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Nothing Could Put Me Off: Assessing the Prevalence and Risk Factors for Perceptual Barriers to Improving the Welfare of Brachycephalic Dogs

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Abstract: The popularity of brachycephalic dogs has increased worldwide despite growing evidence of their profound health and welfare issues, largely as a result of their extreme conformation. This study aimed to evaluate the prevalence and risk factors for known perceptual barriers to improving their welfare. An online survey of n = 2006 UK dog owners was conducted, including owners of non-brachycephalic (non-BC; n = 964), mild-moderate brachycephalic (M-BC; n = 706), and extreme brachycephalic (E-BC; n = 336) dogs. The survey explored contemporary knowledge and attitudes toward brachycephalic dogs, with multivariable statistical analyses identifying risk factors for normalisation of brachycephaly-related abnormalities, preference for flat faces and 'laziness' in dogs, and self-reported intractability to being deterred from buying a brachycephalic breed. Almost 1 in 7 E-BC owners considered that there was 'nothing' that could dissuade them from buying a brachycephalic dog, predicted by a strong preference for flat faces as a highly desirable aesthetic characteristic and beliefs that brachycephaly did not negatively impact lifespan. E-BC owners were most likely to consider flat faces a highly desirable aesthetic characteristic, predicted by highly valuing 'laziness' as a behavioural characteristic. Preference for 'laziness' as a behavioural characteristic was predicted by low levels of pre-purchase research and aesthetic preferences (e.g., flat faces, large size). High levels of normalisation of brachycephaly-related abnormalities were observed across all ownership groups, particularly for clinical signs related to exercise intolerance, with these beliefs predicted by deficits in dog acquisition behaviours and knowledge, and intractability from being deterred from purchasing a flat-faced dog. These findings highlight the pervasiveness of perceptual barriers that inhibit campaigning regarding brachycephaly and the need for targeted interventions to address misconceptions (e.g., 'myth busting' laziness as a positive trait), while being mindful of the heterogeneity of beliefs within the brachycephalic-owning population, particularly the intractable sub-population to whom shifting preferences away from flat-faced conformations may prove impossible without stronger measures, e.g., legislative change.

Keywords: brachycephaly; dog welfare; BOAS; inherited disease; dog owner

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1. Introduction

The popularity of brachycephalic (short-muzzled) dogs has increased worldwide over the past decade, with dramatic rises in registrations documented in the UK, particularly in those breeds with the most extreme manifestation of this conformation (e.g., French Bulldogs, English Bulldogs, Pugs) [1]. The so-called 'brachy boom' phenomenon has occurred in tandem with a surge in scientific evidence documenting the profound health and welfare issues affecting dogs with this conformation, necessitating entire textbooks dedicated to their numerous predispositions [2]. To tackle this paradoxical phenomenon, many UK animal welfare charities and organisations have led campaigns attempting to

reverse this trend, including the RSPCA's 'Bred For Looks, Born To Suffer' [3] and 'Save Our Breath' [4] campaigns, BVA's 'Breed To Breathe' campaign [5], and Blue Cross's 'End The Trend' [6] campaign. Similar actions have been seen internationally, for example, the Australian Veterinary Association and RSPCA Australia running a "Love is Blind" campaign since 2016 [7]. Although their impacts have not been empirically studied, given trends towards increasing ownership of brachycephalic animals during the same time period, their intended effects do not appear to have been achieved. With recent research indicating that large proportions of owners of brachycephalic dogs would re-acquire their breed in the future (e.g., 93.0% of international owners of Bulldogs, French Bulldogs, and Pugs [8]; 57.3% of French Bulldog owners in Denmark [9]), further interventions are clearly needed to change human behaviour and thus protect canine welfare.

In contrast to the expansive literature describing the health challenges of brachycephalic breeds (including identification of their causes and development of techniques to treat or palliate them), studies exploring the 'human' component of the brachycephalic dog-owner dyad are relatively scarce. However, the seeming intractability of this key welfare issue has led to increasing scientific exploration to identify barriers to changing the targeted human behaviours, e.g., the acquisition (and re-acquisition) of dogs with extreme brachycephalic conformations [10]. To date, a range of perceptual barriers have been identified.

Early research characterised the 'normal for the breed' phenomenon, whereby clinical signs of brachycephaly-related disorders (e.g., brachycephalic obstructive airway syndrome, 'BOAS') were normalised by 58% of owners of brachycephalic breeds, and instead of precipitating concern in their owners, were considered 'typical' breed characteristics (e.g., snoring and snorting while awake) [11]. This phenomenon has been observed in studies that followed, for example, in a clinical study of French Bulldogs, 60% of owners failed to recognise BOAS in their dogs despite their clinical signs being considered moderate-severe by veterinary professionals [12]. This finding was again replicated in a more recent study of ownership experiences of Pug, French Bulldog, and Bulldog owners, where owners reported on the presence/severity of four common aspects of brachycephaly-associated airway impairments (breathing difficulty, heat intolerance, eating difficulties, and sleep dysfunction), then reported whether they perceived their dog to have a 'problem' with breathing, heat regulation, eating, or sleeping [13]. Nearly 40% of dogs were reported to exhibit clinical signs indicative of airway obstruction, but when asked directly, only 17.9% of owners considered their dog to have a breathing problem [13].

More recently, normalisation of some BOAS-related abnormalities has progressed to their celebration as a marketable breed trait. Qualitative analysis of free-text exploring why current owners of extreme brachycephalic dogs would recommend their breed identified a perception of them being 'lazy' low-energy dogs as a desirable breed trait [8], rather than a potentially concerning sign of exercise intolerance as a result of BOAS [14]. Owners believed this 'trait' made them ideal dogs for owners unable or unwilling to provide moderate-high levels of exercise for their dog for a variety of reasons, including being disabled, 'low energy', working, and elderly people [8]. When questioned regarding characteristics that influenced their choice of breed, owners of extreme brachycephalic dogs rated breed health and longevity as comparatively less influential to their decision than the owners of non-brachycephalic breeds [15]. Taken together, the normalisation and/or celebration of signs of disease in brachycephalic dogs, along with lesser prioritisation of breed health in acquisition decision-making, are likely to act as substantial barriers to breeding reforms (e.g., serious efforts to reduce BOAS prevalence, such as outcrossing) and not act as a deterrent to acquisition, leading to the failure of campaigns based on educating the public regarding their disease burden.

Further to barriers introduced by misperceptions of disease traits, the aesthetic desires of companion animal owners also constitute a major barrier to owner behaviour change in line with animal welfare. When questioned regarding characteristics that influenced their choice of breed, owners of extreme brachycephalic dogs rated their chosen

breed's appearance as the factor that most highly influenced their choice of breed and was significantly more influential for this ownership group compared with owners of non-brachycephalic breeds [15]. Brachycephalic breeds exhibit many morphological traits of the '*Kindchenschema*' (baby schema, or childlikeness) [16], a set of infantile facial features that are described in classical ethology as 'social releasers'; basic stimuli that evoke a stereotyped response from humans, in this case, nurturing [17]. The instinctive attraction to baby schema features has been described in a range of species [18] and even inanimate objects, e.g., teddy bears [19]. Brachycephalic dogs retain infant features into adulthood [16] and are more likely to be described as 'cute' in online advertisement descriptions for puppies and adult dogs than non-brachycephalic breeds [20]. Although considered attractive to owners, the characteristic flat-face of extreme brachycephalic breeds is the key conformational trait that predisposes them to a number of serious disorders, including BOAS [21]. Whether the aesthetic appeal of these breeds is solely focused on the flatness of their face or other features common in many brachycephalic breeds (e.g., small size, large eyes, wrinkled skin) has not yet been explored but necessitates further study to understand which physical features could be bred away from to improve health while retaining their 'cute' aesthetic appeal to owners dedicated to acquiring these breeds.

Although these aforementioned human factors that promote brachycephalic popularity have been identified, little is known about how common these barriers to change are, the demographic profile of those owners holding these views, or their knowledge and co-occurring beliefs regarding brachycephalic welfare, and thus how to better target future campaigns aimed at reducing the acquisition of brachycephalic breeds.

Therefore, this study aimed to quantify contemporary attitudes toward brachycephalic dogs in the UK and, specifically, to identify prevalence and risk factors for known perceptual barriers to improving brachycephalic welfare, including:

1. Normalisation of brachycephaly-related abnormalities;
2. Aesthetic preference for the flat/short faces in dogs;
3. Behavioural preference for perceived 'laziness' in dogs.

We further aimed to identify the prevalence of, and risk factors for, the perception that 'nothing could put them off' buying a brachycephalic breed, i.e., that a respondent considered themselves intractable to being deterred from buying a brachycephalic breed.

Given calls to shift preference away from extreme brachycephaly to more moderate conformations [22], this study explicitly aimed to explore the views of not just owners of extreme brachycephalic dogs in isolation, or in comparison to non-brachycephalic dogs, as has previously been conducted (e.g., [8,13,15]), but to include and differentiate between owners of mild-moderate vs. extreme brachycephalic dogs compared to owners of non-brachycephalic dogs, to identify any potential differences in their demography and perceptions.

2. Materials and Methods

2.1. Ethical Statement and Recruitment Strategy

This study obtained approval from the Social Science Research Ethical Review Board (SSRERB) of the Royal Veterinary College, UK (SR2023-0147).

An online survey was designed and conducted between Blue Cross (JN, AW) and Censuswide© (https://censuswide.com/ (accessed on 1 September 2024)), a market research and survey consultancy company that recruits participants for research via an online access panel. Data were collected in October 2022. All respondents completed a profiling questionnaire when initially joining the panel, were invited to take part in the survey if they met inclusion criteria (outlined below), and opted-in to this invite. All data were then stored anonymously.

Sampling aimed to recruit a nationally representative sample of ~2000 UK dog owners in terms of geographical area, age, and sex. Within this sample, recruitment aimed for an equal proportion (1:1 ratio) of brachycephalic vs. non-brachycephalic dogs to facilitate well-powered statistical comparisons. Within the brachycephalic group, owners of both extreme

and mild-moderate brachycephalic dogs were invited to take part. For the purposes of this study, published data on canine skull morphology was used to categorise dog breeds (craniofacial ratio; CFR) data from [21] with medians derived from 1 or 2 study sub-populations in this study dependent on breed. From this, extreme brachycephalic (E-BC; those with the most extremely flattened faces) referred to those breeds with a breed median CFR $\leq$ 0.25, specifically the Pug (median CFR: 0.08–0.12), English Bulldog (median CFR: 0.22–0.25), French Bulldog (median CFR: 0.18–0.19), Boston Terrier (median CFR: 0.14–0.23), Japanese Chin (median CFR: 0.04), Pekingese (median CFR: 0.11–0.12), and Shih Tzu (median CFR: 0.20–0.22). Mild-moderate brachycephalic (M-BC) referred to those breeds with varying degrees of brachycephaly (median CFR: 0.26–0.60) that are less extreme than the craniofacial conformation of those in the E-BC group, specifically the Boxer (median CFR: 0.30–0.31), Bullmastiff (median CFR: 0.54), Cavalier King Charles Spaniel (median CFR: 0.36–0.39), Chihuahua (median CFR: 0.34–0.41), Lhasa Apso (median CFR: 0.31–0.56), Maltese (median CFR: 0.57), and Pomeranian (median CFR: 0.53). Crosses of E-BCs were included in the M-BC group based on previous studies [21,23]. Non-BC dogs referred to those that were referred to as non-brachycephalic (either mesocephalic or doliocephalic) in published literature (e.g., [24]).

2.2. Inclusion Criteria and Informed Consent

All participants were required to live in the UK, be 18 years of age or older, and own a dog. Informed consent was obtained from all subjects involved in the study.

2.3. Questionnaire Design

General information was collected from owners, including owner demographic and socioeconomic data (e.g., gender; age; house size; number of household members; and profession), dog ownership history (e.g., first-time breed owner; number of dogs and other pets owned, and age of dog), and dog acquisition behaviours (e.g., research conducted before getting a dog; where they acquired their dog from; if acquiring a puppy, whether they met their parents, cost of their puppy, and age at collection of their puppy; extent of agreement with the statement that health test results of the parents of a puppy would change their decision to get a dog).

The survey explored owner knowledge and perceptions of brachycephalic dogs, with specific sections including:

1. Preferences for physical features in dogs: Owners were presented with a list of 14 physical features and asked to select the three they found most appealing in dogs (large eyes; floppy ears; flat/short face shape; long face shape; wrinkled skin; fluffy/long hair; short tail; long tail; short legs; long legs; short neck; long neck; small size; large size).
2. Preferences for behavioural characteristics in dogs: Owners were presented with a list of 12 'personality' traits in dogs and asked to select the three they found most appealing in dogs (friendly; laidback; happy; comical; playful; affectionate; loyal; stubborn; intelligent; confident; adaptable; lazy).
3. Normalisation of brachycephaly-related abnormalities: Owners reported to what extent they agreed or disagreed that nine different traits were 'normal' for a brachycephalic dog (very short of breath; unable to keep up with me when I walk; unable to engage in physical activity; appears anxious; they regurgitate; always snoring when asleep; sleep while sitting; their tongue lolls out of mouth; they appear unable to close their mouth). Owners rated from strongly agree (scored 1) to strongly disagree (scored 5) for each trait. Scores were aggregated so respondents received a total 'NORM score' out of 45, where a higher score indicated lesser normalisation.
4. What, if anything, would put them off buying a brachycephalic dog: Owners selected all that applied from: 'Nothing'; Not finding the way they look appealing; Their tendency to have health problems (e.g., BOAS, heat stroke, dry/irritated eyes, skin infections); Veterinary costs; Their tendency to have welfare problems (e.g., exercise

intolerance; difficulty breathing; chronic sleep-deprivation); Their tendency to live a lower quality of life than other breeds of dogs.

5. Knowledge and perception of brachycephalic lifespan: Owners reported whether they expected brachycephalic dogs to live longer lives, shorter lives, or the same lifespan as other breeds of dog, or if they were not sure. They then reported on how strongly lifespan affected their decision when choosing a dog (from strongly agreeing it did to strongly disagreeing).
6. Breed loyalty: Owners reported the likelihood of owning their breed of dog again (from not at all likely to very likely), whether they had owned their current breed of dog before, and whether they have friends/family who own the same breed of dog they have.

2.4. Statistical Methods

Statistical analyses were carried out in IBM SPSS Statistics v24 (SPSS Inc., Chicago, IL, USA). Univariable analyses used chi-squared tests for categorical * categorical comparisons (e.g., preference for physical features * skull type grouping). For pairwise comparisons of dog skull type groupings, where significant differences between all groups were detected at the 5% level, Bonferroni-corrected post hoc comparisons were applied, with significant differences ($p < 0.05$) denoted in tables by letters (e.g., a, b, c). Mann–Whitney U tests were used for non-normally distributed continuous * categorical data (e.g., NORM score * skull type grouping), with data distribution ascertained by visual inspection of histograms.

Multivariable models were constructed for the following outcome variables: (i) NORM score—continuous outcome, linear model; (ii) preference for laziness—binary outcome, logistic regression; (iii) preference for short/flat faces—binary outcome, logistic regression; (iv) nothing putting an owner off buying a flat-faced dog—binary outcome, logistic regression.

An 'information theory' approach was taken for the following variables, which were retained in all models regardless of their significance: respondent age, respondent gender, and cephalic grouping of their dog. This method prioritised the incorporation of a priori variables that had been identified as potential confounders [25]. Remaining variables were tested for their association with the four outcomes; factors with liberal associations in univariable tests ($p < 0.2$) were taken forward for multivariable evaluation. Model development used backwards stepwise elimination, and the Hosmer–Lemeshow test statistic was used to evaluate model fit for binary logistic regressions. Results are reported as mean ± standard deviation [SD] for normally distributed variables and median [IQR] for non-normally distributed data.

A p value of <0.05 was considered significant. To control for multiple testing, the False Discovery Rate (FDR) correction was applied to adjust p-values, with both the original p-value and adjusted q values reported.

3. Results

The sample included $n = 2006$ UK dog owners. From this sample, $n = 964$ people were owners of non-brachycephalic dogs (referred to as 'non-BC dog owners', hereafter), and $n = 1042$ people were owners of brachycephalic dogs (referred to as 'BC dog owners', hereafter). The BC dog owner group included owners of $n = 706$ (67.8%) mildly–moderately brachycephalic dog owners (referred to as 'M-BC dog owners', hereafter) and $n = 336$ (32.2%) extreme brachycephalic dog owners (referred to as 'E-BC dog owners', hereafter).

3.1. Dog Demographics

The E-BC group was represented by seven breeds: Boston Terrier ($n = 43$, 9.0%), English Bulldog ($n = 72$, 15.1%); French Bulldog ($n = 155$, 32.6%), Japanese Chin ($n = 10$, 2.1%); Pekingese ($n = 1$, 0.2%), Pug ($n = 109$, 22.9%), and Shih Tzu ($n = 86$, 19.1%). The M-BC group was represented by seven breeds: Boxer ($n = 137$, 24.2%), Bullmastiff ($n = 24$, 4.2%), Cavalier King Charles Spaniel ($n = 152$, 26.9%), Chihuahua ($n = 115$, 20.3%), Lhasa Apso ($n = 32$, 5.7%), Maltese ($n = 33$, 5.8%), and Pomeranian ($n = 38$, 6.7%). The non-BC

group was most commonly represented by: Labrador Retriever (n = 93), Jack Russell Terrier (n = 58), Cockapoo (n = 58), Cocker Spaniel (n = 49), and Border Collie (n = 43).

Compared to non-BC dogs, M-BC and E-BC dogs were more likely to be younger and aged 19–23 months (non-BC: 6.2%, E-BC: 16.2%, M-BC: 17.0%) or 2–3 years old (non-BC: 17.6%, E-BC: 38.7%, M-BC: 36.9%) compared to non-BC dogs, who were significantly more likely to be older and aged 7–10 years old (non-BC: 23.7%, E-BC: 8.0%, M-BC: 13.4%) or over ten years old (non-BC: 11.7%, E-BC: 3.4%, M-BC: 4.3%) (X^2 = 228.5, $p < 0.001$, $q < 0.001$) (Table S1, Supplementary Materials File).

3.2. Owner Demographics

The majority of respondents in the overall sample were female (n = 1509, 75.2%), with the most common age bracket being 26–35 years (n = 683, 34.0%). The most common household structure was two adults with children (n = 807, 40.2%), with almost half of respondents living in a medium-sized property (n = 912, 45.5%), and the majority of respondents owning their accommodation with a mortgage/loan (n = 762, 38.0%). The highest earner in one quarter of households worked in a supervisory or clerical, junior managerial, administrative, or professional role (n = 534, 26.6%), with a further quarter working in an intermediate managerial, administrative, or professional role (n = 514, 25.6%).

Both E-BC (69.7%) and M-BC (67.0%) owners were significantly less likely to be female than non-BC owners (83.7%; X^2 = 84.0, $p < 0.001$, $q < 0.001$). Both E-BC (28.6%) and M-BC (24.4%) owners were younger and more likely to be aged 18–25 years than non-BC owners (15.5%), and less likely to be aged 56–65 (E-BC: 4.6%, M-BC: 5.5%, non-BC: 10.8%) or 66–75 years (E = BC: 0.8%, M-BC: 0.4%, non-BC: 2.8%) than non-BC owners (X^2 = 81.0, $p < 0.001$, $q < 0.001$). Both E-BC and M-BC owners were less likely to live in a large property with > 2 bedrooms than non-BC owners (E-BC: 37.1%, M-BC: 34.1%, non-BC: 53.8%; X^2 = 44.5, $p < 0.001$, $q < 0.001$). E-BC owners (33.8%) were less likely to own their home (with a mortgage/loan) than non-BC owners (41.4%) (X^2 = 44.5, $p < 0.001$, $q < 0.001$). Both E-BC (15.8%) and M-BC (18.9%) owners were more likely to live in a single-person household with no children than non-BC owners (10.4%; X^2 = 45.3, $p < 0.001$, $q < 0.001$). Both E-BC owners (11.3%) and M-BC owners (14.1%) were more likely to work in higher managerial, administrative, or professional roles than non-BC owners (6.6%) (X^2 = 33.3, $p < 0.001$). Both E-BC owners (72.9%) and M-BC owners (72.1%) were less likely to only own one dog than non-BC owners (82.1%; X^2 = 35.6, $p < 0.001$, $q < 0.001$) (Table S2, Supplementary Materials File).

3.3. Dog Acquisition Behaviours and Information Sourcing

A minority of owners reported they would do no research at all before getting a dog (4.6%). Owners of E-BCs and M-BCs were significantly more likely to state they would conduct 'not very much research' compared with owners of non-BCs (E-BC: 23.7%, M-BC: 22.6%, non-BC: 8.0%) and were less likely to report they would conduct 'a lot of research' (E-BC: 36.1%, M-BC: 39.4%, non-BC: 61.3%; X^2 = 141.9, $p < 0.001$, $q < 0.001$). Owners of both E-BCs and M-BCs were less likely to have already used or consider using online information about their breed to research their dog's welfare needs, compared to non-BC owners (Table 1). In contrast, E-BC owners were significantly more likely to have already used or consider using social media to research their dog's welfare needs compared to both non-BCs and M-BCs. E-BC (40.8%) and M-BC (41.7%) owners were both significantly less likely to consider using vets or breeders as information sources when researching their dog's welfare needs than non-BC owners (54.5%).

Table 1. Information sourcing regarding dog welfare needs that had already been used or would be used in the future by owners of extreme brachycephalic dogs (E-BC, n = 476), moderate brachycephalic dogs (M-BC, n = 566), and non-brachycephalic dogs (non-BC, n = 964). Significant differences at the 5% level identified by (Bonferroni-corrected) post hoc comparisons are denoted by letters (e.g., a, b).

Information Source	Have Used Information Source						Would Use Information Source					
	Cephalic Group (%)			Statistics			Cephalic Group (%)			Statistics		
	E-BC (n = 476)	M-BC (n = 566)	Non-BC (n = 964)	Test Statistic (X^2)	p Value	q Value	E-BC (n = 476)	M-BC (n = 566)	Non-BC (n = 964)	Test Statistic (X^2)	p Value	q Value
Vet	35.9	34.6	35.5	0.2	0.903	0.913	40.8 a	41.7 a	54.5 b	33.6	<0.001	<0.001
Animal charity	16.6	19.6	17.2	1.9	0.375	0.449	28.5	25.6	27.9	1.3	0.523	0.579
Online information about the breed	34.9 a	38.9 a	62.2 b	128.5	<0.001	<0.001	38.1 a	43.4 a	63.8 b	102.9	<0.001	<0.001
Family and friends	29.2	27.7	29.8	0.7	0.697	0.722	27.6	28.4	34.0	8.1	0.018	0.031
Social media	25.2 a	20.5 a, b	19.5 b	6.4	0.040	0.063	29.8 a	22.7 b	23.7 b	7.9	0.019	0.032
Breeder	25.2	25.6	34.1	18.2	<0.001	<0.001	26.3 a	32.1 a	41.5 b	34.1	<0.001	<0.001
Animal behaviour specialist	12.2	11.7	8.8	5.2	0.075	0.117	16.5	19.9	20.7	3.5	0.171	0.237
Community forums	18.5	20.5	18.2	1.3	0.511	0.569	20.7	23.9	24.4	2.4	0.309	0.383
Library/books	12.6	11.7	12.7	0.4	0.835	0.849	18.0	16.0	19.5	2.9	0.237	0.309
Other	1.5	1.1	2.4	3.9	0.140	0.200	1.3	2.3	1.7	1.2	0.544	0.595
Nowhere	3.4 a	3.5 a	6.6 b	10.7	0.005	0.010	0	0	0	-	-	-

N.B.: - indicates that this value has not been generated.

Dog breeders were the most common way to source a dog for all three of the cephalic groups, representing over one third of dogs in the study. Owners of non-BC dogs were more likely to have found their dog via a dog breeder than E-BC owners but did not differ from M-BC owners. Around one in three owners of E-BC and M-BC dogs had originally found their dog via a rescue charity (UK-based animal charity plus international animal charity), which was significantly higher than the 1 in 4 for non-BC dogs (Table 2). Around 1 in 7 owners of E-BCs (14.5%) had found their dog via social media, which was significantly higher than for M-BCs (8.7%) or non-BCs (5.4%), with M-BCs more likely to have found their dogs this way than non-BCs.

Table 2. Where dogs were originally sourced by owners of extreme brachycephalic dogs (E-BC, n = 476), moderate brachycephalic dogs (M-BC, n = 566), and non-brachycephalic dogs (non-BC, n = 964). Significant differences at the 5% level identified by (Bonferroni-corrected) post hoc comparisons are denoted by letters (e.g., a, b).

Acquisition Source	Cephalic Group (%)			Statistics		
	E-BC (n = 476)	**M-BC (n = 566)**	**Non-BC (n = 964)**	**Test Statistic (X^2)**	**p Value**	**q Value**
Online Market (e.g., Gumtree, Pets4Homes, Preloved, etc.)	17.2	18.0	16.1	1.01	0.605	0.649
UK-based animal charity	20.8 a	19.8 a	15.0 b	9.5	0.009	0.017
International animal charity	10.5 a	7.8 a	4.1 b	22.2	<0.001	<0.001
Dog breeder	35.9 a	37.8 a, b	43.4 b	8.9	0.011	0.020
Friend or family member	19.5	25.1	22.5	4.6	0.102	0.153
Social media (Facebook, Instagram)	14.5 a	8.7 b	5.4 c	34.1	<0.001	<0.001
Other source	0.2 a	0.4 a	2.5 b	18.3	<0.001	<0.001

Of those owners that purchased their dog, owners of E-BCs and M-BCs paid significantly more than non-BC owners (X^2 = 103.5, $p < 0.001$, $q < 0.001$), being significantly more likely to have paid the highest price category (£3000.01–£5000.00) for their dog and significantly less likely to have paid the lowest (nothing) (Figure 1). E-BCs were significantly more likely to have paid £1000.01–£3000.00 and significantly less likely to have paid less than £1000 than owners of both M-BCs and non-BCs.

For owners who acquired their dog as a puppy, owners of E-BCs (59.2%) and M-BCs (56.9%) were less likely to have met their puppy's parents than owners of non-BCs (63.8%; X^2 = 34.3, $p < 0.001$, $q < 0.001$). E-BC (21.6%) and M-BC (22.1%) owners were significantly more likely to have acquired their puppy when it was less than 8 weeks old than non-BC dogs (9.1%; X^2 = 105.5, $p < 0.001$, $q < 0.001$). Owners of E-BCs, M-BCs, and non-BCs did not differ in their assessment of whether the health test results of their puppy's parents would change their decision to acquire a dog, with the majority of all groups strongly or somewhat agreeing that they would (E-BC: 65.9%, M-BC: 67.9%; non-BC: 66.1%; X^2 = 11.8, p = 0.158, q = 0.221).

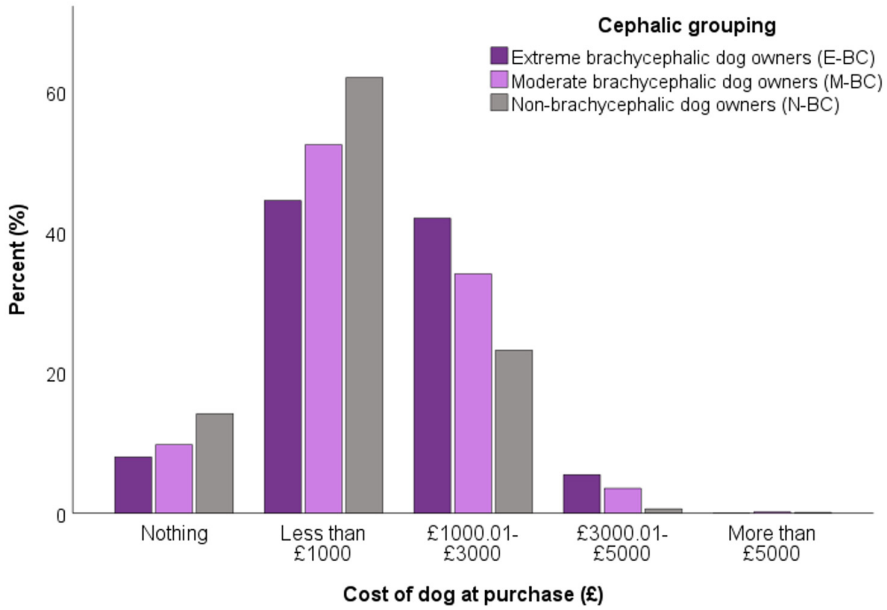


Figure 1. Cost price of dog at purchase (£) paid by owners of extreme brachycephalic dogs (E−BC, $n = 476$), mildly−moderately brachycephalic dogs (M−BC, $n = 566$), and non−brachycephalic dogs (non−BC, $n = 964$).

3.4. Breeding History and Plans

The majority of owners in all cephalic groups reported that they would not and had not bred from their dog, which was significantly higher in non-BC dog owners (84.5%) than E-BC (53.4%) and M-BC (56.4%) owners ($X^2 = 206.3$, $p < 0.001$, $q < 0.001$). A minority of respondents considered themselves a 'breeder'; however, this was higher in E-BC (12.8%) and M-BC owners (12.0%) than non-BC owners (1.8%; $X^2 = 83.9$, $p < 0.001$, $q < 0.001$). Despite not all considering themselves 'breeders' in the previous question, a higher proportion of owners reported that they had already bred from their dog, which was significantly higher in E-BC (17.2%) and M-BC (14.8%) owners than non-BC owners (3.9%; $X^2 = 80.4$, $p < 0.001$, $q < 0.001$). Similarly, a higher proportion of E-BC (20.0%) and M-BC (19.3%) owners were planning to breed from their dog in the future than owners of non-BC dogs (10.8%; $X^2 = 29.9$, $p < 0.001$, $q < 0.001$).

3.5. Knowledge of Brachycephalic Health and Welfare

Around one third of E-BC (30.3%) and M-BC (35.9%) owners were not at all familiar with the term brachycephaly, which was significantly lower than for non-BC owners, of whom almost two thirds (57.0%) were not at all familiar with this term ($X^2 = 132.6$, $p < 0.001$, $q < 0.001$). Around half of E-BC and M-BC owners expected the lifespan of brachycephalic dogs to be shorter compared to other dog breeds; however, when compared to expectations of non-BC dog owners, owners of both E-BC and M-BC breeds were significantly less likely to think that flat-faced dogs would live shorter lives than other dog breeds (E-BC: 48.4%, M-BC: 53.7%, non-BC: 76.1%; Figure 2a). Instead, owners of both E-BC and M-BC breeds were significantly more likely to think there was no difference in lifespan (E-BC: 33.6%, M-BC: 30.2%, non-BC: 11.3%) or that brachycephalic dogs lived longer lives than other dog breeds (E-BC: 10.5%, M-BC: 7.1%, non-BC: 2.4%; $X^2 = 189.7$, $p < 0.001$, $q < 0.001$). The majority of owners felt that a breed's lifespan would affect their decision when choosing a dog, either strongly agreeing (28.7%) or somewhat agreeing (37.1%); however, owners of E-BC and M-BC dogs were less likely to strongly agree than non-BC owners (E-BC: 22.5%, M-BC: 26.7%, non-BC: 32.9%; $X^2 = 25.5$, $p < 0.001$, $q < 0.001$) (Figure 2b).

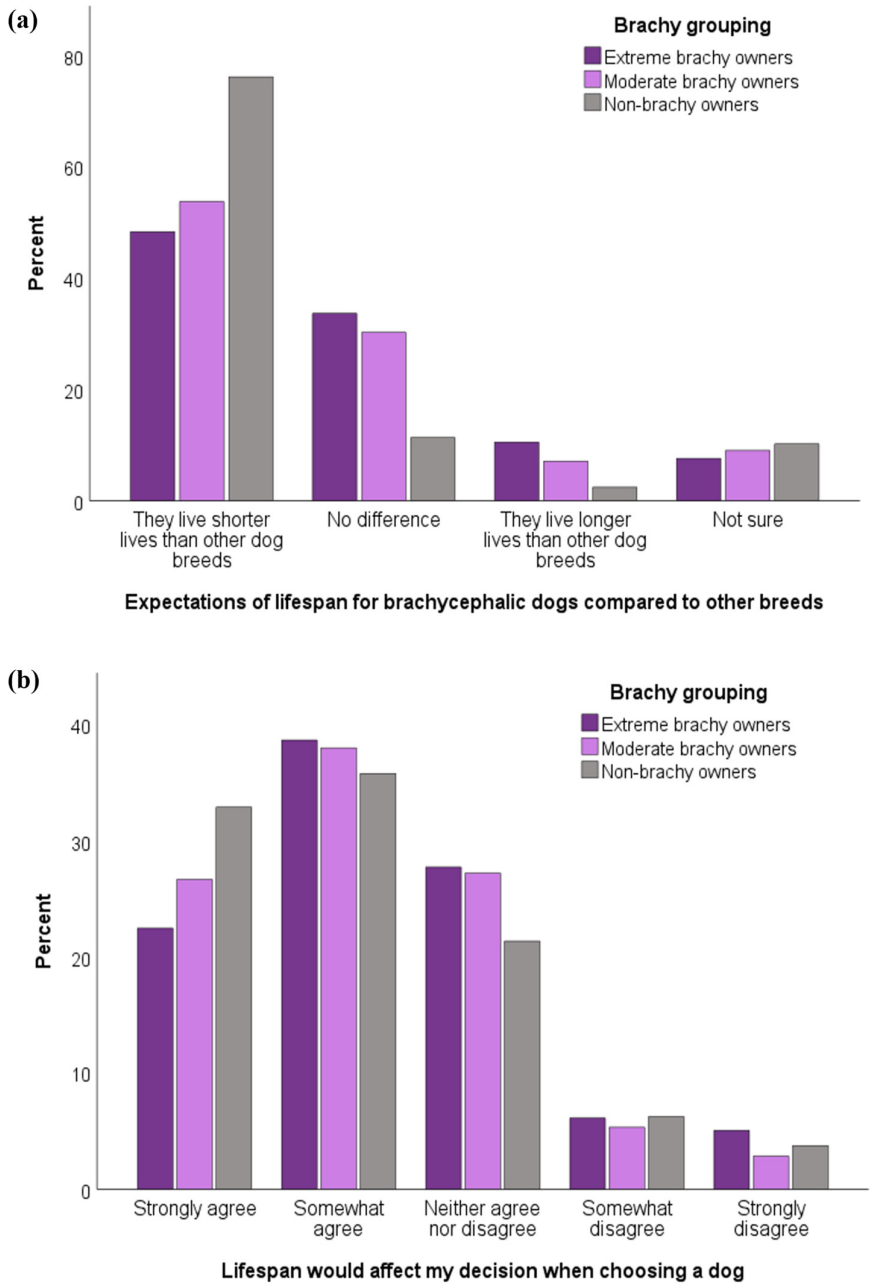


Figure 2. Perceptions of lifespan in brachycephalic dogs; (**a**) Expectations of lifespan for brachycephalic breeds compared to other dog breeds by owners of extreme brachycephalic dogs (E-BC, n = 476), moderate brachycephalic dogs (M-BC, n = 566), and non-brachycephalic dogs (non-BC, n = 964); (**b**) Impact of life expectancy of a breed upon acquisition decisions by owners of extreme brachycephalic dogs (E-BC, n = 476), moderate brachycephalic dogs (M-BC, n = 566), and non-brachycephalic dogs (non-BC, n = 964).

3.6. Breed Loyalty and Recommendation

Around one third of E-BC (33.4%) and M-BC (34.8%) owners had previously owned their current breed before, which was significantly higher than for non-BC owners (28.0%; X^2 = 9.1, p = 0.011, q = 0.020). There was no difference in whether the family and friends of E-BC (42.4%), M-BC (41.9%), or non-BC (44.6%) owners had previously or currently owned the same breed of dog as them (X^2 = 11.2, p = 0.137, q = 0.198). Owners of E-BC and M-BC owners were significantly less likely to indicate they were 'very likely' to own their breed of dog again than non-BCs owners (E-BC: 24.9%, M-BC: 30.7%, non-BC: 54.0%) and were

instead significantly more likely to indicate they were 'somewhat likely' to own their breed of dog again than non-BC owners (E-BC: 36.1%, M-BC: 35.7%, non-BC: 22.9%; $X^2 = 117.4$, $p < 0.001$, $q < 0.001$) (Table S3, Supplementary Materials File S1).

Around one quarter of E-BC and M-BC owners took part in breed-specific events, which was significantly higher than non-BC owners (E-BC: 24.2%. M-BC: 24.6%, non-BC: 8.4%, $X^2 = 92.7$, $p < 0.001$, $q < 0.001$). Owners of E-BC dogs were most likely to post videos of their dogs online 'occasionally', significantly more likely than non-BC dogs (E-BC: 52.7%, M-BC: 48.6%, non-BC: 45.4%). Both E-BC and M-BC owners are less likely to 'never' post videos of their dog online than non-BC owners (E-BC: 9.0%, M-BC: 7.8%, non-BC: 13.6%; $X^2 = 20.2$, $p = 0.003$, $q = 0.006$) (Table S3, Supplementary Materials File S1).

3.7. Reasons for Not Owning a Brachycephalic Dog

Almost 1 in 7 E-BC owners (13.7%) considered that there was 'nothing' that could dissuade them from buying a brachycephalic dog, which was significantly higher than both M-BC (7.2%) and non-BC (7.2%; $X^2 = 19.1$, $p < 0.001$, $q < 0.001$) dog owners (Table 3). E-BC dog owners were significantly less likely to be dissuaded from buying a brachycephalic breed due to not finding the way they look appealing (15.5%) than both M-BC (22.3%) and non-BC dog owners (37.3%; $X^2 = 87.8$, $p < 0.001$, $q < 0.001$). The most common reasons for owners of dogs from all cephalic groups to be dissuaded from buying a brachycephalic dog were their tendency to have health problems (e.g., BOAS, eye and skin problems), followed by their tendency to have welfare problems (e.g., difficulty exercising, breathing, sleeping) and their tendency to live a lower quality of life than other breeds of dog, which were all significantly more likely to dissuade owners in the non-BC group than in the E-BC and M-BC groups (Table 3). Similarly, owners of non-BC dogs (36.9%) were significantly more likely to be dissuaded from buying a brachycephalic dog by veterinary costs compared to E-BC (25.6%) and M-BC (26.3%) dog owners, who did not differ ($X^2 = 27.9$, $p < 0.001$, $q < 0.001$).

Table 3. Factors that would put owners off buying a flat-faced (brachycephalic) dog breed from owners of extreme brachycephalic dogs (E-BC, $n = 476$), moderate brachycephalic dogs (M-BC, $n = 566$), and non-brachycephalic dogs (non-BC, $n = 964$). Significant differences at the 5% level identified by (Bonferroni-corrected) post hoc comparisons are denoted by letters (e.g., a, b).

What, If Anything, Would Put You Off Buying a Flat-Faced Dog Breed?	Cephalic Group (%)			Statistics		
	E-BC ($n = 476$)	M-BC ($n = 566$)	Non-BC ($n = 964$)	Test Statistic (X^2)	p Value	q Value
Do not find the way they look appealing	15.5 a	22.3 b	37.3 b	87.8	<0.001	<0.001
Tendency to have health problems (e.g., BOAS, heat stroke, eye and skin problems)	42.4 a	46.1 a	63.5 b	74.5	<0.001	<0.001
Veterinary costs	25.6 a	26.3 a	36.9 b	27.9	<0.001	<0.001
Tendency to have welfare problems (e.g., difficulty exercising, breathing, sleeping)	29.4 a	34.8 a	52.4 b	85.7	<0.001	<0.001
Tend to live a lower quality of life than other breeds of dog	23.5 a	29.2 a	43.5 b	66.6	<0.001	<0.001
Nothing	13.7 a	7.2 b	7.2 b	19.1	<0.001	<0.001

Multivariable Analysis: Nothing Could Put Them Off Acquiring a Brachycephalic Dog

Eleven variables remained in the final multivariable binary logistic regression model for nothing putting an owner off buying a brachycephalic dog. Respondent age, gender, and cephalic grouping of their dog were retained regardless of significance as per an information theory approach, none of which were significant. Two variables were significantly positively associated with owners feeling that nothing could put them off buying a flat-faced dog (i.e., were more likely to feel this): owners who rated flat/short face shape as one of their three most appealing physical traits compared to those that did not and owners who expected

there to be no difference in the lifespan of flat-faced dogs compared to other breeds or were not sure compared to those who expected flat-faced dogs to live shorter lives than other breeds (Table 4).

Table 4. Multivariable binary logistic regression for variables examined for association with the attitude that nothing could put them off buying a flat-faced dog (n = 2006). † Included as per information theory as a variable of a priori interest, regardless of significance. Significant results are emboldened.

Variable	Category	Coefficient	Std Error	p Value	q Value	Odds Ratio (OR)	95% Confidence Interval (OR)	
							Lower	Upper
Intercept	-	2.19	1.41	0.120	0.176	8.93	0.56	141.68
Gender †	Female	0.39	0.25	0.120	0.176	1.48	0.91	2.42
	Other	−0.21	0.76	0.780	0.798	0.81	0.18	3.60
	Male			Reference				
Age group †	18–25	0.53	1.15	0.650	0.677	1.69	0.18	16.31
	26–35	0.63	1.15	0.580	0.626	1.89	0.20	18.05
	36–45	1.01	1.15	0.380	0.452	2.75	0.29	26.30
	46–55	0.78	1.17	0.510	0.569	2.17	0.22	21.74
	56–65	1.19	1.19	0.320	0.391	3.30	0.32	33.99
	66 and over			Reference				
Cephalic grouping †	E-BC	0.27	0.25	0.290	0.365	1.30	0.80	2.14
	M-MC	−0.30	0.27	0.270	0.346	0.74	0.43	1.26
	Non-BC			Reference				
Rated in respondents' top three most appealing physical traits in dogs	**Flat/short face shape—Yes**	**0.69**	**0.32**	**0.030**	**0.048**	**1.99**	**1.06**	**3.75**
	Flat/short face shape—No			Reference				
Pre-purchase advice source	**Community forums—Yes**	**−0.66**	**0.33**	**0.050**	**0.079**	**0.52**	**0.27**	**1.00**
	Community forums—No			Reference				
Expectation of lifespan of flat-faced dogs compared to other breeds	Longer	−0.04	0.56	0.940	0.940	0.96	0.32	2.90
	No difference	**1.00**	**0.26**	**<0.001**	**<0.001**	**2.71**	**1.63**	**4.50**
	Not sure	**1.74**	**0.31**	**<0.001**	**<0.001**	**5.72**	**3.13**	**10.44**
	Shorter			Reference				
Agreement with statement: "Lifespan would affect my decision when choosing a dog"	**Strongly agree**	**−2.71**	**0.55**	**<0.001**	**<0.001**	**0.07**	**0.02**	**0.20**
	Somewhat agree	**−1.92**	**0.43**	**<0.001**	**<0.001**	**0.15**	**0.06**	**0.34**
	Neither agree nor disagree	**−1.15**	**0.40**	**<0.001**	**<0.001**	**0.32**	**0.15**	**0.69**
	Somewhat disagree	**−1.10**	**0.49**	**0.020**	**0.034**	**0.33**	**0.13**	**0.86**
	Strongly disagree			Reference				
NORM Score	**-**	**−0.11**	**0.02**	**<0.001**	**<0.001**	**0.90**	**0.87**	**0.94**
Where did you acquire your dog(s) from	**Online Market e.g., Gumtree, Pets4Homes, Preloved—Yes**	**−1.63**	**0.39**	**<0.001**	**<0.001**	**0.20**	**0.09**	**0.42**
	Online Market e.g., Gumtree, Pets4Homes, Preloved—No			Reference				
	International Animal Charity—Yes	**−2.37**	**0.83**	**<0.000**	**<0.001**	**0.09**	**0.02**	**0.48**
	International Animal Charity—No			Reference				
Extent of agreement with statement: "Health test results of the parents would change my decision to get a dog"	Strongly agree	−0.53	0.32	0.100	0.152	0.59	0.31	1.11
	Somewhat agree	**−0.87**	**0.26**	**<0.001**	**<0.001**	**0.42**	**0.25**	**0.71**
	Neither agree nor disagree			Reference				
	Somewhat disagree	0.23	0.37	0.53	0.583	1.26	0.61	2.61
	Strongly disagree	0.28	0.57	0.62	0.657	1.33	0.43	4.09

N.B.: - indicates that this value has not been generated.

Six variables were significantly negatively associated with owners feeling that nothing could put them off buying a flat-faced dog (i.e., were less likely to feel this): owners who conducted pre-purchase advice from community forums compared to those that did not use this source; owners who strongly agreed, somewhat agreed, neither agreed nor disagreed, or somewhat agreed with the statement that lifespan would affect their decision when choosing a dog, compared to those that strongly disagreed with this statement; owners

with a higher NORM score (indicating a lesser degree of normalisation of brachycephaly-related abnormalities); owners who acquired their dog from an online marketplace or an international animal charity compared to those that did not; owners who somewhat agreed with the statement that health test results of a puppies' parents would change their decision to get a dog than those that neither agreed nor disagreed with this statement.

3.8. Aesthetic Preferences

When participants reported their three most preferred physical features out of 15 listed (Table 5), the most popular features across all participants were floppy ears, large, expressive eyes, and small size. Owners of E-BCs (12.3%) were significantly more likely to rate flat face as one of their top three desirable traits compared to both M-BC (7.6%) and non-BC (1.8%) dog owners, with M-BC dog owners at an intermediate point, being significantly more likely to favour flat faces traits than non-BC dog owners. The same pattern was observed for short necks, with owners of E-BCs (12.4%) significantly more likely to rate short necks as one of their top three desirable traits compared to both M-BC (4.2%) and non-BC (1.7%) owners, with M-BC owners at an intermediate point, being significantly more likely to favour short necks than non-BC owners. Compared to non-BC owners, owners of both E-BC and M-BC owners were significantly more likely to favour small size, wrinkled skin, short legs, and short tails, and were less likely to favour floppy ears, large eyes, long face shape, and large size (Table 5). In contrast, owners of E-BCs were significantly less likely to rate fluffy/long hair as one of their top three desirable traits than both M-BC and non-BC dog owners, with M-BC dog owners again at an intermediate point, being less likely to favour this trait than non-BC dog owners.

Table 5. Physical features rated in the top three most desirable out of fourteen listed by owners of extreme brachycephalic dogs (E-BC, n = 476), moderate brachycephalic dogs (M-BC, n = 566), and non-brachycephalic dogs (non-BC, n = 964). Significant differences at the 5% level identified by (Bonferroni-corrected) post hoc comparisons are denoted by letters (e.g., a, b, c).

Physical Feature	Cephalic Group (%)			Statistics		
	E-BC (n = 476)	M-BC (n = 566)	Non-BC (n = 964)	Test Statistic (X^2)	p Value	q Value
Floppy ears	32.4 a	36.9 a	55.1 b	85.3	<0.001	<0.001
Large eyes	32.4 a	34.6 a	51.6 b	66.8	<0.001	<0.001
Small size	25.2 a	22.3 a	15.6 b	21.8	<0.001	<0.001
Fluffy/long hair	23.3 a	30.6 b	39.4 c	39.6	<0.001	<0.001
Wrinkled skin	14.9 a	11.0 a	5.6 b	35.2	<0.001	<0.001
Short legs	13.9 a	9.9 a	5.0 b	34.5	<0.001	<0.001
Short tail	12.4 a	8.3 a	2.1 b	63.1	<0.001	<0.001
Short neck	12.4 a	4.2 b	1.7 c	79.1	<0.001	<0.001
Flat face shape	12.3 a	7.6 b	1.8 c	66.7	<0.001	<0.001
Long tail	9.5	10.1	10.8	0.7	0.723	0.744

Table 5. *Cont.*

Physical Feature	Cephalic Group (%)			Statistics		
	E-BC (n = 476)	M-BC (n = 566)	Non-BC (n = 964)	Test Statistic (X^2)	p Value	q Value
Long face shape	8.6 a	9.9 a, b	13.1 b	7.6	0.022	0.037
Large size	7.6 a	10.4 a	15.9 b	23.0	<0.001	<0.001
Long legs	6.6	5.8	4.8	1.7	0.429	0.500
None in particular	3.4 a	4.8 a, b	7.5 b	11.3	0.004	0.008
Long neck	3.2 a, b	4.8 a	1.9 b	10.4	0.005	0.010

Multivariable Analysis: Aesthetic Preference for Flat Face Shape

Fourteen variables remained in the final model for aesthetic preference for flat face shape. Respondent age, gender, and cephalic grouping of their dog were retained regardless of significance as per an information theory approach, of which only cephalic grouping was significant, with E-BC dog owners at 6.85 increased odds of rating flat-face shape in their top three desired physical traits, and M-BC owners at 4.38 increased odds, compared to non-BC dog owners (Table 6). Five variables were positively associated with aesthetic preference for flat face shape, all of which were behavioural traits rated in respondents' top three, namely being (from greatest to least effect): lazy, stubborn, friendly, intelligent, and playful. Six variables were negatively associated with aesthetic preference for flat face shape, all of which were other physical traits rated in the respondents' top three, namely (from greatest to least effect): small size, short legs, large size, fluffy/long hair, long legs, and floppy ears.

Table 6. Multivariable binary logistic regression for variables examined for association with rating a flat-face in the top three most desirable physical traits in dogs (n = 2006). † Included as per information theory as a variable of a priori interest, regardless of significance. Significant results are emboldened.

Variable	Category	Coefficient	Std Error	p Value	q Value	Odds Ratio (OR)	95% Confidence Interval (OR)	
							Lower	Upper
Intercept	-	−3.706	0.490	<0.001	<0.001	0.025		
Gender †	Female	0.226	0.233	0.332	0.403	1.254	0.794	1.982
	Other	−0.478	0.670	0.476	0.540	0.620	0.167	2.308
	Male				Reference			
Age group †	18–25	−0.304	0.422	0.470	0.537	0.738	0.323	1.685
	26–35	−0.347	0.405	0.390	0.458	0.707	0.320	1.561
	36–45	−0.197	0.417	0.637	0.667	0.822	0.363	1.859
	46–55	0.347	0.443	0.432	0.500	1.416	0.595	3.370
	56 and over				Reference			
Cephalic grouping †	**E-BC**	**1.925**	**0.306**	**<0.001**	**<0.001**	**6.853**	**3.761**	**12.490**
	M-MC	**1.478**	**0.313**	**<0.001**	**<0.001**	**4.383**	**2.374**	**8.091**
	Non-BC				Reference			

Table 6. *Cont.*

Variable	Category	Coefficient	Std Error	*p* Value	*q* Value	Odds Ratio (OR)	95% Confidence Interval (OR)	
							Lower	Upper
Rated in respondents' top three most appealing physical traits in dogs	**Floppy ears—Yes**	**−1.921**	**0.321**	**<0.001**	**<0.001**	**0.146**	**0.078**	**0.275**
	Floppy ears—No				Reference			
	Fluffy, long hair—Yes	**−1.292**	**0.316**	**<0.001**	**<0.001**	**0.275**	**0.148**	**0.511**
	Fluffy, long hair—No				Reference			
	Small size—Yes	**−0.740**	**0.267**	**0.006**	**0.012**	**0.477**	**0.283**	**0.806**
	Small size—No				Reference			
	Large size—Yes	**−1.026**	**0.429**	**0.017**	**0.030**	**0.358**	**0.155**	**0.832**
	Large size—No				Reference			
	Short legs—Yes	**−0.852**	**0.359**	**0.018**	**0.031**	**0.427**	**0.211**	**0.861**
	Short legs—No				Reference			
	Long legs—Yes	**−1.774**	**0.745**	**0.017**	**0.030**	**0.170**	**0.039**	**0.730**
	Long legs—No				Reference			
Rated in respondents' top three most appealing behavioural traits in dogs	**Friendly—Yes**	**0.747**	**0.218**	**<0.001**	**<0.001**	**2.110**	**1.377**	**3.234**
	Friendly—No				Reference			
	Playful—Yes	**0.545**	**0.224**	**0.015**	**0.027**	**1.724**	**1.113**	**2.673**
	Playful—No				Reference			
	Intelligent—Yes	**0.694**	**0.253**	**0.006**	**0.012**	**2.002**	**1.219**	**3.289**
	Intelligent—No				Reference			
	Lazy—Yes	**1.434**	**0.314**	**<0.001**	**<0.001**	**4.197**	**2.267**	**7.767**
	Lazy—No				Reference			
	Stubborn—Yes	**0.970**	**0.350**	**0.006**	**0.012**	**2.638**	**1.329**	**5.236**
	Stubborn—No				Reference			

N.B.: - indicates that this value has not been generated.

3.9. Behavioural Preferences

Around 1 in 12 of both E-BC (8.0%) and M-BC owners (8.5%) rated the behavioural trait 'lazy' in their top three most appealing traits, compared to 3.2% of non-BC owners (Table 7). Compared to non-BC dog owners, owners of both E-BC and M-BC dogs were significantly more likely to rate the behavioural traits 'lazy', 'confident', 'adaptable', and 'stubborn' in their top three most appealing. In contrast, owners of both E-BC and M-BC dogs were significantly less likely to rate the behavioural traits 'friendly', 'affectionate', and 'loyal' in their top three, with E-BC owners significantly less likely to rate the behavioural trait 'happy' in their top three compared to non-BC owners (Table 7).

Table 7. Behavioural traits features rated in the top three most appealing out of twelve listed by owners of extreme brachycephalic dogs (E-BC, n = 476), moderate brachycephalic dogs (M-BC, n = 566), and non-brachycephalic dogs (non-BC, n = 964). Significant differences at the 5% level identified by (Bonferroni-corrected) post hoc comparisons are denoted by letters (e.g., a, b).

Physical Feature	Cephalic Group (%)			Statistics		
	E-BC (n = 476)	M-BC (n = 566)	Non-BC (n = 964)	Test Statistic (X^2)	*p* Value	*q* Value
Friendly	39.9 a	36.2 a	50.5 b	33.8	<0.001	<0.001
Affectionate	33.6 a	38.0 a	53.9 b	67.3	<0.001	<0.001
Loyal	33.2 a	36.9 a	46.4 b	27.3	<0.001	<0.001
Playful	33.0	30.2	35.1	3.8	0.150	0.213
Happy	29.8 a	30.9 a, b	36.4 b	8.2	0.016	0.028

Table 7. *Cont.*

Physical Feature	Cephalic Group (%)			Statistics		
	E-BC (n = 476)	M-BC (n = 566)	Non-BC (n = 964)	Test Statistic (X^2)	p Value	q Value
Intelligent	17.2	16.6	20.7	5.0	0.084	0.129
Confident	13.0 a	8.7 a	5.4 b	25.2	<0.001	<0.001
Comical	13.7	16.6	13.8	2.7	0.263	0.335
Laidback	12.0	12.9	10.5	2.2	0.336	0.405
Lazy	8.0 a	8.5 a	3.2 b	23.3	<0.001	<0.001
Adaptable	6.9 a	8.8 a	3.1 b	24.0	<0.001	<0.001
Stubborn	6.5 a	6.2 a	2.2 b	20.9	<0.001	<0.001
None in particular	1.3	2.5	1.7	2.4	0.309	0.383

Multivariable Analysis: Behavioural Preferences

Eight variables remained in the final multivariable binary logistic regression model for behavioural preference for laziness (Table 8). Respondent age, gender, and cephalic grouping of their dog were retained regardless of significance as per an information theory approach; within this, owners of M-BC dogs were significantly more likely to find laziness appealing compared to owners of non-BC dogs. A further five variables were significantly positively associated with behavioural preference for laziness: owners who rated flat/short face shape, short tails, short legs, or large size as one of their three most appealing physical traits in a dog were significantly more likely to find laziness appealing compared to those who did not; and owners who stated they conducted 'not very much' pre-purchase research compared to those that conducted 'a lot'.

Table 8. Multivariable binary logistic regression for variables examined for association with rating 'laziness' in the top three most desirable behavioural traits in dogs (n = 2006). † Included as per information theory as a variable of a priori interest, regardless of significance. Significant results are emboldened.

Variable	Category	Coefficient	Std Error	p Value	q Value	Odds Ratio (OR)	95% Confidence Interval (OR)	
							Lower	Upper
Intercept	-	−4.21	0.49	<0.001	<0.001	0.02	0.01	0.04
Gender †	Female	0.02	0.24	0.92	0.925	1.02	0.65	1.62
	Other	0.73	0.46	0.11	0.164	2.08	0.84	5.13
	Male				Reference			
Age group †	18–25	0.60	0.47	0.20	0.271	1.82	0.73	4.56
	26–35	0.32	0.46	0.49	0.553	1.38	0.56	3.40
	36–45	0.41	0.47	0.39	0.458	1.50	0.59	3.79
	46–55	−0.42	0.58	0.47	0.537	0.65	0.21	2.06
	56 and over				Reference			
Cephalic grouping †	E-BC	0.35	0.28	0.21	0.281	1.42	0.82	2.44
	M-BC	**0.58**	**0.26**	**0.03**	**0.048**	**1.78**	**1.07**	**2.95**
	Non-BC				Reference			

Table 8. *Cont.*

Variable	Category	Coefficient	Std Error	*p* Value	*q* Value	Odds Ratio (OR)	95% Confidence Interval (OR)	
							Lower	Upper
Rated in respondents' top three most appealing physical traits in dogs	**Large size—Yes**	**0.74**	**0.27**	**0.01**	**0.019**	**2.09**	**1.24**	**3.54**
	Large size—No				Reference			
	Short legs—Yes	**1.11**	**0.25**	**<0.001**	**<0.001**	**3.03**	**1.84**	**4.99**
	Short legs—No				Reference			
	Short tail—Yes	**0.94**	**0.28**	**<0.001**	**<0.001**	**2.55**	**1.47**	**4.43**
	Short tail—No				Reference			
	Flat face shape—Yes	**1.14**	**0.29**	**<0.001**	**<0.001**	**3.11**	**1.76**	**5.50**
	Flat face shape—No				Reference			
Level of pre-purchase research conducted	No research	0.24	0.47	0.62	0.657	1.27	0.50	3.22
	Not very much	**0.97**	**0.26**	**<0.001**	**<0.001**	**2.63**	**1.59**	**4.34**
	A small amount	0.15	0.25	0.56	0.608	1.16	0.71	1.90
	A lot				Reference			

N.B.: - indicates that this value has not been generated.

3.10. Perceptions of Normality

Across the whole population, the brachycephaly-related abnormalities most frequently rated as normal for a flat-faced dog were appearing anxious (27.0% strongly or somewhat agree), being unable to engage in physical activity (25.6%), being unable to keep up with owners when walking (22.5%), and sleeping while sitting (23.9%) (Table 9). When considered as a composite 'NORM score' (from 9—the highest level of normalisation to 45—the lowest level of normalisation), non-BC owners had a higher NORM score (indicating a lower level of normalisation of clinical signs) compared with both E-BC and M-BC owners (median (IQR); E-BC: 29.0 (25.0–34.0); M-BC: 29.0 (26.0–35.0); non-BC: 32.0 (27.0–36.0); $X^2 = 88.24$, $p < 0.001$, $q < 0.001$). When individual clinical signs were considered, variability in normalisation emerged. For example, E-BC and M-BC dogs were significantly less likely to consider dogs appearing 'very short of breath' as normal for flat-faced dogs, compared to non-BC owners (strongly agree is normal; E-BC: 18.3%, M-BC: 23.3%, non-BC: 36.5%). In contrast, owners of E-BC and M-BC dogs were significantly more likely to agree that sleeping while sitting was 'normal' for flat-faced than non-BC owners (strongly agree: E-BC: 11.8%, M-BC: 10.1%, non-BC: 6.5%) (Table S4, Supplementary Materials File S1).

Table 9. Level of agreement that different brachycephaly-related abnormalities are 'normal' for a brachycephalic dog in the overall survey sample, including owners of extreme brachycephalic dogs (E-BC, *n* = 476), moderate brachycephalic dogs (M-BC, *n* = 566), and non-brachycephalic dogs (non-BC, *n* = 964).

Brachycephaly-Related Abnormality	Level of Agreement That This Characteristic Is 'Normal' for a Brachycephalic Dog (%)				
	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
Very short of breath (*n* = 1919)	4.0	6.7	21.4	38.2	29.7
Unable to keep up with me when I walk (*n* = 1831)	7.5	15.0	29.1	33.6	14.7
Unable to engage in physical activity (*n* = 1875)	8.7	16.9	29.1	32.2	13.1
Appears anxious (*n* = 1822)	8.8	18.2	34.6	27.2	11.1
Always snoring when asleep (*n* = 1885)	3.3	7.4	22.1	38.2	28.9
Tongue lolling out of mouth (*n* = 1894)	4.9	9.4	26.2	39.8	19.7
Regurgitates (*n* = 1698)	6.7	12.6	39.2	29.3	12.2
Appear unable to close their mouth (*n* = 1843)	7.1	14.6	30.3	33.7	14.2
Sleeping while sitting (*n* = 1677)	8.5	15.4	41.6	24.1	10.5

Multivariable Analysis: NORM Score

Ten variables remained in the final multivariable linear model for the NORM score. Respondent age, gender, and cephalic grouping of their dog were retained regardless of significance as per an information theory approach, all of which were non-significant. Four variables were significantly associated with lower NORM scores, indicating a greater degree of normalisation of brachycephaly-related abnormalities: owners who did not meet the parents of their puppy; owners who conducted pre-purchase advice from online information; owners who reported that nothing could put them off buying a flat-faced dog; and owners who expected there to be no difference in the lifespan of flat-faced dogs compared to other breeds or were not sure if there was a difference compared to those who expected flat-faced dogs to live shorter lives (Table 10). Three variables were significantly associated with higher NORM scores, indicating a lesser degree of normalisation of brachycephaly-related abnormalities: owners who were put off buying a flat-faced dog due to not finding the way they look appealing compared to those that were not put off by their looks; owners who were put off buying a flat-faced dog due to their tendency to live a lower quality of life than other breeds of dog compared to those that were not put off by their lowered quality of life; and owners who strongly or somewhat agreed that lifespan would affect their decision when choosing a dog compared to those who strongly disagreed with this statement.

Table 10. Multivariable linear model for variables examined for association with NORM score (degree of normalisation of brachycephaly-related abnormalities, where a higher score = lower normalisation) (n = 2006). † Included as per information theory as a variable of a priori interest, regardless of significance. Significant results are emboldened.

Variable	Category	Coefficient	Std Error	p Value	q Value	95% Confidence Interval	
						Lower	Upper
Intercept	-	25.22	1.74	<0.001	<0.001	21.81	28.63
Age group †	18–25	1.64	1.46	0.260	<0.001	−1.22	4.50
	26–35	2.24	1.44	0.121	0.334	−0.59	5.08
	36–45	2.54	1.45	0.081	0.176	−0.31	5.38
	46–55	2.03	1.49	0.173	0.125	−0.89	4.94
	56–65	0.74	1.53	0.628	0.238	−2.26	3.74
	66 and over				Reference		
Gender †	Female	−0.44	0.37	0.239	0.309	−1.16	0.29
	Other	−1.36	1.04	0.193	0.263	−3.40	0.69
	Male				Reference		
Cephalic grouping †	E-BC	−0.58	0.40	0.156	0.220	−1.38	0.22
	M-BC	−0.46	0.38	0.227	0.300	−1.22	0.29
	Non-BC				Reference		
Met parents of puppy	I did not get my dog as a puppy	0.58	0.48	0.231	0.303	−0.37	1.53
	No	**−0.84**	**0.37**	**0.023**	**0.038**	**−1.55**	**−0.12**
	Yes				Reference		
Pre-purchase advice source	**Online information about the breed—Yes**	**−0.86**	**0.34**	**0.011**	**0.020**	**−1.52**	**−0.20**
	Online information about the breed—No				Reference		
What, if anything would put you off buying a flat-faced dog?	**I generally do not find the way they look appealing—Yes**	**2.11**	**0.37**	**<0.001**	**<0.001**	**1.37**	**2.84**
	I generally do not find the way they look appealing—No				Reference		
	Tendency to live a lower quality of life than other breeds of dog—Yes	**1.29**	**0.35**	**<0.001**	**<0.001**	**0.61**	**1.98**
	Tendency to live a lower quality of life than other breeds of dog—No				Reference		
	Nothing—Yes	**−2.22**	**0.60**	**<0.001**	**<0.001**	**−3.40**	**−1.03**
	Nothing—No				Reference		

Table 10. *Cont.*

Variable	Category	Coefficient	Std Error	*p* Value	*q* Value	95% Confidence Interval	
						Lower	Upper
Expectation of lifespan of flat-faced dogs compared to other breeds	Longer	−0.85	0.68	0.211	0.281	−2.18	0.48
	No difference	**−1.85**	**0.41**	**<0.001**	**<0.001**	**−2.65**	**−1.05**
	Not sure	**−1.65**	**0.66**	**0.013**	**0.024**	**−2.95**	**−0.35**
	Shorter	Reference					
Agreement with statement: "Lifespan would affect my decision when choosing a dog"	**Strongly agree**	**6.88**	**0.91**	**<0.001**	**<0.001**	**5.09**	**8.67**
	Somewhat agree	**4.73**	**0.89**	**<0.001**	**<0.001**	**2.98**	**6.49**
	Neither agree nor disagree	**1.94**	**0.89**	**0.031**	**0.049**	**0.18**	**3.69**
	Somewhat disagree	1.08	1.06	0.311	0.383	−1.01	3.16
	Strongly disagree	Reference					

N.B.: - indicates that this value has not been generated.

4. Discussion

This study has gleaned a deeper understanding of some of the key barriers to dramatically reducing numbers and popularity of dogs with brachycephaly in the UK and reducing the negative impacts of brachycephaly on the current generations of dogs with brachycephaly, two of the strategic goals of the UK Brachycephalic Working Group [26]. Understanding the prevalence and demography of perceptual barriers to change is essential in shaping future human behaviour change interventions aimed at prospective and current owners of brachycephalic dogs.

4.1. Normalisation

Normalisation of brachycephaly-related abnormalities, particularly those related to exercise intolerance, was common in the study population of owners of both brachycephalic and non-brachycephalic dogs. Although this phenomenon is now well established in brachycephalic dog owners [8,11–13], to the authors' knowledge, this is the first evidence of this normalisation phenomenon in owners of non-brachycephalic dogs. This finding demonstrates how widespread misinformation on brachycephaly has become in UK society and that this normalisation phenomenon is not solely driven by cognitive dissonance associated with brachycephalic ownership, leading to minimisation of health problems, as discussed below [10]. The most commonly normalised signs centred on exercise intolerance, a core clinical sign of BOAS, that has been co-opted as a celebrated trait of these breeds rather than a sign of poor health. Normalisation of brachycephaly-related abnormalities has important implications for future campaigns and messaging aimed at reducing ownership of brachycephalic dogs (e.g., reflecting on the target demographic's pre-existing beliefs when considering basing a campaign on the prevalence of health problems that may already be minimised) and also improving the welfare of the current brachycephalic dog population (e.g., avoiding undertreatment).

Our results indicate that owners' knowledge of canine welfare, and where this knowledge was derived from, were important risk factors for normalisation. Owners who did not meet their puppy's parents demonstrated a greater degree of normalisation of brachycephaly-related abnormalities than those who met them. Lucy's Law in England (2020) and Scotland (2021) has made it illegal to sell a puppy without the buyer seeing it at the place they were bred, interacting with their mother [27]. Purchasing from a breeder/dealer who is not compliant with the law may indicate a general lack of knowledge regarding dog welfare or a willingness to accept lower welfare standards in breeding, which are associated with owner levels of knowledge and attitudes driving normalisation of brachycephaly-related abnormalities. Owners who relied primarily on online pre-purchase information rather than other sources with a lower risk of bias (e.g., veterinary surgeons, animal welfare charities) demonstrated a greater degree of normalisation of brachycephaly-related abnormalities. Information learnt about a breed prior to ownership may influence breed choice (e.g., dissuade an owner from purchasing a breed entirely) or may set expectations for owners who choose to go on to acquire that breed (e.g., how concerned they are if they notice changes in their dog indicative of a health problem). Lack of pre-purchase

education is consistently highlighted as a key welfare concern for companion animals (e.g., rated as one of the top welfare issues by veterinary professionals in the 2023 PDSA Animal Wellbeing 'PAW' Report) [28], and indeed, this study demonstrated that owners of E-BCs and M-BCs were less likely to conduct high levels of research than non-BC dog owners. This finding regarding normalisation, however, highlights that quality is important as well as quantity, with sources accessed as well as time taken researching being key to welfare-related knowledge and perceptions. Vets are often championed as the ideal source of pre-purchase information; however, E-BC and M-BC owners were less likely to rely on veterinary advice than non-BC owners in this study, and recent qualitative research has highlighted a range of perceptual and structural barriers to vets delivering pre-purchase consultations regarding brachycephalic dogs [29]. Consequently, there is an urgent need to develop pre-purchase information that tackles pervasive normalisation narratives (e.g., abnormal respiratory noise being 'cute') that is not limited to animal welfare charity websites or veterinary practices but to sources that owners interested in purchasing extreme brachycephalic dogs are more likely to access. Collaboration with puppy-selling websites, one of the key places puppies are found by prospective buyers in the UK, could aid in getting key messages across at a time when owner's decisions may still be able to be influenced. This mode of information delivery is more likely to appeal to the convenience-driven consumer behaviour that is pervasive in the modern puppy buying market [30].

Owners who reported that 'nothing' could dissuade them from purchasing a flat-faced dog showed higher levels of normalisation. This finding supports the concept of cognitive dissonance in pet ownership (e.g., as previously described in relation to brachycephaly [9,13], where strong emotional attachment to brachycephalic dog(s) can lead to minimisation or denial of health problems). Extreme loyalty to brachycephalic breeds is likely to result in 'belief perseverance', with rejection of new information regarding their health and welfare issues, and indeed, as documented in cognitive psychology for beliefs regarding childhood vaccination [31] and politics [32], may lead to a 'backfire effect' (a sub-type of confirmation bias) where new conflicting evidence is rejected and their original beliefs are strengthened. It is possible that previous messaging regarding brachycephalic health problems may have had such an effect on this sub-population and strengthened normalisation beliefs. Given a substantial 1 in 7 E-BC owners stated that nothing could put them off buying a brachycephalic breed, this sub-population of owners should not be 'written off' as intractable; however, future interventions aimed at this group when discussing normalisation will require a nuanced approach to avoid the backfire effect. Social media was strongly associated with brachycephalic ownership in the current study, with E-BC owners more likely to initially find their dog on social media and to post their dog on social media. It is possible that exposure to the views of other extreme brachycephalic owners throughout the ownership process, starting prior to acquisition, could lead to echo chambers where users are primarily exposed to content that aligns with their existing beliefs, reinforcing normalisation via online 'tribes' (e.g., sharing content of dogs exhibiting clinical signs of breed-related disease without critical evaluation and responses). Further study of social media content surrounding brachycephalic dogs is required to create strategies to counter misinformation and polarisation via these burgeoning platforms and to instead use them for good.

Finally, owners who expected no difference in lifespan between brachycephalic and other breeds or were not sure about this demonstrated greater normalisation. It is now well established that brachycephalic dogs have a shorter lifespan [33–36], and thus this misconception may be linked to a general lack of awareness about breed-specific health issues in brachycephalic dogs or may be a further effect of cognitive dissonance and rejection of this information alongside normalisation beliefs.

Several factors were identified that were associated with lower levels of normalisation of brachycephaly-related abnormalities. Owners who were deterred from purchasing a brachycephalic dog due to their appearance were less likely to normalise their pathologies. This may reflect this sub-population being less impacted by the 'cute effect' [16,20] and thus

less attracted to the distinctive morphology of these breeds. In turn, this may allow for a more rational approach towards information regarding brachycephalic breed health and a greater understanding that clinical signs of disease are not 'normal' in these breeds. Future research is needed, however, to better understand why some individuals are so drawn to the appearance of brachycephalic dogs, including unconscious preferences, e.g., neural responses to the baby schema [37]. Recent research on the baby schema effect in humans has revealed individual differences in how women respond to infant facial features [38]. This study used electroencephalography (EEG) to measure brain responses to digitally altered images of babies. These images were manipulated to show varying degrees of baby schema features, such as eye size and head proportions. The findings demonstrated that women do not uniformly respond to baby schema. A key factor in this variation was the level of oxytocin receptor (OXTR) methylation. OXTR methylation is an epigenetic process that can modify gene activity without altering the genetic code itself. Higher levels of OXTR methylation typically reduce sensitivity to oxytocin. Women with low OXTR methylation showed a more pronounced difference in their neurophysiological responses when viewing infants with high versus low baby schema features. This suggests that their increased sensitivity to oxytocin may enhance their ability to detect and respond to subtle infant facial cues.

Finally, owners who were put off buying a flat-faced dog due to their tendency to live a lower quality of life than other breeds or who considered lifespan as an important factor in dog selection were less likely to normalise brachycephaly-related abnormalities. This association may reflect a generally higher level of awareness of dog health and welfare problems in these individuals and emphasises the importance of educating prospective owners about breed-specific health risks and longevity, given that longevity is drastically reduced in some brachycephalic breeds, e.g., French Bulldogs, with median longevity estimated as low as 3.6 years [39].

4.2. Intractable Owners

The seeming intractability of owners of brachycephalic dogs is an increasing conundrum amongst organisations involved in improving canine welfare, given that standard campaigning approaches have not achieved their desired effects to date (e.g., dramatically reduced numbers of brachycephalic breeds acquired). Previous research has inferred that changing the acquisition behaviours of some individuals may be challenging or indeed impossible based on perceptual barriers to brachycephalic health; however, none have asked directly whether this is a conscious belief for these individuals. In this study, one in seven owners of E-BCs stated that nothing could put them off buying a flat-faced dog. Understanding drivers of this self-reported intractability is important to shaping future attempts to change their beliefs and buying behaviours, given this is a substantial subpopulation of owners. Owners who rated a flat face shape as one of their top three most appealing physical traits in a dog were more likely to express this view, which may reflect their relative sensitivity to the baby schema, as explored above [37]. Attraction to infant features in dogs has complex effects, including being associated with the degree of attachment that owners report to their own pets [40,41]. Indeed, the dog-owner relationship in extreme brachycephalic breeds (specifically Bulldogs, French Bulldogs, and Pugs), as quantified by Monash Dog Owner Relationship Scale (MDORS) scores [42], has been found to be higher for these breeds across all three MDORS subscales (perceived emotional closeness, perceived costs, dog-owner interactions) than other recent studies utilising this tool in other breeds [43–45]. Emotional attachment can significantly amplify the effects of cognitive dissonance, making it more difficult for individuals to change their beliefs or accept new information that conflicts with their existing views [46], and thus the importance of owning a dog with this specific facial morphology may be challenging to overcome for some individuals. Exploring whether moderated, less extreme brachycephalic conformations that pose lower risks to canine health would be an 'acceptable' alternative for this population to acquire is of high priority.

As also seen for the degree of normalisation of brachycephaly-related abnormalities, owners who expected there to be no difference in the lifespan of flat-faced dogs compared to other breeds, or were not sure, were significantly more likely to feel that nothing could put them off buying a flat-faced dog compared to those who expected flat-faced dogs to live shorter lives than other breeds. This result potentially reflects a lack of acceptance of information regarding shortened lifespans or a lack of awareness for those unsure. Many previous campaigns have focused on the poor health of brachycephalic breeds; however, it is possible that emphasising their short lives and untimely deaths could be more effective for some individuals. Focusing on human stories of the grief that previous owners of brachycephalic breeds have experienced due to the death of their young brachycephalic dog may be more effective in humanising statistical evidence regarding this longevity effect and influencing owner decision-making than data alone [47]. Meta-analyses of human health campaigns have found that although statistical evidence has a stronger influence than narrative evidence on beliefs and attitude, narrative evidence has a stronger influence on intention, explained by statistical evidence, beliefs, and attitude primarily relating to cognitive responses, whereas narrative evidence and intention relate more specifically to affective responses [48], which may be more relevant to the human issues related to brachycephalic acquisition.

Several protective factors against owners feeling nothing could deter them from purchasing a brachycephalic dog were identified, some of which were related to other co-occurring attitudes, including a lesser degree of normalisation of brachycephaly-related abnormalities and agreement that both lifespan and health test results of their puppies' parents would affect their decision when choosing a dog. This network of attitudes likely reflects those respondents with a greater awareness and concern regarding dog health and welfare and challenges associated with brachycephaly. Knowledge-related acquisition processes were also negatively associated with being undeterred from purchasing a brachycephalic dog, including conducting pre-purchase advice on community forums. Community forums of owners of dogs of specific breeds are widespread and include sharing of dog ownership experiences such as health concerns; for brachycephalic breed forums, discussions regarding 'corrective' surgery were the most common post type in a recent study [49]. It is possible that exposure to this information from authentic first-hand accounts acts as an effective deterrent for some owners towards brachycephalic ownership, potentially due to these accounts being considered to be unbiased. Finally, owners who acquired their dog from an international animal welfare charity or an online marketplace were significantly less likely to feel that nothing could put them off buying a flat-faced dog than those that did not and acquired from other sources (e.g., dog breeder, social media). It is possible that owners acquiring from these sources were less fixed in their desires regarding the breed they would acquire, given the vast range of dog breeds for sale online [50,51] and the largely mixed-breed profile of international rescue dogs [52], compared to those owners acquiring directly from breeders of their desired breed.

4.3. Behavioural Preference for 'Laziness'

Laziness was frequently rated in the top three most appealing behavioural traits for brachycephalic owners (both extreme and moderate), significantly more so than in non-brachycephalic owners (around 1 in 12 vs. 1 in 30, respectively). Predictors of this preference largely focused on preference for physical traits that are commonly seen in brachycephalic breeds, namely those who rated a flat face shape, short tail, and short legs in their top three most desirable traits. These results concur with previous findings that perceived laziness is recommended by owners of dogs with these conformational traits (i.e., extreme brachycephalic breeds) as a breed-specific positive trait [8]. Knowledge levels were also likely to impact positive perceptions of laziness, with those owners who reported they conducted 'not very much' pre-purchase research significantly more likely to find laziness appealing compared to those that conducted a lot. Perceptions that laziness is likely to reflect poor health in brachycephalic dogs who cannot exercise for long periods, rather

than assumptions that they do not want to exercise, require urgent dispelling to protect canine welfare. Given that a desire for a 'lazy' dog may reflect physical characteristics of the prospective owner (e.g., activity/exercise levels, overweight/obesity status), future investigation could aim to sensitively explore such associations.

Finally, large size, being one of an owner's top three desirable physical traits in a dog, was associated with finding laziness appealing. Previous studies have found that owners of large dogs are less likely to meet Kennel Club requirements for exercise for their breed compared to small dogs (18% vs. 71%, respectively), which for large dogs can exceed 2 h per day [53]. It is possible that misconceptions around large breed activity requirements influence this; for example, articles in the pet press, e.g., [54], refer to some giant breeds being described as 'big lazy dog breeds'. A better evidence base is required to understand the activity levels and exercise needs of different breeds in good health (i.e., free of breed-related disorders such as BOAS in brachycephalic breeds and musculoskeletal disorders in giant breeds) so that owners are aware of these needs prior to acquisition and preference is not based on pathology.

4.4. Aesthetic Preference for Flat Faces

E-BC owners were at 6.85 increased odds of rating flat faces as one of their top three most desirable physical characteristics in dogs, with around 1 in 8 (12.3%) expressing this preference compared to 1 in 13 (7.5%) M-BC and 1 in 55 (1.8%) non-BC dog owners. Improving health in brachycephalic breeds necessitates conformational change away from flat faces, given this aesthetically desirable trait underlies diverse, severe health disorders [21,25,55]. As such, stronger preference for flat faces in a sub-population of owners of those most extreme dogs (e.g., French Bulldogs, Pugs, English Bulldogs) is a major barrier to welfare improvement and goes some way to explain breeders' focus on selecting within-breed, e.g., for 'better breathing' via respiratory function grading [56], than specifically targeting problematic skull morphologies via outcrossing to achieve more rapid change to phenotype and resultant health. In this study, brachycephaly was only described as flat-faced without nuance regarding the degree of brachycephaly, and thus future studies should focus on whether their aesthetic desire is only related to the most extreme manifestations of this trait or whether less extreme versions are also desirable. It is notable that a large proportion of both E-BC and M-BC owners did not rate flat faces in their top three most desirable traits, and thus their future acquisitions may be tractable away from extreme brachycephaly.

Desire for flat faces was positively associated with a range of behavioural traits, most prominently laziness. This reflects previous findings that the 'personality' of brachycephalic breeds is highly valued and recommended by owners [8]. Future human behaviour change initiatives should work to uncouple perceptions of laziness in flat-faced beings as a 'normal' or 'desirable' breed trait and instead as a strong indicator of poor health in dogs with brachycephaly. Other behavioural traits associated with preference for brachycephaly were stubborn, friendly, intelligent, and playful. Conversely, all variables that were negatively associated with a preference for flat faces were other physical features, namely, small size, short legs, large size, fluffy long hair, long legs, and floppy ears. Knowledge of which traits are desirable or undesirable in owners who express preference for brachycephaly could be valuable in developing advice for promoting alternative breeds to these owners, where messaging should transition from warnings of which breeds to be cautious of or avoid (e.g., "Stop and think before buying a flat-faced dog" [57]) to positive suggestions of breeds that fulfil many of the now-identified wants and needs of this ownership group, without associated welfare burdens.

4.5. Sample Characteristics

The study sample benefitted from both owners of brachycephalic and non-brachycephalic dogs, building on previous survey-based studies of this topic that were limited to owners of brachycephalic dogs (e.g., [8,13]). The sample was more strongly represented by female than male owners (75.2%), which could limit generalisability to the general population of

pet owners; however, male respondent levels were higher than previous similar research (e.g., 89.1% female [13]) or regarding dog ownership more broadly (e.g., 92.0% female [58], 91.3% female [59], 86.0% female [60]). With previous international studies finding that females are more likely to own pets than males (e.g., in the United States: 69% versus 55% [61]), this imbalance is likely to have a lesser effect on the validity of results presented.

5. Conclusions

Perceptual beliefs that promote the continued acquisition of brachycephalic dogs are widespread amongst current owners of extreme and mild-moderate brachycephalic dogs (e.g., normalising exercise intolerance) but are now also known to be common in owners of non-brachycephalic dogs, highlighting how widespread misinformation around the health and characteristics of brachycephalic breeds has become. Future campaigns focused on 'myth busting' normalised traits and emphasising the untimely deaths of many brachycephalic dogs, rather than focusing more broadly on brachycephalic breeds being unhealthy, could improve their efficacy. Furthermore, campaigns that target key information sources for this owner demographic (e.g., social media and community forums, for more authentic first-hand accounts via current/former owners that are within their 'tribe' and 'influencers' with negative ownership experiences) could prove more successful than previous attempts to target the public through newspaper adverts and billboards, simply stating entire breeds are unhealthy, for example. Positively, owners of brachycephalic dogs are not homogenous in their beliefs, with the majority of respondents not considering that 'nothing' could put them off buying a flat-faced dog. Furthermore, a minority of owners of brachycephalic breeds rated flat faces as one of their most desirable aesthetic traits in dogs, albeit in higher numbers than non-brachycephalic dog owners. As such, although animal welfare organisations should be conscious of the self-reported intractable sub-population identified here that are strongly wed to this specific high-risk conformation, it appears that many current brachycephalic owners are open to alternatives and could be open to acquiring dogs with more moderate conformation in the future. Equipped with information on the aesthetic and behavioural traits this demographic values or is averse to, owner advice could move from simply avoiding brachycephaly to positively recommending bespoke alternatives with healthier conformations.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/pets1030032/s1, Supplementary File S1: Supplementary Tables S1–S4; Table S1. Age categories of extreme brachycephalic (E-BC, *n* = 476), mild-moderate brachycephalic (M-BC, *n* = 566) and non-brachycephalic (non-BC, *n* = 964) dogs owned by study participants. Significant differences at the 5% level identified by (Bonferroni-corrected) post-hoc comparisons are denoted by letters (e.g., a, b). Table S2. Owner demographics, socioeconomic status and household structure of extreme brachycephalic dog owners (E-BC, *n* = 476), moderate brachycephalic dog owners (M-BC, *n* = 566) and non-brachycephalic dog owners (non-BC, *n* = 964). Significant differences at the 5% level identified by (Bonferroni-corrected) post-hoc comparisons are denoted by letters (e.g., a, b). Table S3. Breed loyalty in owners of extreme brachycephalic dogs (E-BC, *n* = 476), moderate brachycephalic dogs (M-BC, *n* = 566) and non-brachycephalic dogs (non-BC, *n* = 964). Significant differences at the 5% level identified by (Bonferroni-corrected) post-hoc comparisons are denoted by letters (e.g., a, b). Table S4. Level of agreement with whether brachycephaly-related abnormalities are 'normal' for flat-faced dogs by owners of extreme brachycephalic dogs (E-BC, *n* = 476), moderate brachycephalic dogs (M-BC, *n* = 566) and non-brachycephalic dogs (non-BC, *n* = 964). Significant differences at the 5% level identified by (Bonferroni-corrected) post-hoc comparisons are denoted by letters (e.g., a, b). Supplementary File S2: Survey content.

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