1   **Working title: Pre-purchase owner behaviour and purebred dogs**

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3   **Purchasing popular purebreds: Investigating the influence of breed-type on the pre-**

4   **purchase motivations and behaviour of dog owners**

5

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16

17   **Abstract**

18

19   How and why dog owners select a specific breed may impact upon the health of the dog they

20   acquire, and upon the wider health of the breed they select. Brachycephalic (BC) breeds are

21   rapidly increasing in popularity despite increasing evidence linking brachycephalism with

22   chronic and severe health conditions. This study used a questionnaire to explore pre, during

23   and post-purchase behaviours and attitudes of dog-owners who own popular BC dog breeds

24   (n=3 breeds) compared to popular non-BC dog breeds (n=7 breeds). The survey received 1427

25   valid responses. BC breed owners were younger, more likely to live with children, and to be

buying their chosen breed for the first time. The factor that most highly influenced BC owner's decisions to buy their breed was appearance, followed by breed size suited to lifestyle, good dog breed for children and good companion breed. Perceived health of the breed was less influential in decision-making for BC owners compared to non-BC owners. The way in which owners acquired their dog differed by breed type, with BC owners more likely to use puppy-selling websites to find their dog, less likely to see either parent of their puppy, and less likely to ask to see any health records. Despite many BC breed health issues being directly related to conformation, appearance remains the most significant determinant in why people desire these breeds. More targeted educational interventions are needed to change buyer attitudes and, if ineffective, other more direct mechanisms (e.g. legislation) may be required to protect canine welfare.

Introduction

Contemporary estimations of the domestic dog (*Canis familiaris*) population of the United Kingdom (UK) place it at around 10.5 million (Murray et al. 2010), approximately 75-80% of which are purebred (Asher et al. 2011; O'Neill et al. 2014). The process of selecting for breed-specific characteristics in purebred dogs has been identified as having the potential to reduce dog welfare (Rooney & Sargan 2010), with strong links between breed standards and inherited diseases in the top 50 Kennel Club (KC) breeds (Asher et al. 2009). In addition, reduced genotypic variation within these same breeds substantially increases the prevalence of genetic disease (Summers et al. 2010). Public concerns regarding the welfare of purebred dogs and

51 associated selective breeding practices have resulted in a number of high profile reports to

52 address those concerns (All-Party Parliamentary Group for Animal Welfare 2010; Bateson

53 2010).

54

55 Humans have a large appetite for variety in the appearance and behaviour of dogs, with 216

56 breeds currently KC recognised (The Kennel Club, 2015). Breed popularity within the dog

57 population has remained largely stable, but with substantial, and often culturally driven, surges

58 in the popularity of specific breeds (Herzog et al. 2004). Social influence (fashion) is the

59 primary influence on the popularity of companion dog breeds, which is often related to media

60 exposure e.g. featuring in movies (Herzog 2006, Ghirlanda et al. 2014). Both in the United

61 States of America (USA) and the UK, breed popularity appears to lack direct associations with

62 functional traits (e.g. health, trainability) (Herzog 2006, Ghirlanda et al. 2013) whilst

63 displaying a concerning tendency for more popular breeds to have greater numbers of inherited

64 disorders (Ghirlanda et al. 2013). Increased demand may, therefore, place pressure on breeders

65 to provide more individuals from a genetically constrained breeding population. In turn this

66 demand will increase the number of extant recessive disorders being expressed. With regards

67 to the appearance of popular breeds, if demand is based on the extreme appearance of certain

68 breeds, this may result in higher levels of conformation-related disorders in the canine

69 population.

70

71 Evidence suggests that brachycephalic (BC) (short-muzzled) breeds in particular, such as the

72 Pug, French Bulldog and Bulldog have shown substantial increases in numbers in the UK over

73 the past decade (The Kennel Club 2016a). Herzog (2006) suggests that breed popularity, once

74 established, may persist for a decade or more, indicating that BC dog populations will grow,

75 or are unlikely to decline, in the foreseeable future. Brachycephaly has been linked with a

76 variety of inherited diseases including respiratory disorders (Brachycephalic Obstructive

77 Airway Syndrome; BOAS) (Packer et al. 2015a), ophthalmic disease (Packer et al. 2015b) and

78 results in reduced lifespan compared to non-BC breeds (O'Neill et al. 2015). These

79 conformation-related problems have previously led veterinarians to express concerns about

80 the continued breeding of BC dogs (Farrow et al. 2014), with calls to out-cross or even ban

81 certain breeds (Packer et al 2014).

82

83 Little information exists on how and why prospective companion animal owners make

84 decisions round the purchase of purebred dogs. Pre-purchase decisions will be guided by a

85 number of factors, although these may not be entirely predictable (Ghirlanda et al. 2013). In a

86 study of the ideal Australian companion dog, behavioural and physical factors identified as

87 important included being medium sized, short haired, safe with children, friendly, obedient and

88 healthy (King et al 2009). Owner characteristics relevant to decision-making have not been

89 fully investigated, and may include sociodemographic factors (e.g. income, level of education,

90 marital status), social influences (e.g. current breed popularity, celebrity endorsement) and

91 historical influences (e.g. previous dog ownership, childhood dog ownership). External factors,

92 such as access to breed health information may also influence decisions. The processes by

93 which decisions are made during the acquisition of a companion animal are likely to be

94 important at both an individual level (e.g. the health of the dog acquired) and at a population

95 level (e.g. which types of dog and health characteristics are 'in demand'). Understanding this

96 process may allow prospective owners to be better targeted with information, thus improving

97 matching between households and their companion animals and allowing alternative,

98 potentially healthier, breed choices to be promoted.

99

This research aimed to explore differences in owner characteristics, motivations for acquisition and pre-, during and post-purchase behaviours and attitudes between owners of BC and non-brachycephalic (non-BC) breeds within the 10 most popular KC registered pedigrees of 2014 (The Kennel Club 2016a).

Methods

Questionnaire design and dissemination

The questionnaire was designed iteratively amongst the authors (and a small number of pilot respondents) to ensure ease of understanding and comprehensiveness of scope. In general, sections included:

1. General owner demographics: e.g. gender; age; children; house type; income and education level; first time dog owner; first time breed owner;
2. General information on their dog: e.g. signalment; age at acquisition;
3. Pre-purchase motivations: e.g. factors that influenced purchase/acquisition of their specific breed (dog appearance; breed popularity; previous breed experience; celebrity endorsement; companionship; cost);
4. Pre-purchase knowledge and behaviours: e.g. Research conducted on their breed of choice prior to acquisition; amount of time spent considering acquisition of their dog;
5. Acquisition behaviours: e.g. where and how their dog was acquired; which parents of their puppy were seen (if any); requests for health records;
6. Post-purchase attitudes: e.g. Things they would change about the acquisition of their dog if they could go back in time; whether they would recommend their breed; whether they plan to breed from their dog

125

Participants

128 Owners of the top ten KC registered pedigrees of 2014 (1. Labrador Retriever; 2 Cocker Spaniel;

129 3 English Springer Spaniel; 4 French Bulldog; 5 Pug; 6. German Shepherd Dog; 7 Golden

130 Retriever; 8 Border Terrier; 9 Bulldog; 10 Miniature Schnauzer) were purposively sampled via

131 online forums and social media platforms as well as KC breed health coordinators. An

132 explanatory letter was also sent to the administrators of dog-related social media sites seeking

133 permission to engage their online users. Following granting of permission potential

134 respondents were provided with a link to an online questionnaire hosted on SurveyMonkey©

135 (www.surveymonkey.com).

136

137 All participants were required to live in the UK, be 18 years of age or older and own one of the

138 eligible breeds. Respondents were informed of the aims of the project and that submission of

139 the survey would implicitly consent to the usage of their data for research purposes.

140 Respondents with more than one dog fitting the inclusion criteria were requested to answer the

141 survey in regard to the one most recently acquired. This survey was approved by the Royal

142 (Dick) School of Veterinary Studies Student Survey Overview Group.

143

Statistical analyses

145

146 Data analyses were carried out in IBM SPSS Statistics v21 (SPSS Inc, Chicago, IL, USA). Of

147 the 10 targeted breeds, three were characterised as BC (French Bulldog, Pug and Bulldog),

148 with the other seven being non-BC. Associations between breed-type (BC vs. non-BC) and

149   variables related to respondent demographics, pre-purchasing, purchasing and post-purchasing

150   behaviour were explored using Chi-squared tests for categorical variables and Mann-Whitney

151   U tests for non-normally distributed continuous data (with data distribution ascertained by

152   visual inspection of histograms) or ordinal data (e.g. how influential a factor was in the decision

153   to choose a breed on a scale of 0-4). Correction factors were used to control for Type I errors

154   introduced by multiple univariate comparisons. For this, the False Discovery Rate (FDR)

155   (Benjamini & Hochberg 1995) set at 0.05 was used to take into account the number of statistical

156   tests performed in the univariate analyses, and all p values are presented in their raw form and

157   FDR-corrected forms. A binary logistic regression model was used to determine which factors

158   were most influential in the purchase of BC vs. non-BC dogs (binary outcome measure).

159   Factors with liberal associations in univariable tests ($P < 0.2$) were taken forward for

160   multivariable evaluation. Model development used backwards stepwise elimination and the

161   Hosmer-Lemeshow test statistic was used to evaluate model fit.

162

163   **Results**

164

165   Data were collected between June and July 2015. The survey received 1910 responses, of

166   which 1427 responses were complete and valid for inclusion. Between one and two hundred

167   responses were received for each breed: Labrador Retriever (LR, n = 156), Cocker Spaniel (CS,

168   n = 199), English Springer Spaniel (ESS, n = 200), French Bulldog (FB, n = 143), Pug (P, n =

169   127), German Shepherd Dog (GSD, n = 115), Golden Retriever (GR, n = 110), Border Terrier

170   (BT, n = 146), Bulldog (B, n = 114) and Miniature Schnauzer (MS, n = 117). Based on breed

171   (FB, B, P), around one quarter (N = 384/1427; 26.9%) of dogs in the sample were classed as

172   BC with the remainder being non-BC.

173

174 *Canine demographics*

175

176 Over half of all dogs were male (56.9%) and the most common age was 2-4 years (38.3%)

177 followed by 1 year or less (26.7%). There was no association between sex of the dog and skull

178 shape ($P = 0.972$; P-adjusted = 0.972); however, there was an association between the age of

179 the dog and skull shape, with BC dogs younger than non-BC dogs e.g. 33.1% of BCs were 1

180 year or less vs. 24.4% of non-BCs ($X^2 = 38.54$, $P < 0.001$; P-adjusted < 0.001) (Table 1). The

181 majority of dogs were neutered (43.5%) with a further 18.0% planned to be neutered in the

182 future. A higher proportion of BC dogs were entire compared to non-BC dogs (49.8% vs. 34.2%

183 respectively, $X^2 = 41.11$, $P < 0.001$; P-adjusted < 0.001). BC dogs had been owned for a

184 significantly shorter length of time than non-BC dogs (BC median: 21 months; 25th-75th

185 percentile: 10.0 - 33.6 months; non-BC median: 24 months; 25th-75th percentile: 10.0-58.0

186 months; MW=194135.5, $P < 0.001$, P-adjusted < 0.001)

187

188 [Table 1]

189

190 *Respondent demographics*

191

192 The majority of respondents were female (88.5%), with no difference in sex distribution

193 between respondents for BC and non-BC breeds ($P = 0.148$; P-adjusted = 0.187). The most

194 common age group of respondents was 45-54 years (29.1%) followed by 35-44 (24.1%) and

195 25-34 (18.4%). Those with BC dogs were significantly younger than those with non-BC breeds,

196 respondents aged 18-24 comprised 13.3% and 5.2% of the BC and non-BC group respectively,

197 and likewise 25-34 years of age was 27.9% and 15.0% ($X^2 = 93.70$; $P < 0.001$ P-adjusted =

198 0.0027). Of the respondents, 84.3% had attended higher education, with 15.3% attending

199 secondary education, with no difference between BC and non-BC groups ($P = 0.311$; P-

200   adjusted = 0.373). The most common household income bracket was £35,000-£49,999 (21.0%),

201   followed by less than £25,000 (17.0%) and £50,000-£74,999 (16.4%), again with no difference

202   in income between BC and non-BC groups (P = 0.450; P-adjusted = 0.511). The majority of

203   respondents lived in a house (92.0%) vs. only 7.8% in a flat/apartment, with the BC group more

204   likely to live in a flat/apartment (BC = 15.6% vs. non-BC = 5.0%; X^2 = 44.55; $P < 0.001$; P-

205   adjusted = 0.0027). Children did not live in the majority of respondents' homes (71.3%), with

206   BC owners more likely to live with children when compared to the non-BC group (BC = 34.6%

207   vs. Non-BC = 26.6%; X^2 = 8.94; P = 0.003; P-adjusted = 0.0069).

208

209   Over three quarters of respondents (77.3%) had owned a dog before, with 22.6% being first

210   time dog owners. Around half of respondents (51.8%) had not previously owned the breed of

211   dog for which they were answering. After FDR-correction, there was no difference in the

212   proportion of BC vs. non-BC groups that were first time dog owners (BC = 26.0% vs. non-BC

213   = 21.4%; X^2 = 6.29; P = 0.043; P-adjusted = 0.0712); however, respondents in the BC group

214   were more likely to be owning that breed for the first time (BC = 64.8% vs. non-BC = 47.0%;

215   X^2 = 37.05; $P < 0.001$; P-adjusted=0.0027).

216

217   ***Pre-purchase behaviour***

218

219   The majority of respondents stated that they had carried out some pre-purchase research before

220   acquiring their dog (84.3%); however 15.7% (n = 207) admitted that they had carried out no

221   research. Of the respondents who stated they were first time dog owners (n = 398), there was

222   no difference in the proportion carrying out pre-purchase research between the BC and non-

223   BC groups (94.9% vs. 92.0%; P = 0.342, P-adjusted = 0.400). The majority of the sample

224   strongly disagreed that their dog was an 'impulse' purchase (74.3%) and that they should have

225 spent more time considering their purchase (72.5%). Likewise, most reported that they had

226 thought about getting their dog for a long time (56.5%). None of the responses to these

227 questions differed between BC and non-BC groups (Table 2). Most respondents strongly

228 agreed that they had spent an appropriate amount of time considering the purchase of their pet

229 (61.4%), with more respondents strongly agreeing within the BC group as compared to the

230 non-BC group (67.1% vs. 59.3%; $P = 0.004$).

231

232 [Table 2]

233

234 Respondents rated fifteen factors on a scale of 0-4 (from 0= no influence, to 4= heavily

235 influenced) depending upon how much they influenced the purchase/acquisition of their breed

236 of dog. The highest scoring factor in the overall population was 'good companion breed'

237 (median = 4 (2-4); Table 3), followed by 'the size of the breed suited to lifestyle' (3 (3-4)),

238 appearance (3 (3-4)) and 'good dog breed for children' (3 (0-4)). Eleven of the fifteen factors

239 differed in how influential they were in decision-making between BC and non-BC groups

240 (Table 3), for example, appearance was rated as more influential in choosing a BC breed than

241 a non-BC one (and the joint highest most influential factor in acquiring a BC breed) ($P < 0.001$;

242 P-adjusted <0.001), whereas the perception of the breed being 'generally healthy', or 'with a

243 long life expectancy' was less influential for BC breeds compared with those that are non-BC

244 ($P < 0.001$; P-adjusted <0.001). Exercise encouragement ($P < 0.001$; P-adjusted = 0.00) and

245 working ability ($P < 0.001$; P-adjusted <0.001) were comparatively more influential in the

246 choice of non-BC, as opposed to BC, breeds.

247

248 [Table 3]

249

250   Of the eleven purchasing influences that were associated with breed type at the univariate level,

251   nine remained significant in a logistic regression model (Table 4). Higher influence scores for

252   four factors were significantly associated with BC dog ownership ($P < 0.001$): appearance,

253   good dog breed for children, good companion breed, and breed size suited to lifestyle. In

254   contrast, high influence scores for the remaining five factors were associated with non-BC dog

255   ownership: popularity of the breed, childhood experiences, exercise encouragement, generally

256   healthy breed and working ability. For example, every 1 point increase in influence score for

257   the factor 'generally healthy breed' (from 0-4: no influence to heavily influenced) was

258   associated with a 1.6 increased odds of non-BC dog ownership. In contrast, every 1 point

259   increase for the factor 'appearance' was associated with a 0.77 decreased odds of non-BC

260   ownership (Table 4).

261

262   [Table 4]

263

264   ***Purchasing behaviour***

265

266   The median (25th-75th percentile) age (months) at acquisition was 2.25 months (2-3). A minority

267   of dogs (n=24, 1.7%) were acquired while under the legal age of eight weeks. The median cost

268   at purchase was £600 (£400-£900). BC dogs were significantly more expensive to purchase

269   than non-BC dogs (BC median= £1200 (£1000-£1800) vs. non-BC £500 (£350-£700); $U =$

270   15044.5; $P < 0.001$; P-adjusted = 0.0027). The most common source of acquisition was from

271   a KC registered breeder, with 41.6% from KC non-Assured Breeders and 13.5% from KC

272   Assured Breeders (Table 5). There was no significant association between the source of the

273   dog and skull type (X^2= 12.50; $P = 0.052$; P-adjusted = 0.08).

274

275   [Table 5]

276

277   Of the 1065 dogs acquired from a breeder, the most common way of hearing of the breeder

278   was via a puppy selling website (Champdogs, Epupz or Pets4Homes, 27.2%), followed by the

279   Kennel Club website (22.2%) and recommendations from family/friends (18.5%). There was

280   a significant association between where the respondent heard of the breeder and the skull type

281   of the dog they bought, with BC dog buyers more likely to find breeders from puppy websites

282   (BC = 35.7% vs. Non-BC = 23.8%) or selling sites (BC = 5.8% vs. Non-BC = 2.6%) ($X^2 =$

283   57.90; $P < 0.001$; P-adjusted = 0.0027) (Figure 1).

284

285   [Figure 1]

286

287   The majority of owners met the breeder at their home or kennels (97.2%) with a minority

288   meeting at their own home (1.2%) or at a dog show/event (0.6%). A small number of owners

289   did not meet the breeder of their dog (n= 4, 0.4%) and a further 0.6% of owners met the breeder

290   at the following locations: a car park (n=2), an airport (n=2), or at their vet practice (n=2).

291   Following FDR correction, there was no difference in where the owners met the breeder

292   between BC and non-BC dogs (BC = 95.2% vs. non-BC=98.0%; $X^2 =$ 9.69; $P = 0.046$; P-

293   adjusted = 0.0736).

294

295   Half of owners met only the mother of their dog (47.1%), 0.5% met only the father, and 44.3%

296   met both the mother and father. A minority of owners saw neither parent of their dog (n = 72;

297   6.8%). Owners of BC dogs were more likely to see neither parent than non-BC dogs (BC =

298   12.3% vs. non-BC = 4.8%; $X^2 =$ 26.95; $P < 0.001$; P-adjusted = 0.0027). The majority of owners

299   only visited the breeder they purchased their dog from (90.6%), with half of owners visiting

300   that breeder on more than one occasion in addition to the purchasing visit (48.9%), one quarter

301   only once in addition to the purchasing visit (26.4%), and one quarter only visiting to purchase

302   the dog (24.7%). There was no difference between BC and non-BC respondents in whether

303   they visited more than one breeder ($P = 0.671$, P-adjusted $= 0.7002$); however, BC dogs were

304   more likely to be purchased during the first and only visit (BC $= 32.4\%$ vs. non-BC $= 21.7\%$;

305    $X^2 = 12.90$; $P = 0.002$; P-adjusted $= 0.0048$) whilst non-BC dogs were more likely to be

306   purchased after one or more additional visits.

307

308   The majority of respondents did not join a waiting list to buy their dog (88.2%), and less than

309   half of respondents purchased from breeders who had a lifetime returns policy (44.4%). There

310   was no difference between skull type groups for either of these pre-purchase elements (waiting

311   list: $P = 0.123$; P-adjusted $= 0.164$; return policy: $P = 0.573$; P-adjusted $= 0.625$).

312

313   Nearly half (46.1%) of all owners did not ask to see health records for either the sire or

314   dam, although they were available in over half of all dogs purchased (56.4%). Significantly,

315   BC dog purchasers were less likely to ask to see the health records of both parents (Table 6;

316    $P= 0.002$; P-adjusted$= 0.005$) and less likely to have records for available for perusal when

317   they did ask ($P< 0.001$; P-adjusted$= 0.003$) when compared to non-BC purchasers. A large

318   proportion of owners were not sure if the parents of their dog had undergone either genetic

319   (43.3%) or other health tests (63.6%). Respondents for BC breeds were comparatively less

320   likely to know whether their dogs parents had undergone any genetic tests than non-BC

321   respondents ($P = 0.006$; P-adjusted $= 0.012$). Following FDR-correction there was no

322   significant difference between BC and non-BC groups as to whether respondents knew if their

323   dog's parents had undergone any other (non-genetic) health testing ($P = 0.043$; P-adjusted $=$

324   0.0712) (Table 6).

325

326   [Table 6]

327

328   *Post purchase attitudes*

329

330   The majority of respondents would recommend their breed to a friend or family member

331   (96.5%) and reported they would not do anything differently if they could reverse time (84.3%).

332   There were no differences in attitude between BC and non-BC owners for the former ($X^2 = 0.55$;

333    $P = 0.458$, P-adjusted = 0.5133) or, following FDR-correction, the latter (19.5% vs. 14.3%; X^2

334   = 4.60; $P = 0.032$; P-adjusted = 0.0569). For those owners who would behave differently in

335   the pre-purchase phase (n = 224; 15.7%), the most common reason was to change where they

336   acquired their dog (n = 88; 39.1%), followed by level of pre-purchase research (n = 79; 35.2%),

337   the age of their dog when they acquired them (n = 23; 10.1%), the breed of dog they bought (n

338   = 20; 8.9%), and when they acquired their dog (n = 15; 6.7%). There was no difference between

339   BC and non-BC dog owners in these reasons ($X^2 = 2.14$; $P = 0.711$; P-adjusted = 0.7261).

340   Around one tenth of dogs were planned to be bred from in the future (11.6%), which was

341   significantly higher in BC dogs (17.2%) compared to non-BC dogs (9.6%; $X^2 = 22.29$; $P < 0.001$;

342   P-adjusted < 0.001).

343

344   **Discussion**

345

346   Brachycephalic dogs have dramatically increasing in popularity in the UK, and our study has

347   characterised aspects of why and how people acquire these breeds. Identifying factors that

348   impact upon the breed choice of buyers, such as those highlighted in this study, may allow for

349   more targeted educational interventions during the decision-making process; however, these

350   data also suggest that such interventions may not have the desired impact. Despite the recent

351 increase in scientific knowledge of the health consequences of BC conformations (e.g. Packer

352 et al. 2015a/b), several high-profile scientific reports (e.g. Bateson 2010, Rooney and Sargan

353 2010) widespread media coverage, and educational resources for prospective puppy buyers

354 (e.g. UFAW 2016), purchasers of BC dogs appear to still prioritise appearance over both health

355 and longevity. A previous study of veterinary attitudes towards tackling inherited disorders in

356 pedigree dogs found that one of the most common suggestions to decrease disorder prevalence

357 was to educate the public or buyers (Farrow et al. 2014). It appears that improvements in BC

358 dog welfare are unlikely to result solely from the provision of public information or from

359 allowing market forces to dictate desirable features in BC dogs. As such, focusing efforts on

360 both the supply and demand sides of this equation may result in greater improvements in canine

361 health. In this regard, altering the supply of BC dogs in line with health will require

362 fundamental changes to reduce the prevalence of conformation-related disorders. Firstly by

363 altering conformation (which may in part be facilitated by the revision of breed standards by

364 kennel clubs) and, secondly, changing breeding practices (including the development and

365 mandatory implementation of health testing of relevant disorders, and potentially outcrossing

366 to achieve healthier body shapes). If kennel clubs and BC breeders are unwilling to make such

367 changes, and to ensure that BC breeders operating outside of kennel club registration systems

368 are included in any changes, legislation may be the only mechanism to circumvent those

369 purchaser decisions which lie at odds with improvements to BC dog welfare.

370

371 **Who buys a brachycephalic dog and why?**

372

373 Respondents to our survey who owned BC breeds were commonly found to be younger, buying

374 their chosen breed for the first time and had no history of childhood ownership. Although it is

375 unclear as to why this effect occurs, and further research is required, it may reflect increased

376   media influence among younger age groups which, in turn, contributes to the popularity of

377   certain breeds (e.g. their use in advertisement). The media has been identified as a stakeholder

378   with a role to play in improving pedigree dog welfare (Rooney & Sargan, 2010), and

379   moderating the use of BC dogs in the media has been highlighted as a way of mitigating the

380   current high demand for these breeds. In our sample, BC dogs were significantly younger than

381   their non-BC counterparts; recent increases in breed popularity may function to drive down the

382   median age of the BC cohort.

383

384   Owners of BC breeds were more likely to be living with children at the time of the survey. It

385   should be noted that responses only identified if people currently lived with one or more child,

386   not whether they had independent adult children. However, BC owners were also more likely

387   than non-BC owners to consider 'being good with children' as an influential factor in their

388   purchasing decision. Why owners may perceive BC dogs to be good with children requires

389   further exploration; however, factors such as their small size and 'cute' neotenous looks (large,

390   round, wide-set eyes and rounded faces; Lorenz, 1971) may be influential. In addition, owner's

391   expectations of the behaviour of BC breeds are likely to influence perceptions of suitability

392   with children, and indeed, as an 'overall good companion breed', another factor identified here

393   as influencing BC ownership. The breed standards of the three BC breeds explored here suggest

394   that breeders are selecting for an "affectionate nature" in the Bulldog (The Kennel Club, 2016b),

395   a "deeply affectionate" temperament in the French Bulldog (The Kennel Club, 2016c), and an

396   "even-tempered, happy" predisposition in the Pug (The Kennel Club, 2016d). These traits point

397   towards a dog that has a positive and close relationship with their owners and is primarily a

398   companion dog. Indeed, desire for a dog with working ability was negatively associated with

399   BC ownership. This is unsurprising for the Pug and French Bulldog breeds particularly, who

400   have historically been selected for a temperament that suited a 'lap-dog' role (Noller et al,

401   2008). Respondents owning BC breeds were also more likely to live in apartments than their

402   counterparts, reflective of the size of a dog being an important factor in breed choice. Evidence

403   that shorter and smaller breeds have become relatively popular in Australia supports the

404   concept that people attempt to purchase dogs that can fit their lifestyle niche (Teng et al, 2016).

405   Identifying and promoting breeds with fewer health conditions that fit behavioural, lifestyle

406   and trait niches could ensure that owners are aware that a wide variety of dogs can fulfil their

407   needs without the concomitant health implications associated with a particular breed.

408

409   Appearance was considered highly influential in breed selection for BC dogs. Although their

410   conformation may have driven their popularity, breeding for this appearance poses two

411   problems. Firstly, selecting for an extreme brachycephalic appearance runs counter to dog

412   welfare due to its association with conformation-related inherited diseases. Secondly, by

413   prioritising appearance, insufficient selection pressure may be exerted on some traits that would

414   improve animal welfare (McGreevy and Nicholas, 1999). Concerns have been expressed that

415   while it is still common practice to describe "genetically disabled" and "deformed" pets as cute,

416   progress toward functional and healthy animals is likely be difficult (Ott, 1996). Increasing

417   consumer awareness that the appearance of BC breeds is linked with a high risk of welfare-

418   compromising disorders remains a priority of many animal welfare charities. For example, the

419   RSPCA initiated a campaign 'Bred for Looks - Born to Suffer', which sought an end to the

420   breeding of dogs based on looks (RSPCA, 2013). Our data suggests that, despite such actions,

421   the purchasing of BC breeds remains predicated largely on appearance, likely at the expense

422   of health and welfare.

423

424   A desire for a dog that encourages exercise was negatively associated with BC dog ownership.

425   Owners of BC breeds may perceive them to be 'low maintenance' with regards to exercise.

426 However, it is hard to separate reduced exercise requirement from reduced ability to exercise.

427 A large proportion of BC dogs may be unable to engage in normal levels of activity due to the

428 inherent respiratory difficulties (Packer et al 2015, Liu et al 2016). BOAS, a chronic respiratory

429 disorder is prevalent in the three BC breeds explored here, with exercise intolerance one of the

430 key clinical signs of BOAS. This suggests that some companion animal breeds have effectively

431 become 'handicapped' by selection for appearance traits that appeal to our anthropomorphic

432 perceptions (Serpell, 2002). Here it appears that BC dogs may have also become 'handicapped'

433 by humans selecting for (or not strongly selecting against) a disease trait that results in a dog

434 that fits a human lifestyle choice, but is not conducive to good welfare.

435

436 In contrast to BC owners, non-BC dog owners were more highly influenced by a breed being

437 perceived to be 'generally healthy'. This may coincide with their desire for a dog with good

438 working ability that provides exercise encouragement, both of which would may limited in BC

439 breeds. Recent studies indicate that breeds with more inherited disorders have become more

440 (rather than less) popular, suggesting that health considerations have been secondary in the

441 decision to acquire dogs (Ghirlanda et al. 2013). In a systematic review of inherited diseases in

442 the dog, the Pug and Bulldog were affected by more disorders related to their body shape (16

443 each) compared with the seven non-BC breeds studied here (affected by a median of 9 (range:

444 3-15) (Asher et al. 2009). For reform to occur in the health of BC breeds, owners must be aware

445 they are consumers, and their choices affect dogs at a breed health level, as well as individual

446 dog level. If owners are not motivated to buy a healthy individual within a breed, inherent

447 health problems within breeds will be perpetuated, and the motivation of breeders to tackle

448 health problems in their breed lowered. In the absence of such motivations it is important that

449 stakeholders consider direct mechanisms to improve breed health which are not subject to

450 consumer demands.

Purchasing a dog

Respondents that owned BC dogs were less likely to follow recommended processes (e.g. those embedded within the Puppy Information Pack for the BVA AWF & RSPCA Puppy Contract) when purchasing their dog. They were more likely to use puppy-selling websites, less likely to see either parent of their puppy, and less likely to ask for any health records. Despite few owners explicitly admitting to purchasing their dog on impulse, BC dogs were more likely to be purchased during the first and only visit to their breeder. Despite media campaigns such as "Where's Mum" (Pup Aid, 2016) that promote buyers seeing their puppy with its mother (to avoid purchasing from puppy farms), more than 1 in 10 BC owners (12.3%) saw neither of their dog's parents, compared to 1 in 20 non-BC owners (4.8%), thus potentially perpetuating the unethical breeding of these dogs.

The lack of requests to see health records from BC owners may reduce the priority placed on health by BC breeders, by reducing demand for healthy, tested dogs. The development and mandatory implementation of health testing in BC breeds may go some way to improve health, for example functional respiratory tests introduced by the German Pug Club (Deutscher Mopsclub) (Bartels et al. 2015). However, while market forces of supply and demand are not being effectively applied to canine health breed health is unlikely to improve substantially unless breeders are intrinsically motivated to carry out health testing themselves.

Post purchase attitudes

In general the vast majority of the respondents to the survey were content with the breed they had purchased, with relatively few citing any regrets about their dog. Most of those expressing reservations did so in relation to the manner in which they purchased their dog, perhaps reinforcing the need to target prospective owners with pre-purchasing guidelines. It is of value to consider that the current study is only a snapshot of the owners' and their dogs' lives. Post-purchase questions can only be answered relative to the experiences of the respondents so far. With a median age of 20 months, the BC dogs in this population were still relatively young and thus their lifetime conformation-related disease burden may not yet be realised; for example, the mean age at which BC dogs are presented to vets for treatment of BOAS is 3-4 years of age (Monnet 2008). The emotional and financial burden of owning a dog with conformation-related disorders may have an impact upon an owner's perception of the breed, and future longitudinal studies, studies of owners with older BC dogs, or studies of people who have owned BC dogs in the past may provide insights into whether and how their perceptions of BC dogs change as a result of experience.

Our data identified that BC owners were less likely to have neutered their dog, and more likely to be planning to breed from their dog in the future. This is of concern, as increased breeding by younger, first time owners could function to proliferate breed-related issues if they are unaware of the health issues associated with their breed, and how to reduce the risk of them occurring.

As with all self-selected survey samples there are limitations to the data gathered. It is not possible to establish a non-response bias or identify from which forum the majority of respondents accessed the survey. What can be identified is a substantial response bias towards women and those individuals with a higher education. A female response bias to surveys is

500 relatively common (Sax et al. 2003) confounded by the possibility that animal-based interests

501 and occupations may also have greater proportion of women within them. The use of special

502 interest forums may have predisposed the sampling to more educated individuals, although this

503 demographic is generally more likely to respond to surveys (Goyder et al., 2002).

504 Notwithstanding the limitations on the data gathered, and the associated need for some caution

505 in interpreting the results, this research provides novel data in an area of welfare-concern which

506 is otherwise lacking.

507

508 **Animal welfare implications**

509

510 The motivations for the purchasing of dogs and processes by which this is implemented have

511 clear implications for the welfare of current and future generations of dogs. All popular

512 pedigree dog breeds have been found to experience some breed-related health issues and,

513 within this, BC breeds experience some of the most chronic and severe issues. This research

514 improves our understanding of pre-purchase behaviour and motivations for these high-risk

515 breeds, and may allow prospective owners who wish to purchase a BC dog to be counselled

516 more effectively on healthier alternatives, and where that is not possible, to make responsible

517 purchasing choices of BC dogs that drive improvements in breed health rather than

518 perpetuating problems. However, these data may also indicate that breed-related health

519 information alone may not be sufficient to make significant impacts on responsible breed

520 selection, with appearance still prioritised over health and longevity. If education strategies are

521 ineffective at reducing demand for BC breeds in the long-term, other more direct strategies

522 controlling the supply of these breeds may be required to protect canine welfare.

523

524 **Acknowledgements**

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