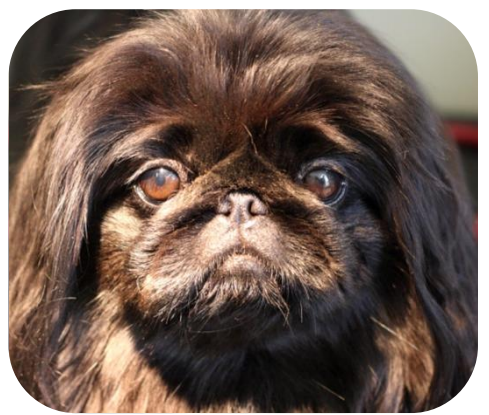
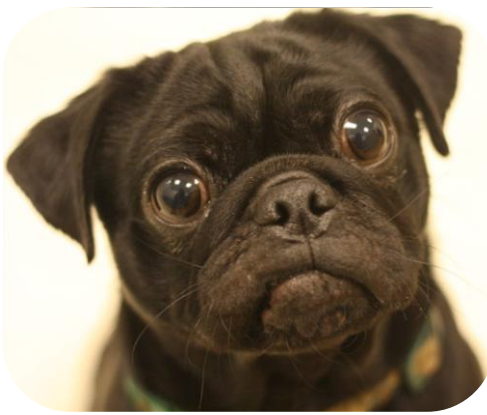


Conference Report: Building Better Brachycephalics 2013



Dr Rowena Packer, Dr Anke Hendricks, Dr Charlotte Burn

A BBSRC Sparking Impact event featuring research funded by



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Introduction

On 11th November, the Royal Veterinary College hosted a 1-day event, “Building Better Brachycephalics”.

The primary aim of this event was to disseminate the research carried out by Dr Rowena Packer, Dr Anke Hendricks and Dr Charlotte Burn, investigating relationships between extreme morphology and inherited disease in domestic dogs – specifically related to the brachycephalic (short-muzzled) conformation.

In addition, the researchers sought the opinions of key stakeholders on the impact of breeding on the health and welfare of short-muzzled dogs.

The conference was opened by Dr James Kirkwood, Chief executive of the Universities Federation for Animal Welfare, and research results were complemented by presentations from experts in the field including soft tissue surgeon Dr Mickey Tivers (Cave Veterinary Specialists) and ophthalmologist Dr David Williams (University of Cambridge), who assisted the research.

Throughout the conference the research team surveyed the audience on key questions regarding brachycephalic health. They displayed the audience’s collective answers in real time to facilitate engagement and discussion. The team tackled difficult issues related to the breeding and treatment of brachycephalic dogs in order to extract real, evidence-based solutions to improve dog welfare.



This report outlines the key events and findings of Building Better Brachycephalics 2013.



Who are we and why did we organise this event?

From 2009-2013, a team of RVC welfare scientists and veterinarians (Dr Rowena Packer, Dr Charlotte Burn and Dr Anke Hendricks, assisted by external experts: soft tissue surgeon Dr Mickey Tivers and ophthalmologist Dr David Williams) conducted research investigating the links between **conformation** and **certain disorders** in domestic dogs.

Prior to this research, the welfare of pedigree dogs had received unprecedented levels of attention from the media, public, veterinary and scientific communities over concerns that certain breeding practices may increase the risk of **inherited disorders** that threaten canine health and welfare. One such concern was that some of the **conformations** desired and selected for, as guided by **breed standards** (formal descriptions of each breed), were intrinsically detrimental to welfare due to their suspected association with disease.

Despite concerns that breeding for 'extreme' and 'exaggerated' morphologies increased the risk of diseases, evidence was lacking, with many associations hypothesised due to perceived high prevalences of specific conditions in breeds exhibiting certain extreme conformations.

Over the past four years we investigated **relationships between canine conformation and disease risk** in two populations of dogs, incorporating a wide variety of breeds and body shapes. Objectives of this research included:

- I. Identifying relationships that exist between **conformations** and **disorders** hypothesised to be associated with each other.
- II. Where such relationships exist, calculating the relative probabilities of being affected by these disorders for dogs ranging in conformation through statistical models. This was to aid identification of **what shape is 'too extreme'**.

One morphology in the spotlight was the **brachycephalic** (short-muzzled) morphology, characteristic of breeds such as the Bulldog, French Bulldog and Pug. Brachycephalic dogs are internationally popular, with the Bulldog the 6th most registered breed in the US, and the Pug 9th in the UK. The popularity of several brachycephalic breeds has increased markedly in the UK in the past decade, most prominently in the Pug and French Bulldog breeds.

Two disorders were investigated, of which the brachycephalic morphology has previously been implicated as a risk factor for:

- **Brachycephalic obstructive airway syndrome (BOAS)** – an airway disorder causing long-term breathing difficulties (Njikam *et al*, 2009)
- **Corneal ulceration** – causing sore eyes, and may lead to blindness (Kim *et al*, 2009)

During this research, a worrying theme was identified in owners of dog with BOAS; 58% of them did not consider the signs of breathing difficulties as a problem, some suggesting that such signs are '**normal for the breed**' (Packer *et al.*, 2012). This is problematic as it may mean BOAS-affected dogs do not receive the veterinary attention that they require, and continue to be used in the breeding population that perpetuates this disorder in future generations. As such, dissemination of research regarding health problems in brachycephalic breeds to all relevant stakeholders is imperative.

The scientific papers reporting the results presented at the event are currently under peer review; however, as brachycephaly was confirmed in both studies as a risk factor for disease, with **more brachycephalic dogs** (those with relatively shorter muzzles) at **higher risk of disease**, consulting stakeholders on how to tackle this conformation-related disorder was of high priority. This event was funded by the **BBSRCs 'Sparking Impact' award scheme**, which funds projects and activities which will increase the likelihood of impact resulting from BBSRC-funded research.

Packer RMA, Hendricks A & Burn CC 2012. Do dog owners perceive the clinical signs related to conformational inherited disorders as 'normal' for the breed? A potential constraint to improving canine welfare. *Animal Welfare*, 21, 81-93.

Njikam IN, Huault M, Pirson V & Detilleux J 2009. The Influence of Phylogenetic Origin on the Occurrence of Brachycephalic Airway Obstruction Syndrome in a Large Retrospective Study. *The International Journal of Applied Research in Veterinary Medicine*, 7, 138-143.

Kim JY, Won HJ & Jeong SW 2009. A Retrospective Study of Ulcerative Keratitis in 32 Dogs. *International Journal of Applied Research in Veterinary Medicine*, 7, 27-31.

PROGRAMME

Location: Conference Centre, Hawkshead Campus, Royal Veterinary College

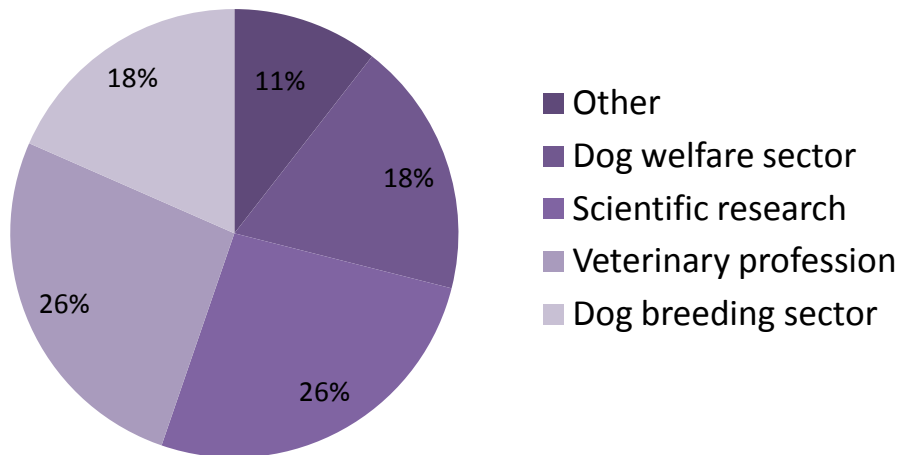
Time	Topic	Speaker
9.30 – 10.00	Registration Refreshments	CPD staff
Session 1		
10.00 – 10.05	Open	James Kirkwood
10.05 – 10.15	Introduction – Does face shape matter to the dogs?	Charlotte Burn
10.15 – 10.20	<i>Survey Session 1</i>	
10.20 – 10.30	<i>Survey Session 2</i>	David Williams
10.30 - 11.00	Corneal ulcers	
11.00 – 11.30	All the better to see you with?	Rowena Packer
11.30 – 12.00	Coffee Break	CPD Staff
Session 2		
12.00 – 12.15	Only skin deep? Facial fold challenges	Anke Hendricks
12.15 – 12.25	<i>Survey Session 3</i>	
12.25 – 1.00	Morning Q & A Session	All speakers
1.00 – 2.00	Lunch	CPD Staff
Session 3		
2.00 – 2.15	<i>Survey Session 4</i>	Mickey Tivers
2.15 – 2.45	BOAS	
2.45 – 3.15	Short muzzle, short of breath?	Rowena Packer
3.15 – 3.30	<i>Survey Session 5</i>	
3.30 – 4.30	<i>Final survey 6</i> and Discussion Forum	All speakers
4.30 Close		

Who attended?



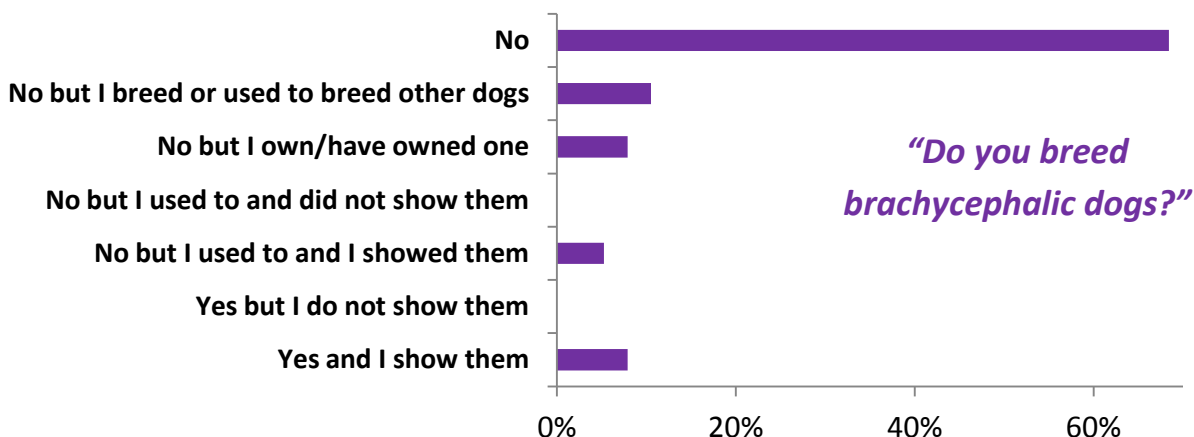
The event was targeted at key professional stakeholders with the capacity to make real improvements to brachycephalic dog welfare.

The event was attended by 50 delegates. A variety of animal welfare charities were represented including **Dogs Trust**, **UFAW**, **RSPCA**, **PDSA** and **Eurogroup for Animals**. Representatives from the veterinary profession were in attendance, including organisations such as the **RCVS** and **BVA**, and the dog breeding community, including the **Kennel Club** and health representatives from several key brachycephalic breed clubs. In addition, key academic experts in the area, including members of the **Advisory Council on the Welfare Issues of Dog Breeding** made up a diverse audience.



The two most common stakeholder sectors represented were the **veterinary** and **scientific research professions** (26% each), followed by the **dog welfare** (18%) and **dog breeding sectors** (18% each). Other attendees included dog industry and media representatives.

The majority of the audience (68%) did not currently own or breed brachycephalic dogs; however 8% of the audience *currently* bred and showed them, 6% had *previously* bred and showed them, and 8% owned or had previously owned them but were not involved in showing. A further 11% of participants bred non-brachycephalic dogs.



TOPIC I: CORNEAL ULCERS

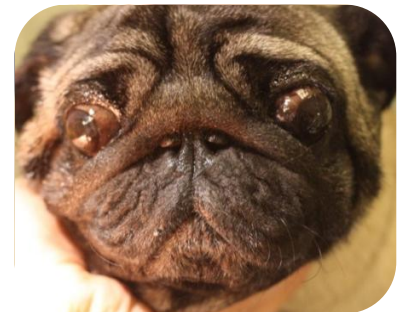
What are corneal ulcers and why do we care?

The cornea is the surface of the eyeball, and is a smooth, polished, moist structure which is transparent when healthy.



The cornea is composed of four layers, with corneal ulceration defined as **loss of one or more layers of the cornea**. Ulceration may be accompanied by **pain, redness, light sensitivity, watering eyes** and **twitching eyelids**. Corneal ulceration is one of the most common eye diseases in domestic dogs, and is a major cause of **blindness** due to either **scarring** or **corneal perforation**.

Damage to the cornea can cause substantial **pain**. Corneal ulcers vary in severity, and can be classified into grades based on their depth. More **superficial lesions** tend to be **more painful** as the nerve endings within the cornea are close to the surface.



Which breeds are affected?

Corneal ulcers have a variety of underlying causes including injury, tear abnormalities; irritants; eyelid or eyelash abnormalities; immune-mediated or allergic inflammation; foreign bodies; or the inability to blink.

There is little scientific literature on breed predispositions to corneal ulcers, with no available prevalence data to date; however, in a recent case series the majority of corneal ulcer cases were **brachycephalic**, with 50% represented by the **prominent-eyed** Shih Tzu and 25% by the Pekingese. This was thought to be due to several conformational risk factors.

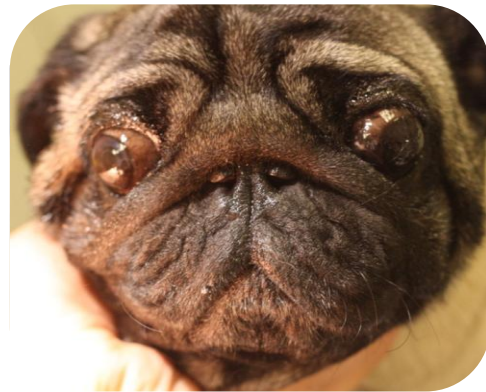
Risk factors for corneal ulcers

Several conformational features that are currently directly or indirectly described in some breed standards were anecdotally reported to increase the risk of corneal ulcers. From our research we have found four major conformational risk factors for corneal ulcers:

Larger eyelid openings



Nasal folds



Shorter muzzles



Exposed 'eye white'



Further details of this study were described during the event, and will be available in a paper currently under review. At present the precise details of this study are under embargo.

Research tools used in our ulcer study

All the key measurements taken during the study are intended to be simple and easy to use. This is so that any findings can be easily applied by dog breeders, owners and judges or anyone else who wishes to predict a dog's risk of eye ulceration from its conformation.

Relative palpebral fissure width

(size of the eyelid opening)

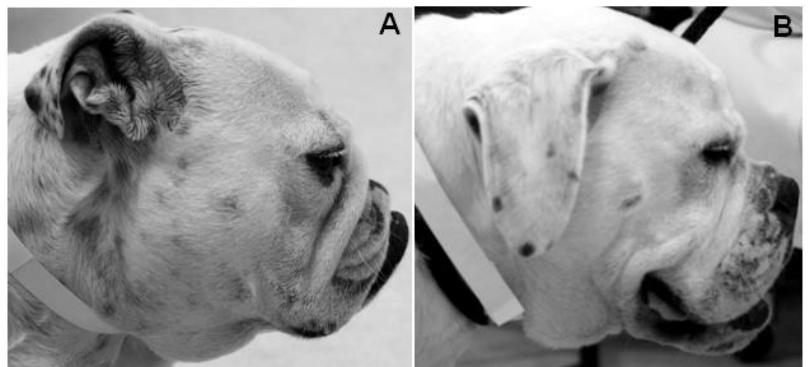
Unstretched palpebral fissure width (mm) was measured in conscious dogs using a soft tape measure pulled taut from the **outer to the inner edge of the eye (from D-E)**. This was held directly (<1cm) in front of the open eye, with the dog's head gently restrained to avoid contact with the cornea



$$\text{Relative palpebral fissure width} = \frac{\text{Palpebral fissure width (mm)}}{(\text{Cranial length (cm)} \times 10)} \times 100$$

Nasal fold

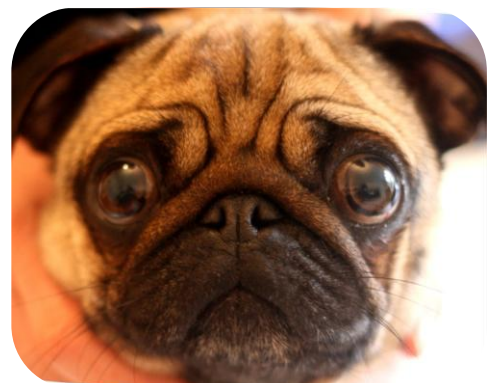
All dogs were examined for the presence of a nasal fold; defined as a **discernible fold of skin** on the dorsal surface of the muzzle that was **present without manipulation** of the skin, and could be easily grasped between vernier callipers.



Dog A on the left exhibits a nasal fold, Dog B on the right does not.

Exposed sclera ('eye white')

All dogs were examined for the presence of visible 'eye white' (sclera) **when looking directly forwards**. This was carried out by gaining the dog's attention (using a toy or treat) and taking a photograph using a digital camera. The overall presence of visible sclera was recorded, and further broken down into whether this was visible above, below or either side of the iris of the eye, and a score of 0-4 was designated for each dog dependent on how many aspects of sclera were visible.



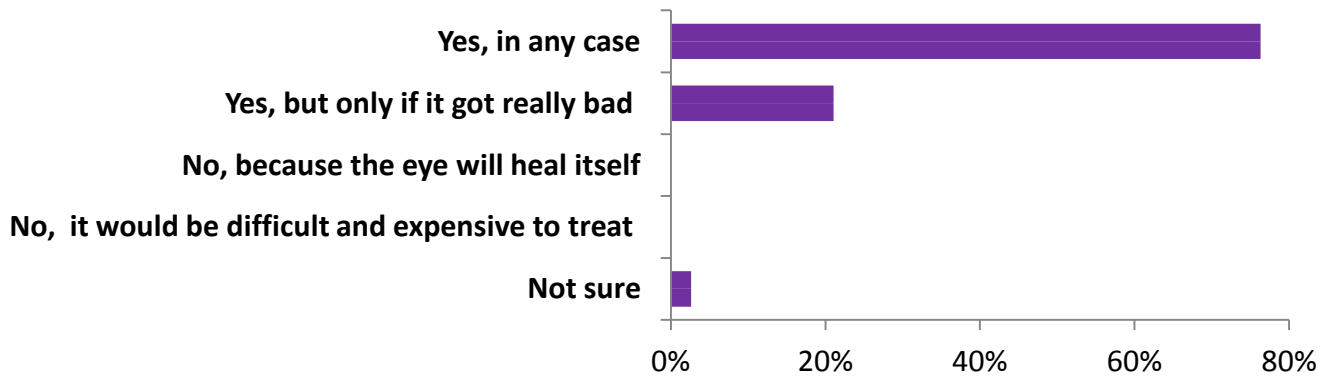
This Pug has visible eye white in all aspects of its eye (4/4)

Corneal ulcers: Stakeholder views

After being presented with the results of our studies, the audience answered the following questions.

Should a dog with a sore eye be taken to the vet?

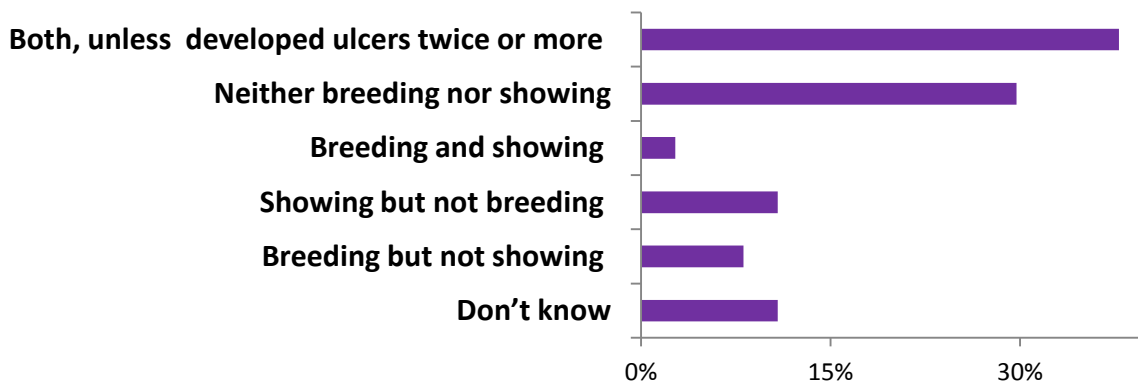
An overwhelming 76% of stakeholders thought that in any case, the dog should be presented to a vet, with a further 21% stating it should if the sore eye got really bad.



Additional comments to this question included:

Yes, in any case – quickly turns into an emergency

If an otherwise healthy brachycephalic dog developed a corneal ulcer would it be suitable to breed from or be shown again?



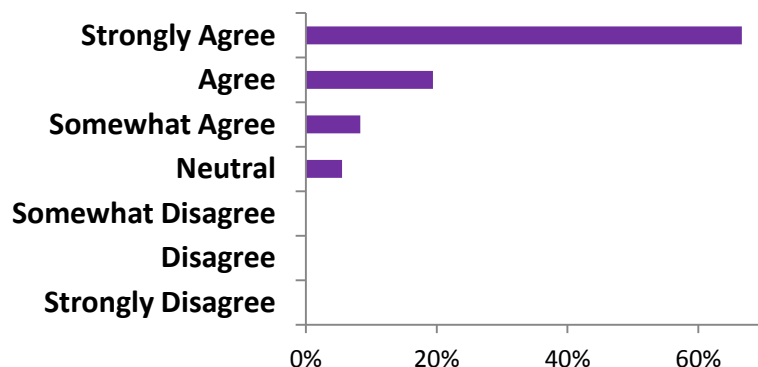
The two most popular answers to this question were at each end of the spectrum – while 30% of stakeholders did not think a dog with an ulcer should be used in showing or breeding again, 38% thought such a dog would be fit for both unless the ulcers developed twice or more. Many stakeholders chose to support their answer with statements such as:

*Depends on the cause!
If conformation- related:
do not breed*

Do you think a corneal ulcer can significantly harm dog welfare?

The majority of the audience (94%) agreed to some extent that a corneal ulcer can significantly harm a dog's welfare with only 6% voting neutrally.

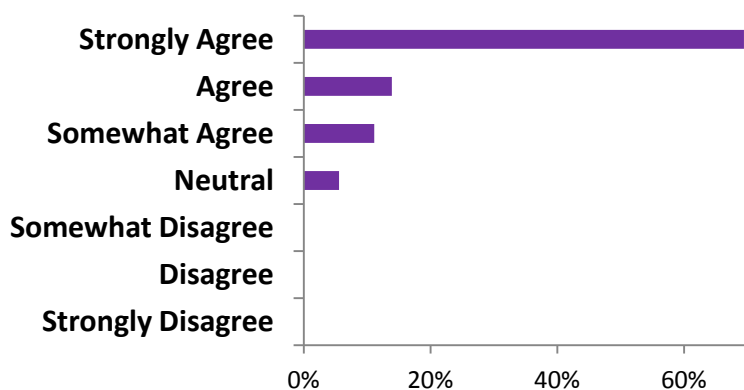
Potential negative welfare consequences of corneal ulcers are in the short-term pain and discomfort, and longer term, behavioural restriction due to impaired vision or blindness from ulcer complications.



Do you think being BRACHYCEPHALIC increases the risk of corneal ulcers?

The majority of the audience (94%) agreed to some extent that being brachycephalic increases the risk of corneal ulcers, with only 6% voting neutrally.

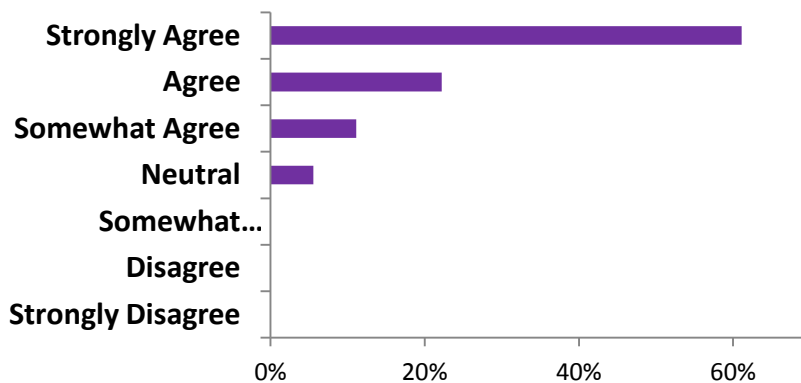
Explanations as to why brachycephalic dogs may be at higher risk of corneal ulcers include their shallow orbits leading to prominent, exposed eyes that are at risk of injury. There are also multiple abnormalities observed in brachycephalic dogs that may increase ulcer risk, including corneal abrasion from in-rolling of the eyelid at the inner corner of the eye; abnormal eyelash development; hairs on the inner corner of the eye; and a disorder characterised by reduced tear production ('dry eye'). In addition, relatively lower corneal sensitivity in brachycephalic dogs leaves the eye less responsive to irritants, with increased opportunity for traumatic injury, and they allow early stage ulcers to go unnoticed by owners.



Do you think LARGE EYES increase the risk of corneal ulcers?

The majority of the audience (94%) agreed to some extent that having 'large' eyes increases the risk of corneal ulcers, with only 6% voting neutrally. This was the risk factor with the most agreement from the audience (joint with brachycephaly).

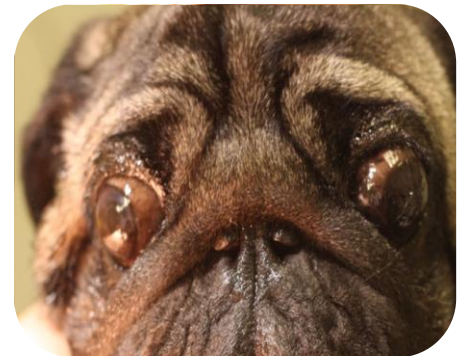
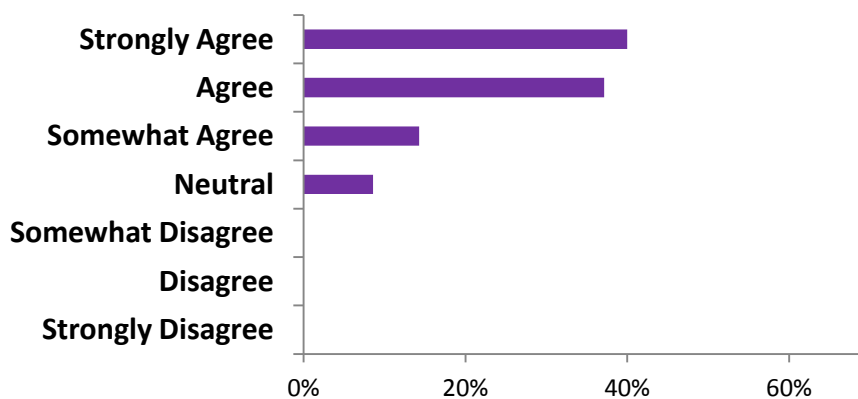
Large eyes may be a risk factor for ulcers as large eyelid openings can result in prominent (bulging) eyes, exposed and prone to trauma. In addition, this conformation can result in an inability to fully close the eyelids, which compromises tear film spreading. This may result in corneal drying with secondary erosion and ulceration.



Do you think NASAL FOLDS increase the risk of corneal ulcers?

The majority of the audience (91%) agreed to some extent that nasal folds increase the risk of corneal ulcers, with only 9% voting neutrally.

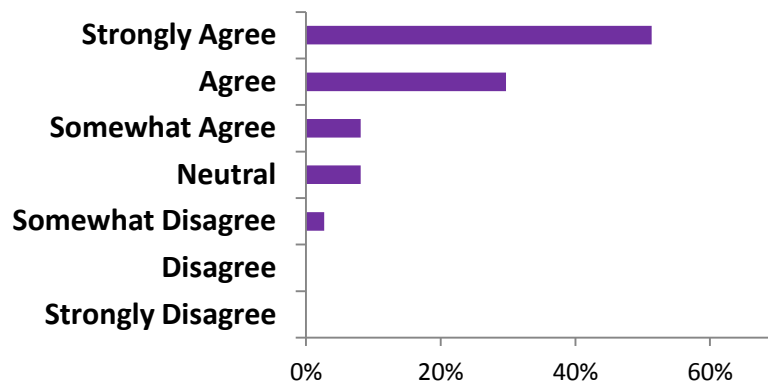
This may be due to the excess skin (and hair growing on the skin) of the nasal fold rubbing against the cornea causing inflammation, ulceration and pain. In some cases this necessitates surgical removal of the excess skin to improve eye health.



Do you think EXPOSED SCLERA (eye white) increases the risk of corneal ulcers?

The majority of the audience (89%) agreed to some extent that exposed sclera (eye white) increase the risk of corneal ulcers, with 8% voting neutrally and 3% somewhat disagreeing. This was the risk factor with the least agreement from the audience. Additional comments during the event clarified that some audience members did not think exposed sclera per se increased risk, but was associated with factors that increased risk (such as 'eye size').

The increased corneal ulcer risk posed by sclera exposure may be explained by only the most prominent eyes (most shallow orbits and largest eyelid openings) exhibiting visible sclera, which may predispose the eye to external trauma and increase the likelihood of being unable to fully close the eyelids.



Additional comments to this question included:

Yes- indicates the eye is more protruding

No, but a large amount of exposed sclera would suggest prominence of the eye and inadequate blink and spreading of tear film

TOPIC II: BOAS

What is BOAS and why do we care?

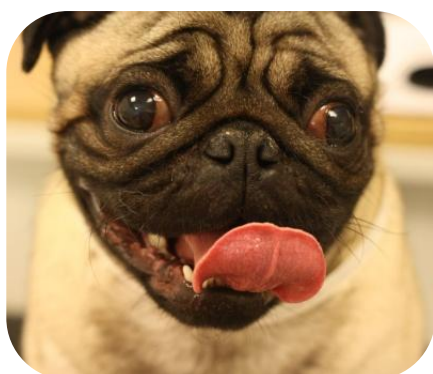
Brachycephalic obstructive airway syndrome (BOAS) describes a syndrome of the upper airway that involves obstruction of the airway, leading to **restricted breathing**.

This is characterised by signs such as:

- **Laboured breathing and respiratory distress**
- **Exercise intolerance** – reduced ability to exercise and play
- **Increased and abnormal respiratory noise** including snoring (stertor) and wheezing (stridor)

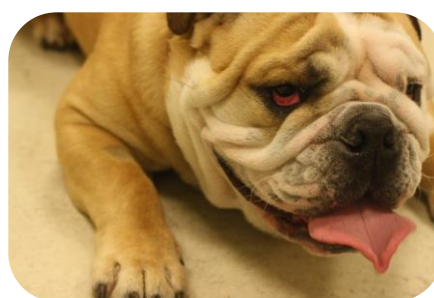
Markedly restricted breathing can lead to:

- **Blue mucous membranes** (cyanosis)
- **Overheating** (hyperthermia) and death by heat stroke
- **Fainting** (syncope)



Severely affected individuals show **laboured breathing**, often adopting a wide stance with their elbows held away from their chest, with the visible use of **abdominal muscles** and **over inflation of the chest**. Activity associated with both good and bad experiences (e.g. stress, but also exercise and excitement) can act as aggravators, leading to **respiratory distress**.

BOAS has the capacity to affect the dog whilst both awake and asleep, with **sleep-disordered breathing** (including episodes of 'apnoea' where the dog stops breathing briefly).



The effects of BOAS are not just limited to the respiratory system, with problems such as **gagging, regurgitation** and **vomiting often seen**. The signs of BOAS are often severe by 12 months of age and are life-long thereafter. BOAS has **potentially severe welfare consequences**, with the most affected dogs described as having *"little or no activity"* because they are fully occupied just with breathing.

Brachycephaly and BOAS

As the name of the disorder implies, **brachycephalic** dogs are primarily affected by BOAS. In these dogs, the **upper jaw is markedly foreshortened**, resulting in a characteristically short muzzle.

For several brachycephalic breeds, this skull shape was originally selected for use in fighting, but for many brachycephalic breeds they originally were and continue to be bred for a companion role.

Despite the name of the syndrome, scientific literature quantitatively linking brachycephaly with BOAS is scarce, with this relationship based on **brachycephalic breeds being highly represented** in international **case series of BOAS**.

BOAS has been reported in over 10 brachycephalic breeds internationally (see overleaf), with a recent risk factor analysis finding dogs that were classified as brachycephalic to be nearly 40x more likely to have BOAS than 'non-brachycephalic' dogs (Njikam et al, 2009).



Anatomical abnormalities

The clinical signs of BOAS arise as a result of obstruction of the upper airways caused by **anatomical abnormalities** that narrow the airways and increase airway resistance. This encourages secondary collapse.

Primary abnormalities include:

- **Elongated soft palate**
- **Stenotic (narrowed) nostrils**
- **Stenotic nasal vestibule**
- **Abnormal nasal conchae**
- **Oversized tongue**

Secondary changes include:

- **Laryngeal collapse**
- **Bronchial collapse**
- **Enlargement of the tonsils**
- **Enlargement of the pharyngeal muscles**
- **Gastrointestinal abnormalities**

Associated abnormalities include:

- **Tracheal hypoplasia (narrowing)**

Which breeds are affected?

Breed/Study	Breed representation in BOAS case series' (%)					
	Riecks <i>et al</i> (2007) 62 dogs, USA	De Lorenzi <i>et al</i> (2009) 40 dogs, Italy	Poncet <i>et al</i> (2005) 73 dogs, France	Torrez and Hunt (2006) 73 dogs, Australia	Ginn <i>et al</i> (2008) 53 dogs, USA	Njikam <i>et al</i> (2009) 39 dogs, Belgium
Bulldog	43.6	32.5	17.8	19.2	18.0	30.8
Pug	21.0	50.0	6.8	26.0	32.0	38.5
French Bulldog	3.2	17.5	67.0	2.7	6.0	17.9
Pekingese	6.5	0.0	2.8	2.7	3.0	0.0
Boston Terrier	12.9	0.0	1.4	0.0	6.0	0.0
Boxer	0.0	0.0	1.4	1.4	9.0	0.0
Shih Tzu	0.0	0.0	0.0	1.4	11.0	5.1
Cavalier King Charles Spaniel	0.0	0.0	0.0	20.6	0.0	2.6
Staffordshire Bull Terrier	0.0	0.0	0.0	5.5	0.0	0.0
Shar Pei	1.6	0.0	1.4	1.4	0.0	0.0
Rottweiler	0.0	0.0	0.0	1.4	0.0	0.0
Chow Chow	1.6	0.0	0.0	0.0	0.0	0.0
Pomeranian	3.2	0.0	0.0	0.0	0.0	0.0
Bullmastiff	3.2	0.0	0.0	1.4	0.0	0.0
Lhasa Apso	0.0	0.0	1.40	0.0	3.0	2.6

Riecks TW, Birchard SJ and Stephens JA 2007 Surgical correction of brachycephalic syndrome in dogs: 62 cases (1991-2004). *Journal of the American Veterinary Medical Association* 230: 1324-1328

De Lorenzi D, Bertoncello D and Drigo M 2009 Bronchial abnormalities found in a consecutive series of 40 brachycephalic dogs. *Journal of the American Veterinary Medical Association* 235: 835-840

Poncet CM, Dupre GP, Freiche VG, Estrada MM, Poubanne YA and Bouvy BM 2005 Prevalence of gastrointestinal tract lesions in 73 brachycephalic dogs with upper respiratory syndrome. *Journal of Small Animal Practice* 46: 273-279

Torrez CV and Hunt GB 2006 Results of surgical correction of abnormalities associated with brachycephalic airway obstruction syndrome in dogs in Australia. *Journal of Small Animal Practice* 47: 150-154

Ginn JA, Kumar MSA, McKiernan BC and Powers BE 2008 Nasopharyngeal turbinates in brachycephalic dogs and cats. *Journal of the American Animal Hospital Association* 44: 243-249

Njikam IN, Huault M, Pirson V and Detilleux J 2009 The influence of phylogenetic origin on the occurrence of brachycephalic airway obstruction syndrome in a large retrospective study. *The International Journal of Applied Research in Veterinary Medicine* 7: 138-143

Risk factors for BOAS

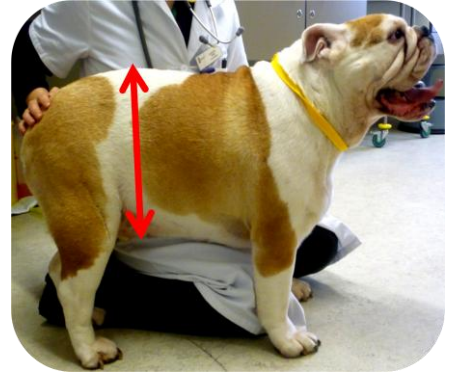
Our research identified two major conformational risk factors (currently described directly or indirectly in breed standards for some breeds) and one lifestyle risk factor for BOAS:



Shorter muzzle



Thicker neck



Overweight

Further details of this study were described during the event, and will be available in a paper currently under review. At present the precise details of this study are under embargo.

Research tools used in our BOAS studies

Craniofacial ratio (CFR) (Relative muzzle shortness)

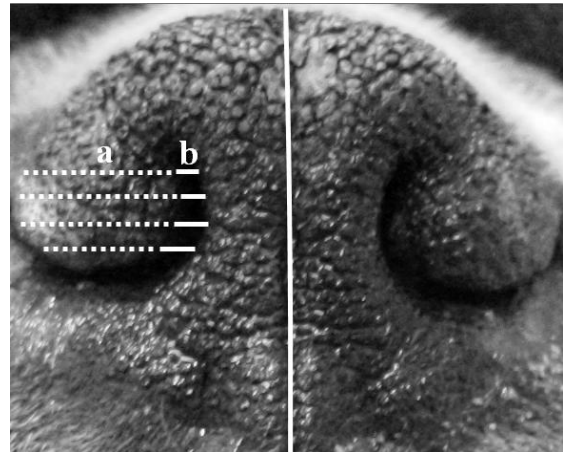
Craniofacial ratio =
Muzzle length (A-B)
Cranial length (B-C)



Nares ratio (nostril narrowing)

Published in Packer et al. (2012) *Animal Welfare*, 21, 81-93

- 'a' (dotted lines) indicates the width of the alae nasi (nostril cartilage)
- 'b' (solid lines) indicates the width of the adjacent external airway
- The central line indicates the philtrum, delineating the left and right sides of the nasal planum.



To quantify the degree of narrowing of the external nares, four measures of the width of the wing of the nostril ('a') were taken from a single photograph of both nostrils, along with the width of the adjacent airspace ('b').

An **overall ratio of wing of the nostril to airway diameter (b/a)** ('nares ratio') was calculated for each dog from these measures.

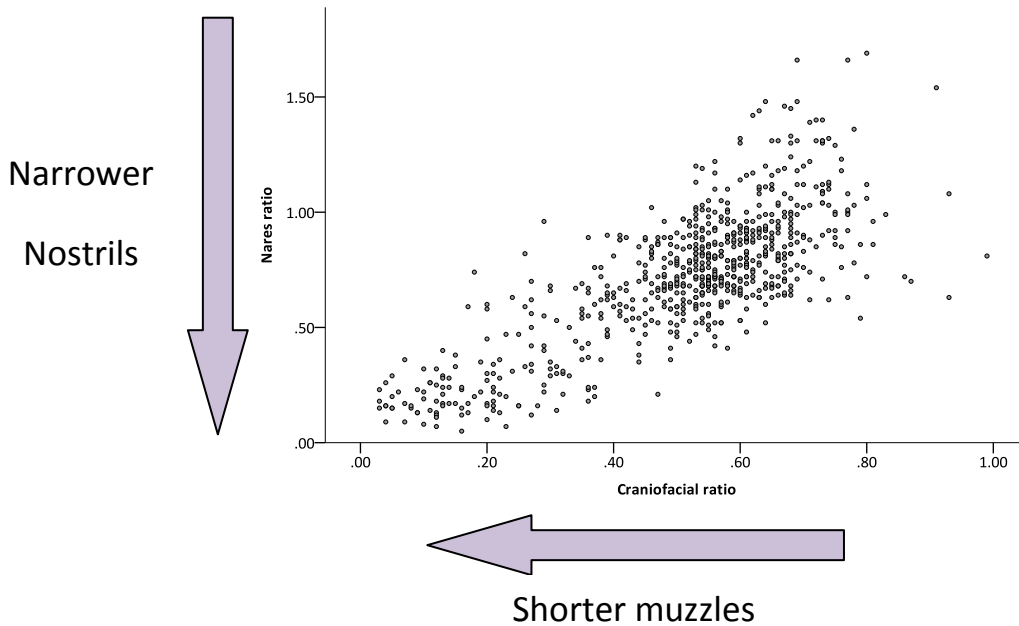
Neck girth: Measured using a soft tape measure around the circumference of the neck, half way between the occiput (bony projection at the back of the skull) and the withers

Body condition score (obesity): Purina 9-point scale, available at:

www.purina.co.uk > Helping to keep your dog healthy section of their website

Nostrils: the good, the bad and the ugly

Narrowed nostrils (or 'stenotic nares') are often observed in brachycephalic dogs; in fact, we found that **shorter muzzles were associated with narrower nostrils**. The data are displayed in the graph below. N.B. No breed standards dictate that nostrils should be narrow, and some even state they should be wide open.



Here are examples of nares ratios observed in our study dogs – higher numbers indicate more open nostrils and should be selected towards in breeding programmes. Low values may require surgical correction.



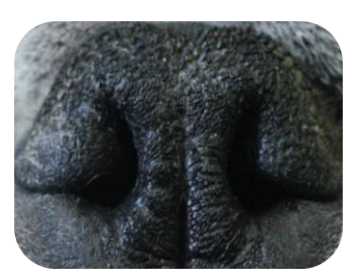
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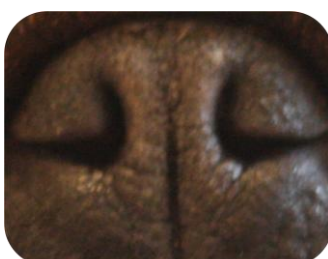
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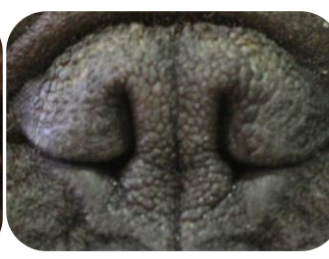
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0.20



0.15



0.09



0.06

19

The Owner Reported Breathing score

We asked owners of all the dogs in the study questions concerning signs of (A) breathing difficulties and (B) breathing sounds in four different scenarios. Owners were indicated to tick the appropriate boxes, and scores (not present on the questionnaire) were used to calculate the Owner Reported Breathing (ORB) Score for each dog.

(A) BREATHING DIFFICULTY – How often does your dog show difficulty breathing in the following situations?

Difficulty breathing could include your dog appearing very short of breath (more so than gentle panting), appearing unable to keep up with you or engage in physical activity, may appear anxious. During sleep this may include episodes where your dog stops breathing.

	Never (Score = 0)	Rarely (Score = 1)	Monthly (Score = 2)	Weekly (Score = 3)	Daily (Score = 4)	More than once/day (Score = 5)
At rest e.g. while lying down awake						
Gently walking e.g. walking around the house						
Activity/exercising e.g. on a walk, while playing						
Asleep						

(B) BREATHING SOUNDS – What does your dog's breathing sound like in the following circumstances?

	Very quiet (Score = 0)	Panting but no snoring/ snorting/ wheezing (Score = 1)	Slight snoring/ snorting/ wheezing (Score = 2)	Some snoring/ snorting/ wheezing (Score = 3)	Frequent snoring/ snorting/ wheezing (Score = 4)	Almost continuous snoring/ snorting/ wheezing (Score = 5)
At rest e.g. while lying down awake						
Gently walking e.g. walking around the house						
Activity/exercising e.g. on a walk, while playing						
Asleep						

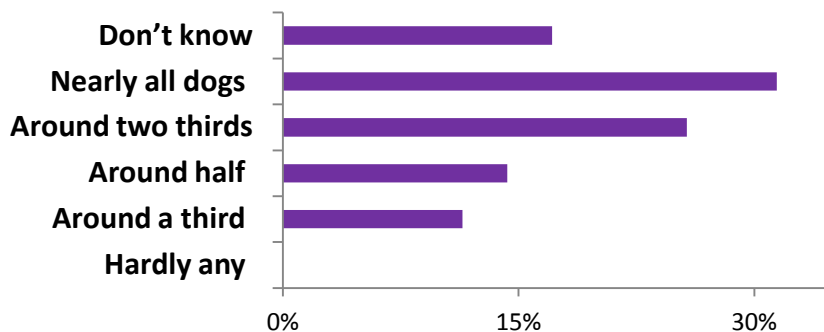
Published in Packer, Hendricks and Burn (2012) *Animal Welfare*, 21, 81-93.

BOAS: Stakeholder views

How common do you think it is for brachycephalic dogs to have breathing difficulties at some point in their life?

The prevalence of BOAS is currently unknown. The most popular stakeholder response (31%) was that **nearly all** brachycephalic dogs have breathing difficulties at some point in their life; followed by 26% believing that around two thirds are affected.

Some participants believed the prevalence was lower than this, with 11% voting that only around a third are affected; however, no participants believed that 'hardly any' brachycephalic dogs are affected.



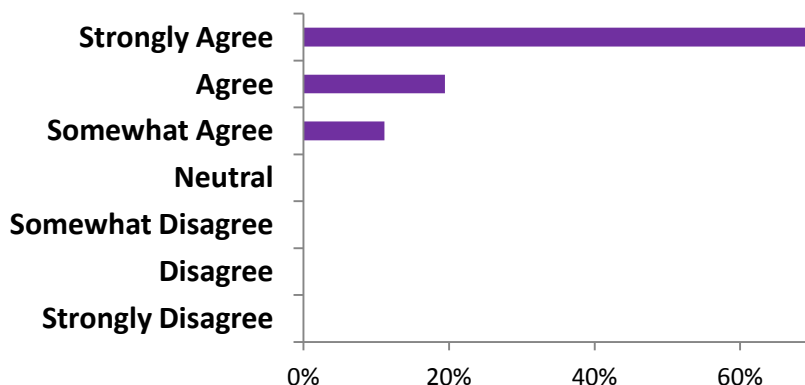
Additional written comments on this question included:

100% certain they will have some aspect at some point

Almost universal – especially in hot weather and with exercise

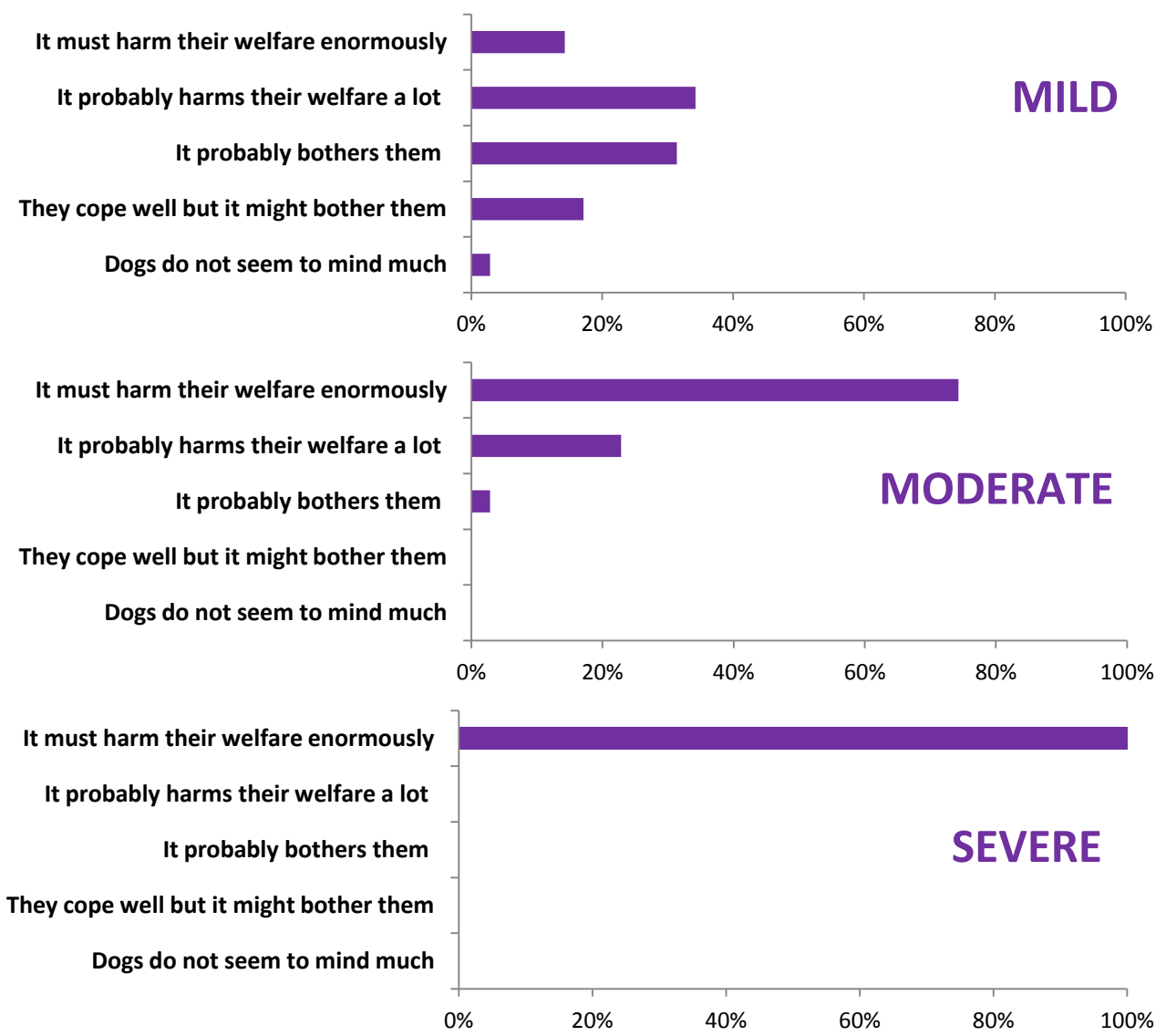
Do you think being brachycephalic increases the risk of breathing problems?

The majority of stakeholders (69%) **strongly agreed** that being brachycephalic increases the risk of breathing problems, with all remaining stakeholders either agreeing or somewhat agreeing with this relationship.



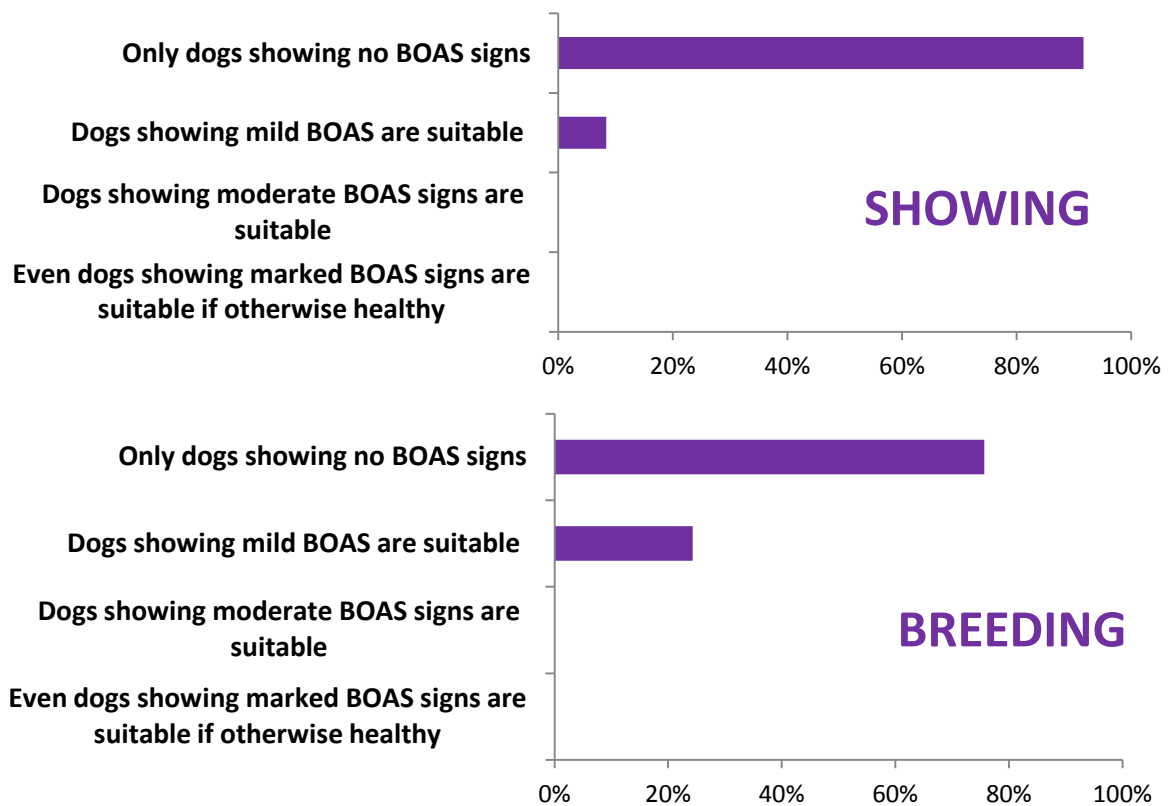
Stakeholders were then presented with video footage of brachycephalic dogs of various breeds exhibiting differing severities of clinical signs of BOAS. They were then asked whether they think that dogs at each stage of severity (mild, moderate, severe) had poor welfare.

- **MILD BOAS** was defined as: noisy breathing, effortful panting only after exercise, snoring and occasional disrupted sleeping
- **MODERATE BOAS** was defined as: noisy breathing, effortful panting after exercise, occasional choking and gagging when swallowing, disrupted sleeping, but no history of collapse
- **SEVERE BOAS** was defined as: noisy breathing, effortful panting, inability to exercise, choking and gagging when swallowing, occasional collapsing, disrupted sleeping



As severity increased, more stakeholders voted that BOAS must harm a dog’s welfare enormously (14%; 74%; 100%). The option ‘dogs do not seem to mind much’ was only voted for by 3% of stakeholders, and for mildly affected dogs only.

Stakeholders were then asked at what level of BOAS (no signs, mild, moderate, severe) they would consider an otherwise healthy brachycephalic dog to be suitable for showing or breeding.



The majority of stakeholders believed that only dogs showing **no signs of BOAS are suitable for showing (92%) and breeding (76%)**; however, a percentage also believed that dogs showing mild signs of BOAS are suitable for showing (8%), and breeding (24%).

The belief that mildly affected dogs are suitable for breeding may be a reflection of stakeholders' desires to maintain a reasonably large breeding population. This may be particularly pertinent in breeds where a high prevalence of dogs are affected, necessitating the use of affected animals to increase genetic diversity.

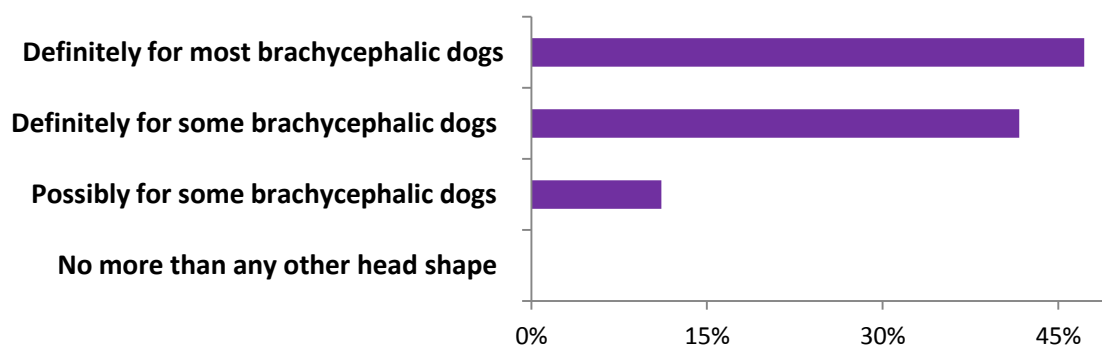
In contrast, the low number of stakeholders who voted that mildly affected animals could be used in showing may reflect the concept that only healthy animals, which are excellent examples of breed health, should be put on show and rewarded in the show ring.



Discussion Forum

After presentation of the study results, complemented by talks from clinical experts, the surveys continued with a discussion forum in the afternoon.

Do you think being brachycephalic can significantly harm a dog's welfare?



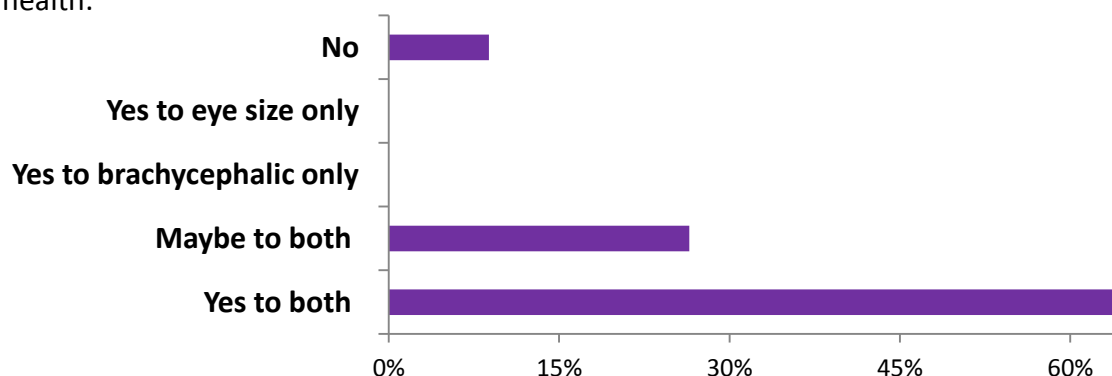
All stakeholders agreed that being brachycephalic can significantly harm a dog's welfare, with 47% believing this was for most brachycephalic dogs. No stakeholders voted that brachycephaly is no more harmful than any other head shape.

QUANTITATIVE LIMITS

Do you think a quantitative limit to brachycephaly or eye size in breed standards could help improve breed health?

The vast majority (91%) of stakeholders agreed that 'quantitative limits' could possibly be used to help improve breed health. Quantitative limits are numerical thresholds for conformations, beyond which more extreme conformations should not be selected for, to ensure healthy dogs (e.g. how short a muzzle is too short to avoid an unacceptable risk of BOAS). Such limits could be introduced into breed standards to increase their precision, reduce ambiguity and room for interpretation, and safeguard against exaggeration.

Around two thirds (65%) of stakeholders voted that they could help with **both eye size and muzzle length**. Only 9% of stakeholders did not think that such limits could improve breed health.



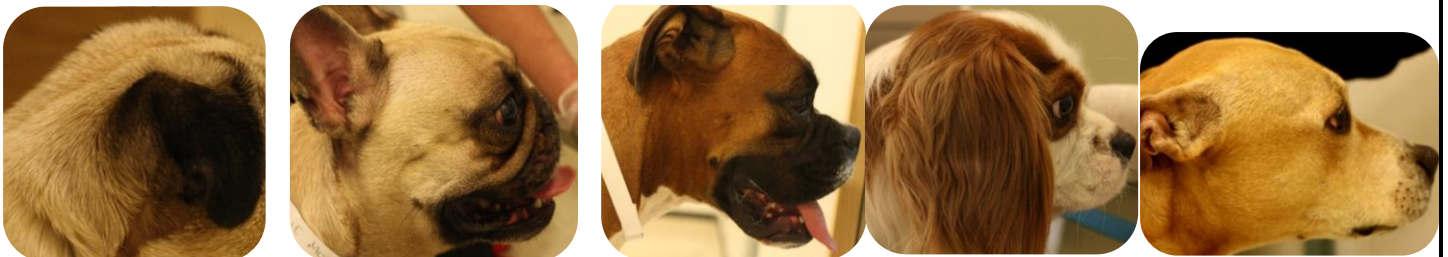
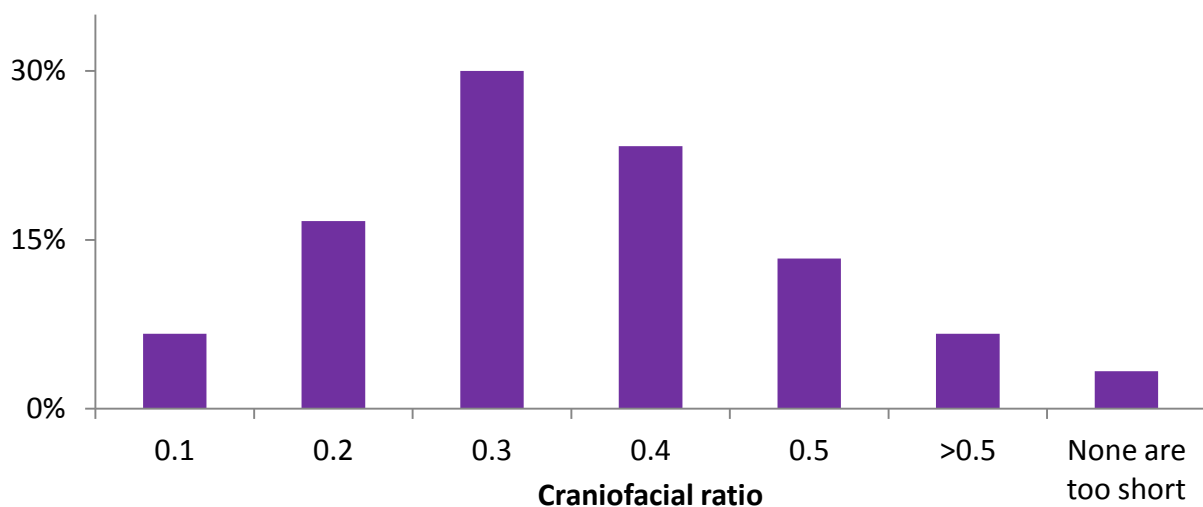
How short a muzzle is too short for you to be confident that the dog has good welfare?

Data regarding the risk of BOAS and corneal ulcers as relative muzzle length decreases (muzzles get shorter) were presented to stakeholders, with the craniofacial ratio (or 'CFR' - the length of the muzzle divided by the length of the cranium) used to quantify muzzle length.

The most popular vote (30% stakeholders) was that 0.3 was too short, a muzzle 30% the length of the cranium. To put this figure into context, this is close to the average muzzle length of a Boxer.

A further 23% thought that CFR 0.4 was too short (approximately average Cavalier King Charles Spaniel muzzle length) and 13% thought 0.5 was too short (approximately average Staffordshire Bull Terrier muzzle length)

At the other end of the spectrum, some stakeholders (17%) voted that shorter muzzle lengths of 0.2 (approximately average French Bulldog muzzle length) and even (7%) 0.1 (approximately average Pug muzzle length) were where the cut off of 'too short' should be made to be confident that the dog has good welfare. Only 3% of stakeholders believed that no muzzle length was 'too short' for them to be confident about a dog's welfare.



Left-Right: Pug, French Bulldog, Boxer, Cavalier King Charles Spaniel, Staffordshire Bull Terrier

BREED STANDARDS

To help combat the breathing and eye disorders discussed, stakeholders voted on changing dog breed standards, the formal descriptions of the ‘ideal’ dog for each breed.

Stakeholders were asked whether certain phrases should be permitted in breed standards. Examples of where these terms are currently used in Kennel Club breed standards were displayed, as shown below, but it should be noted that the wording frequently differs between equivalent breed standards internationally.

“Short” to describe muzzle length

43% of stakeholders thought that the word ‘short’ should *not* be used to describe **muzzle length** in breed standards, with 49% voting that it could be used, but only with additional safeguarding descriptors. Only 3% of stakeholders agreed it could be used on its own.

Breed	Breed standard text referring to the muzzle
Affenpinscher	Muzzle blunt and short but not flattened sufficiently to cause difficulty in breathing or wrinkling of skin
Boston Terrier	Muzzle relatively short , square, wide and deep
Bulldog	Muzzle short , broad, turned upwards
Bullmastiff	Muzzle short ; distance from tip of nose to stop approximately one-third of length from tip of nose to centre of occiput
Chihuahua	Muzzle moderately short
Dogue de Bordeaux	The muzzle is powerful, short . Length from nose to stop between a quarter and one third of the length of the head
Griffon Bruxellois	Relatively short , wide muzzle
Pekingese	Muzzle must be evident, but may be relatively short and wide
Pug	Muzzle relatively short , blunt, square
Shih Tzu	Muzzle of ample width, square, short , not wrinkled

Potential safe-guarding descriptors were discussed freely following this question. The use of terms such as ‘moderately’, ‘relatively’ and ‘in proportion to’ was questioned, and mention was made of the fact that some breeders have used rule of thumb, such as being able to ‘balance a pencil’ on the dog’s muzzle. Some breed standards already include a qualifier that the muzzle conformation should not cause difficulty breathing.

Nasal folds

59% of stakeholders voted that **nasal folds** should **not** be permitted in brachycephalic breed standards at all, with 38% voting they could be but only with additional safeguarding descriptors. Only 3% of stakeholders agreed it could be used on its own.

The support for removal might not only have stemmed from information regarding their impact on eye ulceration; this it may also have been influenced by a presentation on associated skin problems by Dr Hendricks.

The tightly opposed skin of the frequently deep recesses created by nasal folds in brachycephalic dogs is often inflamed due to friction and the over-growth of microbes (bacteria and yeasts), promoted by the increased humidity and accumulation of secretions in this environment. This skin fold dermatitis causes odour and discomfort, and may lead to facial self-trauma from rubbing or scratching. Daily cleansing of the folds is widely advocated by some brachycephalic breed clubs as standard of care, but may not be sufficient to control the problem.

Breed	Breed standard text referring to the presence of a nasal fold
Bulldog	Over nose wrinkle, if present, whole or broken, must never adversely affect or obscure eyes or nose. Pinched nostrils and heavy over nose roll are unacceptable and should be heavily penalised.
Pekingese	A slight wrinkle, preferably broken, may extend from the cheeks to the bridge of the nose in a wide inverted 'v'. This must never adversely affect or obscure eyes or nose.
Pug	Wrinkles on forehead clearly defined without exaggeration. Eyes or nose never adversely affected or obscured by over nose wrinkle.

“Large” to describe eye size

42% of stakeholders voted that the word '**large**' should **not** be used to describe **eye size** in breed standards, with 55% voting they could be but only with additional safeguarding descriptors. Only 3% of stakeholders agreed it could be used on its own.

Breed	Breed standard text referring to eye size
Japanese Chin	Moderately large , dark, set far apart. Size should be in proportion to size of skull
King Charles Spaniel	Relatively large , dark, set wide apart, eyelids block square to face line, pleasing expression

Several other UK Kennel Club breed standards now state that the eye should be 'not too' large, for example the Pug, Boston Terrier and Pekingese.

Exposed sclera (eye white)

83% of stakeholders voted that **exposed sclera (eye white)** should **not** be described in breed standards, with 17% voting they could be but only with additional safeguarding descriptors. No stakeholders agreed it could be used on its own.

Breed	Breed standard text referring to eye white
Japanese Chin	Small amount of white shows in the inner corners, giving characteristic look of astonishment.

“Thick” necks

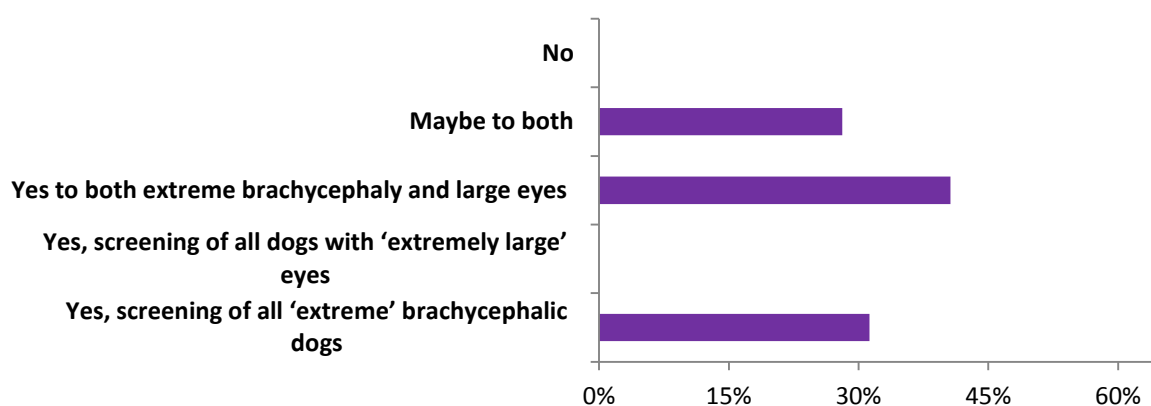
47% of stakeholders voted that the word ‘thick’ should **not** be used to describe neck girth in breed standards, with 53% voting they could be but only with additional safeguarding descriptors. No stakeholders agreed it could be used on its own.

Breed	Breed standard text referring to neck thickness
French Bulldog	Powerful, well arched and thick, of moderate length
Bulldog	Moderate in length, thick, deep and strong
Pug	Slightly arched to resemble a crest, strong, thick with enough length to carry head proudly.
Pekingese	Relatively short and thick

HEALTH SCREENING

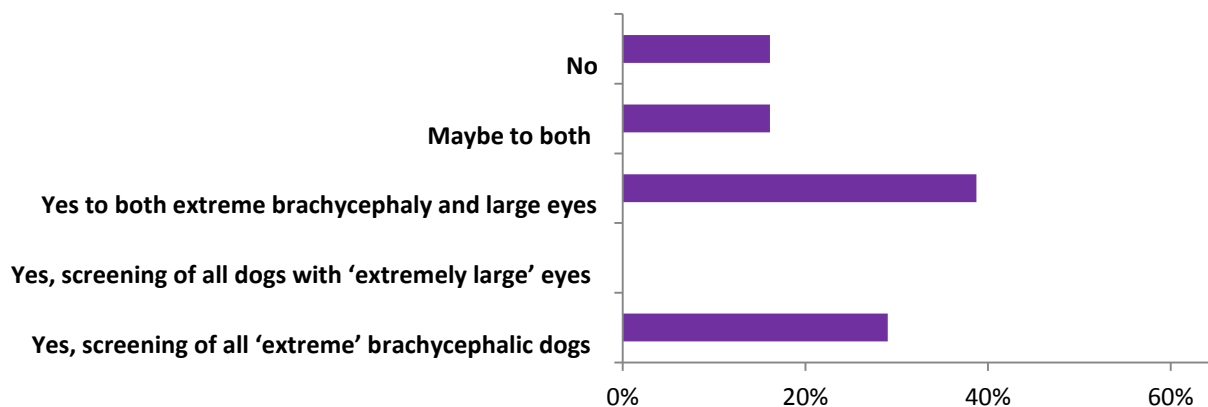
Do you think physical health screening for relevant diseases in brachycephalic dogs with conformations beyond a certain threshold could help improve breed health?

The most popular vote from stakeholders (41%) was that **health screening both extremely short muzzled dogs and extremely large eyed dogs could improve breed health**. No stakeholders thought that physical health screening would not improve breed health. Around one third of stakeholders (31%) voted that extreme brachycephalic dogs should be screened, but not those with extremely large eyes.



Do you think genetic screening of dogs could help improve brachycephalic breed health (if suitable tests existed)?

At present, the genetic underpinnings of BOAS and corneal ulcers are not well understood, and it is not known whether for these disorders genetic testing will be suitable. We questioned stakeholders as to whether they think genetic screening, if it were developed, could improve breed health. In contrast with health screening (for which all stakeholders believed that it might improve breed health), 16% of stakeholders did not think that genetic screening would improve breed health.



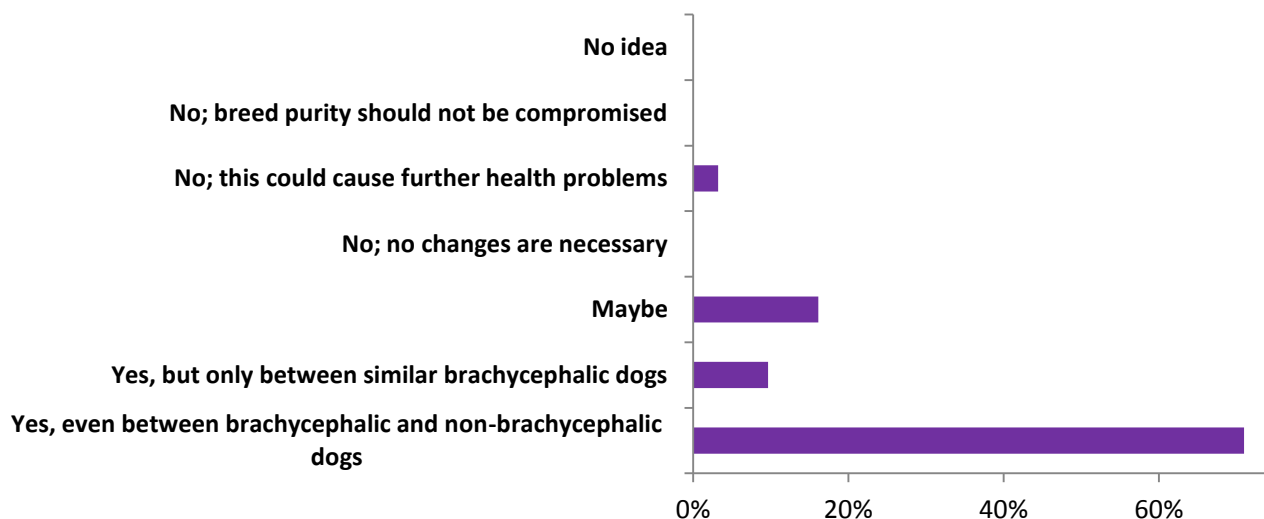
OUT-CROSSING AND BANNING BREEDS

At the end of the discussion forum, more contentious topics in breed health were confronted. Some of the breeds studied had very high proportions of dogs affected by BOAS and corneal ulcers, which would make selecting for healthy dogs difficult, so alternative strategies to improve dog health were considered.

Are you concerned enough to consider out-crossing certain brachycephalic breeds to improve breed health?

Out-crossing is the practice **mating a dog of one breed with a bitch of another breed** in order to introduce desired traits. With regard to BOAS and corneal ulcers, this may involve crossing an extreme brachycephalic breed with large eyes with a less brachycephalic breed with smaller eyes, in an attempt to **reduce disease risk in the first breed**. This is potentially a contentious subject.

The majority of stakeholders (81%) voted that they were sufficiently concerned to consider out-crossing, with 71% of these stakeholders even considering this between brachycephalic and non-brachycephalic dogs. No stakeholders thought that no changes were necessary, and similarly no stakeholders were concerned about compromising breed purity; however, 3% were concerned it could cause further health problems.



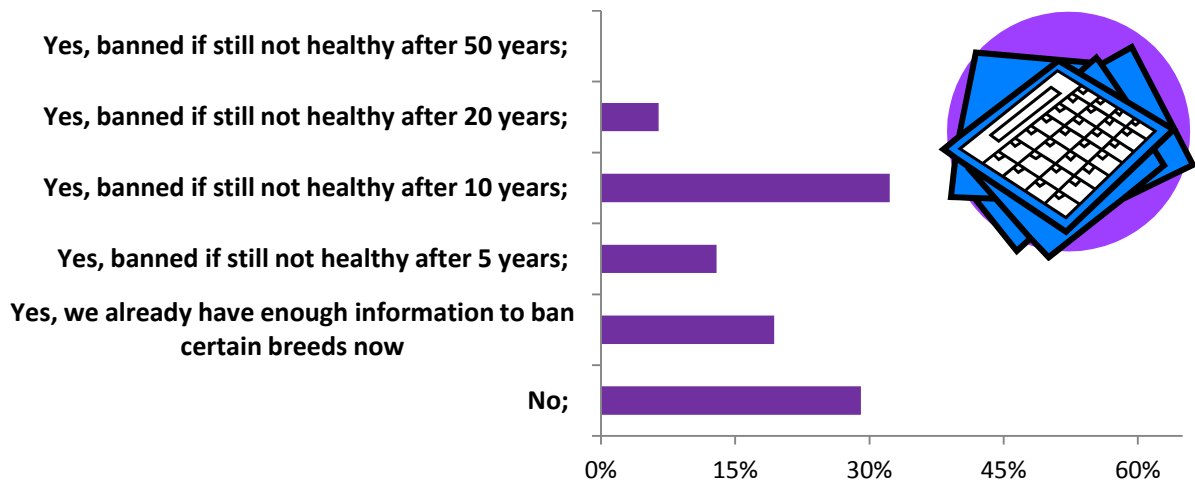
Existing examples of brachycephalic crosses include (Left-Right) a Pug x Jack Russell ('Jug'), Pug x Cavalier King Charles Spaniel ('Pugaliere') and Pug x Beagle ('Puggle')



Do you think that health problems are serious enough that some breeds should be banned if their health cannot be dramatically improved after a certain amount of time?

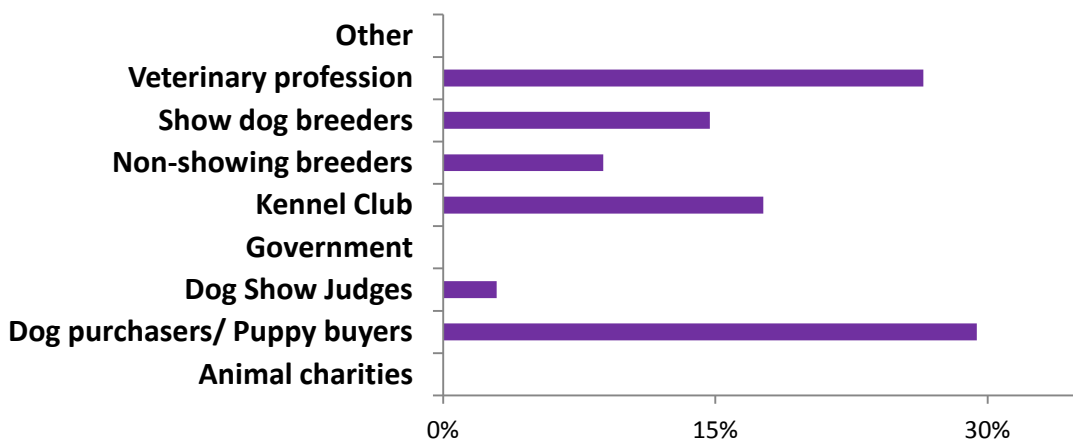
Nearly one third (29%) of stakeholders thought that no breeds should be banned regardless of timescale to health improvements. Conversely, one fifth (20%) of stakeholders thought there was enough information already to ban certain breeds **now**.

Of the stakeholders who thought **time** should be allowed for improvements to be made before banning, 13% voted that breeds should be banned if they were still not healthy after 5 years, 32% after 10 years and 7% after 20 years.



WHO IS RESPONSIBLE?

Finally, stakeholders were asked to rank the top 3 stakeholder groups that are most responsible for safeguarding the future health and welfare of brachycephalic dogs.



The top 3 stakeholders perceived as responsible were (1) Dog purchasers/puppy buyers; (2) The veterinary profession; and (3) The Kennel Club.

Study sponsors

- The **Royal Veterinary College (RVC)** is the UK's largest and longest established veterinary school and is a constituent College of the University of London. The RVC offers undergraduate, postgraduate and CPD programmes in veterinary medicine and veterinary nursing and is ranked in the top 10 universities nationally for biosciences. It is the only veterinary school in the world to hold full accreditation from AVMA, EAEVE, RCVS and AVBC.

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- The event was funded by a **Biotechnology and Biological Sciences Research Council (BBSRC)** Sparking Impact Award. BBSRC also provided funding for the research presented via an RVC/BBSRC PhD studentship. BBSRC invests in world-class bioscience research and training on behalf of the UK public. Our aim is to further scientific knowledge, to promote economic growth, wealth and job creation and to improve quality of life in the UK and beyond.

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- The **Universities Federation for Animal Welfare (UFAW)** is an internationally recognised, independent scientific and educational animal welfare charity. It works to improve knowledge and understanding of animals' needs in order to achieve high standards of welfare for farm, companion, research, captive wild animals and those with which we interact in the wild. UFAW improves animal welfare worldwide through its programme of awards, grants and scholarships; by educational initiatives, especially at university and college level; by providing information in books, videos, reports and in its scientific journal Animal Welfare. UFAW provides information on welfare aspects of a wide range of genetic diseases of companion animals at <http://www.ufaw.org.uk/geneticwelfareproblems.php>
- **Dogs Trust** is the UK's largest dog welfare charity and cares for over 16,000 abandoned and unwanted dogs a year. Dogs Trust has a non-destruction policy, and will never put a healthy dog to sleep. The charity is working towards the day when all dogs can enjoy a happy life, free from the threat of unnecessary destruction. <http://www.dogstrust.org.uk/>

NOTE TO PRESS: At the time of writing this report, the scientific papers describing the study details were awaiting publication and under press embargo. Please contact the authors to request an update on the progress of the papers.

Thank you

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The research presented at the event formed part of a PhD thesis:

Packer RMA (2013) Quantitative investigation of healthy conformational limits in domestic dog breeds. Royal Veterinary College, University of London.

Citation:

Packer RMA, Hendricks A & Burn CC (2014) Conference Report: Building Better Brachycephalics 2013. The Royal Veterinary College, North Mymms.

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