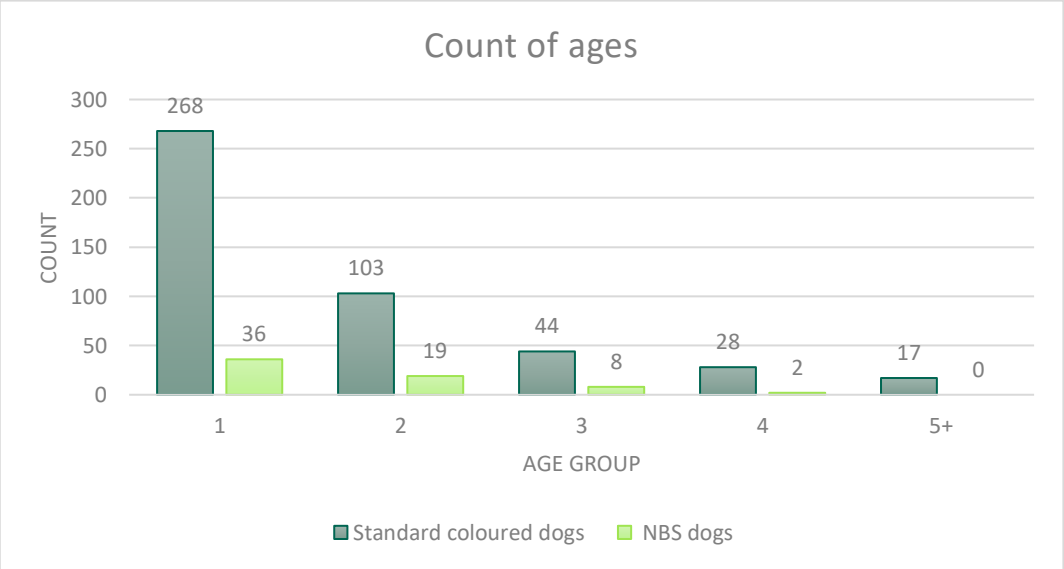
important to consider that an element of self-selection may occur, whereby it is not mandatory for owners to submit results following participation.

A full report is available here:
http://www.frenchbulldogclubofengland.org.uk/uploads/1/5/9/2/15927418/fbcehealthschemesummary2019.pdf

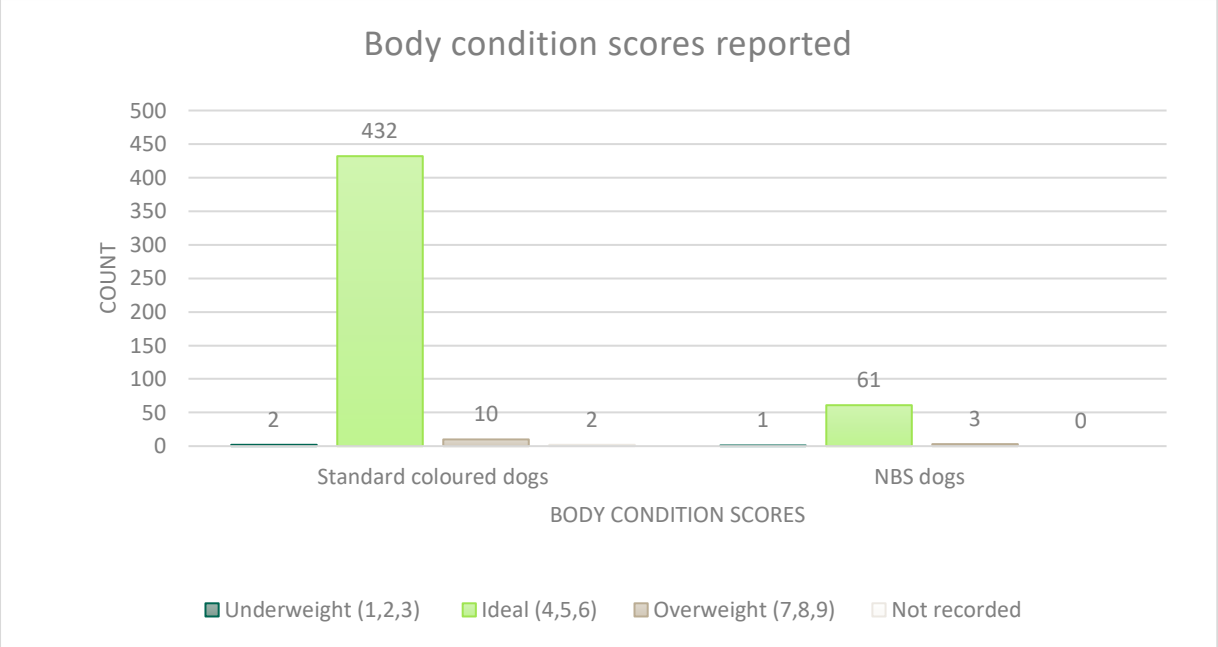
Scheme statistics – May 2020 – July 2023

Between this time, following a revision of the health scheme, 513 dogs have participated with the majority 448 being of standard colour (87.3%), 65 NBS's (non-breed standard colour) have been issued the basic confirmation of participation (12.7%). Thirteen gold awards have been certified during this time.

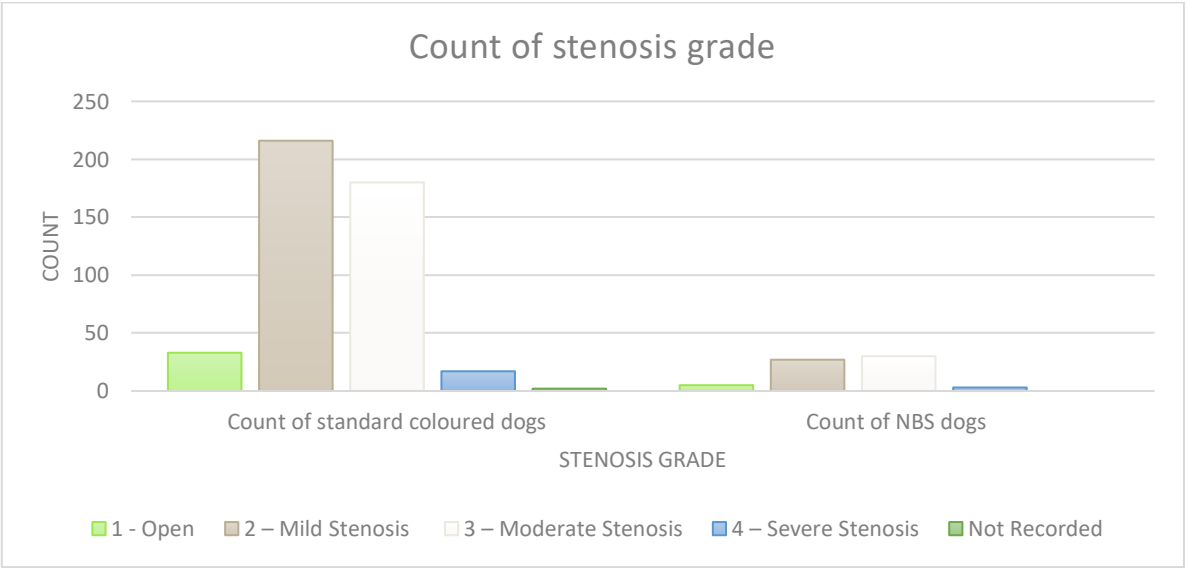
The age range of dogs that have completed the scheme to date are shown below:



Similarly, the body condition score of dogs that have taken part are shown in the graph below with the vast majority (96.5%) scoring as ideal, 0.6% underweight, 2.5% overweight, and 0.4% not recorded.



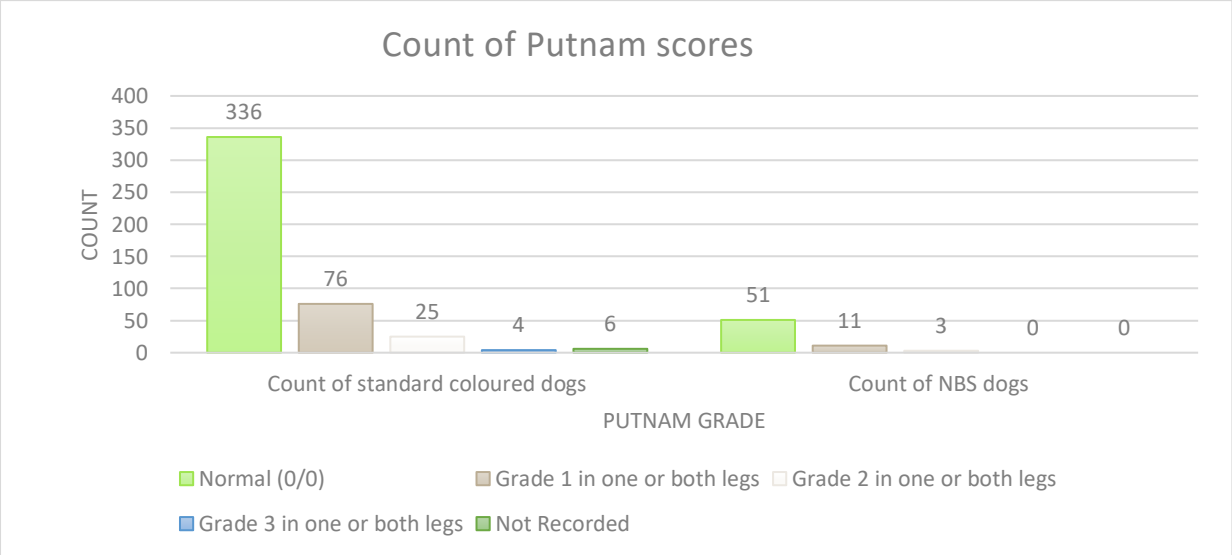
Nostril stenosis grading forms part of the assessment, with guidance document issued from Cambridge scheme. The majority of dogs (47.4%) scored with mild stenosis, followed by 40.9% with moderate stenosis, 7.4% open, 3.9% severe and 0.4% not recorded.



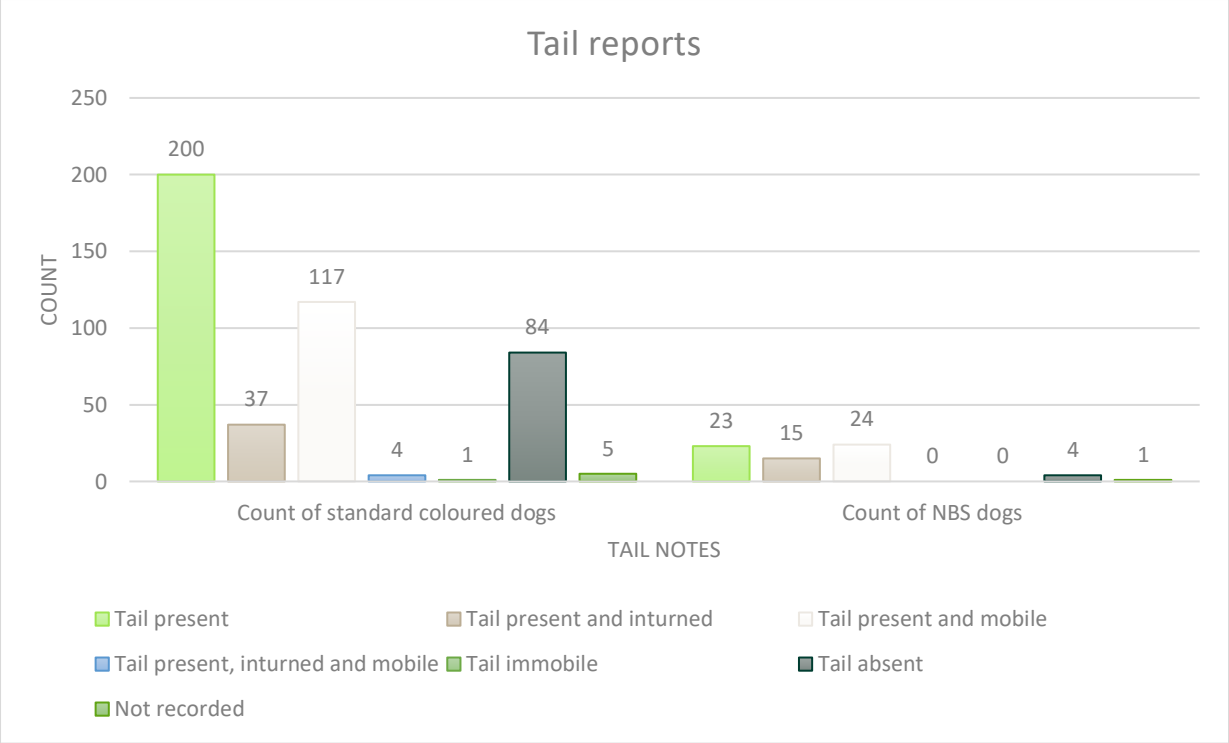
As of 2015, the health scheme incorporated the breathing protocol outlined by the University of Cambridge/ KC Respiratory Function Grading Scheme. In June 2020 the scheme form changed to avoid confusion with the Respiratory Function Grading system and Aug 2020 the Respiratory Function Grading was included at Bronze level. This therefore means that during the reporting period numerous different scoring results were submitted, including old forms using the old scoring system. The breathing reports given to date are shown in the table below:

Breathing Grade	Standard coloured dogs	CNR dogs	% Score
Grade 0	161	17	6.1%
Grade 1	132	12	17.9%
Grade 2	12	7	0.6%
Grade 3	0	0	0.0%
Very good	1	0	0.6%
Poor	1	0	0.6%
Good/Good	90	20	45.3%
Good/Acceptable	31	4	17.9%
Acceptable	9	5	6.1%
Acceptable/Good	1	0	0.6%
Acceptable/Poor	6	0	2.8%
Not Recorded	3	0	1.7%

Patella 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. The majority of dogs have been graded as a 0 (75.6%), followed by grade 1 (17.05%), grade 2 (5.5%), not recorded (1.2%) and grade 3 (0.8%).



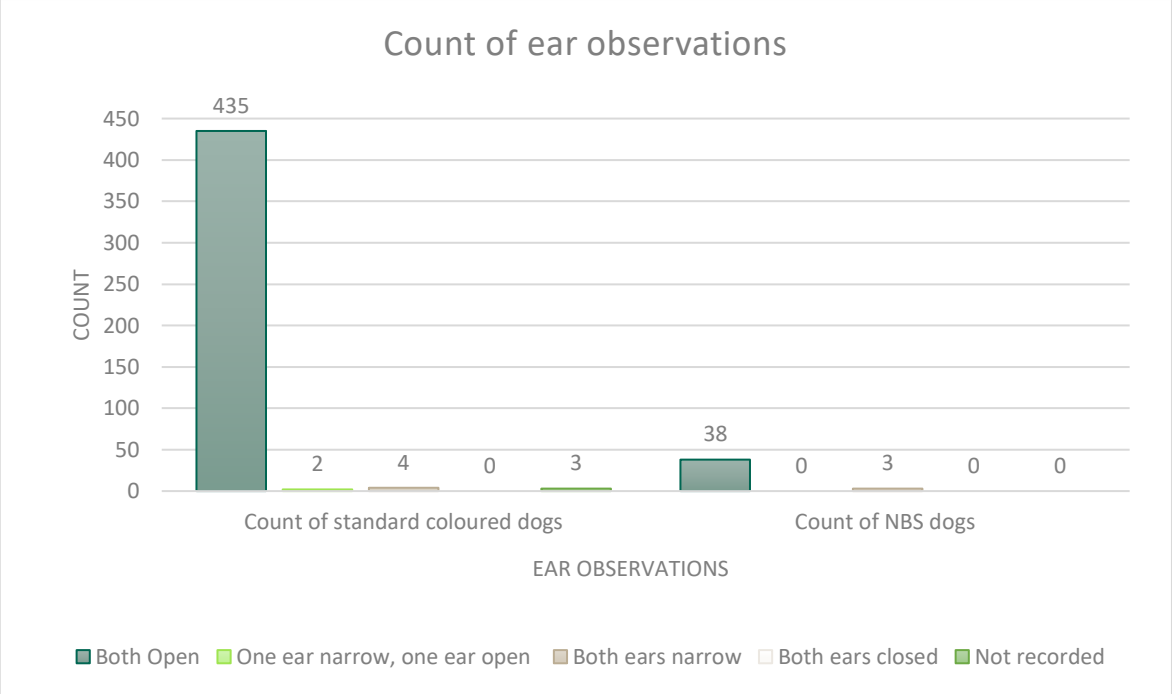
Abnormalities in the tail also form part of the scheme, with the reports given to date in the graph below. Again the majority of dogs (43.3%) had a normal tail present, 27.4% normal and mobile tail, 17.4% absent or lack of tail, 10.1% inturned tail, 1.2% not recorded, 0.8% tail present, inturned but mobile, and tail immobile (0.2%).



Forty of the dogs were recorded to have an eye observation, with these shown in the table below:

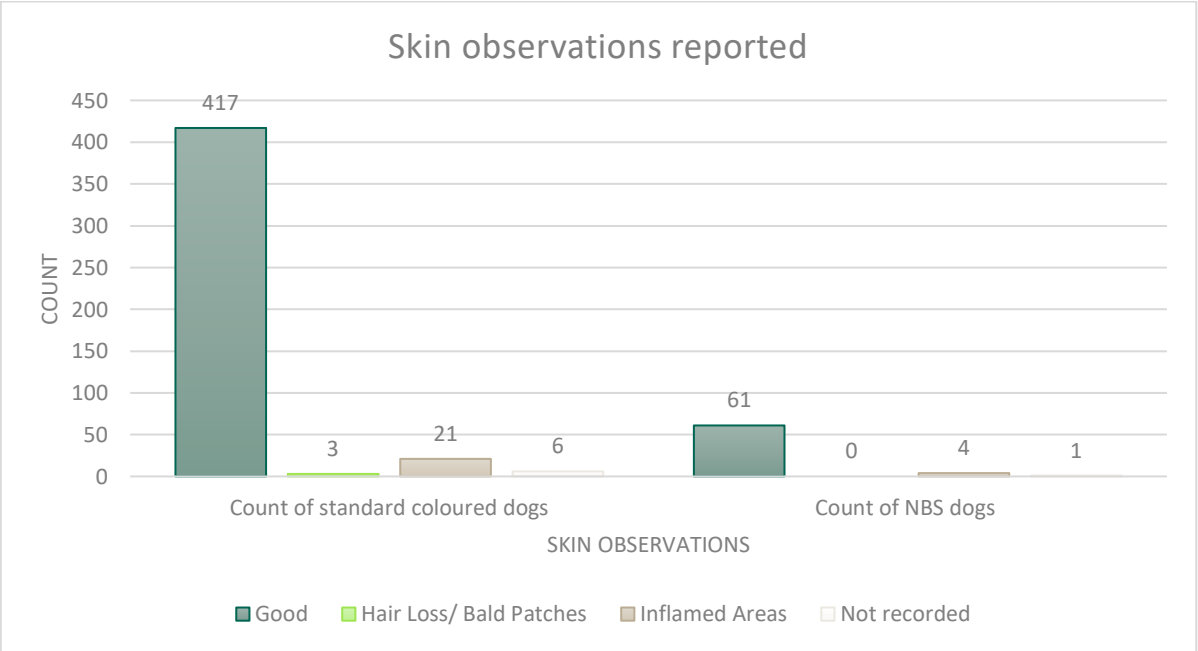
Eye Observation	Standard coloured dogs	NBS dogs
Excessive tearing	7	1
Entropion	4	3
Eyes of unequal size	3	2
Distichiasis	2	3
Ectropion	0	0
Enlarged third eyelid	0	0
Eye removed due to trauma	0	1
Corneal scarring	2	2
Dry eye	0	0
Pannus	0	0
Not Recorded/ incomplete information	6	0
Multiple Issues	0	4

Similarly to the above, ear observations are also recorded, with the report given in the graph below. A total of 97.5% of dogs had normal open ear canals, followed by 1.4% with both ears narrowed, 0.6% not recorded, and 0.4% with one ear narrowed. No dogs were reported to have both ears closed.



With regard to heart auscultation, one dog was reported to have a grade 1 heart murmur. One dog was found to have sinus arrhythmia.

The majority of dogs were reported to have no skin disorders (93.2%), with some 4.9% affected by inflamed areas, 1.4% not recorded, and 0.6% hair loss/ bald patches.



The basic health assessment includes check for palpable spinal abnormalities. Only one standard dog was recorded as presenting with kyphosis of the lumbar region, with veterinary advice to X-ray.

For the Gold certification a Spinal Xray and Grading is required, there was a lack of formal scores held prior to May 2020. Breed Health Administrator has made requests

during 2021/2022 to all owners with Gold Certificates to resubmit their scoring sheets for data collection.

A total of 31 dogs have submitted spine scores (30 standard and one NBS) during the period completing scoring using the suggested formula as follows.

Cervical, thoracic and lumbar regions scored:

- Grade 0. No abnormality
- Grade 1. Partially wedged vertebra
- Grade 2. Fully wedged vertebra
- Grade 3. Double wedged (butterfly) vertebra

Total score and total number of abnormalities have been recorded as follows:

Spines		Total spine score	Total abnormalities
	Average	10.68	6.77
	Min	0	0
	Max	21	13
	Median	10	7

A total of seven dogs (four standard/ three NBS) were recorded with signs of aggression during examination. All were recorded with vets' comments reading "fear aggression on exam".

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).

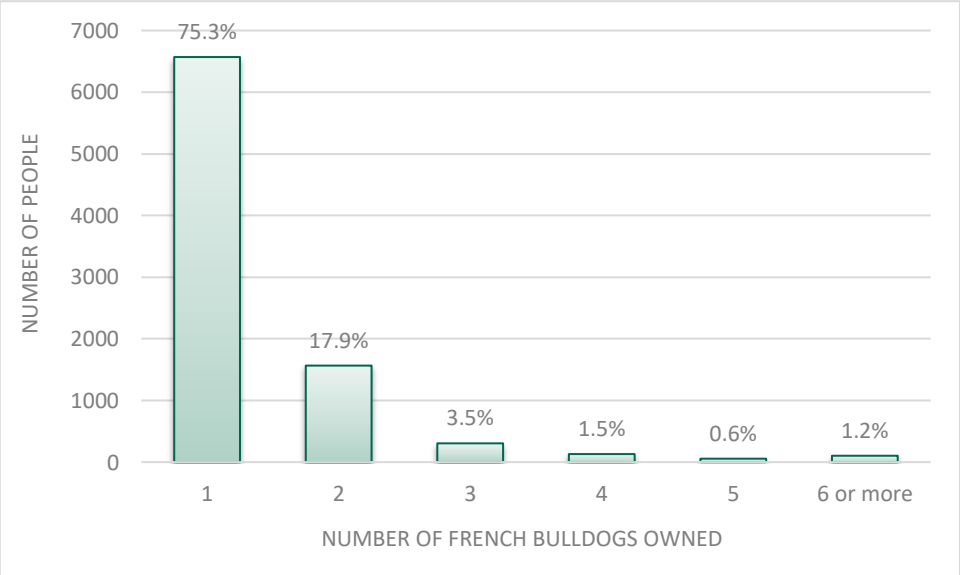
2014 Morbidity results: Health information was collected for 330 live French Bulldogs of which 210 (63.6%) had reported no conditions and 120 (36.4%) reported affected by at least one condition. The most frequently reported specific conditions were hypersensitivity (allergic) skin disorder (6.46%, 17 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).

2020 Breed Health Survey

After removing all unusable responses (for example, respondents did not consent to use of their data for research purposes) a total of 8,727 individual responses remained, representing 12,025 dogs.

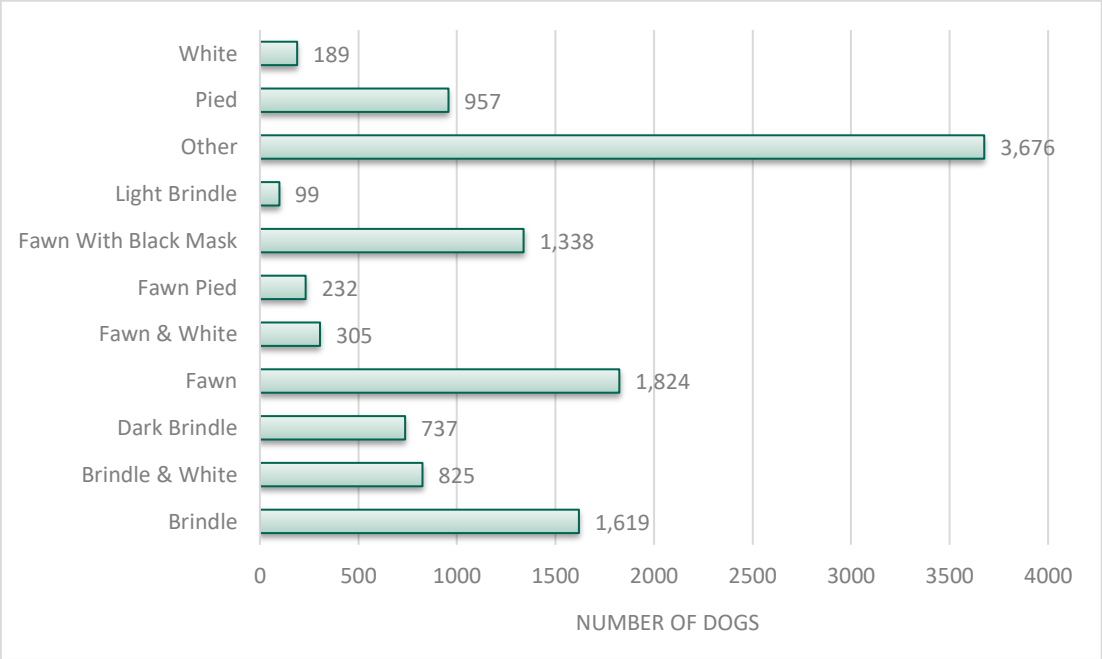
When asked how many French Bulldogs do you own, out of 8,727 responses, the majority (n=6,570) responded with one, with the spread shown in the graph below.



Of 11,801 dogs, 53.2% were male and 46.8% were female, with 53.8% entire and 46.2% neutered (table below).

Sex	Neutered Status		Total
	Entire	Neutered	
Female	3,016 (25.6%)	2,508 (21.3%)	**5,524**
Male	3,329 (28.2%)	2,948 (25.0%)	**6,277**
Total	**6,345**	**5,456**	**11,801**

Regarding colour, out of 11,801 dogs, 31.2% were reported as 'other', 15.5% fawn, 13.7% brindle, 11.3% fawn with black mask, and 8.1% pied. Results are shown in the graph below.



The most common colours specified under 'other' were blue (n=807), blue and fawn (n=321), blue and tan (n=296), blue brindle (n=260), and black and tan (n=245).

Lifestyle

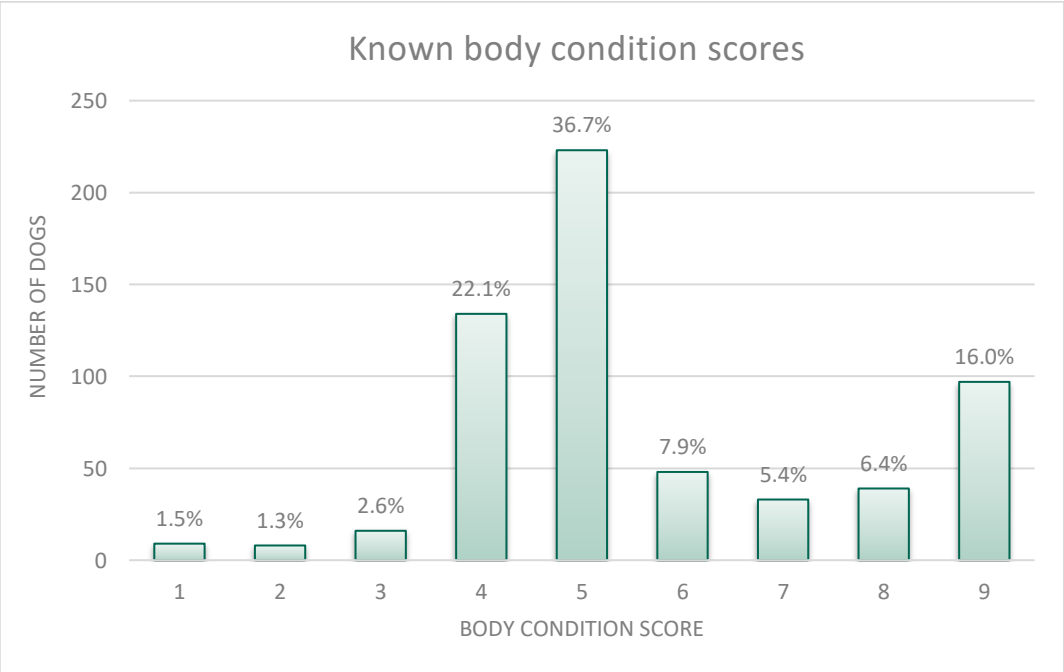
The table on the next page shows the duration of exercise the dogs included in this survey get on a typical weekday and weekend, where such responses were available. During both the weekdays and the weekend the majority of the French Bulldogs included in this survey are given over 2 hours of free running/playing in the garden and approximately 30 minutes to 1 hour of walking on the lead.

Duration	Weekday exercise		Weekend exercise	
	Free running/playing in the garden	Walking on the lead	Free running/playing in the garden	Walking on the lead
Under 30 minutes	1,098 (11.1%)	2,733 (27.7%)	724 (7.4%)	2,012 (20.4%)
30 minutes to 1 hour	2,631 (26.6%)	4,715 (47.8%)	1,920 (19.5%)	3,886 (39.5%)
1 hour to 2 hours	2,337 (23.7%)	1,641 (16.6%)	2,384 (24.2%)	2,619 (26.6%)
Over 2 hours	3,536 (35.8%)	290 (2.9%)	4,548 (46.1%)	875 (8.9%)
None of the above	160 (1.6%)	427 (4.3%)	158 (1.6%)	391 (4.0%)
Not known	112 (1.1%)	64 (0.7%)	123 (1.1%)	68 (0.7%)
Total	**9,876**	**9,872**	**9,857**	**9,851**

The majority of owners in this survey considered their dog to be moderately active (50.3%, 4,905 of 9,760).

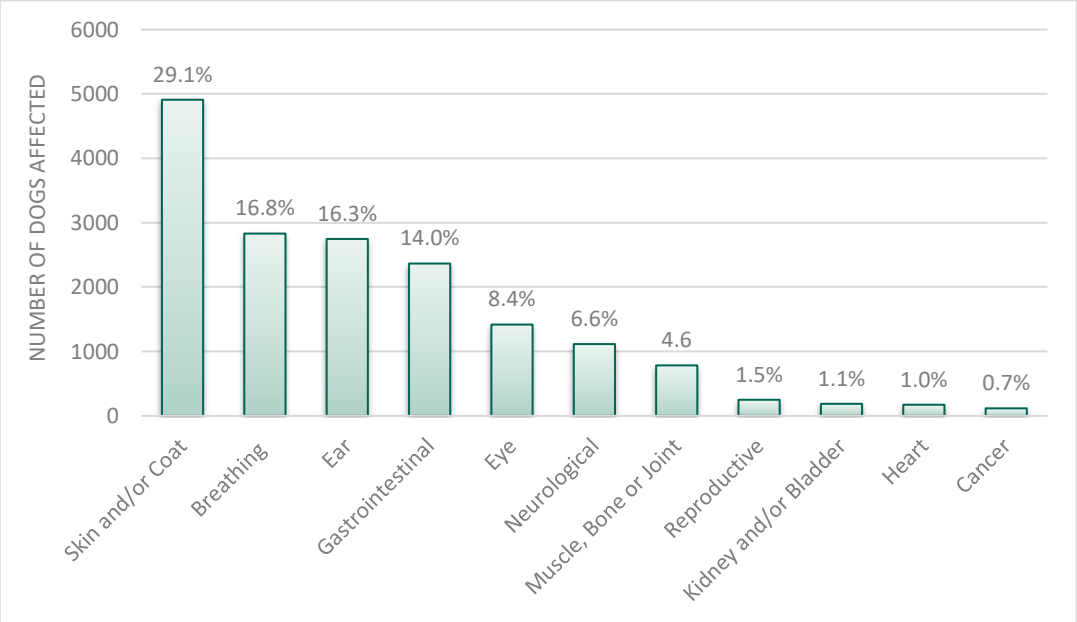
Activity	Number of dogs	Percentage
Highly active	2,678	27.4%
Mildly active	1,939	19.9%
Moderately active	4,905	50.3%
Not at all	237	2.4%
Total	**9,760**	

Out of 607 known body condition scores (8.9% of 8,060 responses), the mean score was 5 (range 1-9). The graph below shows a breakdown of scores.



Health

The survey investigated the number of dogs affected by specific conditions within different organ systems. Within each of these categories, the respondents were given a choice of specific conditions, the choices of “not known” and “other” were also given. As shown in the graph below, skin and/or coat disorders were the most commonly affected.



The data collected from this survey represents the total number of conditions selected by respondents about their dog(s). One dog might be affected by more than one condition (e.g., one dog may be affected by both food and environmental allergies) therefore the data often shows more conditions reported per category than number of dogs in that category.

The total number of specific conditions reported in this survey was 16,901. Out of the 16,901 specific conditions reported 29.1% were for ‘Skin and/or Coat’, 16.8% were for ‘Breathing’, 16.3% were for ‘Ear’, 14.0% were for ‘Gastrointestinal’, and 8.4% were for ‘Eye’. The results for each category are given below.

Body system	Number affected	Percentage
Skin and/or Coat	4,911	29.1%
Breathing	2,832	16.8%
Ear	2,748	16.3%
Gastrointestinal	2,366	14.0%
Eye	1,418	8.4%
Neurological	1,115	6.6%
Muscle, Bone or Joint	784	4.6%
Reproductive	250	1.5%
Kidney and/or Bladder	187	1.1%
Heart	173	1.0%
Cancer	117	0.7%
TOTAL	**16,901**	

Please note: the total number of dogs affected by a ‘Dental/periodontal’, ‘Haematological’, ‘Hepatic’ or ‘Hormonal’ condition are not included in the summary

above because, prior to the survey, these were not considered to be a concern within the breed and therefore the total number of dogs affected by specific conditions within each category was not collected.

Nevertheless, 173 owners reported that their dog(s) had been affected by a dental/ periodontal condition, 31 owners reported that their dog(s) had been affected by a haematological condition, 29 owners reported that their dog(s) had been affected by a hepatic condition and 75 owners reported that their dog(s) had been affected by a hormonal condition.

Skin and/or coat conditions

In total, 2,536 (38.5%, of 6,586 responses) suggested their dog(s) had been affected by a skin and/or coat condition.

The total number of individual skin and/or coat conditions reported was 4,911. Of these, the most commonly reported condition was itchiness/ skin irritation, which affected 20.8% of the study sample (1,023 of 4,911). This was followed by allergies – dust, mites, pollen (17.6%), allergies – unknown (16.8%), allergies – food (15.2%) and rash between skin folds (6.3%). The table below shows the total number and percentage of dogs affected by each reported skin and/or coat condition in descending order.

Specific condition	Number affected	Percentage
Itchiness/skin irritation	1,023	20.8%
Allergies (dust, mites, pollen etc)	866	17.6%
Allergies - unknown	823	16.8%
Allergies (food)	745	15.2%
Rash between skin folds	310	6.3%
Alopecia	194	4.0%
Dermatitis	166	3.4%
Demodectic mange/ demodex	135	2.8%
Interdigital cysts	102	2.1%
Pododermatitis	93	1.9%
Seasonal alopecia	70	1.4%
Pyotraumatic dermatitis	65	1.3%
Pyoderma	36	0.7%
Lipoma	29	0.6%
Sebaceous cysts	25	0.5%
Sarcoptic mange	7	0.1%
Pigmented cutaneous papillomatosis	4	0.1%
Not known	88	1.8%
Other	130	2.7%
Total	**4,911**	

The most common answers to “other” for skin and/or coat conditions not already listed in the survey were: dry/flaky skin (n=17), itchy ear/ear infection (n=17), itchy paw (n=14), and histiocytoma (n=8).

Breathing conditions

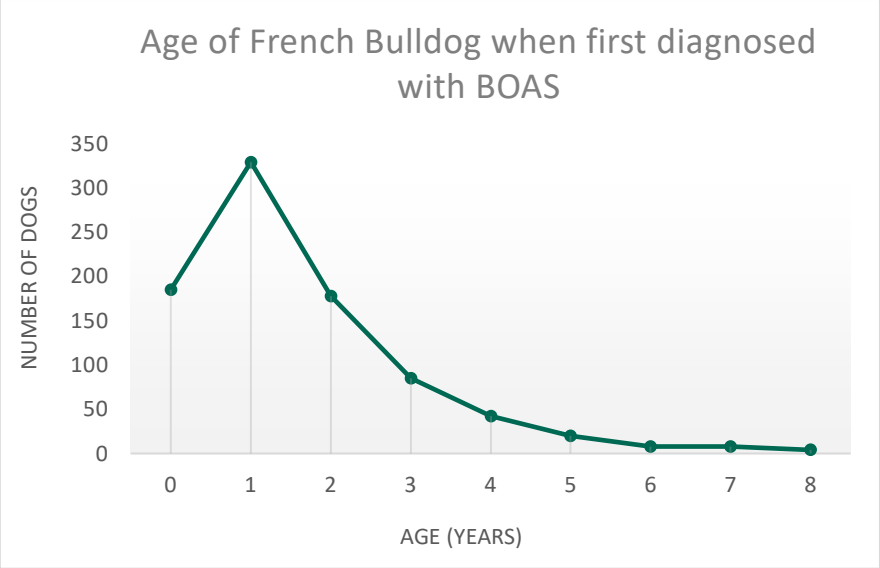
In total, out of the 7,285 responses, 1,794 (24.6%) indicated that their dog(s) had been affected by a breathing condition, with 75.4% unaffected.

The total number of individual breathing conditions reported was 2,832. Of these, the most commonly reported condition was Brachycephalic Obstructive Airway Syndrome (BOAS), which affected 30.1% of the study sample (853 of 2,832). This was followed by stenotic nares (15.0%), elongated soft palate (14.2%), regular reverse sneezing (12.7%) and laboured breathing (8.9%).

Specific condition	Number affected	Percentage
BOAS	853	30.1%
Stenotic nares	425	15.0%
Elongated soft palate	401	14.2%
Regular reverse sneezing	359	12.7%
Laboured breathing	253	8.9%
Aspiration pneumonia	90	3.2%
Kennel cough	72	2.5%
Nasopharyngeal turbinates	50	1.8%
Tonsil problems	48	1.7%
Laryngeal collapse	42	1.5%
Bronchiectasis	18	0.6%
Multiple upper respiratory tract problems	18	0.6%
Chronic rhinitis/ nose infection	17	0.6%
Lung lobe torsion	2	0.1%
Not known	106	3.7%
Other	78	2.8%
Total	**2,832**	

The most common answers to “other” for breathing conditions not already listed in the survey were: laboured breathing/vomiting during hot weather or exercise (n=24), regurgitation/reflux (n=10), snoring (n=9), reverse sneezing (n=9), sleep apnea (n=3) and allergies/hay fever (n=3).

The median age that French Bulldogs were first diagnosed with BOAS was 1 year. The graph below shows the total number of dogs diagnosed with BOAS per year of age.



When asked if any of their dogs have had any form of upper airway corrective surgery, out of the 1,418 responses, 768 (54.2%) answered 'Yes' and 650 (45.8%) answered 'No'. Owners that answered 'Yes' were also asked to specify how many of their dogs have had upper airway corrective surgery and a total of 825 French Bulldogs were reported to have had this form of surgery.

When asked if they had heard of the University of Cambridge/Kennel Club Respiratory Function Grading (RFG) Scheme, 20.3% (of 6,751 responses) answered 'Yes' and the remaining 79.7% answered 'No'. Similarly, 396 dogs (of 7,130 responses) indicated their dog(s) had undertaken the scheme.

Grade	Number of dogs	Percentage
0	189	48.2%
1	122	31.1%
2	65	16.6%
3	16	4.1%
Total	**392**	

Please note: the total number of RFG Scheme results received by the Kennel Club to date (13/01/2021) for the French Bulldog is 211. This difference may be due to the results not being submitted, the results are still pending or that the owners simply did not understand the question.

Ear conditions

In total, out of the 6,254 responses, 1,955 (31.3%) reported their dog(s) had been affected by an ear condition.

The total number of individual ear conditions reported was 2,748. Of these, the most commonly reported condition was recurrent ear infections, which affected 37.7% of the study sample (n=1,035). This was followed by excessive ear wax (19.5%), otitis externa (14.7%), otitis media (10.7%), and ear canal stenosis (3.3%).

Specific condition	Number affected	Percentage
Recurrent ear infections	1,035	37.7%
Excessive ear wax	536	19.5%
Otitis externa	405	14.7%
Otitis media	295	10.7%
Ear canal stenosis	90	3.3%
Not known	121	4.4%
Other	265	9.6%
Total	**2,748**	

The most common answers to “other” for ear conditions not already listed in the survey were: infrequent ear infection (n=82), haematoma (n=43), allergies (n=30), itchy ears (n=26), yeast infection (n=25) and ear mites (n=25).

Gastrointestinal conditions

In total, 1,187 (20.2% of 5,879 responses) reported that their dog(s) had been affected by a gastrointestinal condition.

The total number of individual gastrointestinal conditions was 2,366. Of these, the most commonly reported condition was food allergies/intolerance, which affected 20.0% of the study sample (474 of 2,366). This was followed by flatulence (17.6%), acute gastroenteritis (12.9%), regurgitation (11.9%), and chronic diarrhoea (10.5%).

Specific condition	Number affected	Percentage
Food allergies/intolerance	474	20.0%
Flatulence	417	17.6%
Acute gastroenteritis	306	12.9%
Regurgitation	281	11.9%
Chronic diarrhoea	249	10.5%
Impacted anal glands	137	5.8%
Chronic vomiting	136	5.8%
Colitis	104	4.4%
Pancreatitis	73	3.1%
Constipation	39	1.7%
Inguinal hernia	13	0.6%
Not known	33	1.4%
Other	104	4.4%
Total	**2,366**	

The most common answers to “other” for gastrointestinal conditions not already listed in the survey were: intermittent diarrhoea/ vomiting (n=23), giardia (n=18), hiatus hernia (n=15), acid reflux (n=10), sensitive stomach (n=8) and allergies (n=8).

Eye conditions

When asked if any of their dogs have suffered from an eye condition(s), out of the 6,186 responses, 1,147 (18.5%) answered “Yes” and 5,039 (81.5%) answered “No”.

The total number of individual eye conditions reported was 1,418. Of these, the most commonly reported condition was corneal ulceration, which affected 36.8% of the

study sample (522 of 1,418). This was followed by prolapsed gland (17.3%), trauma to the eyeball (6.1%), keratoconjunctivitis sicca (5.2%), and chronic discharge (4.0%).

Specific condition	Number affected	Percentage
Corneal ulceration	522	36.8%
Prolapsed gland	245	17.3%
Trauma to the eyeball	87	6.1%
Keratoconjunctivitis sicca	74	5.2%
Chronic discharge	57	4.0%
Distichiasis	47	3.3%
Cataract (non-inherited)	31	2.2%
Epiphora	30	2.1%
Glaucoma	15	1.1%
Incomplete blink	13	0.9%
Uveal cysts	13	0.9%
Entropion	10	0.7%
Imperforate lower nasolacrimal punctum	6	0.4%
Pigmentary keratitis	6	0.4%
Ectropion	4	0.3%
Retinal dysplasia	2	0.1%
Hereditary cataract (unknown)	1	0.1%
Persistent pupillary membranes (PPM)	1	0.1%
Not known	43	3.0%
Other	211	14.9%
Total	**1,418**	

The most common answers to “other” for eye conditions not already listed in the survey were: conjunctivitis (n=45), eye ulcer (n=37), cherry eye (n=23), eye infection (n=22), and ocular dermoid (n=11).

When asked if any of their dogs have ever been eye tested under the BVA/KC/ISDS Eye Scheme, out of the 7,781 responses, just 6.4% reported they had.

When asked if any of their dogs have been DNA tested for hereditary cataracts (HC), out of the 7,681 responses, 989 (12.9%) answered “Yes” and 6,692 (87.1%) answered “No”. The table below shows the known DNA test results provided by owners. The number of test results formally received by the Kennel Club for this DNA test are shown under “DNA TEST RESULTS” (see Contents).

Test result	Number of dogs	Percentage
Affected	1	0.11%
Carrier	13	1.38%
Clear	926	98.51%
Total	**940**	

Neurological conditions

When asked if any of their dogs have suffered from a neurological condition(s), out of the 6,459 responses, 839 (13.0%) answered “Yes” and 5,620 (87.0%) answered “No”.

The total number of individual neurological conditions reported was 1,115. Of these, the most commonly reported condition was intervertebral disc disease (IVDD), which affected 28.6% of the study sample (319 of 1,115). This was followed by hemivertebrae (12.0%), mobility problems (8.9%), epilepsy (5.7%), and paralysis (5.6%).

Specific condition	Number affected	Percentage
Intervertebral disc disease (IVDD)	319	28.6%
Hemivertebrae (HV)	134	12.0%
Mobility problems	99	8.9%
Epilepsy	63	5.7%
Paralysis	62	5.6%
Seizures	35	3.1%
Tremors	23	2.1%
Degenerative myelopathy (DM)	17	1.5%
Cerebellar ataxia	16	1.4%
Kyphosis	16	1.4%
Vestibular disease	15	1.4%
Loss of vision	13	1.2%
Spinal arachnoid diverticula (SAD)	13	1.2%
Congenital sensorineural deafness	7	0.6%
Spina bifida	7	0.6%
Canine polyneuropathy	4	0.4%
Wobbler's syndrome	3	0.3%
Not known	69	6.2%
Other	200	17.9%
Total	**1,115**	

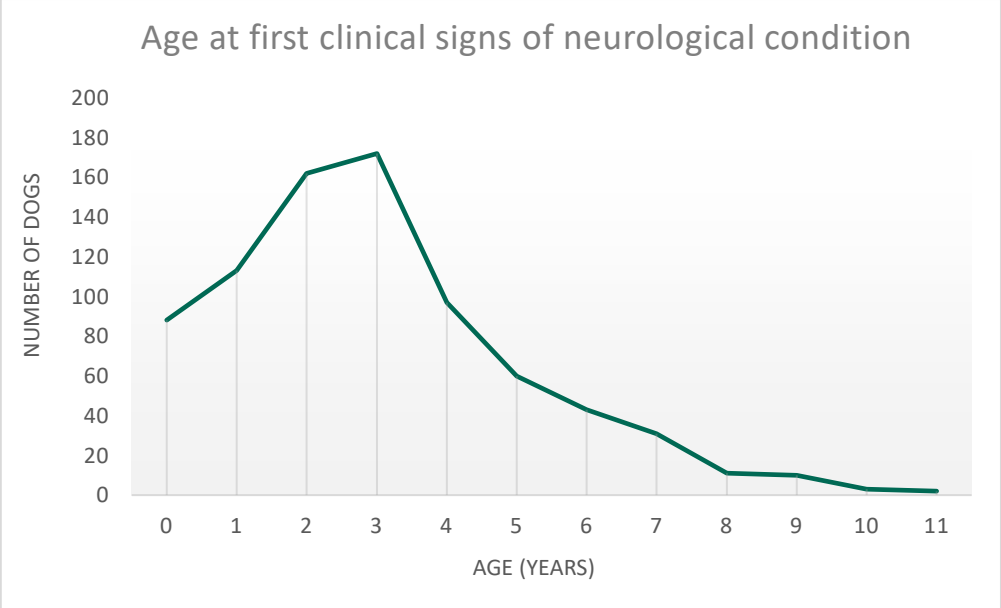
The most common answers to “other” for neurological conditions not already listed in the survey were: slipped disc (n=37), chiari-like malformation and syringomyelia (n=12), ruptured disc (n=12), malformed/curved spine (n=11) and trapped nerve in spine (n=11).

When asked to select the clinical signs seen in their affected dog(s), the most common clinical sign reported was ‘difficulty or reluctance rising, jumping, running or climbing stairs’, which affected 419 dogs (10.4%, 419 of 4,013 reported clinical signs). This was followed by back pain (9.9%), difficulty walking (8.5%), weakness in the hind limb(s) (6.5%) and abnormal posture (5.8%). The total symptoms provided are given below.

Clinical signs for a neurological condition(s)	Number affected	Percentage
Difficulty or reluctance rising, jumping, running or climbing stairs	419	10.4%
Back pain	397	9.9%
Difficulty walking	339	8.5%
Weakness in the hind limb(s)	259	6.5%
Abnormal posture	232	5.8%
Decreased range of motion	213	5.3%
Collapsing	213	5.3%
Loss of coordination (ataxia) at the hind limbs	207	5.2%
Loss of balance (wobbling)	206	5.1%
Loss of mobility	187	4.7%
Paralysis in the hind limb(s)	186	4.6%
General stiffness	178	4.4%
Decreased muscle tone	174	4.3%
Urinary incontinence	138	3.4%
Head tilt	110	2.7%
Faecal incontinence	99	2.5%
Disorientation	86	2.1%
Complete paralysis	79	2.0%
Abnormal eye movements	71	1.8%
Weakness in the fore limb(s)	42	1.1%
Difficulty swallowing	33	0.8%
None	50	1.3%
Other	95	2.4%
Total	**4,013**	

The most common answers to “other” for clinical signs not already listed in the survey were: seizures/fitting (n=16), pain (n=10), sight loss/ eye problems (n=7), drooling (n=4), neck pain (n=4) and shaking (n=4).

The median age that affected dogs started to experience the clinical signs associated with a neurological condition was 3 years. The graph below shows the total number of affected dogs starting to experience the clinical signs associated with a neurological condition per year of age.



When asked if any of their dogs have been DNA tested for degenerative myelopathy (DM), out of the 6,967 responses, 1,111 (16.0%) said “Yes” and 5,856 (84.1%) said “No”.

Test result	Number of dogs	Percentage
Affected	11	0.7%
Carrier	113	7.6%
Clear	942	63.0%
Not known	430	28.7%
Total	**1,496**	

When asked if any of their dogs have ever been suspected as having DM, out of the 6,269 responses, 45 (0.7%) answered “Yes” and 6,224 (99.3%) answered “No”. The suspected diagnosis was confirmed by a veterinary surgeon in 21 of these dogs, but whether these were diagnosed by post-mortem is not available.

Muscle, bone or joint conditions

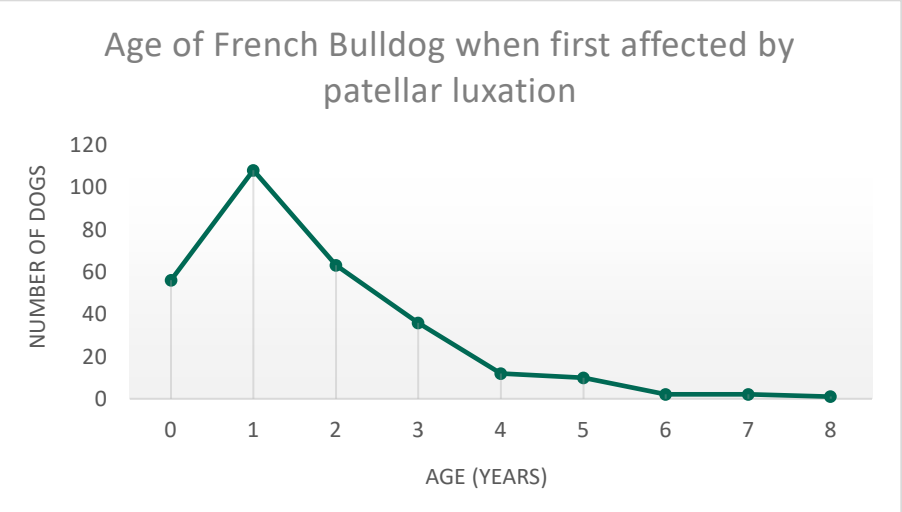
In total, 675 (11.6% out of the 5,827 responses) reported that their dog(s) had been affected by a muscle, bone and/or joint condition.

The total number of individual muscle, bone or joint conditions reported was 784. Of these, the most commonly reported condition was patellar luxation, which affected 39.7% of the study sample (311 of 784). This was followed by hip dysplasia (10.8%), lameness (8.8%), cruciate ligament disease (5.2%), and osteoarthritis (4.6%).

Specific condition	Number affected	Percentage
Patellar luxation	311	39.7%
Hip dysplasia	85	10.8%
Lameness	69	8.8%
Cruciate ligament disease	41	5.2%
Osteoarthritis	36	4.6%
Elbow dysplasia	29	3.7%
Humerus bone fracture	15	1.9%
Muscular dystrophy	4	0.5%
Legg-Calve-Perthes Disease	1	0.1%
Not known	80	10.2%
Other	113	14.4%
Total	**784**	

The most common answers to “other” for muscle, bone or joint conditions not already listed in the survey were: fractured leg (n=11), sprain (n=8), arthritis (n=7) and stiffness (n=5).

The median age that French Bulldogs were first affected by patellar luxation was 1 year and 6 months.



When asked to specify how patellar luxation was diagnosed, out of the 337 responses, the three most commonly reported methods of diagnosis were manipulation by veterinary surgeon (41.0%), visual diagnosis by veterinary surgeon (24.0%), and radiography (17.5%).

Diagnosis	Number of dogs	Percentage
Manipulation by Veterinary Surgeon	138	41.0%
Visual diagnosis by Veterinary Surgeon	81	24.0%
Radiography (X-rays)	59	17.5%
Magnetic resonance imaging (MRI)	16	4.8%
Putnam Patellar Luxation Grading System	11	3.3%
Computerised tomography (CT) scan	8	2.4%
Other	5	1.5%
Not known	19	5.6%
Total	**337**	

In total, 527 (8.3%, of 6,350 responses) had had their dog(s) tested under the Putnam scoring scheme.

Grade	Number of dogs	Percentage
0	293	66.4%
1	69	15.7%
2	46	10.4%
3	24	5.4%
4	9	2.0%
Total	**441**	

Reproductive conditions

Of the 6,705 responses, 235 (3.5%) answered that their dog(s) had been affected by a reproductive condition and 6,470 (96.5%) had not.

The total number of individual reproductive conditions reported was 250. Of these, 26.8% were for male conditions (67 out of 250), 54.4% were for female conditions (n=136) and 18.8% were for other/not known (n=47).

Overall the most commonly reported reproductive condition across sexes was cryptorchidism, which affected 20.8% of the study sample (52 of 250). This was followed by pyometra (20.4%), pseudopregnancy (14.0%), mastitis (2.4%) and follicular cysts (1.6%).

	Specific condition	Number affected
Male conditions	Cryptorchidism	52 (77.6%)
	Other	15 (22.4%)
	Total	**67**
Female conditions	Pyometra	51 (37.5%)
	Pseudopregnancy	35 (25.7%)
	Mastitis	6 (4.4%)
	Follicular cysts	4 (2.9%)
	Other	40 (29.4%)
	Total	**136**
Other (sex unknown)		5
Not known		42
Total		**250**

The most common answers to “other” for reproductive conditions not already listed in the survey were: prolapsed uterus (n=5), dystocia (n=5), uterus infection (n=4), inability to conceive (n=4), tumour/lumps (n=4), enlarged prostate (n=3), infrequent seasons (n=3), urinary tract infection (n=3), and hermaphroditism (n=2).

Of the 6,633 responses, 917 (13.8%) had bred from their dogs. When asked if any of these dogs had ever had a caesarean section, 548 (60.0%, of 913 responses) answered ‘Yes’ and 365 (40.0%) answered ‘No’.

A total of 206 owners were able to report if the caesarean section was an elective or an emergency procedure, the results are shown in Table 21. One hundred and twenty-eight (62.1%) reported the caesarean section to be elective and 78 (37.9%) reported the caesarean section to be an emergency.

	Number affected (C-section 1)	Number affected (C-section 2)	Total
Elective	72	56	**128**
Emergency	61	17	**78**
Total	**133**	**73**	**206**

NB: *(C-section 1/C-section 2 refers to the first and second caesarean section performed on the same bitch)*

Out of 62 known reasons for the caesarean section, dystocia was the most common (51.6%), following by uterine inertia (32.3%), then stillborn (16.1%), as shown in Table 22.

Reasons	Number affected (C-section 1)	Number affected (C-section 2)	Total
Dystocia	26	6	**32**
Uterine Inertia	18	2	**20**
Stillborn	9	1	**10**
Not known	100	36	**136**
Other	62	16	**78**
Total	**215**	**61**	**276**

The most common answers to “other” were safety/vet recommended (n=12), puppy stuck in birth canal (n=11), breeder choice (n=5) and long labour (n=4).

Kidney and/or bladder conditions

When asked if any of their dogs have suffered from a kidney and/or bladder condition(s), out of the 5,837 responses, 160 (2.7%) answered “Yes” and 5,677 (97.3%) answered “No”.

The total number of individual kidney and/or bladder conditions reported was 187. Of these, the most commonly reported condition was urinary tract infection, which affected 57.8% of the study sample (108 of 187). This was followed by urolithiasis (11.8%), and cystinuria (5.4%).

Specific condition	Number affected	Percentage
Urinary tract infection	108	57.8%
Urolithiasis	22	11.8%
Cystinuria	10	5.4%
Kidney disease	8	4.3%
Urethral sphincter mechanism incompetence	4	2.1%
Hyperuricosuria	3	1.6%
Not known	7	3.7%
Other	25	13.4%
Total	**187**	

The most common answers to “other” for kidney and/or bladder conditions not already listed in the survey were: cystitis (n=4), incontinence (n=4), stones (n=3), and urinary crystals (n=3).

Heart conditions

Out of 5,849 responses, 145 (2.5%) reported that their dog(s) had been affected by a heart condition.

The total number of individual heart conditions reported was 173. Of these, the most commonly reported condition was heart murmur, which affected 66.5% of the study sample (115 of 173). This was followed by pulmonic stenosis (9.3%), irregular heart rate and/or rhythm (8.7%), heart attack (2.3%), and aortic stenosis/ subaortic stenosis (1.7%).

Specific condition	Number affected	Percentage
Heart murmur	115	66.5%
Pulmonic stenosis	16	9.3%
Irregular heart rate and/or rhythm	15	8.7%
Heart attack	4	2.3%
Aortic stenosis/subaortic stenosis	3	1.7%
Atrial septal defect (ASD)	2	1.2%
Not known	5	2.9%
Other	13	7.5%
Total	173	

The most common answers to “other” for heart conditions not already listed in the survey were: enlarged heart (n=4) and enlarged aorta (n=2).

Cancer

When asked if any of their dogs have suffered from cancer, out of the 5,671 responses, 105 (1.9%) answered “Yes” and 5,566 (98.2%) answered “No”.

The total number of individual cancers reported was 117. Of these, the most commonly reported type of cancer was mast cell tumour - cancerous, which affected 40.2% of the study sample (47 of 117). This was followed by lymphoma (6.8%), mammary tumour – cancerous (6.0%), canine cutaneous histiocytoma (3.4%), and epulis (3.4%).

Specific condition	Number affected	Percentage
Mast cell tumour (cancerous)	47	40.2%
Lymphoma	8	6.8%
Mammary tumour (cancerous)	7	6.0%
Canine cutaneous histiocytoma	4	3.4%
Epulis	4	3.4%
Primary brain tumour (cancerous)	3	2.6%
Testicular tumour (cancerous)	3	2.6%
Testicular tumour (non-cancerous)	3	2.6%
Lipoma	2	1.7%
Mammary tumour (non-cancerous)	2	1.7%
Mast cell tumour (non-cancerous)	2	1.7%
Melanoma	1	0.9%
Primary brain tumour (non-cancerous)	1	0.9%
Superficial Corneal Squamous Cell Carcinoma	1	0.9%
Not known	10	8.6%
Other	19	16.2%
Total	**117**	

The most common answers to “other” for cancerous conditions not already listed in the survey were: skin cancer (n=3), bone cancer (n=2) and nasopharyngeal carcinoma (n=2).

Dental/ periodontal conditions

When asked if any of their dogs have suffered from a dental/periodontal condition, out of the 5,573 responses, 173 (3.1%) answered “Yes” and 5,400 (96.9%) answered “No”.

When asked to specify the dental/periodontal condition(s), the most common answers were: teeth extracted (n=39), tooth decay (n=19), periodontal disease (n=14), overcrowding (n=11), teeth misalignment (n=9), excess plaque/tartar (n=8), under bite (n=6), gingivitis (n=6), loose teeth (n=5), and four reports for each of the following: epulis, broken tooth, extra teeth, bad breath, retained puppy teeth, growth, missing teeth, and lost teeth.

Hormonal conditions

A total of 75 (1.4% of 5,573 responses) were affected by a hormonal condition with the most common answers were: phantom pregnancy (n=33), infrequent seasons (n=7), phantom milk production (n=3), and two for each of the following: split seasons, vaginitis, irregular oestrous cycle, hair loss, and vaginal hyperplasia.

Haematological conditions

Just 31 dogs (0.6% of 5,573 responses) were affected by a haematological condition, with the most common answers being: clotting problem (n=4), haematoma (n=3), and two each for: von Willebrand Factor, mass on spleen/spleen removed, and immune system attacking red blood cells.

Hepatic (liver) conditions

Twenty-nine dogs (0.5% of the 5,573 responses) were affected by a hepatic condition with these being: increased liver enzymes (n=6) and liver failure (n=4).

Additional reported single conditions are given in the Appendix (page 65).

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. However, papers from overseas have been included too, as it is acknowledged that dog populations are not restricted to any one country, and new findings in other countries may be relevant to the population within the UK.

Cancers

Mast cell tumours: A retrospective study of over 9,000 histopathologically confirmed diagnoses of cutaneous mast cell tumours (MCTs) from a nationwide veterinary diagnostics laboratory in the USA, 108 of which were French Bulldogs, found that the French Bulldog demonstrated a higher relative risk of developing MCTs (Mochizuki et al, 2016). The relative risk for the breed was estimated as 2. C8ompared to all purebred dogs.

Intracranial tumours: A Japanese study of 186 intracranial tumours suggested the breed may be predisposed to a particular type of brain tumour, glial tumours, compared to the overall dog population (Kishimoto et al, 2020). This was based on 293 dogs of the breed, of which 22 presented with a glial tumour, making up 64.7% of the total glial tumours accounted for. An odds ratio of 60.6 (95% CI 29.7 – 123.8) was established for the breed. The authors noted that brachycephalic breeds in general appeared to be predisposed.

Cardiovascular conditions

Congenital heart disease: An Italian study investigated the epidemiology of several heart conditions across routinely screened (e.g. Boxers) and non-screened (e.g. French Bulldogs, Bulldogs) breeds to evaluate the change in disease incidence overtime (Brambilla et al, 2020). The French Bulldog was identified as commonly affected with pulmonic stenosis, with a 90% probability of dogs screened affected by this condition in 1997. This trend reduced slightly overtime, but as of 2017 there was an 80% probability that dogs of the breed would present with disease. The breed was proposed as being 7.0 times (95% CI 5.6-8.7) more likely to present with a congenital disease compared to all breeds.

Echocardiographic measurements: The French Bulldog, and other brachycephalic breeds, have been more recently explored to determine if there are fundamental differences in cardiology parameters within brachycephalic breeds. A small study of

57 dogs determined that brachycephalic breeds did have several differing parameters to non-brachycephalic dogs, and further that BOAS affected dogs differed from unaffected brachycephalic dogs (Brloznik et al, 2023).

Dermatological conditions

Atopic dermatitis: A multicentre study compared apparent breed predispositions for atopic dermatitis in different geographical locations and found an overrepresentation of the breed with the condition in Hamburg, Germany with an odds ratio of 46.9 (95% C.I. 16.7-131.3) compared to dogs of other breeds (Jaeger et al, 2010). In that study, affected dogs of the breed were most likely to present with otitis externa and facial lesions. More recently, the French Bulldog was reported one of the breeds that was affected most often with allergic/ atopic skin clinical signs, based on a survey of dog owners in Finland, with 33.8% of the 71 French Bulldogs in the survey reported to be affected (Anturaniemi et al, 2017).

Ear canal stenosis: A German paper compared dogs from two brachycephalic breeds, including the French Bulldog (n=55), with non-brachycephalic breeds, and determined that the brachycephalic breeds had significantly narrowing of the external ear canals (Topfer et al, 2022). Middle ear effusion (i.e. fluid within the ear space) was also significantly more frequent in the brachycephalic breeds, however no statistical correlation was found between narrower ear diameter and presence of ear infection.

Gastrointestinal conditions

Persistent vomiting: A German survey of 39 French Bulldogs found that 41% showed vomiting/ regurgitation at least once daily (Roedler et al, 2013). The authors considered this to be part of 'brachycephalic syndrome', affecting primarily the respiratory and gastrointestinal systems. Some 25.6% were also found to choke on food daily. The authors also recorded the prevalence of dyspnoea during feeding, of which 20.5% experienced this daily.

Chronic enteropathy: A large retrospective Swedish study (Holmberg et al, 2022) of dogs visiting two referral hospitals determined the French Bulldog as one of several breeds with a higher relative risk of being presented with an enteropathy (exact value not provided). Dogs of the breed were also identified as being affected a younger age, but this may well reflect the relatively young population of the breed as a whole. The role of major histocompatibility complexes (MHCs – a class of genes that regulate the immune system, also known as dog leucocyte antigens, or DLAs) has been investigated as a possible influence towards complex conditions that have an immune-mediated basis, and may feature in chronic enteropathies (Nakazawa et al, 2021). In this recent paper, a number of alleles were found to have protective/ risk effects within the French Bulldog population tested and may be candidates for future investigation.

Musculoskeletal conditions

Humeral condyle fracture (HCF): The breed has been mentioned in a number of studies reporting on the incidence and predisposition to HCF (Villamil et al, 2020; Strohmeier and Harris, 2021; Davenport et al, 2023; Franklin et al, 2023; Anderson et al, 2023; Schettler et al, 2022). The breed have been found to have 5 to 6 times the risk of developing a fracture compared to other breeds, making up 20-29% of cases studied (Villamil et al, 2020; Smith et al, 2020). Similarly, when considering immature dogs (12 months or under) the French Bulldog was found to be overrepresented, with the breed making up 41% of 118 fractures (Smith et al, 2020), and having a median age at presentation of 3.7 months (Davenport et al, 2023).

Neurological conditions

Hemivertebrae: Congenital vertebral malformations such as hemivertebrae are common in the thoracic vertebral column of brachycephalic 'screw-tailed' breeds such as the French Bulldog, Boston Terrier, Bulldog and Pug (Gutierrez-Quintana et al, 2014; Lackmann et al, 2021). A study of 105 French Bulldogs in Germany investigating hemivertebrae reported a prevalence of 85%. Heritability estimates for the number and grade of hemivertebrae were 0.58±0.15 and 0.53±0.16, respectively (Schlensker and Distl, 2016). Interestingly, the presence of a larger number of coccygeal vertebrae correlated with a lower number and less severe grade of hemivertebrae, suggesting that genetic progress could be made quite quickly by utilising long tailed dogs, although limited numbers of these exist. Another paper agreed that selecting away from dogs with tail malformations could also be used to reduce the incidence of congenital malformations (Lackmann et al, 2021).

A more recent retrospective study looked at the prevalence of vertebral malformations in neurologically normal dogs attending the Royal Veterinary College, including 62 French Bulldogs (Ryan et al, 2017). Of these dogs, 58 (93.5%) were found to be affected by hemivertebrae, with the majority of these affected by more than one (79.0%). The authors noted that neurologically normal dogs of the breed were more likely to be affected compared to the other breeds included (Bulldogs and Pugs), a finding which has been mirrored in more recent explorations (Brown et al, 2021).

Intervertebral disc disorder (IVDD): The French Bulldog was the second most frequently affected breed with IVDD in a study of electronic patient records of over 90,000 dogs examined at the University of California-Davis Veterinary Medical Teaching Hospital, USA, between 1995 and 2010, with a breed-specific prevalence of 27.1% (Bellumori et al, 2013). A recent study of 178 French Bulldogs which had been treated at the Royal Veterinary College (RVC) between 2010 and 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 (Inglez de Souza et al, 2018).

The breed have also been referenced as having a higher risk of presenting with epidural haemorrhage associated with disc extrusion, with two studies finding a

prevalence of 41.3% - 66.0% respectively (Poli et al, 2022; Santifort et al, 2022). In both papers, dogs that presented with epidural haemorrhage were more likely to be unable to walk on presentation.

Several more recent papers have explored the recurrence rate of IVDD in surgically treated French Bulldogs. In two papers, 51.0% and 52.7% of the dogs that had undergone surgery suffered from recurrence of clinical signs, with thoracolumbar recurrence higher in both studies compared to surgery in the cervical region (Kerr et al, 2021; Leu et al, 2023). The median timeframe of recurrence was nine to 12 months respectively.

Interestingly, a more recent Swiss paper investigated the possible external impacts of temperature on the presentation of disease (specifically IVDE), and found that colder temperatures increased the likelihood of affected dogs showing pain, as well as increased risk of muscle injury, which has similarly been found in humans (Barandun et al, 2020). This was based on 101 dogs presented over a six-year period, with French Bulldogs making up 19.8% of the affected population. However, the specific factors pertaining to this trend need further investigation.

Lumbosacral osteochondrosis: A study assessed 183 CT scans of the breed submitted to a French veterinary hospital and identified at least one type of lumbosacral abnormality in 91.8% (Lecourtois et al, 2023). The majority of dogs with abnormalities had been presented for a neurological disorder, so this paper will represent a heavily biased population. Of the affected dogs, the most common abnormalities found were lumbosacral disc herniation (77.4%), osseous fragment (62.0%), disc mineralisation (48.8%), lumbosacral endplate contour defect (47.0%), and spondylosis (47.0%). The authors did mention that further work is needed to determine the relationship of these findings with clinical signs.

Screw tail: A mutation in the *DVL2* gene is known to be causative factor for screw tail and other vertebral malformations in a number of breeds, including the French Bulldog (Mansour et al, 2018). In a more recent paper, the frequency of the mutation responsible was explored across 211 French Bulldogs, with this found to be fixed within this population (Niskanen et al, 2021).

Ocular conditions

Brachycephalic ocular syndrome: An Irish group looked to analyse a set of ocular disorders suggested to come under a syndrome of disorders associated with brachycephalism, including 38 French Bulldogs (Costa et al, 2021). Dogs included originated from Germany and Portugal. Corneal fibrosis was found to affect 29% of tested French Bulldogs, with other diagnosed disorders including palpebral masses (n=5), prolapse of the nictitating membranes (n=3), cataracts (n=3), macroblepharon (n=2), lens luxation (n=2), and iris cysts (n=1). The authors noted there were differences between breeds and incidence of disease, and therefore the entirety of disorders could not be attributed evenly across all brachycephalic breeds.

Ulcerative keratitis: This inflammatory condition is a common ocular disease which affects the surface of the eye, often from insufficient corneal protection. Affected

dogs may present with clinical signs such as light sensitivity, irritation, excessive tearing and excessive discharge. A Japanese study of breed prevalence in relation to ulcerative keratitis evaluated 8,877 dogs presented to an animal eye clinic, of which 1,018 were affected by this condition (Iwashita et al, 2020). The breed were suggested as being more frequently affected, with 87 eyes of the breed included in the dataset. However, whilst overrepresented, the breed did more commonly present with a milder form of disease than other breeds.

Dermoids: A Portuguese research group assessed the prevalence of congenital ocular disorders across both dogs and cats, using 123 cases (Saraiva & Delgado, 2020). Dermoids are characterised by tissue growing in abnormal areas, with ocular dermoids found on the cornea or conjunctiva. The breed was the most commonly presented breed (n=16), with 75% of ocular dermoids diagnosed in the breed (95% CI 50.5%-89.8%). However, the relatively small sample size should be taken in to consideration.

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 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.

Subsequently to this, further research was undertaken by the University of Cambridge BOAS research group to assess the feasibility of introducing an exercise-induced respiratory stress test, which can be used as an alternative to whole-body barometric plethysmography (WBBP) – a testing method which has previously been identified as an objective measure for disease severity (Riggs et al, 2019). This test was developed to enable higher testing of brachycephalic dogs, as WBBP testing relies on specialist equipment and has a significantly longer assessment time. The authors used 44 brachycephalic dogs, and found the sensitivity of the three-minute

exercise test to be 93.3%, post-exercise. Additionally, the authors looked at auscultation (use of a stethoscope) to determine degree of laryngeal stridor, as a precursor to laryngeal collapse, and found this significantly improved following exercise. A screening scheme has been developed using these findings, with further information given on page 24.

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.

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.

A more recent VetCompass paper included analysis of 2,781 French Bulldogs, compared to 21,850 dogs of other breeds (O'Neill et al, 2021). The authors explored 43 disorders across breeds, and established that the breed had higher odds for 20 of these. Those conditions with significantly increased odds are shown in the table below.

Disorder	Count of dogs affected	Odds ratio (95% CI)
Stenotic nares	51 (1.8%)	42.1 (18.5 – 96.0)
BOAS	153 (5.5%)	30.9 (20.9 – 45.6)
Aural discharge	74 (2.7%)	14.4 (9.1 – 22.9)
Skin fold dermatitis	61 (2.2%)	11.2 (7.2 – 17.4)
Dystocia	35 (1.3%)	9.1 (5.2 – 16.1)
Allergic skin disorder	50 (1.8%)	7.7 (5.0 – 11.9)
Food hypersensitivity	52 (1.9%)	7.0 (4.6 – 10.5)
Musculoskeletal injury	70 (2.5%)	5.5 (3.9 – 7.7)
Upper respiratory tract infection	48 (1.7%)	4.9 (3.2 – 7.4)
Demodicosis	42 (1.5%)	4.6 (2.9 – 7.4)
Corneal ulceration	45 (1.6%)	4.4 (3.0 – 6.5)
Dermatitis	54 (1.9%)	3.5 (2.5 – 5.0)
Allergy	88 (3.2%)	2.8 (2.1 – 3.6)
Gastroenteritis	91 (3.3%)	2.6 (2.0 – 3.3)
Pododermatitis	58 (2.1%)	2.5 (1.8 – 3.4)
Patellar luxation	57 (2.0%)	2.3 (1.7 – 3.2)
Atopic dermatitis	38 (1.4%)	2.1 (1.7 – 3.2)
Claw injury	58 (2.1%)	2.1 (1.5 – 2.8)
Otitis externa	262 (9.4%)	1.6 (1.4 – 1.8)

Dermatological 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.

Skin fold dermatitis: In a study of 905,553 dogs, the French Bulldog was one of three breeds found to be predisposed to this form of dermatitis (or intertrigo) with an odds ratio of 25. 9 (95% CI 19.6-34.3) (O'Neill et al, 2022). The prevalence in the breed was found to be 2.7% (95% CI 2.2 – 3.2), with the most commonly affected areas being the face (56.9%), tail (11.4%) and vulva (8.9%).

Metabolic conditions

Heatstroke: A recent VetCompass paper looked at risk factors for heat-related illness, or heatstroke, and predisposing factors as part of a warming planet (Hall et al, 2020). French Bulldogs were one of several breeds found to have a significantly increased risk of disease, with an odds ratio of 6.49 (95% CI 3.62-11.63) and incidence of 0.18% (95% CI 0.12-0.25%). As well as brachycephalism and breed type, an increased bodyweight relative to breed/ sex and older age were also found to be predisposing factors across breeds.

Subsequent to this research, the authors have developed a grading tool to aide owners and veterinarians in gauging the severity of a dog's heat-related illness based on clinical signs frequently reported (Hall et al, 2021). These range through three grades: mild, moderate and severe, with the range of clinical signs shown below.

The VetCompass Clinical Grading Tool for Heat-Related Illness in Dogs

Grade	Clinical Signs	Suggested Treatment	Previous Terminology Used for Presentation
Mild	Continuous panting or respiratory effort unresolved following cessation of exercise or removal from hot environment. Lethargy, stiffness or unwilling to move.	Active cooling if hyperthermia present. Rehydration (may be oral only). Supportive care for organ systems affected (e.g. oxygen for dyspnoea). May be able to manage on the scene. Monitor for progression of clinical signs.	Heat stress
Moderate	Progression of Stage 1 – no response to cooling and/or fluids. Hypersalivation, diarrhoea and/or vomiting (no blood present). A single seizure. Episodic collapse with spontaneous recovery (no impaired consciousness).	Active cooling if hyperthermia present. Rehydration – may require intravenous fluids. Supportive care for organ systems affected (e.g. gastrointestinal support). Consider hospitalisation to monitor progression of clinical signs.	Heat exhaustion
Severe	Progression of Stage 2. Any of: Central nervous system impairment (ataxia, two or more seizures, profound depression, unresponsive, coma). Liver or kidney dysfunction. Gastrointestinal haemorrhage. Petechiae/purpura.	**Requires hospital care.** Active cooling if hyperthermia present. Coagulation assessment required. Supportive care for organ systems affected: • Neurological support (e.g. osmotic agents, seizure management); • Intravenous fluid therapy, blood glucose and electrolyte management; • Respiratory support (e.g. oxygen, intubation); • Circulatory support (e.g. vasopressors); • Gastrointestinal support (e.g. antiemetics, GI protectants, antibiotics); • Transfusion products.	Heat stroke

Sourced from: https://www.nature.com/articles/s41598-021-86235-w

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.

Vestibular disease: A VetCompass paper established 759 cases of vestibular disease out of a total of 906,544 dogs, with the French Bulldog suggested as being predisposed to this condition (Radulescu et al, 2020). The breed had an odds ratio of 9.25 (95% CI 4.81-17.76) with a breed prevalence of 7% per 10,000 dogs. The authors concluded that brachycephalic dogs as a whole were also slightly predisposed.

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.

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 1: 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 3. The top five specific causes of VCEs were vomiting/diarrhoea/enteritis, otitis, dermatitis/pyoderma/folliculitis, corneal ulcer, and allergy/atopy.

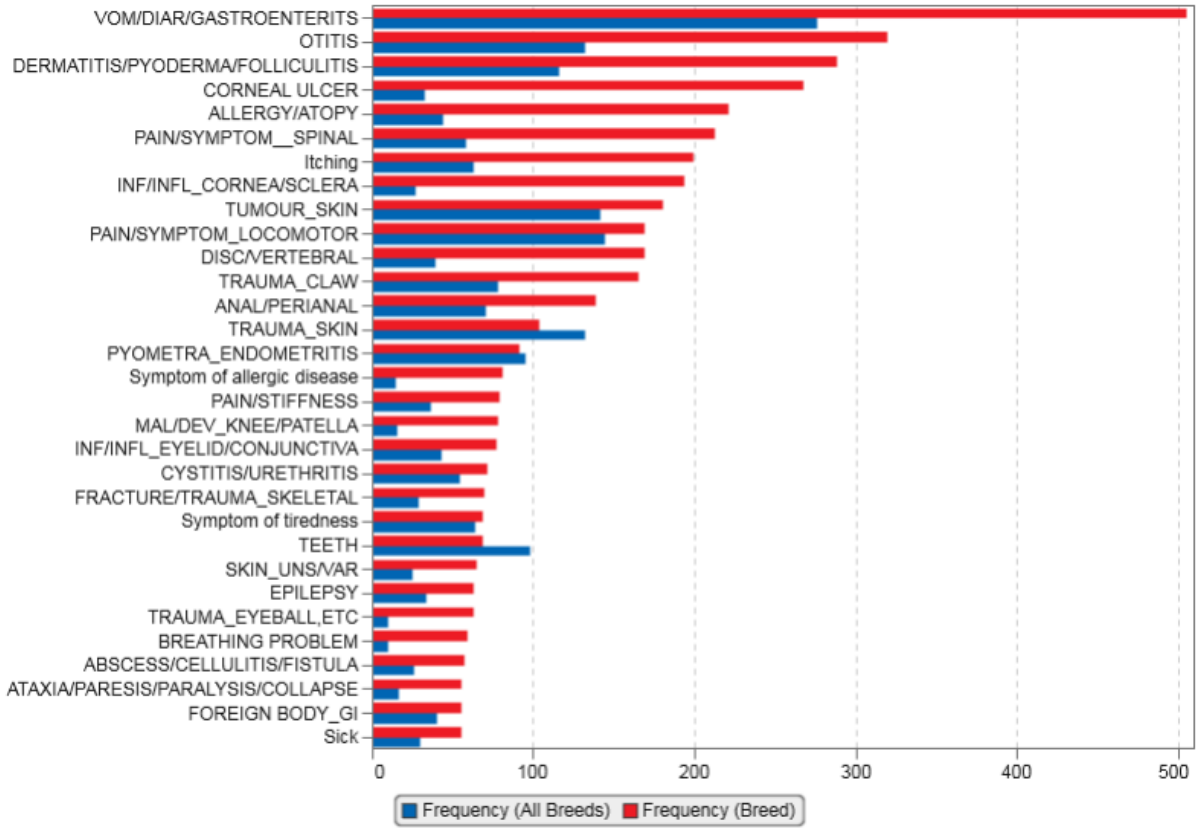


Figure 3: The most common specific causes of VCEs for the French Bulldog compared to all breeds in Sweden 2011 - 2016, from Swedish Agria insurance data.

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 4. 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.

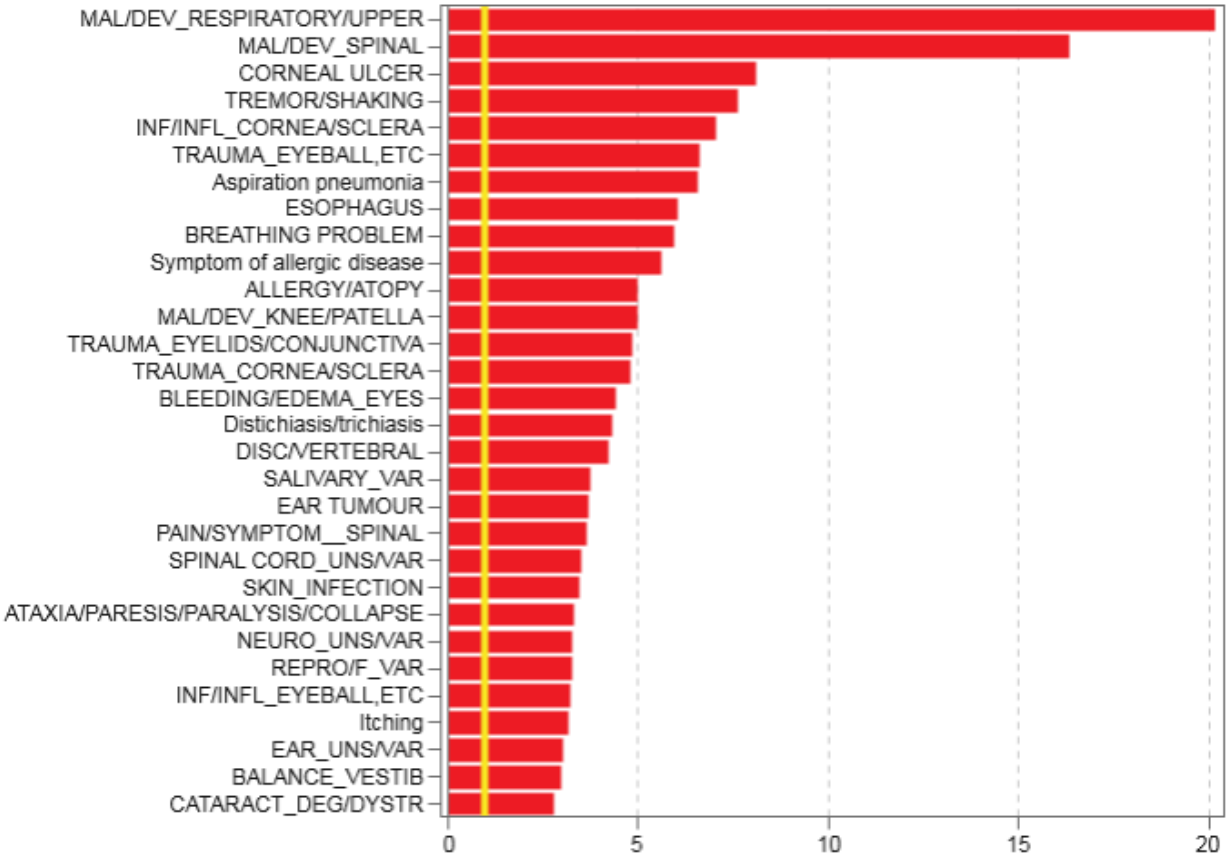


Figure 4: The specific causes of VCEs for the French Bulldog ordered by relative risk compared to all breeds in Sweden 2011 - 2016, from Swedish Agria insurance data.

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 5).

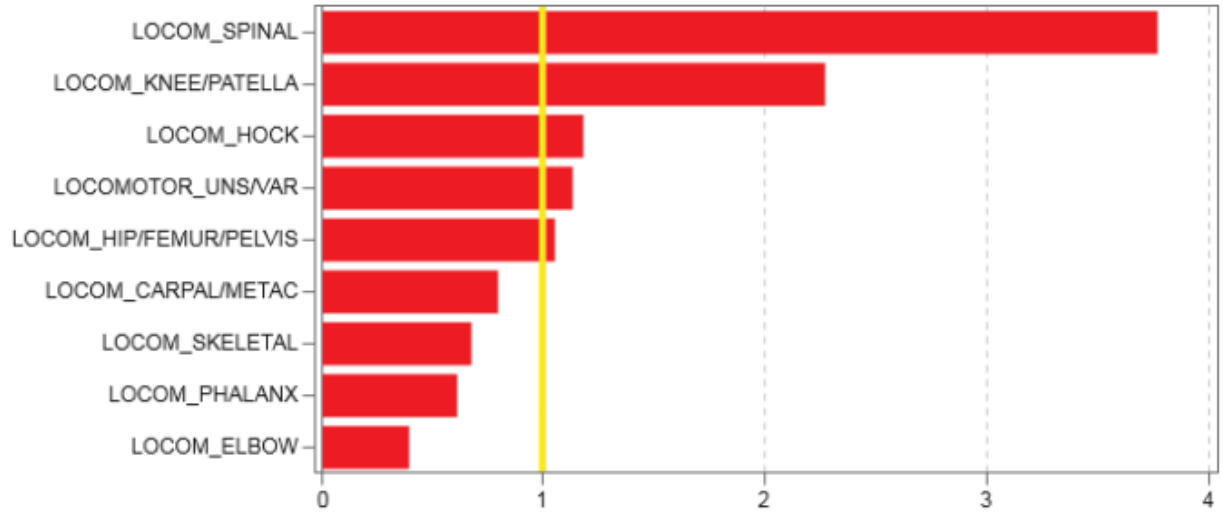


Figure 5: Relative risk morbidity for locomotor disorders compared to all breeds in Sweden 2011 – 2016, from Swedish Agria insurance data.

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 6).

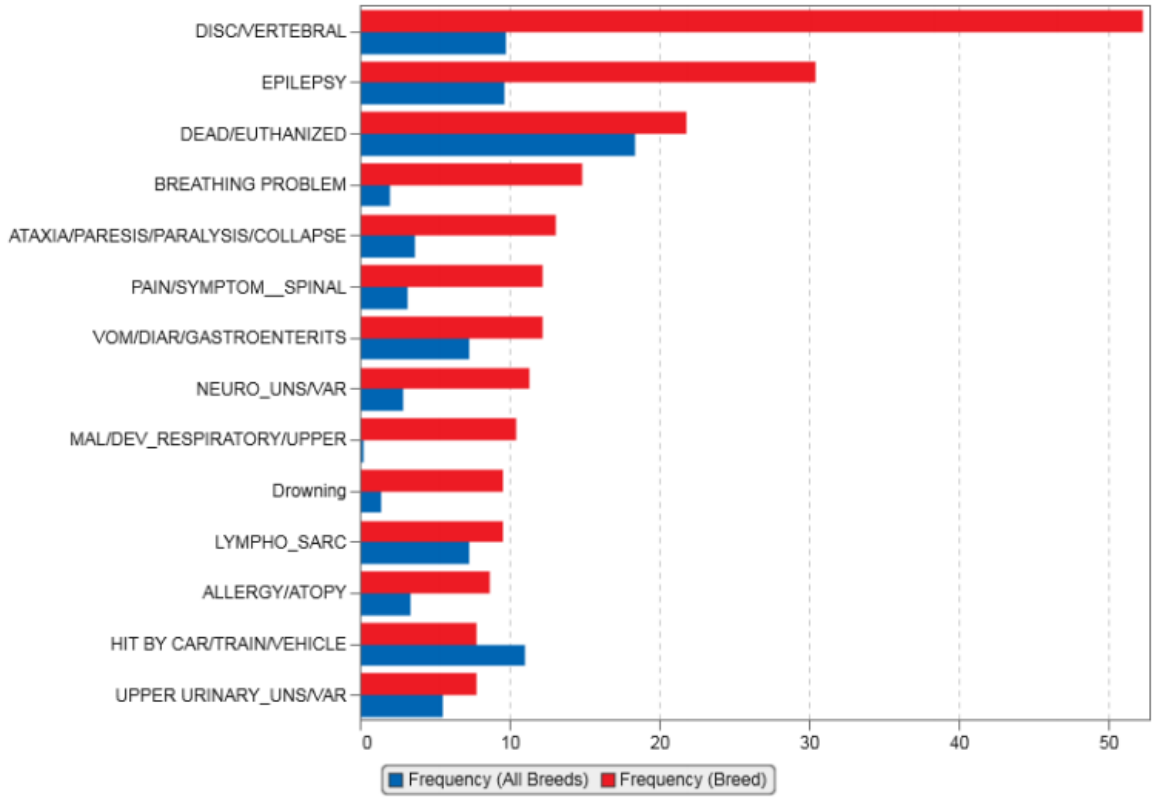


Figure 6: The most common specific causes of death for the French Bulldog compared to all breeds in Sweden between 2011 and 2016, from Swedish Agria insurance data.

BREED WATCH

As a category two breed judges' health monitoring forms are mandatory. The points of concern reported are shown below in Table 28. Those marked with a * indicate newly reported points of concern.

Unfortunately, due to the COVID-19 pandemic and the lack of shows due to a national lockdown, there are little data for 2020 and so these have not been included. Further, from this time, The Kennel Club have been unable to send reminders to judges, which has resulted in a clear drop in monitoring form submissions. This is clearly reflected in the number of dogs reported from 2021.

Update (July 2023) – The Kennel Club are currently reviewing the entirety of Breed Watch, and have taken a number of recommendations to the Board. Following approval, these recommendations will begin to be implemented from January 2024.

Table 1: Percentage of French Bulldogs exhibited at Dog shows with points of concern for 2016 to 2022. Those with a * indicate newly reported point of concern.

Point of concern	2016	2017	2018	2019	2021	2022
Difficulty breathing	0.4%	0.8%	-	-	0.2%	0.4%
Dogs showing respiratory distress including difficulty breathing or laboured breathing	-	0.1%	0.6%	0.4%	-	-
Exaggerated roach in the top line	2.0%	-	2.2%	1.8%	2.7%	-
Excessively prominent eyes	0.7%	0.5%	0.1%	-	0.2%	-
Incomplete blink	0.9%	2.1%	0.1%	-	-	-
Incorrect bite	1.7%	0.4%	0.7%	1.2%	0.4%	0.2%
Inverted tail	0.3%	0.2%	0.4%	-	-	-
Lack of tail	4.6%	-	1.6%	-	-	-
Lack of tail, screw tail, inverted tail and tight tail	-	2.1%	3.2%	3.0%	12.0%	0.4%
Overly short neck	0.9%	2.3%	-	-	1.0%	-
Pinched nostrils	7.7%	2.0%	5.0%	3.5%	4.7%	2.6%
Prominent eyes	-	-	0.5%	-	-	-
Screw tail	0.6%	5.2%	-	0.3%	-	-
Short neck	-	1.0%	2.6%	0.8%	-	-
Signs of dermatitis in skin folds	0.1%	0.6%	0.1%	0.2%	-	-
Tight tail	1.9%	9.1%	0.5%	-	-	-
* Excessive wrinkle	0.1%	-	-	-	-	-
* Eye/Eyelid abnormalities	-	0.2%	-	-	-	-
* Lower lip over incisors (tight lip)	-	0.2%	-	0.2%	-	-
* Overly short body	-	-	-	-	0.2%	-
*Weak hind movement	0.7%	0.2%	0.2%	-	-	-
Total	**2482**	**2686**	**2808**	**1870**	**515**	**464**

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 2 below. No reports have been received since 2019.

Table 2: PTS surgeries granted to date for exhibits per year.

	Year				
Surgery	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 BREEDERS 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
- DNA test for hereditary cataracts (HC) – HSF4
- Participate in the French Bulldog Health Scheme

DNA TEST RESULTS

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

- HC-HSF4
- DM

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

Laboratories that test for these DNA tests and the methods through which the Kennel Club accept results can be found through the Breed's A-Z:

- French Bulldog | Breeds A to Z | The Kennel Club

HC-HSF4

The results for 25,104 dogs which had been DNA tested for HC-HSF4 up to July 2023 are shown in Table 3.

Table 3: HC-HSF4 DNA test results held by the Kennel Club for French Bulldogs.

CLEAR	CARRIER	AFFECTED	HEREDITARY CLEAR
4,688 (18.7%)	37 (0.1%)	0 (0.0%)	20,379 (81.2%)

The proportion of results that are from a genotyped dog are provided in the below graph. There appears to have been a peak between 2012-13.

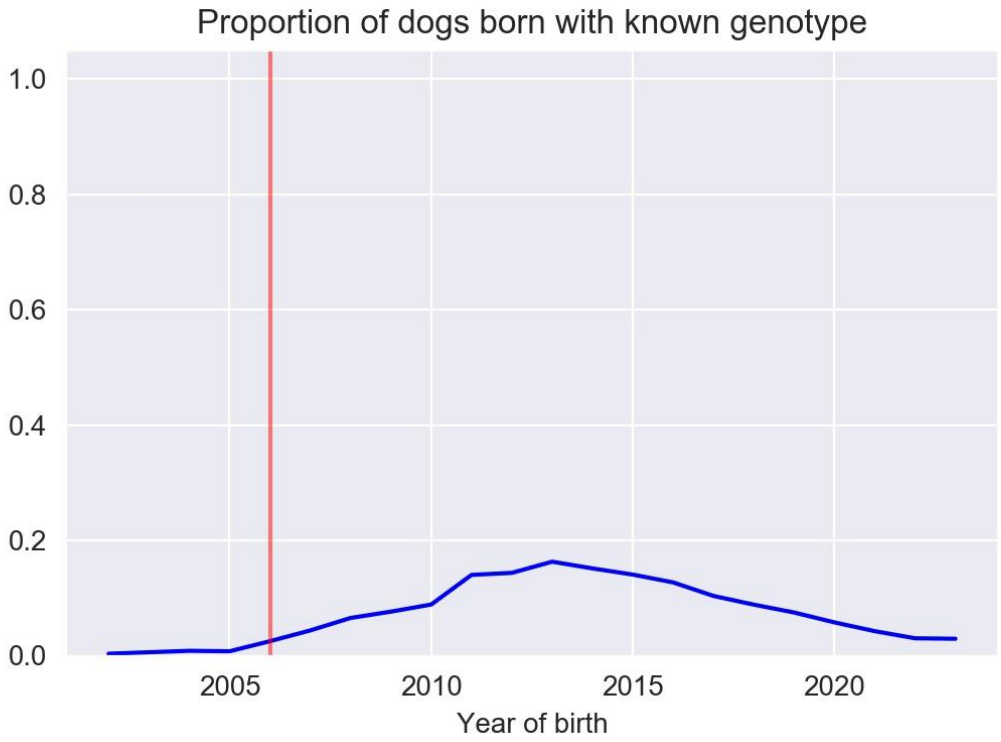


Figure 3: Proportion of results received from dogs that have been genotyped (NB: the red line marks the year the test was recognised).

The mutation frequency overtime in dogs tested is given in the figure below. This has shown a discernible decrease in both genotyped dogs, and those with hereditary status. As of 2019-22 the 3-year mean mutation frequency in genotyped dogs was 0.0%.

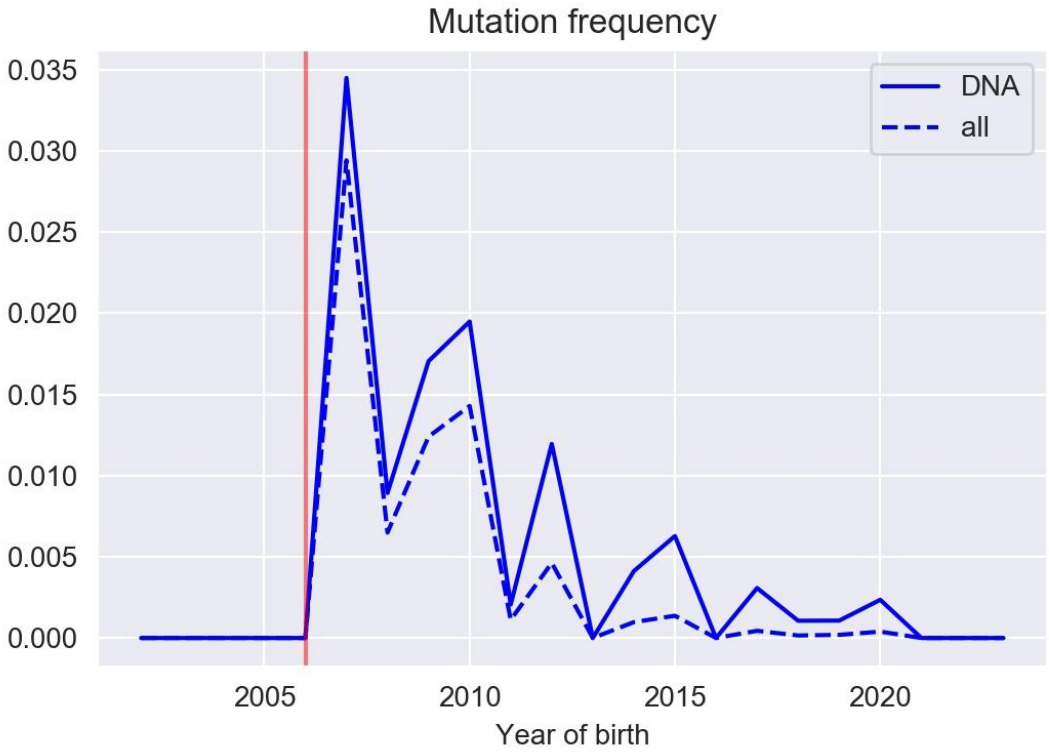


Figure 4: Mutation frequency trend for HC-HSF4 DNA tested and all recorded dogs.

DM

To date, 10,447 DNA test results have been received for the breed.

Table 4: DNA test results held by the Kennel Club for DM to date.

CLEAR	CARRIER	AFFECTED	HEREDITARILY CLEAR	HEREDARILTY CARRIER	HEREDITARILY AFFECTED
2,919 (27.9%)	800 (7.7%)	80 (0.8%)	6,555 (62.7%)	92 (0.9%)	1 (0.0%)

It is worth noting with respect to DM that the validity of the test in the breed is questionable, and although the SOD1 mutation has been found in the breed (Zeng et al, 2014), the inheritance of DM is known to be complex (i.e. autosomal recessive with incomplete penetrance), and therefore this test is classed as a 'risk-based' test. Given that no data confirming the association with genotype and clinical onset has been determined in the French Bulldog, the recommendation that this test is used before breeding was removed from the ABS in 2021 and is not included in The Kennel Club's DNA Testing Service package for the breed. The results for this mutation are still recorded for data purposes, but it is not seen as a priority test for the breed.

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 57 French Bulldogs have been hip scored as part of the BVA/KC Hip Dysplasia Scheme in the past 15 years (to the end of 2022). For dogs born in the past 8 years this represents 0.01% of the population. The median hip score received for more recent dogs tested (i.e. in the past 8 years) was 10 (range 5 – 43).

ELBOWS

Thirteen French Bulldogs have been elbow scored as part of the BVA/KC Elbow Dysplasia Scheme in the last 15 years to date. For dogs born in the past 8 years this represents 0.004% of the population born. Of these, nine were graded 0, four graded as a 1 and one as a 3.

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.

In total, 467 dogs have been tested in the past 15 years, with the proportion tested per year of birth shown in the Figure below.

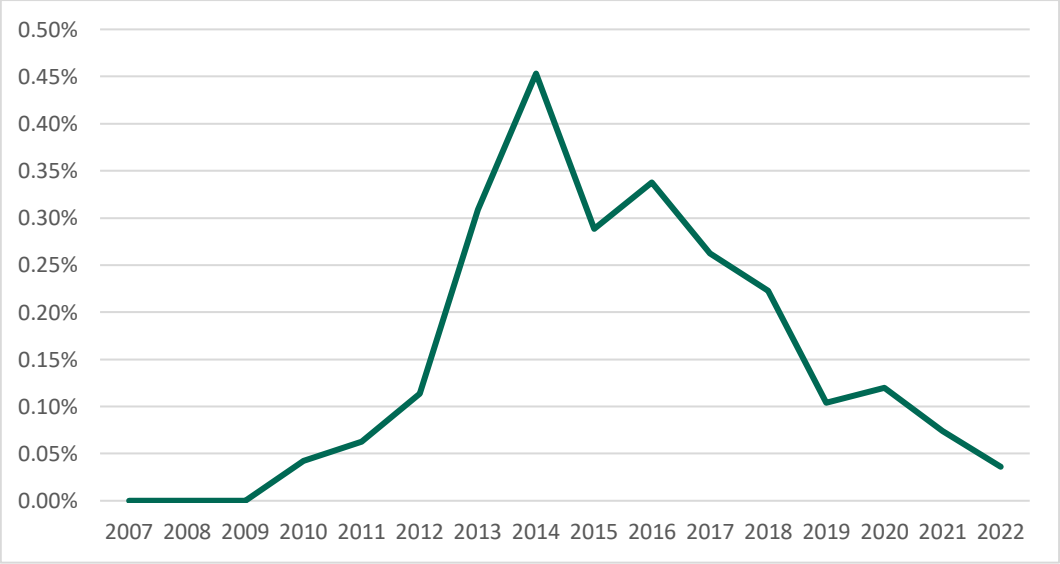


Figure 5: Proportion of dogs eye tested per year of birth.

The results of dogs tested are given in the Table below, with just one dog having been tested as affected for HC. “Observation made – refer to owner” denotes that an observation has been made, but for a condition that does not have a known hereditary component (e.g. distichiasis or injury).

Table 5: Eye results recorded under the BVA/KC/ISDS Eye Scheme.

Test Result	Count
Affected	1 (0.21%)
Observation made – refer to owner	272 (58.2%)
Unaffected	194 (41.5%)

Schedule B has been replaced with sightings reports, 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 below.

Table 6: 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	
2019	107 adults 1 litter	2 – anterior cortical cataracts 1 – corneal lipid deposition 10 – distichiasis 1 – entropion 1 – imperforate punctum 1 – macroblepharon 1 – MRD-like appearance 1 – nuclear cataract 2 – post cataract	
2020	22 adults 1 litter	1 – chorioretinopathy 1 – distichiasis 1 – ectropion 1 – persistent pupillary membranes 1 – uveal opacity	

Year	Number seen	Comments
2021	90 adults	1 – hereditary cataract 1 – anterior capsular cataract 3 – anterior cortical cataract 9 – distichiasis 4 – entropion 2 – optic nerve hypoplasia/ post segment coloboma 1 – persistent pupillary membrane
2022		*Awaiting report*

AMERICAN COLLEGE OF VETERINARY OPHTHALMOLOGISTS (ACVO)

Results of examinations through AVCO are shown in Table 7 below. Between 2018 and 2022, 3,010 dogs of the breed were examined by the ACVO and prevalence data are shown in Table 7 alongside data from previous years. Overall, 78.6% (2,367 of 3,010) 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.

Table 7: ACVO examination results for French Bulldogs, 1993 – 2022.

Disease Category/Name	Percentage of Dogs Affected	
	1993-2017 (n=4,742)	**2018-2022** (n=3,010)
Eyelids		
Entropion	1.0%	1.5%
Distichiasis	6.5%	5.1%
Nasolacrimal		
Imperforate lower nasolacrimal punctum	1.0%	0.9%
Cornea		
Corneal dystrophy	0.8%	1.0%
Uvea		
Persistent pupillary membranes (iris to iris)	2.7%	2.3%
Persistent pupillary membranes (iris to cornea)	1.3%	0.6%
Persistent pupillary membranes (endothelial opacity/no strands)	0.9%	1.6%
Lens		
Cataracts (significant)	4.6%	4.4%
Retina		
Retinal dysplasia	2.3%	0.8%

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

RESPIRATORY FUNCTION 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.

To date (July 2023), 1,419 results have been received overall for French Bulldogs, of which 84.8% have been graded either a 0 or 1 (Figure 6).

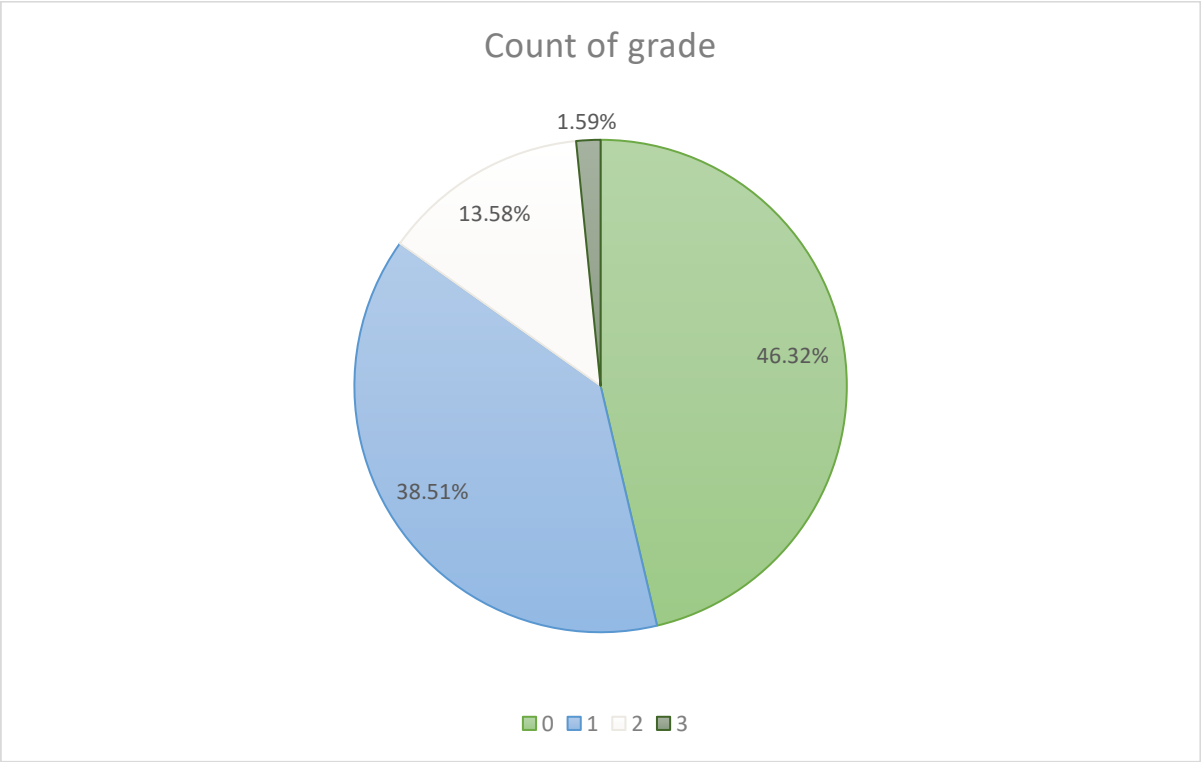


Figure 6: Total grades received for French Bulldogs between 2016 and 2023.

The breakdown by sex is also provided in the table below.

Table 8: University of Cambridge/KC RFG Scheme results for male and female French Bulldogs, 2016 – 2023.

Grade	Male	Female
0	191 (35.9%)	467 (52.6%)
1	227 (42.7%)	319 (36.0%)
2	101 (19.0%)	92 (10.4%)
3	13 (2.4%)	9 (1.0%)
Total	**532**	**887**

The number of dogs tested per year is shown in Figure 7 below, with this having plateaued slightly from 2021.

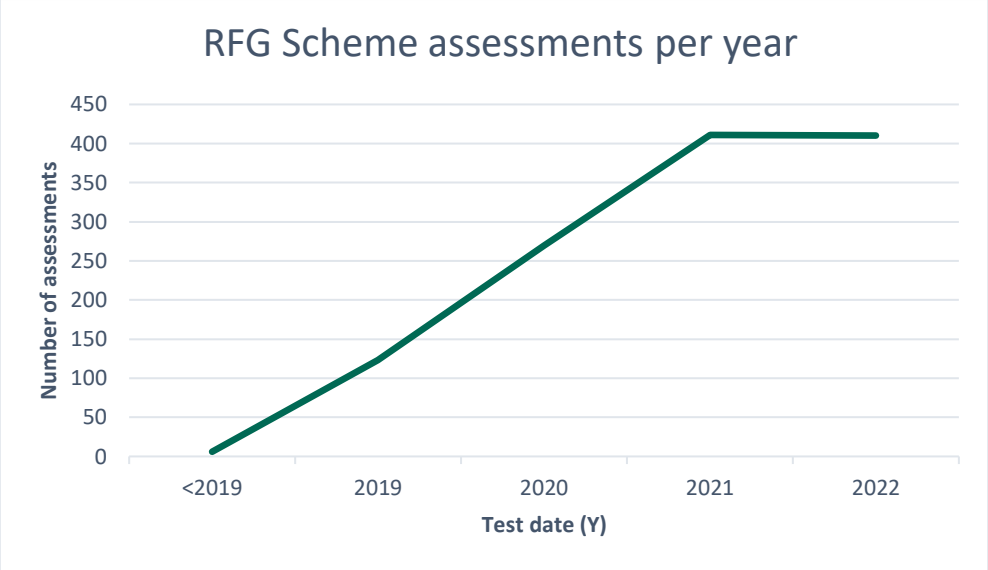


Figure 7: Number of RFG results received per year for the French Bulldog.

In terms of the proportion of litters born from RFG tested parents, this is shown in the figure below. Both trends are slowly increasing over this time period.

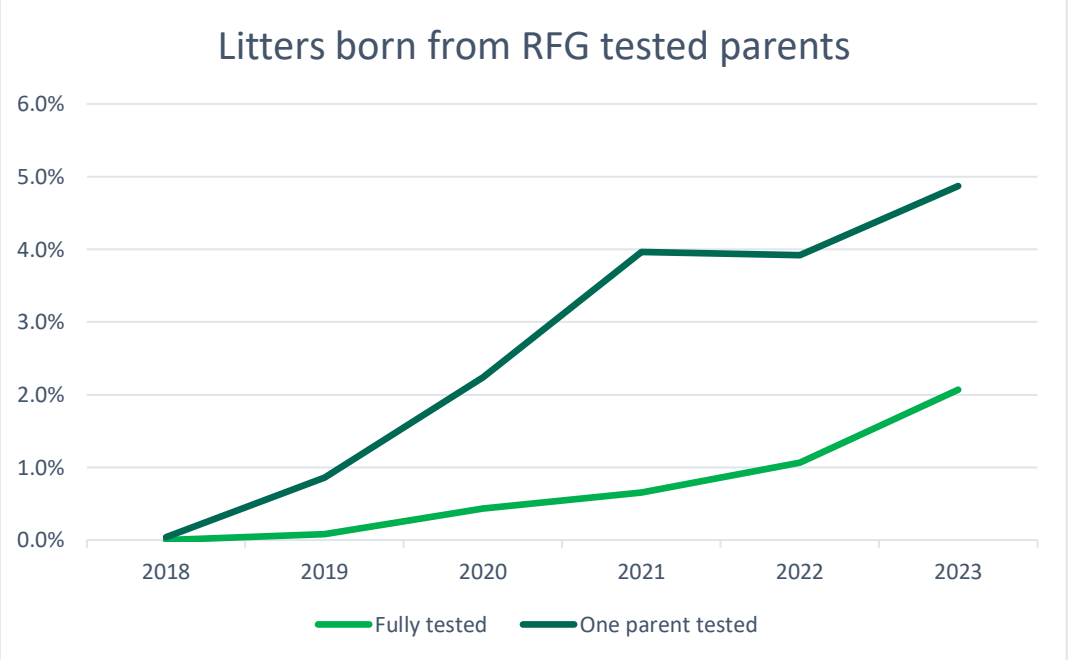


Figure 8: Proportion of litters born from fully or partially RFG tested parents.

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.

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 below.

Table 9: Number of litters of French Bulldogs registered per year and number of caesarean sections reported per year, 2013 to 2022.

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)*
2013	1485	493	33.3%	10.0%
2014	2089	709	33.9%	10.6%
2015	3155	1066	33.6%	11.7%
2016	4620	1633	33.6%	13.9%
2017	5783	2192	41.2%	15.0%
2018	7047	2972	39.6%	17.2%
2019	6822	2618	38.4%	15.7%
2020	8655	3294	38.1%	16.8%
2021	10324	3578	34.7%	16.5%
2022	7762	2286	29.5%	12.0%

GENETIC DIVERSITY MEASURES

The Kennel Club are currently undertaking a full analysis of breed populations, and will be develop breed-specific reports at the beginning of 2024. Once available, this report will be fed into the BHCP for the French Bulldog.

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 9. 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.

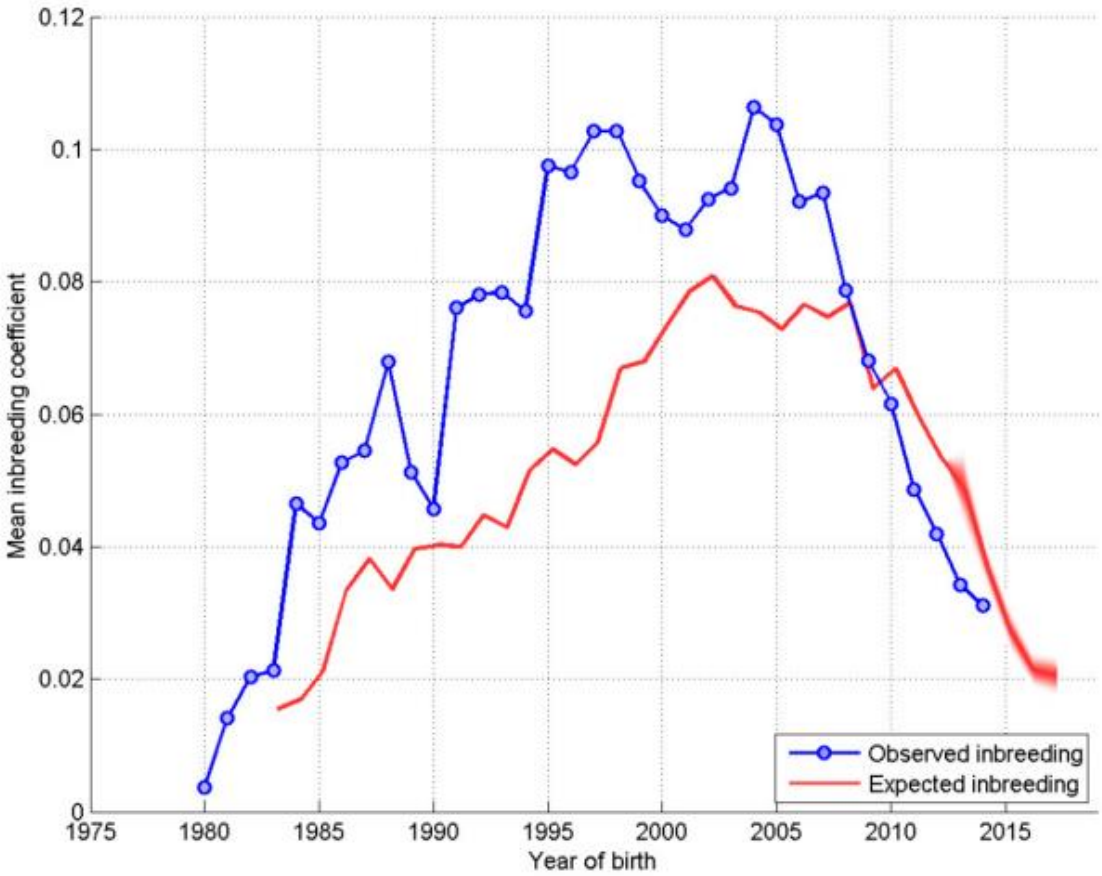


Figure 9: Annual mean observed and expected inbreeding coefficients.

Below is a histogram ('tally' distribution) of number of progeny per sire and dam over each of seven 5-year blocks (Figure 10). 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 10).

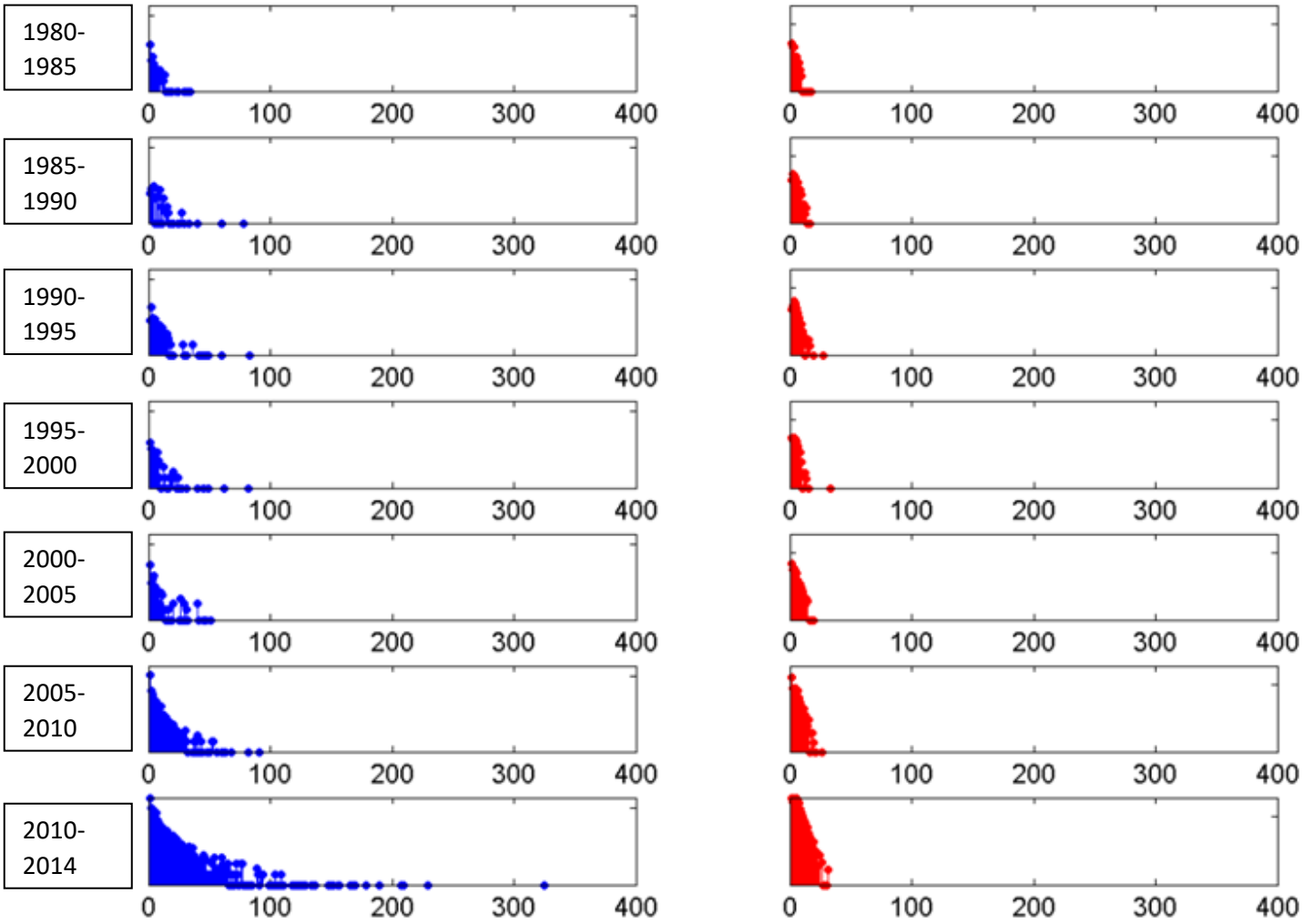


Figure 10: Distribution of progeny per sire (blue) and per dam (red) over 5-year blocks (1980-4 top, 2010-14 bottom). Vertical axis is a logarithmic scale.

CURRENT RESEARCH

The French Bulldog has been part of the BOAS research ongoing at the University of Cambridge. There is also appetite to be involved in IVDD research, to determine quality of life long-term in affected dogs amongst other aspects of clinical onset and screening potential. This is covered as part of the action plan.

PRIORITIES

A meeting was held with the French Bulldog breed representatives in August 2023, following the development 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 remain:

- BOAS
- Spinal disorders
- Allergies

ACTION PLAN

Following the meeting held in August 2023 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. Completed actions can be seen under Annex A.

Both partners are expected to action these points prior to the next review (2026).

Breed Club actions include:

- The breed to continue to support, attend and participate in actions set out by the Brachycephalic Working Group with the additional support of the Kennel Club. - **ONGOING**

- The clubs to send their collected health data to The Kennel Club for inclusion and analysis as part of the BHCP evidence base. - **ONGOING**

- 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 to 10% and provide details of health testing sessions to the Kennel Club. - **ONGOING**

- The breed clubs to take the amended breed standards – specifically with respect to the definition of top line – to their club's AGM and feedback to The Kennel Club to progress changes to the breed standard. – **ONGOING**

- The breed clubs to send details for all health testing events to The Kennel Club for inclusion in the 2024 health calendar via the health clinic form.

- The breed clubs to update and/or include general skin care advice on their websites.

Kennel Club actions include:

- The Kennel Club to promote the RFG scheme to a wider audience and range of breeders, with particular emphasis on pet breeders, with an aim of having 10% of breeding dogs graded by 2024, and coverage at a 30-mile radius. In 2023, 3.0% of French Bulldog litters had a single RFG screened parent, and 1.0% had both parents screened. The Kennel Club will further share the Marketing campaign details with the breed clubs for reference.

- The Kennel Club to run an IVDD feedback survey in collaboration with the neurology working group, to try to identify long-term impacts, clinical features of disease, and prevalence of other spinal concerns that are present in the breed - **ONGOING**

- The Kennel Club to keep the breed updated with respect to review of Breed Watch and discuss further how this may impact the breed going forward.

- The Kennel Club to share details of the revised population analysis with the breed, once drafted and any policy recommendations to be recommended to The Kennel Club Board.
- 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 explore the incidence of heart disease in the breed via a feedback survey, as part of the wider project with the Veterinary Cardiology Society.
- The Kennel Club to take the proposal to the BVA/KC/ISDS Eye Panel Working Party for the removal of HC-HSF4 from the KIOD schedule, and investigate the feasibility of developing a grading scheme for brachycephalic breeds. - **ONGOING** (*the proposal to remove HC-HSF4 was denied by the Eye Panel Working Party in 2022. The possibility of developing a grading scheme is ongoing as part of Dr C Kafarnik's research at the Royal Veterinary College*).

ANNEX A - COMPLETED ACTIONS

Details for completed actions are provided below:

Breed club actions

- The Breed Clubs to consider making a proposal to adding relevant DNA tests as a requirement under the Assured Breeder Scheme. – **COMPLETE** *(this action was completed in 2020, and the DNA test for the breed can be found on page 44)*

- The breed clubs to monitor the incidence of a point of concern in the breed, and look to add to Breed Watch. – **COMPLETE** *(this action was completed in 2017, whereby the tail points of concern were condensed into one point. More information can be found on page 42)*

- The breed clubs to take the amended breed standards to their club's AGM and feedback toTthe Kennel Club . – **COMPLETE** *(this action was completed in 2021, with several changes made to the standard. It is worth noting that the standard is under review at this time, with further changes to be made in the next year)*

- The Breed Club to consider developing a health survey, with The Kennel Club to assist in dissemination. – **COMPLETE** *(a survey was disseminated in 2020, with the findings reported on page 14).*

- The Breed Club to participate in the University of Cambridge BOAS/ CM/SM research. – **COMPLETE** *(the research for the French Bulldog concluded in 2018, and a formal scheme launched in 2019. More information is available on page 50).*

Kennel Club actions

- The Kennel Club to take the proposal to remove DM DNA testing from the Assured Breeders Scheme, and assess the test's validity before reinstating. – **COMPLETE** *(DM was removed from the scheme in 2021. Further investigation into the relevance of the mutation with clinical disease has not managed to determine a link between phenotype and genotype)*

- The Kennel Club to monitor outcomes and/or research on allergies, specifically with regard to skin problems, which include the French Bulldog. – **ON HOLD** *(given the complexity of allergies and possible factors this action has been placed on hold, as it is unlikely at this time that research would produce meaningful outcomes that could support the breed in selecting against these diseases)*

ANNEX B – OTHER CONDITIONS IN BREED HEALTH SURVEY

Below shows the other conditions reported in the 2020 breed health survey:

Category/ Condition	Count	Category/ Condition	Count
Gastrointestinal	**97**	***Muscle, bone or joint***	**30**
Hernia	16	Screw tail/ deep tail pockets/ inverted tail/ incomplete tail blocking tail	11
Anal gland issues	13	Fractures	3
Blocked anal glands	10	Carpal deformities	2
Anal gland abscess	8	Pigeon chest	2
Food allergies	7	Pulled muscle	1
Pancreatitis	6	Back trauma	1
Cleft palate	5	Ruptured knee	1
Anal gland removal	4	Cruciate ligament rupture	1
Sensitive stomachs	4	Limping	1
Irritable bowl syndrome	2	Possible IVDD	1
Giardia infection	2	Hip dysplasia	1
Oesophagus pouch	2	Patellar luxation	1
Salivary mucocele	2	Leg pain	1
Blocked salivary ducts	2	Dwarfism	1
Colitis	2	Masticatory muscle myositis	1
Rectal polyp	2	Inverted sternum	1
Oesophagitus	1	***Reproductive***	**18**
Difficulty drinking	1	Undescended testicle	4
Gallbladder removal	1	Pyometra	3
Leaky gut	1	Enlarged prostate	3
Water infection	1	Phantom pregnancy	2
Tonsillitis	1	Recurring penis infection	1
Vomiting	1	Enlarged nipples	1
Megaoesphagus	1	Vaginoplasty	1
Oesophagus stricture	1	Vaginitis	1
Twisted small intestine	1	Irregular seasons	1
Dermatological (skin)	**53**	Vaginal prolapse	1
Allergies	22	***Cancer***	**16**
Paw irritation	7	Histiocytoma	6
Papilloma	5	Benign lump/ tumour	4
Non-cancerous lumps	4	Brain tumour	2
Dew claw problems	3	Unspecified	2
Tail pocket infections	3	Ovarian	2
Lipoma	2	***Ear***	**14**
Reaction to stiches	1	Hearing loss/ deafness	7
Dermoid cysts	1	Haematomas	3
Spots/ acne	1	Abscess	1
Skin melanoma	1	Polyp	1
Dry nose	1	Yeast infection	1
Severe itching	1	Total ear ablation	1
Skin tags	1	***Eye***	**6**
Neurological	**34**	Cherry eye	2
Seizures/ fitting	11	Retinal atrophy	1
Meningitis	7	Conjunctivitis	1
Epilepsy	6	Overactive tear duct	1
Head tremors	1	Benign cyst	1
CM/SM	1	***Respiratory***	**10**
Stroke	1	Reverse sneezing	2
Brain haemorrhage	1	Nasal hyperkeratitis	2
Fluid on the brain	1	Throat inflammation	1
Degenerative spinal disease	1	Kennel cough	1
Calcification of spine/ rib cage	1	Collapsed airways	1
Slipped disc	1	Mass removal – larynx	1
Extra hemivertebrae	1	Acid reflux	1
Trapped nerve	1	Nose infection	1

Category/ Condition	Count	Category/ Condition	Count
Behavioural	**9**	***Immunological***	**6**
Aggression	3	Vaccine reactions	3
Separation anxiety	2	Lupus	2
Nervousness	1	Canine herpes virus	1
Unpredictable behaviour	1	***Urinary***	**4**
Depression	1	Urinary tract infection	2
General behavioural issues	1	Congenital kidney dysplasia	1
Haematological	**6**	Incontinence	1
Pneumonia	3	***Other***	**7**
Internal bleeding with removal of spleen	3	Heat intolerance	5
Hormonal	**9**	Hay fever	2
Cushing's disease	6		
Irregular seasons	1		
Hyperthyroidism	1		
Enlarged adrenal gland	1		

REFERENCES

Anderson, O.J., Langley-Hobbs, S.J., Parsons, K.J. (2023) Humeral condylar fractures and fissures in the French Bulldog. *Veterinary Surgery* **52(1)**: 134-145 doi: 10.1111/vsu.13907.

Anturaniemi, J., Uusitalo, L. and Hielm-Björkman, A. (2017) Environmental and phenotype-related risk factors for owner-reported allergic/atopic skin symptoms and for canine atopic dermatitis verified by veterinarian in a Finnish dog population. *PLoS ONE* **12**(6): e1078771 https:// doi.org/10.1371/journal.pone.0178771

Baradun, M.A., Bult, S., Demierre, S., Vidondo, B., Forterre, F. (2020) Colder ambient temperatures influence acute onset canine intervertebral disc extrusion. *Frontiers in Veterinary Science* **7:175** doi: 10.3389/fvets.2020.00175

Bellumori, T.P., Famula, T.R., Bannasch, D.L., Belanger, J.M., Oberbauer, A.M. (2013) Prevalence of inherited disorders among mixed-breed and purebred dogs: 27,254 cases (1995-2010) *Journal of the American Veterinary Medical Association* **232(11)**: 1549-1555

Brambilla, P.G., Polli, M., Pradelli, D., Papa, M., Rizzi, R., Bagardi, M., Bussadori, C. (2020) Epidemiological study of congenital heart disease in dogs: prevalence, popularity, and volatility throughout twenty years of clinical practice. *PLOSone* **15(7)** https://doi.org/10.1371/journal.pone.0230160

Brloznik, M., Svete, A.N., Erjavec, V., Petric, A.D. (2023) Echocardiographic parameters in French Bulldogs, Pugs and Boston Terriers with brachycephalic obstructive airway syndrome. *BMC Vet Res* **19(1)**:49 doi: 10.1186/s12917-023-03600-9.

Brown, J.D., Podadera, J., Ward, M., Goldsmid, S., Simpson, D.J. (2021) The presence, morphology and clinical significance of vertebral body malformations in an Australian population of French Bulldogs and Pugs. *Australian Veterinary Journal* **99(9)**: 378-397 DOI: 10.1111/avj.13094

Costa, J., Steinmetz, A., Delgado, E. (2021) Clinical signs of brachycephalic ocular syndrome in 93 dogs. *Irish Veterinary Journal* **74:3** https://doi.org/10.1186/s13620-021-00183-5

Davenport, A., Clements, D., Dancer, S. (2023) Humeral intracondylar fissures and intracondylar sclerosis are common CT findings in the limb contralateral to humeral condylar fracture in French Bulldogs and Spaniel breeds. *Veterinary Radiology and Ultrasound* **64(4)**: 686-693 https://doi.org/10.1111/vru.13264

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

Franklin, C., Herrtage, M., Harris, K., Genain, M-A. (2023). Prevalence of incidental humeral intracondylar fissures in brachycephalic breed dogs in CT studies. *Veterinary Radiology and Ultrasound* **64(2)**: 194-200 doi: 10.1111/vru.13191.
Gutierrez-Quintana, R., Guevar, J., Stalin, C., Faller, K., Yeamans, C. and Penderis, J. (2014) A proposed radiographic classification scheme for congenital thoracic vertebral malformations in brachycephalic "screw-tailed" dog breeds. *Veterinary Radiology and Ultrasound* **55**(6):585-591

Hall, E.J., Carter, A.J., Bradbury, J., Barfield, D., O'Neill, D.G (2021) Proposing the VetCompass clinical grading tool for heat-related illness in dogs. *Scientific Reports* **11:6828** https://doi.org/10.1038/s41598-021-86235-w

Hall, E.J., Carter, A.J., O'Neill, D.G. (2020) Incidence and risk factors for heat-related illness (heatstroke) in UK dogs under primary veterinary care in 2016. *Scientific Reports* **10:9128** https://doi.org/10.1038/s41598-020-66015-8

Holmberg, J., Pelander, L., Ljungvall, I., Harlos, C., Spillmann, T., Haggstrom, J. (2022) Chronic enteropathy in dogs – epidemiologic aspects and clinical characteristics of dogs presenting at two Swedish animal hospitals. *Animals* **12(1507)** https://doi.org/10.3390/ani12121507
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

Iwashita, H., Wakaiki, S., Kazama, Y., Saito, A. (2020) Breed prevalence of canine ulcerative keratitis according to depth of corneal involvement. *American College of Veterinary Ophthalmologists* **23**: 849-855 DOI: 10.1111/vop.12808

Jaeger, K., Linek, M., Power, H.T., Bettenay, S.V., Zabel, S., Rosychuk, R.A.W., Mueller, R.S. (2010) Breed and site predispositions of dogs with atopic dermatitis: a comparison of five locations in three continents. *Veterinary Dermatology* **21**: 119-123

Kerr, S., Crawford, A.H., De Decker, S. (2021) Late onset recurrence of clinical signs after surgery for intervertebral disc extrusion in French Bulldogs. *J Small Anim Pract* **62(8)**: 683-689 DOI: 10.1111/jsap.13331

Kerr, S., Crawford, H., De Decker, S. (2021) Late onset recurrence of clinical signs after surgery for intervertebral disc extrusion in French Bulldogs. *Journal of Small Animal Practice* **1-7** DOI: 10.1111/jsap.13331

Kishimoto, T.E., Uchida, K., Chambers, J.K., Kok, M.K., Son, N.V., Shiga, T., Hirabayashi, M., Ushio, N., Nakayama, H. (2020) A retrospective survey on canine intracranial tumours between 2007 and 2017. *The Japanese Society of Veterinary Science* **82(1)**: 77-83 doi: 10.1292/jvms.19-0486

Lackmann, F., Forterre, F., Brunnberg, L., Loderstedt, S. (2021) Epidemiological study of congenital malformations of the vertebral column in French Bulldogs, English Bulldogs and Pugs. *Veterinary Record* **190(1)**:e509 https://doi.org/10.1002/vetr.509

Lecourtois, C., Baudin-Trehiou, C., Blond, L. (2023) Lumbosacral endplate contour defect is frequently observed concurrent with other lumbosacral abnormalities on spinal CT of French Bulldogs. *Vet Radiol Ultrasound* DOI: 10.1111/vru.13271

Lecourtois, C., Baudin-Trehiou, C., Blond, L. (2023) Lumbosacral endplate contour defect is frequently observed concurrent with other lumbosacral abnormalities on spina CT of French Bulldogs. *Veterinary Radiology & Ultrasound* **1-10** https://doi.org/10.1111/vru.13271

Leu, D., Vidondo, B., Stein, V., Forterre, F. (2023) Recurrence rate of intervertebral disc disease in surgically treated French Bulldogs: a retrospective study (2009-2019). *Acta Vet Scand* **65(1)**:3 DOI: 10.1186/s13028-023-00667-0

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

Mansour, T.A., Lucot, K., Konopelski, S.E., Dickinson, P.J., Sturges, B.K., Vernau, K.L., Choi, S., Stern, J.A., Thomasy, S.M., Doring, S., Verstraete, F.J.M., Johnson, E.G., York, D., Rebhun, R.B., Hc, H.H., Brown, C.T., Bannasch, D.L. (2018) Whole genome variant association across 100 dogs identifies a frame shift mutation in dishevelled 2 which contributes to Robinow-like syndrome in Bulldogs and related screw tail dogs breeds. *PLOS Genetics* **14**:e1007850 https://doi.org/10.1371/journal.pgen.1007850

Mochizuki, H., Motsinger-Reif, A., Bettini, C., Moroff, S., & Breen, M. (2016). Association of breed and histopathological grade in canine mast cell tumours. *Veterinary and Comparative Oncology*. doi: 10.1111/vco.12225

Nakazawa, M., Miyamae, J., Okana, M., Janemoto, H., Katakura, F., Shiina, T., Ohno, K., Tsuijimoto, H., Moritomo, T., Watari, T. (2021) Dog leucocyte antigen (DLA) class II genotypes associated with chronic enteropathy in French Bulldogs and Miniature Dachshunds. *Veterinary Immunology and Immunopathology* **237** https://doi.org/10.1016/j.vetimm.2021.110271

Niskanen, J.E., Reuanen, V., Salonen, M., Bannasch, D., Lappalainen, A.K., Lohi, H., Hytonen, M.K. (2021) Canine *DVL2* variant contributes to brachycephalic phenotype and caudal vertebral anomalies. *Human Genetics* **140**: 1535-1545 https://doi.org/10.1007/s00439-021-02261-8

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., 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., 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., Packer, R.M.A., Francis, P., Church, D.B., Brodbelt, D.C., Pegram, C. (2021) French Bulldogs differ to other dogs in the UK in propensity for many common disorders: a VetCompass study. *Canine Medicine and Genetics* **8:13** https://doi.org/10.1186/s40575-021-00112-3

O'Neill, D.G., Rowe, D., Brodbelt, D.C., Pegram, C., Hendricks, A. (2022) Ironing out the wrinkles and folds in the epidemiology of skin fold dermatitis in dog breeds in the UK. *Nature* **12:10553** https://doi.org/10.1038/s41598-022-14483-5

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

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

Poli, F., Calistri, M., Meucci, V., Dl Gennaro, G., Baroni, M. (2022) Prevalence, clinical features, and outcome of intervertebral disc extrusion associated with extensive epidural haemorrhage in a population of French Bulldogs compared to Dachshunds. *J Vet Med Sci* **84(9)**: 1307-1312 doi: 10.1292/jvms.22-0210.

Radulesca, S.M., Humm, K., Eramanis, L.M., Volk, H.A., Church, D.B., Brodbelt, D., O'Neill, D.G. (2020) Vestibular disease in dogs under UK primary veterinary care: epidemiology and clinical management. *Journal of Veterinary Internal Medicine* **1-12** DOI: 10.1111/jvim.15869

Riggs, J., Liu, N-C., Sutton, D.R., Sargan, D., Ladlow, J.F. (2019) Validation of exercise testing and laryngeal auscultation for grading brachycephalic obstructive airway syndrome in pugs, French Bulldogs, and English bulldogs by using whole-body barometric plethysmography. *Veterinary Surgery* **48**: 488-496

Roedler, F.S., Pohl, S., Oechtering, G.U. (2013) How does severe brachycephaly affect dog's lives? Results of a structured preoperative owner questionnaire. *The Veterinary Journal* **198** (3): 606-610

Ryan, R., Gutierrez-Quintana, R., ter Haar, G., De Decker, S. (2017) Prevalence of thoracic vertebral malformations in French Bulldogs, Pugs and English bulldogs with and without associated neurological deficits. *The Veterinary Journal* **221**: 25-29 http://dx.doi.org/10.1016/j.tvjl.2017.01.018

Santifort, K.M., Gutierrez-Quintana, R., Bernardini, M., Kortz, G.D., Gomes, S.A., Lowrie, M., De Decker, S., Glass, E.N., Bergknut, N. (2022) Vertebral vascular canal dysplasia in French and English Bulldogs: clinical, CT, and MRI characteristics and prevalence. *Vet Radiol Ultrasound.* **63(3)**: 281-291 doi: 10.1111/vru.13067.

Saraiva, I.Q., Delgado, E. (2020) Congenital ocular malformations in dogs and cats: 123 cases. *American College of Veterinary Ophthalmologists* **23**: 964-978 DOI: 10.1111/vop.12836

Schettler, M., Cassel, N., Elliot, R.C., Fosgate, G.T., Schettler, K., Biller, D. (2022) A prevalence study of canine humeral condylar fractures over a ten-year period at an academic teaching hospital. *Vet Comp Orthop Traumatol* **35(3)**: 191-197 doi: 10.1055/s-0042-1744445.

Schlensker, E., Distl, O. (2016) Heritability of hemivertebrae in the French bulldog using an animal threshold model. *The Veterinary Journal* **207**: 188-189

Smith, M.A.J., Jenkins, G., Dean, B.L., O'Neill, T.M., MacDonald, N.J. (2020) Effect of breed as a risk factor for humeral condylar fracture in skeletally immature dogs. *Journal of Small Animal Practice.* **61**: 374-380 DOI: 10.1111/jsap.13144

Strohmeier, U.W., Harris, K.P. (2021) Humeral intracondylar fissures in French Bulldogs. *Veterinary Record* **189(11)**: e504 DOI: 10.1002/vetr.504

Topfer, T., Kohler, C., Rosch, S., Oeschtering, G. (2022) Brachycephaly in French Bulldogs and Pugs is associated with narrow ear canals. *Veterinary Dermatology* **33(3)**: 214-e60 https://doi.org/10.1111/vde.13067

Villamil, C.S., Phillips, A.S.J., Pegram, C.L., O'Neill, D.G., Meeson, R.L. (2020) Impact of breed on canine humeral condylar fracture configuration, surgical management, and outcome. *Veterinary Surgery* **49**: 639-647 DOI: 10.1111/vsu.13432

Zeng, R., Coates, J.R., Johnson, G.C., Hansen, L., Awano, T., Kolicheski, A., Ivansson, Perloski, M., E., Lindblad-Toh, K., O'Brien, D.P., Guo, J., Katz, M.L., Johnson, G.S. (2014) Breed distribution of *SOD1* alleles previously associated with canine degenerative myelopathy. *J Vet Intern Med* **28**: 515-521