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Owner and Animal Factors Predict the Incidence of, and Owner Reaction Towards, Problem Behaviors in Companion Dogs

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1 **OWNER AND ANIMAL FACTORS PREDICT THE INCIDENCE OF, AND OWNER**
2 **REACTION TOWARDS, PROBLEM BEHAVIORS IN COMPANION DOGS**

3
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35 **Abstract**

36

37 Unwelcome behaviors in pet dogs may have serious implications for the quality of life of both the
38 animals and their owners. We investigated owners' perceptions about their dogs' behavioral issues
39 as well as other factors that might be predictive of potential canine problem behaviors. We
40 distinguished between "undesirable behaviors" (behaviors that were unpleasant to the owners) and
41 "problematic behaviors" (behaviors that the owners found difficult to overcome).

42 We designed an on-line survey eliciting information about owners, their dogs, their relationship
43 with their dogs and whether the animals exhibited any of 15 potentially problematic behaviors. The
44 largest proportion of respondents (65%) reported that their dogs exhibited undesirable, but not
45 problematic, behaviors and were not interested in their modification. Only 32% of the respondents
46 considered the behavior to be both undesirable and problematic and wished to change it. The
47 owners' perception of a problem was associated with reports of fear- and anxiety-related behaviors.
48 The owner's gender, marital status and attitude towards the dog as his/her child as well as the dog's
49 age, size, age at acquisition and breed emerged as robust predictors. Compared to all other
50 behavioral categories, reported aggressive canine behaviors were three times more likely to elicit an
51 owner's wish to address them. This study revealed that the behaviors of dogs may be perceived
52 differently by their owners and the type of perception may influence the owner's actual willingness
53 to change those behaviors. Moreover, we identified the most robust set of factors that, either
54 individually or combined, would help predict a dog's potential problem behaviors and an owner's
55 attitude towards them, which will be useful in improving rational prevention and treatment
56 strategies.

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59 **Keywords:** behavior; dog; owner

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69 **Introduction**

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71 The occurrence of problem behaviors is common in dogs (Clark and Boyer, 1993; Hiby et al., 2004)
72 and can be associated with a dog's distress or be the cause of an owner's discomfort (Beerda et al.,
73 1997; Casey, 2002), possibly determining the failure of the human-dog bond (Salman and others,
74 1998; Overall, 2013). Scientists have different criteria by which they categorize problem behaviors
75 as "abnormal". Beaver (1994) defines "abnormal behavior" as "any behavior that varies from the
76 norm expected for a species". Overall (1997) differentiates between "appropriate" and
77 "inappropriate" behavior, whereas Pageat (1998) recognizes the aspect of "pathology" and
78 considers a behavior either as "physiological" or "pathological". According to Mills (2003), it is
79 worth distinguishing between maladaptive and dysfunctional behaviors. Maladaptive behaviors are
80 defined as attempts to behave in an adaptive way in an environment to which complete adaptation
81 may not be possible. Dysfunctional behaviors are defined as expressions of direct disruption of the
82 nervous system, e.g. age related decline in function. However, the majority of problem behaviors
83 originate in the normal processes regulating the species-typical behavior of the individual, with the
84 problem being not the animal's behavior per se but rather the problem that it poses for its owner
85 (Askew, 2003). A behavior may be "normal" in the dog population (Overall, 1997) and "adaptive"
86 for the individual, but the owner may consider it "abnormal" because it is not acceptable for the
87 environmental context in which it occurs (Bräm Dubè et al., 2008). Unfortunately, a large
88 proportion of dogs are given to rescue organizations because they have displayed behaviors
89 perceived by their owners as problematic (Blackwell et al., 2003). It therefore becomes imperative
90 to learn more about how owners perceive their dog's behavior and to explore the potential benefits
91 of addressing these perceptions to promote successful dog-owner relationships.

92 Previous studies have indicated how a variety of canine intrinsic factors, such as the breed, age, sex,
93 reproductive status, diet, source and age of acquisition (Wells and Hepper, 2000; Pierantoni et al.,
94 2011), may influence a dog's likelihood of displaying a problem behavior. Other studies have
95 focused on the impact of some owner behaviors and personal traits on the quality of the owner's
96 relationship with the pet, providing controversial evidence of their associations with a dog's
97 behavior. For example, Jagoe and Serpell (1996) indicate that obedience training, timing of meals,
98 sleeping arrangements and previous experience with dogs are significantly related to the incidence
99 of certain behaviors. Bennet and Rohlf (2007) also show an association between training and fewer
100 behavioral problems. However, other studies found no relationship between formal dog training and
101 behavior problems or even indicated that an owner's anthropomorphic attitudes and spoiling

102 activities (i.e., letting the dog sleep on the owner's bed and feeding it from the table) do not
103 contribute to the occurrence of behavioral problems (Takeuchi et al., 2001; Blackwell et al., 2008).
104 In 1993, Peachey reported an owner's lack of knowledge about or experience with dogs to be a
105 contributing factor in the aetiology of behavior problems, whereas Borchelt and Voith (1986) found
106 the opposite results. Surprisingly there is limited evidence about the links between a dog's behavior
107 and an owner's characteristics other than the owner's personality and behaviour as well as
108 demographic variables. Demographics refer to lasting individual characteristics that are stable over
109 time (Belk, 1975) and could thus be better predictors than behavioral variables, which are more
110 hypothetical and situation specific. The number and composition of family members and the type of
111 housing may affect canine behaviors such as aggression and disobedience (Kobelt et al., 2003;
112 Bennett and Rohlf, 2007). Kubinyi et al. (2009) showed that an owner's gender, age, education,
113 previous experience with dogs and purpose of keeping the dog had detectable effects on a dog's
114 behavior. We agree with these authors (Kubinyi et al., 2009) that analysing these variables in
115 samples of dog owners might reveal yet uncovered associations.

116 The purpose of this study was to explore owners' perception of their dogs' behaviors, separating
117 "problematic" from "undesirable" behaviors, and to investigate whether and how these perceptions
118 were correlated with the way the owner addressed the behavior. With "undesirable behaviors" we
119 meant behaviors that the owners found unpleasant or annoying, whereas with "problematic
120 behaviors" we meant behaviors that posed a problem, in that the owners found them difficult
121 to overcome or solve. We also examined whether owners' perceptions, together with other selected
122 owner and dog demographic, cognitive and behavioral variables, were significantly associated with
123 a dog's potentially problematic behavior.

124

125 **Materials and methods**

126

127 *Participants*

128

129 Participants were recruited via the Internet. The questionnaire was posted online and published in
130 the media (pet magazines and websites). We collected reports by owners on 371 dogs, and none of
131 the dogs was younger than one year of age at the time of the survey. Moreover, to obtain results
132 consistent with those of our previous study (Pierantoni et al., 2011), none of the recruited dogs was
133 older than two months at acquisition or had experienced the additional effects of a shelter
134 environment or life as a stray. Owners over 18 years of age who were directly involved in the pet's
135 care were asked to complete the questionnaire.

136 *Questionnaire*

137

138 *Section 1 - owner factors*

139 Information about the participant's demographics, such as gender, age, municipality of residence,
140 region of residence, marital status, household, presence of children, education, presence of a house
141 yard and past dogs, was collected. By analysing the participants' responses, we derived an
142 adjunctive factor, namely the living area (urban, rural). For that purpose, we defined the
143 municipality of residence for each participant as rural or urban according to a modified version of
144 the Commission Decision 2001/752/EC.

145

146 *Section 2 - dog factors*

147 We collected demographic variables for the dogs: age, sex, age at acquisition, sexual status, breed,
148 size and source.

149

150 *Section 3 – owner/dog factors*

151 This section contained single-choice questions related to the relationship between the owners and
152 their dog.

153

154 *Section 4 - dog's behavior*

155 This section was divided into two parts. In Part 1, the owners were asked generic questions
156 regarding how they perceived their dogs' behavior and how they dealt with unwanted behaviors. In
157 Part 2, the owners had to indicate whether their dogs exhibited any of 15 common types of
158 potentially problematic behaviors (Table 1). The response option for these listed behaviors was yes
159 or no. A brief explanation describing the types of behavioral signs involved in each behavior based
160 on a literature review (Overall, 2005; Pierantoni et al., 2011) was provided.

161

162 **Statistical analysis**

163 Statistical analyses were performed using IBM SPSS Statistics for Windows, version 21.0
164 (Armonk, NY: IBM Corp). Pearson's χ^2 goodness-of-fit test was employed to analyse the
165 participants' responses to questions in Section 4 – Part 1 of the survey as well as the prevalence of
166 owner-reported potentially problematic behaviors. Backward stepwise logistic regression analyses
167 were performed to identify factors that actually influenced presence of the behaviors. Initially, all
168 owner, dog and owner-dog variables were entered into the model, with the least significant
169 variables removed one at a time until only significant variables associated with values of $P < 0.05$

170 remained. The significance of each predictor was assessed using likelihood-ratio tests, and the odds
171 ratio was calculated to evaluate the strength of such a relationship. The Hosmer-Lemeshow test was
172 used to assess the goodness of fit of the logistic regression models. If needed, Pearson's χ^2 test of
173 independence was applied in 2x2 contingency tables to investigate the sample of dogs in an attempt
174 to find critical cues that might help interpret the results of the logistic regressions. Fisher's exact
175 test was performed when the expected frequency of the observations was lower than five. A two-
176 sided $P < 0.05$ was considered statistically significant.

177

178 **Results**

179

180 *Section 1 – owner factors*

181 The majority of respondents were female (78%) and between 18 and 30 years of age (52%). They
182 were drawn from all over Italy, though the majority were from the northern regions (74%) and lived
183 in urban settings (90%). Most of the owners were single (59%) and resided in a childless (83%),
184 multiple-person household (85%). More than half of the respondents (63%) had a high school
185 diploma, whereas 29% had a university degree, 28% had attended secondary school, and 4% had
186 only attended primary school. More than half of the respondents (55%) lived in houses with lawns,
187 and the majority had previously owned a dog (70%).

188

189 *Section 2 – dog factors*

190 The sample of dogs was balanced for sex, though significantly more females than males were
191 neutered (56% vs 17%, neutered females vs neutered males). The majority of dogs (47%) were
192 young (one-four years old), of large size (40%) and purebred (74%). More dogs were adopted at the
193 age of two months (89%) than earlier and came from a friend/relative (56%) rather than a breeder
194 (39%) or pet shop (6%).

195

196 *Section 3 – owner/dog factors*

197 The majority of owners were self-taught trainers of their own dog (Table 2). The most common
198 reason for dog acquisition was “to repeat the experience”. Most of the respondents perceived their
199 animal as a member of the family, particularly as a child (62%). Most of the owners believed that
200 their dogs considered them to be pack members, particularly the pack leader (68%). The vast
201 majority of owners walked the dog three-four times per day (46%), compared to those who reported
202 to walk the dog once (14%), twice (13.5%), more than four times per day (10.8%) or never (15%).
203 A greater proportion of respondents answered “to cooperate with the owner” as the dog's natural

204 attitude, compared with respondents who answered “to obey the owner”, to “act freely” and “to be
205 scared of the owner”. Approximately half of the sample had participated in professional training
206 courses with their dog, reporting positive results. Excessive cost and a lack of time were the most
207 common reasons for not attending training courses.

208

209 **Section 4 – dog’s behavior**

210

211 *Section 4 - Part 1*

212 As reported in Table 3, the owners were found to perceive the behavior of their dogs differently
213 ($\chi^2=210.442$, $P < 0.0005$). A χ^2 goodness-of-fit test showed that the attitudes of owners regarding
214 attempting to change their dog’s behavior differed significantly depending on how they perceived it
215 ($\chi^2=95.372$, $P < 0.0005$). Significant differences were found regarding the reactions of owners
216 towards undesirable behaviors of their dogs ($\chi^2=291.793$, $P < 0.0005$), as well as in the type of
217 punishment inflicted ($\chi^2=239.734$, $P < 0.0005$).

218

219 *Section 4 - Part 2*

220 Attention-seeking and dog aggression were the most frequently reported behaviors, occurring in
221 74% and 61% of the dogs, respectively ($P < 0.05$, Fig. 1). The results from the logistic regression
222 analyses are presented in Table 4. As indicated by the Hosmer-Lemeshow tests, the overall fit of the
223 models was good. For all of the listed behaviors, owner-reported prevalence showed a significant
224 relationship with one or more factors under study. In brief, the owner’s perception of a dog’s
225 problematic behaviors was significantly associated with dog aggression, food possessiveness,
226 fearfulness on walks, excessive barking, aversion to strangers, stranger aggression, toy
227 possessiveness, house soiling, owner aggression, attention-seeking and noise reactivity ($P < 0.05$).
228 An owner’s wish to change his/her dog’s showed a strong relationship with both owner and dog
229 aggression ($P < 0.05$). A small dog size was the only significant predictor for excessive barking,
230 whereas a young dog age was the only significant predictor for pica and fearfulness on walks. Pure
231 breed was significantly associated with toy possessiveness, and small-breed senior dogs had a
232 significantly high probability of body licking. A dog’s young age, medium/large size and mixed
233 breed were all significant predictors for destructiveness. Noise reactivity had an elevated probability
234 in adult/senior mixed-breed dogs of medium/large size that were owned by women ($P < 0.05$).
235 Small/medium dogs owned by men and divorced individuals were significantly more likely to
236 exhibit house soiling. Attention-seeking had high odds of eliciting complaints from divorced
237 owners who considered the dog a child. Both an owner considering the dog to be a child and a dog’s

238 young age were positively associated with the reported exhibition of tail chasing. Dogs adopted by
239 male owners before they were two months of age had an elevated probability of exhibiting owner
240 aggression ($P < 0.05$).

241 Pearson's χ^2 test in 2x2 contingency tables revealed significant differences in the acquisition
242 process of dogs of different sizes: an association between the size of the dogs and both age
243 ($\chi^2=6.674$, $P < 0.05$) and source ($\chi^2=28.802$, $P < 0.05$) of acquisition was found. Significantly more
244 divorced participants did not have a lawn (66.7% vs 33.3% with a house yard, $\chi^2=6.079$, $P<0.05$).
245 Moreover, a significant majority of them had neutered female dogs (58.3% vs 12.5% entire females,
246 25% entire males and 4.2% castrated males, Fisher's exact test=14.214, $P < 0.05$) and were
247 childless (92% vs 8% owners with children, Fisher's exact test=16.147, $P < 0.05$).

248

249 Discussion

250

251 In the present study, the owners fell into three main categories depending on how they perceived
252 their dog's behaviors: 1) owners indicating that their dogs engaged in behaviors that they
253 considered neither problematic nor undesirable (3%), 2) owners reporting that their dogs displayed
254 undesirable but not problematic behaviors (65%) and 3) owners reporting that their dogs exhibited
255 single or multiple behaviors that they considered undesirable and problematic (32%). An owner's
256 attitude towards his/her dog's behavior appeared to be guided by whether he/she considered the
257 behavior a problem. In fact, 80% of the owners who believed the dog might have a problem sought
258 behavioral modification *versus* 37% of the owners in the second category. None of the owners in
259 the first category expressed interest in modifying their dog's behavior.

260 The dog behaviors most likely to be perceived as problematic to their owners included those
261 potentially related to fear and anxiety. Among these, owner-directed and dog-directed aggression
262 were predicted by the owners' clear wish to obtain behavioral adjustment, which might indicate that
263 they were perceived as particularly serious. Excessive barking, fearfulness on walks and aversion to
264 strangers were the behaviors with the highest probability of being perceived as problematic. The
265 positive relationship that we found between excessive barking and the small size of dogs provided
266 new information, as excessive barking was previously reported to be significantly predicted by only
267 the "training engagement" and "age at acquisition" variables (Bennet and Rohlf, 2007; Pierantoni et
268 al., 2011). This association appeared to be mediated by a combination of a dog's inadequate
269 socialization and less care in selecting the dog. In fact, these dogs were purchased mainly from pet
270 shops before the age of two months and, in accord with our previous study (Pierantoni et al., 2011)
271 and with that of Appleby et al. (2002), early separation from the litter may interfere with

272 socialization and foster the development of fearful behavior. Although difficult to confirm, this
273 could also be considered a potential cause of the reported aversion to strangers. Dogs exhibiting this
274 behavior were almost three times more likely to be of mixed breed rather than purebred. We
275 hypothesize that the (uncertain) individual genetic backgrounds and behavioral history of these
276 mixed breed dogs may have increased the likelihood of the emergence of this specific fear. Fearful
277 behaviors during walks were three times more likely to be displayed by the youngest dogs. As
278 situational fear and anxieties are common in young dogs as they learn about their new environment
279 (Beaver, 2009), it might be that these pets had not yet become completely habituated to the stimuli
280 on the street.

281 Reactivity to noises and attention-seeking were also perceived as problematic, though to a lesser
282 extent as the aforementioned behaviors. Apparently, this finding contrasts with the high prevalence
283 of these behaviors because they were, respectively, the first and the third most frequent complaints.
284 However, this is not unexpected, given that these behaviors are known to be common incidental
285 findings on routine behavioral consultations that owners tend to ignore or downplay (Blackwell et
286 al., 2008). In our study, as the age of the dog increased, so did the probability of exhibiting
287 reactivity to noises. The higher prevalence of reactivity to noises in older dogs could possibly be
288 explained by the natural development of fearful behaviors over time through the processes of
289 sensitization and generalization (Overall, 1997).

290 Gender differences in owner report of problematic behaviors may depend on differences in the
291 relationships between companion animals and male or female owners. Because women tend to be
292 particularly empathic, more so than men (Prato-Previde et al., 2006), female owners are more likely
293 to be affected by dogs that are perceived to be fearful. The perception of helplessness leads female
294 owners to show encouraging behaviors (Ben-Michael, 2005) that reinforce fearful-related behaviors
295 such as those linked to reactivity to noises (Levine, 2009). As for both men and women with
296 children, male owners are more inclined than females to become irritated and angry (Ben-Michael,
297 2005). Moreover, gender differences in housework still persist (Gwozdz and Sousa-Poza, 2010),
298 and cleaning is traditionally a female chore (Evertsson, 2006) that men are reluctant to perform.
299 These psychosociological issues might be potential reasons underlying the complaints about a dog's
300 house soiling from men. In addition, dogs may be sensitive to the owner's sex, experiencing
301 feelings of anxiety and/or fear depending on the person's gender. This could, at least partially,
302 explain the positive association that we found between male owners and owner aggression.
303 Hennessy et al. (1998) found that dogs being petted by a woman had a lower plasma cortisol
304 concentration and showed more relaxed behavior than did dogs petted by a man. Wells and Hepper
305 (1999) reported more behaviors that were suggestive of defensive-aggressive reactions towards

306 men than women in shelter dogs. Apart from the gender difference, in our study, house soiling was
307 more likely to elicit complaints from divorced owners. Divorced men and women are reported to be
308 less involved in any physical activities, including walking (Sobal and Hanson, 2010; Trost et al.,
309 2003). Furthermore, it has been reported that a great proportion of owners do not consider their dog
310 a reason to walk (Cutt et al., 2008). Thus, we could hypothesize that our sample of divorced owners,
311 most of whom did not have a house yard, might spend an insufficient amount of time walking their
312 dogs, bringing them back into the house too soon before they have finished eliminating. Another
313 possibility that must be considered is an owner's confusion of house-soiling behavior with urinary
314 incontinence, which is a very common medical disorder in spayed female dogs (de Bleser et al.,
315 2011). Consistently, in our study, significantly more respondents who reported house soiling were
316 owners of neutered females. Of course, elimination in the house can also be a sign of separation
317 anxiety if it occurs in the owner's absence (Flannigan and Dodman, 2001).

318 Divorced owners were significantly more likely to indicate that a dog was attention-seeking, which
319 was also predicted by the owners' perception of the dog as a child. Unsurprisingly, the vast majority
320 of these owners were childless. People living without children are more devoted to their dogs
321 (Marinelli et al., 2007) and may be substantially more attached to their pet. It is therefore plausible
322 that these owners are prone to repeatedly reinforcing and encouraging attention-seeking behaviors
323 in their dogs.

324 Pica, tail chasing, body licking and destructiveness were unlikely to be perceived as problematic
325 behaviors, perhaps supporting the notion that sometimes the "problem" depends on the problem that
326 the behavior poses for the owner (Askew, 2003). Nevertheless, owners might have considered these
327 as normal or, some way, acceptable behaviors. Supporting this view, we determined young dogs to
328 be at a higher risk of showing tail chasing, destructiveness and pica, which could be normal
329 developmental behaviors or could be associated with environmental stimulation and management
330 (Pierantoni et al., 2011). At the same time, repetitive body licking was more prevalent among older
331 dogs and could be attributable to age-related cognitive dysfunction syndrome (CDS) (Blackwell et
332 al., 2008). It is known that many owners do not even report signs of CDS, unless veterinarians are
333 proactive in asking about them, perhaps because they think they are insignificant (Landsberg and
334 Denenberg, 2014).

335 As observed from the above-mentioned results and discussion, except for the owner's perception
336 and view of the dog, only demographics emerged as significant predictors. This finding emphasizes
337 the central role played by these types of variables in the study of animal behavior problems.

338 There are some limitations to our study. First, the findings should be interpreted with caution
339 because owners were required to interpret their dog's behavior patterns, inevitably resulting in a

340 degree of subjectivity. In addition, it is possible that the respondents' answers were influenced by
341 both popular stereotypes and/or perceptions of which answers would be deemed acceptable, even
342 though the questionnaire was anonymous. Second, the present sample is a population of Italian-
343 speaking dog owners, and external validity of the present questionnaire should be investigated to
344 verify whether it at least resembles dog owners in other countries with similar socioeconomic
345 status. Third, this paper expands on the authors' previous research (Pierantoni and others 2011) that
346 focused on the separation of a puppy from the litter early during the socialization period as a
347 potential ontogenetic cause of problematic behaviors as an adult. Thus, we recruited the sample of
348 dogs in the present study according to the same criteria (no shelter animals, dog's age at acquisition
349 not beyond 60 days old), despite the potential of this to give rise to additional bias. However, to
350 remedy these potential confounding variables, we are conducting on-going research on a sample of
351 dogs of all other ages, including those from shelters or strays.

352

353 *Conclusions*

354 In conclusion, improving the welfare of both owners and dogs requires the identification of factors
355 that have an impact on the dog-owner relationship (Meyer and Forkman, 2014). Here, we identify
356 variables that could be used to predict behavior problems in dogs and to predict which owners are
357 more likely to be sensitive to a dog's behaviors as well as what types of animals are best suited for
358 specific individuals. Canine behavioral evaluations should be focused on the owner-dog dyad and
359 should include the owner's perceptions of the dog, aspects that are fundamental to the successful
360 outcome of the case, as they might affect the owner's compliance.

361

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364 for-profit sectors.

365

366 **Conflict of interest statement**

367 The authors declare no conflicts of interest.

368

369 **Ethical Approval**

370 This study did not require ethical approval.

371 **Authorship**

372 The idea for the paper was conceived by Federica Pirrone and Ludovica Pierantoni.

373 The experimental protocol was designed by all authors.

374 The data were statistically analysed by Federica Pirrone and discussed by all authors.

375 The paper was written by all authors.

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510 **FIGURE CAPTION**

511 **FIGURE 1.** Frequencies of behaviors in the dogs that participated in the study. N Actual
512 number of dogs. * : differences between behaviors, Pearson's χ^2 goodness-of-fit test, $P < 0.05$.

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1 **Table 1**
 2 Dog's behavior (Questionnaire - Section 4)

| List of dog behaviors | Description |
|--------------------------|--|
| Destructiveness | Destructive chewing of objects that occurs in your presence. |
| Excessive barking | The dog barks frequently and persistently in your presence. |
| Fearfulness during walks | The dog shows behavioral signs of fear (panting, dilated pupils, hypervigilance, flattened posture, shyness, avoidance, flight/freeze, trembling, lip-licking, swallowing, salivation, vocalisation, piloerection, etc.) during walks. |
| Reactivity to noises | The dog shows behavioral signs of fear (panting, pacing, restlessness, hypervigilance, inappetence, trembling, eliminating, hiding, cowering, 'being jumpy') in response to noises such as fireworks, thunderstorms, gunshots or any other sort of loud and sudden noises. |
| Toy possessiveness | The dog engages in a competitive dispute over objects (toys, bones or any stolen object) with family members. The situation is characterised by aggressive signalling, including any combination of growling, lip lifting, teeth showing, staring, threatening posture, snapping and biting. |
| Food possessiveness | The dog engages in a competitive dispute over food resources (food bowl or treats) with family members. The situation is characterised by aggressive signalling, including any combination of growling, lip lifting, teeth showing, staring, threatening posture, snapping and biting. |
| Attention-seeking | The dog seeks attention and physical contact from you (or other members of the household) by nuzzling or pawing you for attention when you are sitting down, jumping up on you, asking to be petted. |
| Aversion to strangers | The dog shows avoidance behaviors, including any combination of lunging, snarling, growling, teeth baring and withdrawing from unfamiliar people. |
| Stranger aggression | The dog shows approach behaviors directed in an agonistic way towards unfamiliar people, including any |

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|------------------|--|
| | combination of lunging, snarling, growling, teeth baring, snapping and biting. |
| Owner aggression | The dog shows approach behaviors directed towards you (or other familiar people), including any combination of lunging, snarling, growling, teeth baring, snapping and biting. |
| Dog aggression | The dog shows approach behaviors directed towards other dogs, including any combination of lunging, snarling, growling, teeth baring, snapping and biting. |
| Tail chasing | The dog shows repetitive behavior, expressed as slow-to-rapid circling with attention directed towards its tail. |
| Body licking | The dog directs excessive licking towards its body. |
| Pica | The dog exhibits consistent ingestion of non-food material. |
| House soiling | The dog urinates and/or defecates in the house. |

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23 **Table 2**

24 Distribution of owner-dog relationship factors in the study

| Owner-dog relationship factor | | N | % |
|--------------------------------------|--------------------------------|-----|------|
| Source of training information | Myself | 203 | 55 |
| | Web, books, TV | 156 | |
| | Instinctively | 47 | |
| | Other owners | 2 | 0.5 |
| | Trainer | 130 | 35 |
| | Veterinarian | 21 | 6 |
| | Other | 15 | 3.5 |
| Person who decided to obtain the dog | Me | 222 | 59.8 |
| | Someone else | 26 | 7 |
| | Shared decision | 123 | 33.2 |
| Reason for keeping the dog | For company | 22 | 9.9 |
| | To repeat the experience | 84 | 37.8 |
| | For a specific function | 25 | 11.3 |
| | To try the experience | 24 | 10.8 |
| | To comply with children's wish | 5 | 2.3 |
| | Other | 62 | 27.9 |
| Daily walks (N) | 0 | 56 | 15.1 |
| | 1 | 52 | 14 |
| | 2 | 50 | 13.5 |
| | 3 | 98 | 26.4 |
| | 4 | 75 | 20.2 |
| | >4 | 40 | 10.8 |
| Owner's view of the dog | Simply an animal | 37 | 10 |
| | Family member | 220 | 59.1 |
| | Child | 136 | |
| | Brother/sister | 84 | |
| | Friend | 114 | 30.9 |
| Dog's view of the owner | Human friend | 139 | 37 |
| | Pack member | 232 | |
| | Leader | 158 | |
| | Parent | 74 | |

| | | | |
|---|--------------|-----|------|
| Dog's appropriate behavior | Act freely | 11 | 3 |
| | Cooperate | 281 | 75.7 |
| | Fear | 4 | 1.1 |
| | Obey | 75 | 20.2 |
| Training courses | Yes | 168 | 45 |
| | No | 203 | 55 |
| Outcome of training courses | Positive | 158 | 94 |
| | Negative | 10 | 6 |
| Reason for not attending training courses | Expensive | 75 | 36.9 |
| | Lack of time | 61 | 30 |
| | Unneeded | 48 | 23.6 |
| | Ineffective | 19 | 9.4 |
| Dog ownership's overall effect | Stress | 6 | 1.6 |
| | Well being | 364 | 98.1 |
| | None | 1 | 0.3 |

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44 **Table 3**

45 Owners' perceptions about dog's behavior (Questionnaire Section 4 - Part 1)

| Behaviors (Open-ended) | | N | % |
|---|-----------|-----|-------|
| Problematic but not undesirable | | 0 | 0 |
| Problematic and undesirable | | 119 | 32.1 |
| Undesirable but not problematic | | 240 | 64.7* |
| Not problematic and not undesirable | | 12 | 3.2 |
| Owners wishing to change dog's behavior | No | 185 | 49.9 |
| | Yes | 186 | 50.1 |
| Problematic and undesirable behaviors | No | 23 | 19.3 |
| | Yes | 95 | 79.8* |
| Undesirable but not problematic behaviors | No | 151 | 62.9 |
| | Yes | 89 | 37.1* |
| Owner's reaction | Ignoring | 78 | 21 |
| | Punishing | 267 | 72 |
| | Absent | 26 | 7 |
| Type of punishment | Vocal | 260 | 97.4 |
| | Physical | 7 | 2.6 |

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47 Pearson's χ^2 goodness-of-fit test significance: $P < 0.05$. *: between response options.

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Table 4

Logistic regression model result predicting problem behaviors from the list provided to owners

| Problem behavior | P | EXP (B) | 95% CI for EXP (B) | | Hosmer-Lemeshow test |
|-----------------------------|---------|---------|--------------------|---------|----------------------|
| | | | Lower | Upper | |
| Excessive barking | | | | | |
| Dog size (small) | 0.001 | 3.636 | 1.738 | 7.606 | 0.288 |
| Perceived problem behaviors | < 0.001 | 4.659 | 2.459 | 8.812 | |
| Pica | | | | | |
| Dog age (young) | 0.005 | 2.335 | 1.296 | 4.205 | 0.994 |
| Noise reactivity | | | | | |
| Owner gender (F) | 0.048 | 1.907 | 1.007 | 3.613 | 0.771 |
| Dog age | | | | | |
| Adult | 0.003 | 2.255 | 1.315 | 3.869 | |
| Senior | 0.002 | 2.841 | 1.482 | 5.448 | |
| Dog breed (mix) | 0.005 | 2.198 | 1.272 | 3.797 | |
| Dog size | | | | | |
| Small | 0.004 | 2.556 | 1.343 | 4.863 | |
| Medium | 0.020 | 1.998 | 1.114 | 3.584 | |
| Perceived problem behaviors | 0.029 | 1.755 | 1.058 | 2.512 | |
| House soiling | | | | | |
| Owner gender (M) | 0.004 | 3.729 | 1.538 | 9.043 | 0.319 |
| Owner m. status (divorced) | 0.013 | 5.062 | 1.405 | 18.240 | |
| Dog size | | | | | |
| Small | < 0.001 | 10.824 | 3.483 | 33.639 | |
| Medium | 0.044 | 3.129 | 1.033 | 10.033 | |
| Perceived problem behaviors | 0.022 | 2.499 | 1.142 | 5.471 | |
| Attention seeking | | | | | |
| Owner m. status (divorced) | 0.015 | 13.093 | 1.651 | 103.821 | 0.932 |
| Dog is a family member | 0.003 | 2.253 | 1.322 | 3.843 | |
| Perceived problem behaviors | 0.025 | 1.910 | 1.085 | 3.364 | |
| Tail chasing | | | | | |
| Dog age (young) | 0.015 | 3.093 | 1.248 | 7.667 | 0.833 |
| Dog is a family member | 0.007 | 3.652 | 1.612 | 19.818 | |
| Body licking | | | | | |
| Dog age (senior) | 0.034 | 2.439 | 1.071 | 5.553 | 0.693 |
| Dog size (small) | 0.042 | 2.024 | 1.027 | 3.987 | |
| Destructiveness | | | | | |

| | | | | | |
|-------------------------------|---------|-------|-------|--------|-------|
| Dog age (young) | 0.037 | 1.958 | 1.042 | 3.680 | 0.591 |
| Dog size | | | | | |
| Medium | 0.004 | 3.497 | 1.450 | 8.208 | |
| Large | 0.008 | 3.312 | 1.366 | 8.033 | |
| Dog breed (mix) | 0.040 | 2.009 | 1.032 | 3.913 | |
| Stranger aggression | | | | | |
| Dog breed (mix) | 0.004 | 2.339 | 1.302 | 4.202 | 0.207 |
| Perceived problem behaviors | 0.000 | 3.587 | 2.149 | 5.984 | |
| Owner aggression | | | | | |
| Owner gender (M) | 0.041 | 2.208 | 1.032 | 4.723 | 0.139 |
| Dog adoption age (< 2 months) | 0.029 | 2.672 | 1.106 | 6.454 | |
| Perceived problem behaviors | 0.017 | 2.356 | 1.166 | 4.760 | |
| Owner's wish to correct | 0.015 | 2.577 | 1.198 | 5.544 | |
| Dog aggression | | | | | |
| Perceived problem behaviors | 0.008 | 2.134 | 1.216 | 3.746 | 0.978 |
| Owner's wish to correct | < 0.001 | 2.743 | 1.671 | 4.502 | |
| Toy possessiveness | | | | | |
| Dog breed (pure) | 0.043 | 2.382 | 1.029 | 5.515 | 0.350 |
| Perceived problem behaviors | 0.001 | 2.917 | 1.559 | 5.458 | |
| Food possessiveness | | | | | |
| Perceived problem behaviors | 0.014 | 2.237 | 1.178 | 4.248 | 0.965 |
| Aversion to strangers | | | | | |
| Dog breed (mix) | 0.001 | 2.701 | 1.519 | 4.802 | 0.866 |
| Perceived problem behaviors | < 0.001 | 4.533 | 2.611 | 7.869 | |
| Fearfulness on walk | | | | | |
| Dog age (young) | 0.002 | 2.841 | 1.182 | 6.828 | 0.186 |
| Perceived problem behaviors | < 0.001 | 5.751 | 2.718 | 12.171 | |

63 Dog age: indicates the dog's age at the time of the survey. Only factors for which a significant
64 difference emerged are reported. Significance: $P < 0.05$.

65 Exp (B): Exponentiation of the B coefficient (odds ratio).

66 CI: Confidence interval.

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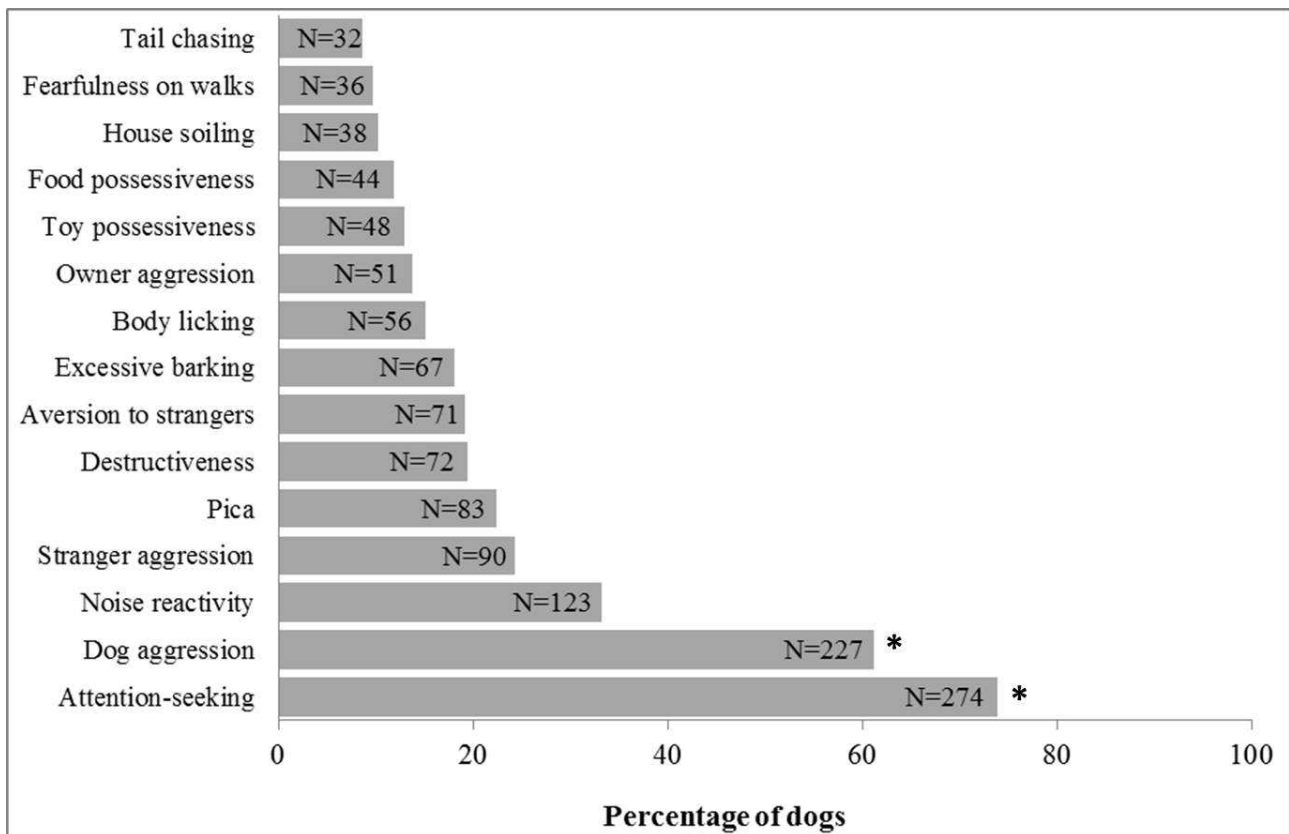


Fig. 1

Highlights

- 1) Dog-owners have different perceptions of canine undesirable and problematic behaviors
- 2) The perception of a dog's behavior as a problem steers owners towards its modification
- 3) Dog behaviors that are perceived as problematic are related to fear and anxiety
- 4) We identified owner- and dog-related predictors of potential canine problem behaviors
- 5) The identified factors may provide a useful focus for animal behaviorists