

1 **An exploration of attitudes towards pedigree dogs and their disorders as expressed by a**  
2 **sample of companion animal veterinarians in New Zealand.**

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4 **Abstract**

5 **Aims:**

6 To explore veterinary perception of pedigree dogs within New Zealand, with particular focus  
7 on inherited disorders and how these affect animal health and welfare.

8 **Methods:**

9 An online questionnaire was distributed to members of the Companion Animal Society (CAS)  
10 of the New Zealand Veterinary Association (NZVA) using an online survey system. Data  
11 were analysed using SPSS predictive analytical software v21.0 for Windows (IBM Inc.,  
12 Chicago IL, USA). Responses which were incomplete or ambiguous were classified as  
13 missing. Results were considered significant if  $p \leq 0.05$ .

14 **Results:**

15 The most commonly identified breeds were Boxer, German Shepherd (GSD), Bulldog, Shar  
16 Pei, West Highland White Terrier (WHWT), and Cavalier King Charles Spaniel (CKCS). The  
17 most commonly identified inherited disorders were Hip dysplasia, Elbow dysplasia, Atopy,  
18 Skin problems, Cardiac disease, and Brachycephalic syndromes. Veterinarians felt little had  
19 changed in the attitudes of breeders and owners of pedigree dogs toward inherited disorders,  
20 and that legislative change was unlikely to decrease the prevalence of inherited disorders in  
21 pedigree dogs. Veterinarians possessed a strong sense of obligation to treat the problems

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22 arising from inherited disorders, and to try to prevent propagation of inherited disorder  
23 through breeding advisement. Veterinarians gave a number of suggestions to decrease the  
24 prevalence of inherited disorders within pedigree dogs.

#### 25 **Conclusion:**

26 Inherited disorders appear to be a significant issue in a number of pedigree breeds in New  
27 Zealand, though the breed-disorder associations identified by veterinarians in New Zealand  
28 occasionally differ from those within the literature. This may reflect a unique New Zealand  
29 context resulting from being a geographically (and genetically) isolated country. Veterinarians  
30 are concerned about inherited disorders in pedigree dogs, seem supportive of measures to  
31 improve the welfare of pedigree dogs, and appear motivated to assist in decreasing the  
32 prevalence of inherited disorders. Uncertainties remain over how veterinarians assess the  
33 importance of inherited disorders, and how this may impact advice given to breeders and  
34 clients. Further exploration of inherited disorders in the specific New Zealand context would  
35 be beneficial.

#### 36 **Clinical Relevance:**

37 The prevalence and perceived importance of inherited disorders will impact how the clinician  
38 advises his/her clients. An understanding of the most common breed-associated inherited  
39 disorders, and how these impact animal health and welfare is critical to provide prudent  
40 guidance to pedigree breeders and dog owners in clinical practice.

41 **Key Words: Animal welfare, Breed standards, Congenital, Dog, Inherited disorder,**  
42 **Pedigree, Veterinary services**

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43 CAS Companion Animal Society, NZVA New Zealand Veterinary Association, GSD  
44 German Shepherd Dog, CKCS Cavalier King Charles Spaniel, WHWT West Highland White  
45 Terrier

## 46 **Introduction**

47 The relationship between humans and dogs is perhaps our most enduring, although opinions  
48 differ as to precisely where and when it occurred (Larson *et al.* 2012; Lopes and Silva 2012;  
49 Wang *et al.* 2013). Since domestication began, selective breeding has been used to alter the  
50 characteristics of dogs to increase their utility (McGreevy and Nicholas 1999; King *et al.*  
51 2012), however, more recently, there has been a shift towards the dog's role as a companion  
52 animal (McCrinkle *et al.* 1999; Hedhammar *et al.* 2011). The switch from utility to  
53 companionship has been accompanied by changes in breeding goals from functional to  
54 aesthetic, culminating in approximately 400 classified dog breeds in the present day  
55 (Streitberger *et al.* 2012). With the progression of pedigree breeding there has been a  
56 concomitant recognition of inherited disorders (Hodgman 1963) many of which continue to  
57 be problematic (Bellumori *et al.* 2013; Lewis *et al.* 2013).

58 Inherited disorders within pedigree dogs are typically described as either being related or  
59 unrelated to breed standards (Collins *et al.* 2010; Leroy 2011). Disorders related to breed  
60 standards are the result of selection for exaggerated characteristics, for example  
61 Brachycephalic Airway Obstruction Syndrome (BAOS) due to the shortened muzzle of  
62 breeds such as Bulldogs (Asher *et al.* 2009) and pugs (Packer *et al.* 2012). Those not, or more  
63 likely indirectly, related to breed standards are inherited genetic conditions, such as von  
64 Willebrand's Disease in breeds such as German Wirehaired Pointers (Gavazza *et al.* 2012)  
65 and Doberman Pinschers (Brooks *et al.* 2001). Similar studies using the top 50 breeds of dog  
66 in the United Kingdom (UK) have found 396 inherited disorders related to breed standards

67 (Asher *et al.* 2009), and a further 300 disorders not related to breed standards (Summers *et al.*  
68 2010). Certain inherited disorders occur more frequently in some breeds than others  
69 (McGreevy and Nicholas 1999; Collins *et al.* 2010), and numerous online databases which  
70 catalogue breeds and the inherited disorders affecting them are freely available (Nicholas *et*  
71 *al.* 2011).

72 The relative importance of inherited disorders is generally considered to be substantial by  
73 veterinarians, breeders and owners alike (Leppanen *et al.* 2000; Buckland *et al.* 2013).  
74 However, studies have shown that pedigree dog owners often overlook health problems on  
75 the assumption that it is 'normal' for that breed (e.g. BAOS Packer *et al.* 2012)). As such,  
76 animals with significant health problems may not receive veterinary attention based on the  
77 assumption the problem is 'normal for the breed'. This presents an issue regarding the  
78 welfare of these animals, as significant health issues may be overlooked. This is in addition to  
79 the ongoing ethical discussion over breeding animals with known heritable disorders which  
80 may negatively affect their welfare (McGreevy and Nicholas 1999; Rooney and Sargan 2010;  
81 Bell 2011; Palmer 2012; Bell 2012).

82 Previous studies have focussed on the attitudes of various stakeholders within the realm of  
83 pedigree dogs, including veterinarians (Leppanen *et al.* 2000; Buckland *et al.* 2013).  
84 However, few have specifically focussed on the attitudes of veterinarians, who arguably,  
85 have one of the most important roles in care and management of, as well as prevention and  
86 reduction of, inherited disorders in pedigree dogs (Hedhammar *et al.* 2011; Keller *et al.* 2011;  
87 Sampson 2011; Leroy 2011).

88 This study has attempted to fill this gap by asking New Zealand veterinarians what they  
89 perceive to be the most common breeds and their presenting problems. It also gauges their  
90 broader opinions on pedigree dogs seen in practice. This information, will provide the first

91 descriptive study of veterinary perception of pedigree dogs within New Zealand, and is  
92 intended to provoke discussion surrounding pedigree dogs, particularly as it pertains to the  
93 role of the veterinarian. This has relevance to the international movement to reduce the  
94 incidence and propagation of inherited disorders in pedigree dogs (Bedford 1994; Wilson and  
95 Wade 2012), but also locally supports the aims of the New Zealand Veterinary Association's  
96 (NZVA) strategic plan to 'facilitate and support companion animal (pedigree dog) wellness'  
97 (Anonymous 2013).

98 It is well documented that veterinary attitudes towards animal welfare change over time  
99 (Edwards and Schneider 2005). Based on previous studies of veterinary attitudes in New  
100 Zealand (Williams *et al.* 2005; Laven *et al.* 2009; Keown *et al.* 2011), we hypothesise  
101 veterinary perception of pedigree dogs will be affected by sex, time since graduation and the  
102 degree of interaction with pedigree dogs.

103

## 104 **Materials and methods**

105

### 106 **Questionnaire**

107 An anonymous online questionnaire was developed in line with previous studies (Waran *et al.*  
108 2010; Keown *et al.* 2011) and distributed via direct email link to members of the Companion  
109 Animal Society (CAS) of the NZVA using the online survey system  
110 ([www.surveymonkey.com](http://www.surveymonkey.com)). CAS membership is voluntary, and as of 2013 all 647 members  
111 of the CAS were qualified veterinarians with of which 44% were male (S Blaikie, pers.  
112 comm.). This research was approved by the Unitec Research Ethics Committee, Auckland,  
113 New Zealand.

114 The questionnaire contained three main sections (see appendix 1). The first section collected  
115 demographics of practitioners including age, sex, year of qualification and whether  
116 qualification occurred in New Zealand. Respondents were also asked whether they were  
117 currently practicing, whether their practice was urban or rural, and whether the practice was  
118 primarily small animals, mixed practice, exotics, referral or emergency. Lastly respondents  
119 were asked about their dog ownership status and whether any dogs owned were pedigree  
120 breeds recognised by the New Zealand Kennel Club (NZKC). The second section collected  
121 information on respondents' clinical experiences with pedigree dogs, their heritable disorders,  
122 screening and advice offered for such disorders, and owner attitudes towards the dogs they  
123 are responsible for. Respondents were also asked whether they considered legislative support  
124 able to assist in decreasing heritable disorders in pedigree dogs. The third section collected  
125 respondents' levels of agreement with a number of statements regarding pedigree dogs and  
126 veterinary care. Responses were collected using a five-point likert scale (Likert 1932), with  
127 available choices ranging from 'absolutely agree' to 'absolutely disagree'. Lastly an open  
128 ended question asked respondents to suggest viable solutions to decrease the rates of  
129 inherited disorders in pedigree dogs.

130

### 131 **Statistical Analyses**

132 Data were analysed using SPSS predictive analytical software v21.0 for Windows (IBM Inc.,  
133 Chicago IL, USA). Responses which were incomplete or ambiguous were classified as  
134 missing. Departures from parity in gender ratio of veterinarians were tested using a one-  
135 sample  $\chi^2$  test. Whether practice type or location were associated with the likelihood of  
136 pedigree dog presentation, and whether perception of inherited disorders was independent of  
137 respondents' sex, time since graduation or owning a NZKC registered breed dog were

138 examined using contingency tables. Whether offering genetic screening was associated with  
139 perception of inherited disorders, and whether advice against purchasing pedigree animals  
140 was independent of respondents' ownership of a NZKC registered breed dog, practice type or  
141 perception of inherited disorders were examined using contingency tables. Whether  
142 perception of inherited disorders was independent of attitudes toward health and welfare and  
143 likelihood of euthanasia, and whether year of graduation was associated with change in  
144 prevalence of inherited disorders or attitudes towards them were also examined using  
145 contingency tables. Results were considered significant if  $p \leq 0.05$ .

## 146 **Results**

147 Of the 647 CAS members, 227 responded (35.1%), basic demographic information is  
148 summarised in table 1. There was a significant sex bias toward female respondents  
149 ( $\chi^2=15.929$ ;  $df=1$ ;  $p<0.001$ ), and toward more recent graduates ( $\chi^2=56.502$ ;  $df=4$ ;  $p<0.001$ ).  
150 The majority of respondents were currently practicing in small animal or mixed practice in  
151 urban or mixed urban/rural areas.

152 The majority of respondents (163/223; 73.1%) owned one or more dogs, and over half of  
153 these (92/163; 56.4%) owned a NZKC recognised breed dog. Most of the respondents  
154 (118/217; 54.4%) believed pedigree dogs were more likely to be presented at clinic, 27/217  
155 (12.4%) were unsure. There was no significant difference in response to this question based  
156 on the respondent's practice type ( $\chi^2=2.040$ ;  $df=4$ ;  $p=0.728$ ) or location ( $\chi^2=5.783$ ;  $df=4$ ;  
157  $p=0.216$ ).

158 The majority of respondents (194/216; 89.8%) believed inherited disorders in dogs were a  
159 major issue at least sometimes. There was no significant difference in response when  
160 considering the respondent's sex ( $\chi^2=0.844$ ;  $df=2$ ;  $p=0.656$ ), year of graduation ( $\chi^2=9.754$ ;

161 df=8; p=0.283) or whether the respondent owned a NZKC recognised breed of dog  
162 ( $\chi^2=2.574$ ; df=2; p=0.276).

163 Most respondents (128/218; 58.7%) reported routinely offering genetic screening at least  
164 sometimes. There were significant differences in this response depending upon whether the  
165 respondent believed inherited disorders in dogs were a major issue ( $\chi^2=15.230$ ; df=4;  
166 p=0.004). The five most common screening tests offered were hip score, elbow score, eye  
167 tests, clotting tests, and genetic screening tests.

168 Respondents identified twenty-eight breeds commonly encountered in practice, and twenty-  
169 nine disorders within these breeds. The five pedigree breeds identified most often and  
170 inherited disorders associated with each breed are given in table 3.

171 Almost half the respondents (100/207; 48.3%) had advised clients against purchasing a  
172 pedigree dog due to common inherited disorders. This was not significantly affected by  
173 respondent KC breed ownership ( $\chi^2=4.576$ ; df=2; p=0.101), practice type ( $\chi^2=3.659$ ; df=4;  
174 p=0.454), or whether respondent believed inherited disorders were a significant problem  
175 ( $\chi^2=3.336$ ; df=4; p=0.503).

176 Respondents identified nineteen breeds they commonly advised against purchasing/owning,  
177 and sixteen disorders within these breeds. The five pedigree breeds identified most often and  
178 inherited disorders associated with each breed are given in table 4.

179 The vast majority of respondents (183/207; 85.6 %) considered the health and welfare of  
180 some breeds to be too compromised to continue breeding at least sometimes. This response  
181 was not significantly different between respondents who believed inherited disorders were a  
182 significant issue and those who did not ( $\chi^2=5.884$ ; df=4; p=0.208). Respondents identified  
183 twenty-one breeds of greatest concern (see table 5).



184 ....The majority of repondents (200/204; 98%) had not ever reported a case of unethical  
185 breeding to the authorities.

186 Of the respondents, 149/204 (73%) stated they had prematurely euthanised a pedigree dog  
187 primarily due to genetic illness, and there was a significant relationship between response to  
188 this question and whether or not respondents thought inherited disorders were a major issue  
189 ( $\chi^2=8.808$ ;  $df=2$ ;  $p=0.012$ ). Despite this.... Respondents identified twenty-one breeds which  
190 commonly result in premature euthanasia and twenty disorders within these breeds. The five  
191 pedigree breeds identified most often and inherited disorders associated with each breed are  
192 given in table 6. Of the respondents, 65/204 (31.9%) had been asked to euthanise pedigree  
193 puppies because they did not meet breed standards.

194 During their time in practice, 132/199 respondents (66.3%) reported seeing no change in  
195 prevalence of inherited conditions, and approximately half of respondents (103/204; 50.5%)  
196 reported seeing positive change in attitudes toward inherited disorders among pedigree dog  
197 owners. Neither perceived change in the prevalance of disorders ( $\chi^2=13.032$ ;  $df=8$ ;  $p=0.111$ )  
198 nor perceived change in attitudes towards these disorders ( $\chi^2=6.759$ ;  $df=8$ ;  $p=0.563$ ) were  
199 significantly affected by respondent's year of graduation. Fewer than half of respondents  
200 (81/207; 39.1%) thought legislative support would help decrease inherited disorders in  
201 pedigree dogs, 89/207 (43%) were unsure.

202 Table 8 shows the levels of respondents' agreement with statements. Overall, respondents  
203 strongly agreed with statements suggesting veterinarians have obligations to treat problems  
204 irrespective of origin, that breeding practices are a major contributing factor in maintenance  
205 of inherited disorders, and that veterinarians have and obligation to advise against breeding  
206 practices which increase prevalance of inherited disorders. Respondents tended to disagree  
207 with statements suggesting veterinary standards of care are influenced by pedigree breed, or

208 that inherited disorders in pedigree breeds comprise a significant source of income.  
209 Respondents strongly disagreed with the statement that breed standards support health and  
210 welfare, and they also tended to disagree with the statement that certain breeds and  
211 responsible persons have been unfairly targeted by media. Respondents generally agreed that  
212 genetic testing should be a requirement for registration of pedigree breed puppies.

213 Twenty-five different suggestions were given by respondents as viable solutions to decrease  
214 prevalence of inherited disorders in pedigree dogs, and these can be found in full in table 9.  
215 The five most common suggestions were: alter breed standards, educate public/buyers,  
216 compulsory genetic testing, better/more cost effective genetic tests, mandatory disclosure of  
217 test results/inherited disorder status.

218

## 219 **Discussion**

220 The Boxer was the breed identified by respondents most commonly for presentation as well  
221 as for euthanasia. Respondents identified atopy as the most likely reason Boxer dogs were  
222 presented in practice, a condition commonly mentioned in the literature associated with  
223 Boxers (Groux 2001; Nicorescu and Crivineanu 2007; Zur *et al.* 2012). Dysplasia was  
224 identified by respondents as the most likely reason Boxer dogs were euthanised, and this  
225 association was also evident in the literature (van Hagen *et al.* 2005; Sturaro *et al.* 2006;  
226 Malm *et al.* 2007). Heart disease was suggested to be over-represented in Boxer dogs  
227 (Bussadori *et al.* 2010; Menegazzo *et al.* 2012; Wess 2012; Caro-Vadillo *et al.* 2013;  
228 Pasawska *et al.* 2013), however respondents in this research associated cardiac disease with  
229 the Boxer breed fifteen times over all three categories (commonly seen, advised against, and  
230 euthanised often) which is moderate association when compared with other disorders.

231 The Bulldog breed was frequently identified by respondents in association with

232 Brachycephalic syndromes, an association echoed in the literature (Burbidge *et al.* 1988;  
233 Asher *et al.* 2009; Bannasch *et al.* 2010). Associations between the Bulldog breed and cardiac  
234 disorders (Buchanan 2001; McConkey 2011), and anasarca (Zoldag *et al.* 2001; Mazzullo *et*  
235 *al.* 2008) are reported, however respondents to this survey associated cardiac disorders with  
236 the Bulldog breed only five times over all categories (seen commonly, advised against  
237 purchasing, and euthanised often). The association between German Shepherd dogs and joint  
238 dysplasia identified by respondents was mirrored within the literature (Konde 1947;  
239 Marschall and Distl 2007; Wigger *et al.* 2008; Stock *et al.* 2011). Respondents identified  
240 cardiac disease as being commonly associated with the Cavalier King Charles Spaniel breed,  
241 however the literature suggests a stronger association with Chiari-like  
242 malformation/Syringomyelia (Mandigers and Rusbridge 2009; Rutherford *et al.* 2012; Shaw  
243 *et al.* 2012; Penderis 2013; Driver *et al.* 2013). Respondents did not identify Chiari-like  
244 malformation or Syringomyelia in this study. Skin problems are commonly noted in the  
245 Cavalier King Charles Spaniel breed (Florant 2001; Barnett 2006; Hartley *et al.* 2012),  
246 although respondents did not often identify this association (three associations over all  
247 categories - seen commonly, advised against purchasing, and euthanised often). The  
248 association between skin problems and West Highland Terriers identified by respondents was  
249 also found within the literature (Tarpataki and Marot 2008; Salzmann *et al.* 2011; Roque *et*  
250 *al.* 2012).

251 Breed-disorder associations identified by respondents which were not mirrored in the  
252 literature may reflect a specific New Zealand context. Several factors may contribute to this  
253 unique context. As a geographically isolated country with strict regulation of animal  
254 importation, it is possible New Zealand may have breed-associated disorders which differ  
255 from those found elsewhere in the world due to the isolated genetic pool. Because of the strict  
256 importation regulations, breeders may be more thorough in screening potential breeding

257 animals for genetic disorders prior to importation, meaning the ‘classic’ disorders may be  
258 selected out of the New Zealand breeding population. New Zealand is a small country, and it  
259 is therefore likely the market for pedigree puppies is limited, which may reduce the incentive  
260 for indiscriminate breeders to produce large numbers of animals (which may be at greater  
261 risk of suffering from inherited disorders). Greater research would need to be undertaken  
262 both nationally and internationally to determine if the breed-associated disorders in New  
263 Zealand parallel those overseas, or if there are unique associations.

264 While many breeds appeared consistently in most categories, the Shar Pei was not in the top  
265 five for either commonly seen breeds, or commonly euthanised breeds, yet it was second on  
266 the list for concern, and breeds advised against. Unfortunately respondents were not asked  
267 why they were concerned about particular breeds, but the reasons given for advising against  
268 purchasing/owning a Shar Pei were skin problems, entropion, aggression, and ear problems.  
269 Similarly the Pug was the third breed of most concern, despite not being within the top five  
270 for any of the other categories. Despite the Boxer being in the top three for commonly seen,  
271 most advised against, and most often euthanised prematurely, it ranked only number six in  
272 the list of breeds of concern. It is not easy to explain this disparity in reporting. It is possible  
273 that there may be a mismatch between what practitioners see, and their perception of the  
274 severity of that issue and its impact upon the dog and/or owner. There is a paucity of case-  
275 based information within the literature regarding breeds of dogs and inherited disorders  
276 commonly seen by veterinarians, although one such study exists, produced in Australia over  
277 forty years ago (Johnston and Cox 1970). A study similar to this which also explores actual  
278 case data to determine prevalence and reported severity of inherited disorders, and which  
279 breeds are most affected would be beneficial.

280 Respondents identified hip dysplasia most frequently as both a disorder commonly seen, and  
281 as a disorder often resulting in premature euthanasia. However, it was only third on the list

282 for reasons why clients are advised against some breeds. Similarly, cardiac disease was  
283 identified in the top three disorders commonly seen, and resulting in premature euthanasia,  
284 but only fourth for advisement against a breed.

285 As with dog breed, it appears that veterinarians rank some disorders as being of greater  
286 concern, despite evidence suggesting they are less severe, and/or less common. It may be of  
287 value to conduct further research to understand how and why veterinarians determine the  
288 relative importance of disorders, and what impact they feel the disorder has on the welfare of  
289 affected animals.

290 The 35% response rate to this survey was slightly better than previous studies of this type  
291 which have ranged between 23-28% (Williams *et al.* 2005; Waran *et al.* 2010; Keown *et al.*  
292 2011). A female bias in respondents, as well as a bias toward recent graduates was also  
293 expected in light of these previous studies. When contrasted with the CAS sex ratio, the  
294 response to this survey seems to exaggerate the existing female bias by a further 12% (from  
295 56% female members of CAS to 63% female respondents to the survey). It should be noted  
296 that a non-response bias may be present due to the low response rate, and results should be  
297 interpreted in light of this. For example, those veterinarians who considered inherited  
298 disorders to be only of minor concern may have been less likely to respond.

299 Practice type and location had no significant effect on respondents' attitudes toward or  
300 observations about pedigree dogs and inherited disorders. It may have been expected that  
301 respondents from a small animal practice in an urban location might see more pedigree dogs  
302 in their caseload, and as such rate the problems associated with them higher due to increased  
303 exposure, however this was not evident in the data. There is little in the literature which  
304 explores the how practice type or location affects caseload, this may be an area for future  
305 research.

306 It was hypothesised that the views of veterinarians that owned a pedigree dog would be  
307 influenced by that ownership, however this effect was not reflected in the data. It would have  
308 been of interest to ask how many of the respondents were also breeders, as other studies have  
309 indicated breeders may view pedigree issues differently from other stakeholders (Bennett and  
310 Perini 2003; Tolle *et al.* 2004; Buckland *et al.* 2013).

311 The causal relationship between whether respondents felt inherited disorders were a large  
312 problem and whether or not they routinely offered screening can not be determined from  
313 these data. It may be that veterinarians who felt inherited disorders were a problem were more  
314 likely to offer screening, but it is equally likely that those who routinely offer screening  
315 identify more animals with disorders, and therefore perceive it to be a larger issue than those  
316 not offering routine screening (and therefore not identifying disorders as often).

317 Although over 90% of respondents thought inherited disorders were a major issue at least  
318 sometimes, less than half of them have advised against purchasing/owning a dog because of  
319 inherited disorders. One possible explanation for this is that veterinarians may not be  
320 consulted prior to acquisition of a pet, and so there is limited scope for advising against  
321 purchasing/owning an inappropriate or undesirable animal. It has been suggested that many  
322 people access pet pre-purchase information from the internet or from breeders, which may  
323 fail to address the issue of inherited disorders (Marder and Duxbury 2008). Although there is  
324 much in the literature about the veterinarian's role in identification and management of  
325 inherited disorders (Sampson 2011; Verhoeven *et al.* 2012), and in genetic counseling (Bell  
326 2010; Hedhammar *et al.* 2011; Bell 2012), there appears to be little which specifically  
327 addresses the prevalence of pre-purchase pet counseling. There is some evidence to suggest  
328 that clients with access to veterinary advice are less likely to have problems with adopted  
329 animals (Kidd *et al.* 1992), although much of this information relates to behaviour problems  
330 rather than health issues. Literature suggests clients have expectations of the veterinarian

331 which extend beyond medical care (Ozen *et al.* 2004; Fernandez-Mehler *et al.* 2013), and  
332 may therefore be quite open to pre-purchase pet counseling.

333 It is worth noting that very few respondents had reported a case of unethical breeding to the  
334 authorities. When considering the level of agreement with statements in section three of the  
335 questionnaire, it seems that most respondents felt somewhat ambivalent about the attitudes of  
336 breeders, and the health of puppies from breeders. It would appear that veterinarians are not  
337 strongly against the actions of pedigree breeders, but nor do they appear to think breeders  
338 have the health and welfare of animals at the forefront of the agenda.

339 Nearly 75% of respondents reported having prematurely euthanised a pedigree dog due to an  
340 inherited disorder, and this was significantly related to respondents' feelings on whether  
341 inherited disorders were a major problem. Again, we cannot infer a cause and effect  
342 relationship. It is possible that veterinarians who have had to euthanise dogs for inherited  
343 disorders frequently are therefore more likely to perceive inherited disorders as a problem, or  
344 it may be that those who perceive inherited disorders as a large problem are more likely to  
345 offer euthanasia as a treatment option. Further research in this area may be warranted.

346 Time since graduation appeared to have no effect on whether respondents perceived a change  
347 in prevalence of, or attitudes towards inherited disorders. It might be expected that  
348 respondents who graduated earlier had been in practice longer, and therefore privy to a longer  
349 period of time in which changes may have occurred. The fact this relationship is not apparent  
350 lends weight to the claims of respondents that there has in fact been little change in  
351 prevalence of inherited disorders. The literature supports the notion that there is a shift in  
352 attitudes toward transparency surrounding inherited disorders in pedigree dogs (Higgins and  
353 Nicholas 2008; Nicholas 2011; Crispin 2011), and an international movement to begin to

354 reduce the prevalence of these disorders (Hedhammar *et al.* 2011; Keller *et al.* 2011; Collins  
355 *et al.* 2011; Leroy and Rognon 2012).

356 Respondents appeared not to believe legislative support had power to decrease the prevalence  
357 of inherited disorders. This is a sentiment echoed within the literature, in which the role of  
358 law and legislation in management of inherited disorders remains cloudy at best (Peyer and  
359 Steiger 1998; Crispin 2011; Boissevain 2012; Nolte 2013). However respondents did suggest  
360 a number of potential mechanisms they considered may be of value in reducing the  
361 prevalence of inherited disorders in pedigree dogs. The most popular suggestion was to  
362 change breed standards, and while this may assist in controlling the disorders which are  
363 related to breed standards, it is unlikely to influence prevalence of disorders which are not  
364 directly related to breed standards. As discussed in Asher *et al.* 2009), it is first necessary to  
365 have a firm understanding of which inherited disorders are likely to be influenced by breed  
366 standards. Further research is required to absolutely determine which disorders are of most  
367 concern in New Zealand, and whether altering breed standards is likely to decrease the  
368 prevalence of these. Education of both buyers and breeders was commonly mentioned by  
369 respondents, though there appears to be little within the literature which discusses how  
370 education can be used to alter the prevalence of inherited disorders. Further research to  
371 develop a deeper understanding of the extent to which inherited disorders are a problem in  
372 New Zealand, and the methods by which these might be controlled would be beneficial  
373 before meaningful and targeted education could be undertaken.

374 It is unlikely that any one strategy will be the 'magic bullet' to end the problems associated  
375 with inherited disorders in pedigree dogs. It remains a complex issue with many stakeholders  
376 with different opinions and different motivations. True progress is only likely to be made  
377 with commitment from all stakeholders and cooperation to achieve a common goal. As  
378 discussed in Hedhammar *et al.* 2011), it is an international problem, and collaboration is



379 required on a global scale if there is to be any meaningful progress in reducing the prevalence  
380 of inherited disorders in pedigree dogs.

381

## 382 **Conclusion**

383 In general it is evident that inherited disorders of pedigree dogs are considered to be of  
384 concern by the veterinarians sampled and that some breeds are considered to be of greater  
385 concern than others. Respondents to this survey also provide a number of mechanisms by  
386 which inherited disorders may be managed and these could form the basis of future  
387 discussions within the profession. It should be noted that this research is primarily formative.  
388 However, it highlights valuable information as to the attitudes of veterinarians regarding  
389 pedigree dogs and inherited disorders. As a common source of information for pedigree dog  
390 owners and breeders, providing a broader understanding of small animal practitioners  
391 opinions is important for supporting future discussion and developments within the  
392 profession. There are some clear differences between those disorders commonly seen and the  
393 degree of concern provided for those disorders. Further exploration of clinical cases would be  
394 of value, allowing wider understanding of this issue in New Zealand, and internationally.

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Table 1. Basic demographic information of respondents to a survey of veterinary attitudes towards pedigree dogs and their disorders

<b>Characteristic</b>	<b>Response</b>	<b>N (%)</b>	<b>Total</b>
<b>Sex</b>	Female	143 (63)	226
<b>Qualified in New Zealand</b>	Yes	174 (77.7)	224
<b>Year of graduation</b>	1963-1972	4 (1.8)	227
	1973-1982	49 (21.6)	
	1983-1992	73 (32.2)	
	1993-2002	54 (23.8)	
	2003-2012	47 (20.7)	
<b>Currently practicing</b>	Yes	224 (99.1)	
<b>Practice type</b>	Small animal	128 (57.9)	226
	Mixed	82 (37.1)	
	Exotic, emergency, referral	11 (5)	
<b>Practice location</b>	Urban	108 (48.4)	221
	Rural	27 (21.1)	
	Mixed	88 (39.5)	
<b>Own one or more dogs</b>	Yes	163 (73.1)	223
<b>Own a New Zealand Kennel Club recognised breed dog</b>	Yes	92 (56.4)	163

Table 2. Screening tests for heritable disorders offered by respondents to a survey of veterinary attitudes towards pedigree dogs and their disorders. Responses were open-ended and voluntary allowing a maximum of three responses per practitioner. In total 247 responses were received across 227 valid questionnaires.

<b>Tests administered</b>	<b>Number of respondents offering test</b>
Hip score	73
Elbow score	57
Eye test (entropion, shirmer, PRA, collie eye)	41
Clotting test (vWF, BMBT)	13
DNA test	11
Joint test (patella, ortolani, arthritis)	9
Cardiac screening	8
Radiography (x-ray, ultrasound)	7
Hormone test (ACTH, thyroid)	3
Blood test	3
Skin test	2
Other <sup>a</sup>	15

**Table 3. Pedigree dog breeds commonly presented in practice and the three disorders most often associated with each breed, as identified by respondents to a survey. Respondents were able to nominate up to three breeds, and one disorder per breed. CHECK Disorders with fewer than five identifications were not included.**

<b>Breed (#)</b>	<b>Disorder 1 (#)</b>	<b>Disorder 2 (#)</b>	<b>Disorder 3 (#)</b>
Boxer (125)	Hip dysplasia (58)	Elbow dysplasia (24)	Cardiac disease (6)
Bulldog (70)	Brachcephalic syndromes (30)	Hip dysplasia (5)	Skin (5)
GSD (50)	Hip dysplasia (15)	Elbow dysplasia (7)	Skin (5)
CKCS (41)	Cardiac disease (19)	Brachycephalic syndromes (6)	
WHWT (27)	Skin (8)	Atopy (6)	

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**Table 4. Pedigree dog breeds clients are advised against purchasing and the three disorders most often associated with each breed, as identified by respondents to a survey. Respondents were able to nominate up to three breeds, and one disorder per breed. CHECK Disorders with fewer than five identifications were not included.**

<b>Breed (#)</b>	<b>Disorder 1 (#)</b>	<b>Disorder 2 (#)</b>	<b>Disorder 3 (#)</b>
Bulldog (73)	Brachycephalic syndromes (36)	Whelping issues (6)	Skin (5)
Sharpei (52)	Skin (18)	Entropion (12)	Aggression (9)
Boxer (32)	Hip dysplasia (8)	Neoplasia (6)	Cardiac disease (5)
WHWT (29)	Skin (16)		
GSD (24)	Hip dysplasia (14)		

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**Table 5. Breeds of concern as identified by respondents to a survey of veterinary attitudes towards pedigree dogs and their disorders**

Breed of most concern	Number of identifications
Bulldog	148
Shar Pei	46
Pug	38
German Shepherd	24
French Bulldog	17
Boxer	16
Neapolitan Mastiff	14
Cavalier King Charles Spaniel	11
Shih Tzu	11
Chihuahua	8
Dachshund	8
Newfoundland	7
West Highland Terrier	6
Other <sup>a</sup>	13

<sup>a</sup>Cocker Spaniel, Basset Hound, Griffon, Bull Terrier, Doberman, Rottweiler, Japanese Spitz, Yorkshire Terrier

**Table 6. Pedigree dog breeds most often euthanised and the three disorders most often associated with euthanasia of each breed, as identified by respondents to a survey. Respondents were able to nominate up to three breeds, and one disorder per breed. CHECK Disorders with fewer than five identifications were not included.**

Breed (#)	Disorder 1 (#)	Disorder 2 (#)	Disorder 3 (#)
Boxer (64)	Hip dysplasia (23)	Elbow dysplasia (11)	Arthritis (6)
GSD (34)	Hip dysplasia (23)	Vertebral disorders (5)	
Bulldog (30)	Brachycephalic syndromes (17)		
CKCS (15)	Cardiac disease (14)		
Rottweiler (15)	Hip dysplasia (5)		

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**Table 7. Level of agreement felt by respondents considering statements**

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<b>Statement</b>	<b>Disagree</b>	<b>%</b>	<b>Neutral</b>	<b>%</b>	<b>Agree</b>	<b>%</b>	<b>Total</b>
Breed standards support the health and welfare of dogs.	165	80.5	31	15.1	9	4.4	<del>410</del> 205
Vets are more thorough when presented with pedigree dogs for annual check-ups.	120	58.5	50	24.4	33	16.1	<del>411</del> 205
Vets have an obligation to treat animals irrespective of the origins of the problem.	3	1.5	6	2.9	196	95.6	<del>412</del> 205
Certain dogs breeds and the persons responsible for them have been unfairly targeted in the media.	88	43.1	73	35.8	43	21.1	<del>413</del> 204
Adverse health and welfare disorders only affect a small percentage of pedigree dogs.	82	40.0	49	23.9	74	36.1	<del>414</del> 205
Vets have an obligation to advise against breeding that may cause and increase in inherited disorders.	3	1.5	3	1.5	198	97.1	<del>415</del> 204
A significant proportion of veterinary income comes from the treatment of inherited disorders in pedigree dogs.	99	48.3	57	27.8	49	23.9	<del>416</del> 205
Breeders of pedigree dogs are greatly concerned with the health and welfare of their dogs.	61	29.9	81	39.7	62	30.4	<del>418</del> 205
Breeding practices are a major contributing factor to the maintenance of inherited disorders.	11	53.7	23	11.2	171	83.4	<del>419</del> 205
Puppies from registered breeders are generally in good health.	20	9.9	70	34.5	113	55.7	<del>420</del> 205
Genetic testing for heritable disorders should be a requirement of registration for pedigree puppies.	18	8.9	34	16.6	153	74.6	<del>421</del> 205

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**Table 8. Respondent suggestions to decrease prevalence of inherited disorders in pedigree dogs**

<b>Suggestion</b>	<b>Number of times suggested</b>
Alter breed standards	43
Education – public/buyer	28
Compulsory genetic testing	26
Better/cost effective genetic tests	23
Mandatory disclosure of affected animals	23
Prevent registration of affected/unknown animals	21
Regulation of breeders	20
Education – breeder	20
Change selection goals	19
Breed certified unaffected animals only	18
Sterilise affected individuals	16
Public database	12
Compulsory veterinary checks of sire/dam prior to breeding	12
Compulsory veterinary checks of puppies	10
Legislative change	8
Ban worst affected breeds	9
Fines for non-compliance/rewards for compliance	6
Restrictions on/standardisation of show judging	5
Other (Allow more international genetic exchange, Collaboration between stakeholders, Central governing body, Regulation of sales, Anonymous report to independent body, Further research, Show winners can only be certified unaffected animals)	22

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