Spanish Dangerous Animals Act:

Impact on the epidemiology of dog bites

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Abstract

The effectiveness and suitability of legislations regarding the issue of dangerous dogs, especially those targeting so-called “dangerous breeds” (DB), have been the object of a lot of criticism. However, the shortage of scientific studies in this field makes difficult an objective assessment of the impact of current legislation. In the present study, dog bite-related incidents from Aragón (Spain) were analysed for a ten-year period (1995-2004). With the aim of assessing the impact of the Spanish Dangerous Animals Act on the epidemiology of dog bites, data from the non-legislated (1995-1999) and the legislated period (2000-2004) were compared in two different areas, namely low and high-populated area. According to the results, the population density did exert a significant effect on the incidence of dog bites, whereas the legislation in force did not. Popular breeds as German Shepherd and crossbreed dogs accounted for the great majority of the incidents during the two periods of study. Specifically, the German Shepherd proved to be significantly over-represented among canine population. DB, on the other hand, were involved in a small proportion of the incidents both before and after the introduction of legislation. The present results suggest that the implementation of the Spanish legislation exerted little impact on the epidemiology of dog bites. Besides the scarce effectiveness, the results suggest that the criteria to regulate only so-called DB were unsuitable and unjustified. It is hoped that this study will be helpful in the elaboration of future regulation measures in this matter.

Keywords: dog bites, epidemiology, legislation, public health, breed.

Introduction

Dogs are considered one of the favourite pets in modern industrialised societies. In spite of the important psychological, physical and social benefits derived from living with a dog (McNicholas and Collis, 2000; Wells, 2007), the ability to ocasionally bite people has made these animals become the focus of a public health and security challenge (see Overall and Love, 2001; Palacio et al., 2005; Morgan and Palmer, 2007; for reviews). In addition to this, a great number of dogs that show aggressive behaviour are abandoned or euthanased, which poses problems in the field of animal welfare (Hunthausen, 1997; Mikkelsen and Lund, 2000).

Canine aggression directed towards people has given rise to an enormous interest both in the media and in the scientific literature during the last two decades. Moreover, the problem has pervaded at a political level and several countries in Europe, North America and Australia have regulated dog ownership with the aim of -reducing the number of people injured by dog bites and prevent new episodes (Butcher et al., 2002; Ledger et al., 2005; Collier, 2006).

Two kinds of legislation have been developed in this regard. On one hand, Breed Specific Legislation (BSL), which is based on a series of regulations, including banning measures, applied to the so-called "dangerous breeds" (DB). It is thought that the elaboration of DB lists has been influenced to a large extent by biases in the media and the subsequent social alarm in relation to fatal dog attacks. On the other hand, non-Breed Specific Legislation (nBSL), which includes different regulation measures in order to promote responsible dog ownership regardless of the animal breed.

Most countries apply BSL in first instance, and complement it with characteristic nBSL measures (De Meester, 2004). According to the literature, BSL has not been proven effective in decreasing the number of people injured by dog bites (Ledger et al., 2005; Collier, 2006, Kuhne and Struwe, 2006) nor in preventing fatal dog attacks (Sacks et al., 2000). However, it is difficult to assess the impact of a particular type of

legislation reliably due to the scarce scientific studies and data in this field. With this purpose, studies over long periods of time both before and after the introduction of the legislation should be carried out (De Meester, 2004). To our knowledge, only the study by Klaassen et al. (1996) has been performed in this way, but it is important to note that relatively brief periods of time (3 months) were assessed. This study showed that the implementation of the Dangerous Dogs Act 1991 in the UK had limited impact on the rate of attendance for dog bites in one urban Accident and Emergency department.

According to several studies based on data from both hospitals and public health departments, the so-called DB contribute to only a few of the dog bite-related incidents (e.g. Kahn et al., 2003; León, 2006). This finding therefore contradicts the belief that these breeds are more dangerous and discredits DB lists. There are however no published data that demonstrate the effectiveness of nBSL over BSL (De Meester, 2004). This shows the necessity of performing more comparative scientific studies in this field.

The problems posed by dog attacks towards people in Spain (Knobel et al., 1997, Méndez et al., 2002; León et al., 2004) gave rise to specific legislation in 1999 (Spanish Dangerous Animals Act: ley 50/1999). At first, the act opted for the principles of nBSL, but in 2002 (RD 287/2002), this regulation was completed with the inclusion of a DB list.

The aim of this study was to assess in an objective way the impact of the Spanish Dangerous Animals Act on the epidemiology of dog bites and to discuss the effectiveness and suitability of legislation regarding the issue of dangerous dogs. The study analysed epidemiological data of medically-attended dog bites, comparing those belonging to the periods prior to (1995-1999) and following (2000-2004) the introduction of legislation. Furthermore, the impact of both the nBSL and the BSL was assessed. To this end, two main parameters were used: first, the incidence of dog bite-related incidents in two different areas, namely areas of low and high population

density; second, the relative proportion of involved breeds. In addition, a breed-related risk factor analysis was carried out.

Materials and Methods

Materials

Dog bite-related incidents reported between 1995 and 2004 to the Public Health department of Aragón (Spain) were collected using the Rabies Control and Prevention Programme.. According to this programme, the health staff from the Public Health centre where the victim is attended (i.e., primary care centre, emergency department, etc.) fills out a record with information related to the incident and then reports it to the Public Health department. Subsequently, the dog is submitted to an observation period carried out by official veterinarians. Records archives were obtained and information related to the number of cases and the dog's breed was gathered for the present study.

The region of Aragón (area 47,719.2 Km^2) is situated in the northeast of Spain and it comprises three provinces, each of them with a provincial capital. The most important of the latter represents also the region's capital and it is located in the centre of the region.

Human population data were extracted from the 2001 official census of Aragón. The total population was 1,204,215 inhabitants; of these, 53.6% lived in the region's capital and its outskirts. In order to avoid bias, data on the number of cases were divided into two strata: (a) low-populated area (average density: 12.2 inhabitants per Km^2), made up of towns and villages and (b) high-populated area (average density: 337.6 inhabitants per Km^2), made up of the region's capital and its outskirts. Only post-1997 data were available in the high-populated area.

Canine population data were obtained from the 2004 municipal census of the three main urban areas (provincial capitals). In this regard dogs were registered by a tax code linked to the rabies vaccination which remains mandatory once a year in this region. The registered population totalled 15,493 dogs, of which 644 (4.2%) belonged to the so-called DB and their crosses. According to Spanish legislation (RD 287/2002),

131 the DB list includes the Pit bull Terrier, Staffordshire Bull Terrier, American
132 Staffordshire Terrier, Rottweiler, Argentine Dogo, Brazilian Fila, Tosa Inu and Akita Inu
133 breeds.

134 Both crossbreed dogs (generic term to name mongrels and mixed dogs) as
135 shepherd-type dogs (non-purebred dogs that people describes as shepherd-like
136 animals according to morphological and/or functional aspects) were considered as
137 separated breeds. In addition, particular crosses within the crossbreed group were
138 dealt with independently, namely: German Shepherd crosses, Mastiff crosses and DB
139 crosses. These subdivisions were considered relevant in the light of their frequent
140 involvement in bite incidents according to literature and other features such as body
141 traits and original function.

142 For the purposes of simplifying results, only data of the 32 most popular breeds
143 (accounting for the 90% of all registered dogs) were presented, thereby excluding
144 breeds with registered population lower than 85 individuals; with the exception of
145 shepherd-type dogs (65 individuals). Among these 32 breeds, the six most popular
146 ones (crossbreeds, Cocker Spaniel, German Shepherd, Yorkshire Terrier, Poodle,
147 Siberian Husky) together with the DB group (DB and their crosses) accounted for 65%
148 of all registered dogs.

149 Lastly, regional records for the number of dogs vaccinated annually against
150 rabies were used as a proxy for the evolution of canine population in Aragón. Since
151 rabies vaccination in this region is mandatory, it was expected that vaccinated canine
152 population highly mirrored the total canine population.

153 Statistical analysis

154 First, the annual incidence of dog bite-related incidents during the non-
155 legislated period (1995-1999) and the legislated one (2000-2004) was calculated in the
156 low and the high-populated area. Incidence was expressed as the number of bite
157 incidents per 100,000 inhabitants. In addition, an univariate analysis of variance
158 (weighted general linear model) was used to examine simultaneously the effect of

159 legislation (L) and population density (D) on the incidence of dog bites. A first test was
160 carried out by establishing two main periods of time within each area of study: non-
161 legislated period and legislated period. A second test included a subdivision of the
162 latter, considering a nBSL period (2000-2001) and a BSL period (2003-2004). Since
163 2002 was considered as a transition period (introduction of BSL), this year was
164 excluded from the second test. The interaction between explanatory variables was also
165 included (LxD).

166 Second, the relative proportion of the biting individuals within the breeds was
167 studied during the two five-year periods. These proportions were compared with
168 reference information from the canine census in order to detect disparities between
169 both sets of data. To complete the assessment of breed dangerousness, a breed-
170 related risk factor analysis was carried out. The study was designed as a retrospective
171 Case-Control type, where "cases" were the animals of a given breed that caused bites
172 and "controls" were the rest of registered animals of that breed. *Odds Ratio* (OR) and
173 its Confidence Interval (CI) were used to test the association between the variables
174 "breed" and "bite incident". The factor “breed” was considered positively associated
175 with “bite incident” when OR>1, and negatively when OR<1. In addition the Chi-square
176 test was used to determine the statistical significance between the association.
177 Because the canine census was just available for the last period of study in the main
178 urban areas, only data from 2000 to 2004 in these areas were used for the analysis.

179 Calculations were performed using the statistical program SPSS 13.0. for
180 Windows (SPSS, Inc, Chicago, USA). Estimation of OR and CI was carried out using
181 the epidemiological program Win Episcope 2.0. (Thrusfield et al., 2001). P <0.05 was
182 considered significant.

183

184 **Results**

185 A total of 4,186 dog bite-related incidents were registered during the course of
186 the period of study, 1,877 during the first five-year period (1995-1999) and 2,309 during

187 the second one (2000-2004). Breed information was available in 48.7% (*n*= 915) of
188 collected cases during the first period and in 52.1% (*n*= 1203) during the second one.

189 Annual incidences from 1995 to 2004 together with the evolution of canine
190 population during this period are represented in Figure 1. The following incidence mean
191 values (standard error) were obtained during the non-legislated and legislated period,
192 respectively: (a) low-populated area: 71.8 (3.8) and 73.0 (3.3), and (b) high-populated
193 area: 18.6 (3.9) and 9.3 (3.0) (bite incidents per 100,000 inhabitants). Univariate
194 analyses of variance showed a significant effect of the population density (D) on the
195 incidence of dog bites regardless of the periods. A non-significant effect of legislation
196 (L) in general (first test), and of nBSL or BSL in particular (second test) was observed.
197 In addition, non-significant interaction was detected between both variables (LxD)
198 Table 1 shows the results from the second test .

199 The distribution of bites according to the breed is summarised in Table 2. The
200 same seven breeds (German Shepherd -and its crosses-, crossbreeds, shepherd-type
201 dogs, Mastiff, Siberian Husky, Cocker Spaniel and Belgian Shepherd) accounted for
202 more than 70% of the bite incidents across the two periods of study, although German
203 Shepherd and crossbreeds stood out among the rest of biting breeds. When
204 considering a “shepherd group” made of German Shepherd and its crosses, Belgian
205 Shepherds and shepherd-type dogs, they were involved in 38.3% and 34.7% of the
206 incidents during the first and the second period, respectively. No DB were included
207 among these seven most bite-causing breeds, although Rottweilers bit in similar
208 proportion to Belgian Shepherds. Figure 2 shows the involvement of the seven most
209 popular breeds (Mastiff and shepherd-type dogs have also been represented because
210 of the importance of the aforementioned results) in biting episodes during both five-
211 year periods. From the most biting breeds group, only crossbreeds and Cocker Spaniel
212 did appear under-represented with respect to their relative presence on a reference
213 canine population.

214 During the period 2000-2004 (legislated period), a total of 401 dog bite-related
215 incidents were registered in the main urban areas. Breed information was available in
216 228 (56.9%) of the cases, of which 12 (5.3%) belonged to the DB group. The results of
217 the breed related-risk factor analysis are shown in Table 3. Only in the case of German
218 Shepherd the breed was positively associated with causing an incident. Instead,
219 crossbreeds and Cocker Spaniel appeared significantly under-represented when
220 comparing with registered dogs. Moreover, belonging to the DB group was not
221 significantly associated with causing a bite.
222
223 **Discussion**
224 In the present study, the impact of the Spanish Dangerous Animals Act
225 (50/1999, R.D. 287/2002) on the epidemiology of dog bite-related incidents was
226 assessed. It is important to note that this study only deals with medically-attended dog
227 bites.
228 According to the results, the implementation of nBSL measures and the
229 subsequent DB list did not exert a significant effect on the incidence of dog bites with
230 respect to the situation during the non-legislated period. Since this finding was
231 observed both in the region's capital area -high populated area- as in the rest of the
232 territory -low populated area-, the results suggest that introduction of the act was
233 unsuccessful in the attempt to reduce the number of people injured by dog bites.
234 In spite of this finding, some aspects should be considered when interpreting the
235 results. On one hand, it is likely that a rise in canine population occurred during the last
236 period, thus increasing the probability of being bitten by a dog (Berzon et al., 1972).
237 According to the records on vaccinated dogs against rabies in Aragón (Fig. 1) a striking
238 rise in the number of dogs did indeed occur just before enacting the law. On the other
239 hand, it is also likely that a greater tendency to notify bite incidents existed as a result

240 of the growing public awareness after introduction of legislation (Berzon et al., 1972).
241 By contrast, this is difficult to estimate, especially in small towns and villages.

242 These results are similar to those found by Klaassen et al. (1996), who carried out a
243 comparative prospective study in one Accident and Emergency department before the
244 implementation of the Dangerous Dogs Act 1991 in UK and again two years later. In
245 this case, two three-month periods of time were compared showing little impact of
246 legislation on the rate of attendance after legislation.

247 Furthermore, the present results show that there were significant differences in the
248 incidence of dog bites depending on the area of study, namely low-populated (71.8 and
249 73.0 per 100,000 inhabitants) and high-populated area (18.6 and 9.3 per 100,000
250 inhabitants). It is important to note that these differences already exited before enacting
251 the law. A study conducted in another Spanish region (Valencia) found very similar
252 results, showing an incidence of 71.5 bites (per 100,000 inhabitants) in the total region
253 and of 19.8 bites (per 100,000 inhabitants) in the region's capital area (León, 2006).
254 These findings are in agreement with a recent survey which found that respondents
255 from rural areas were three times more likely to have been bitten by dogs in their
256 lifetime experience than city dwellers (Wake et al., 2006).

257 The differences in the incidence values depending on the population density might be
258 accounted for by physical environment-related factors. Thus, it is likely that most dog
259 owners might not allow their pets to roam freely and unattended in densely populated
260 areas with few open spaces and heavy traffic (e.g. a major city). By contrast, people
261 living in an area characterised by one-family homes and much open space (e.g. small
262 towns and villages) might allow dogs to roam unleashed because of the considerably
263 less hazardous situation (Harris et al., 1974). In addition, psychological and cultural
264 factors might also influence the incidence of dog bites in each particular area (Beck
265 and Jones, 1985).

Considering this, it could be hypothesised that the physical environment by itself might indirectly raise people's consciousness in densely populated areas promoting a more responsible dog-ownership. Moreover, it is likely that compliance with the regulation measures in these already sensitised populations may turned out to be easier than in areas of low population. In fact, in the present study the incidence of dog bites in the region's capital area underwent a downward trend during the legislated period. It is possible that a significant decrease might be observed by including further years in the study. Even so, the situation in this area before the implementation of the law did not seem to be critical compared to the situation in the rest of the territory or in other reviewed studies in Spain and abroad (e.g. Knobel et al., 1997:100/100,000; Thompson, 1997: 73/100,000; Borud and Friedman, 2000: 85/100,000; León, 2006:71.5/100,000).

According to the data on bite-causing dogs, the present results suggest that no great changes in the distribution of involved breeds occurred since legislation was first introduced. Thus, German Shepherd together with crossbreed dogs, two of the most popular breeds, accounted for the vast majority of the total bite incidents during both five-year periods. It is suggested that the breed of dogs most often involved in dog bites covary with the popularity of the breed (reviewed by Overall and Love, 2001). Other popular breeds such as Cocker Spaniel or Siberian Husky but also less popular ones such as Mastiff, shepherd-type dogs or Belgian Shepherd constituted the rest of the main biting breeds. Furthermore, the shepherd group was involved in a third of the incidents across the two periods of study.). On the other hand, the distribution of only certain breeds (German Shepherd, Mastiff and shepherd-type dogs) according to their involvement in bite incidents during each five-year period was disproportionate to the distribution in a reference canine population (see Fig.2).

Recent results from prospective and retrospective studies in hospitals or in public health departments (e.g. Kahn et al., 2003; León, 2006; Schalamon et al., 2006)

293 agreed that German Shepherd was the most frequently involved breed. It is worth
294 mentioning that some large, dark coloured dogs might be incorrectly classified as
295 German Shepherds (Mathews and Lattal, 1994) causing an over-reporting of this
296 breed. Despite the misinterpretation, this finding might suggest that German Shepherd-
297 like dogs are frequent biting animals. The shepherd group (Horisberger, 2002) and the
298 crossbreed dogs (Avner and Baker, 1991; Gracia et al., 1992) were among the most
299 bite-causing animals in other studies.

300 Data on DB, on the other hand, denote that these animals were involved in a small
301 proportion (<4%) of the incidents during both five-year periods. This finding had been
302 previously observed in studies from hospitals and public health departments (e.g.,
303 Kahn et al., 2003; León, 2006). Moreover, a behaviour test showed no significant
304 differences in the frequency of inadequate aggressive behaviours between the
305 legislated breeds and a comparison group of Golden Retrievers (aggression assessed
306 according to the scaling system of the study, Johann, 2004). On the other hand, a
307 slight increase in the notification of DB was noted during the second period. Although
308 this might be explained by a rise in the number of DB dogs, this seem to be unlikely
309 considering the example of the dramatic fall in the number of registered Rottweilers in
310 Spain during the last years precisely as a consequence of the introduction of legislation
311 (data from the Spanish FCI Official Kennel Club, cited by Fatjó, 2006). Instead, it might
312 be reasonable to assume that a greater likelihood to notify incidents caused by DB and
313 include breed information occurred after the implementation of the act, especially BSL
314 (Sacks et al., 1989). In this regard, it has been proven that an important aspect in the
315 evaluation of canine aggressiveness is the breed related preconceived opinion, which
316 would be biased by the media (Nordhaus, 2001)

317 The study conducted by Klaassen et al. (1996) showed similar results regarding the
318 involvement of German Shepherd and crossbreed dogs in bite incidents before and
319 after legislation. In the case of DB, however, a higher proportion of these animals was

observed during the first period (6.1%) and a substantial increase was registered during the second one (12.25%).

Considering the aforementioned results, it is important to note however that a breed might appear over-represented in bite rates just because there are a great number of dogs of this breed among canine population (Wright, 1991). According to the breed-related risk factor analysis carried out in the main urban areas, only German Shepherd was significantly over-represented among the most biting breeds. Instead, belonging or not to the DB group was not significantly associated with the likelihood of causing a bite incident.

Scientific literature regarding breed-related risk factor analysis (*Odds ratio*) is scarce. It is worth mentioning that German Shepherd -both alone as along with other shepherd dogs- was significantly represented among the most biting breeds in all reviewed studies (Gershman et al., 1994; Horisberger, 2002; León, 2006). In addition, similar results were also found in studies where the *Risk index* (RI: ratio between the proportion of aggressive dogs of each breed and the representation of that breed among canine population) was calculated (Thompson, 1997; Schalamon et al., 2006). However, calculation of the RI instead of the OR analysis makes it difficult to establish comparisons among breeds in order to detect significant differences.

On the other hand, risk factor results regarding the rest of breeds differ from one study to another. These differences might be explained by particular characteristics of canine population depending on the area and the period of study (Wright, 1991; AVMA, 2001). Considering this, caution should be always exercised in extrapolating results from one geographic area to another one. In addition, differences might be related to the type of study performed. A recent study conducted in a referral practice in Spain showed that the Cocker Spaniel displayed the highest risk for aggression towards people, especially for owner-directed aggression (Fatjó, 2006). It is likely that data from behavioural

practices and public health departments reflect the situation concerning the canine aggression issue from different perspectives.

Some questions could be raised regarding the risk factor analysis carried out in this study. On one hand, results were obtained for only certain breeds due to limitations related to the number of registered animals, which influence the validity of the statistical analysis. However, we considered important to assess the statistical validity of the association “breed-bite incident”. On the other hand, other animal related risk factors (e.g., sex or age) were not considered. Further analyses on this aim in different geographic areas are needed to accurately deal with this matter.

Finally, considering the results related to incidence of dog bites together with the data on breeds, some arguments can be gathered in order to discuss the effectiveness and suitability of the legislation regarding the issue of the dangerous dogs, especially that based on a DB list. The present results suggest that BSL was fundamentally flawed since both the involvement of DB in biting episodes during the non-legislated period (2.4%) as the target population according to the reference urban census (4.2%) was very small.

Besides the scarce effect in reducing the incidence of dog bites, the minor involvement of DB in bite incidents during the two five-year periods highlights that BSL are discriminatory and entail a problem of over-inclusiveness because they assume that all DB dogs are aggressive by nature (Lockwood, 1988; Bandow, 1996). In addition, the criteria to include only so-called “fighting breeds” according to their original use might be obsolete in the light of recent findings that suggest that the breed-typical behaviour today has no relationship with the function in the breeds' origin owing to recent selection pressure (Svartberg, 2006). On the other hand, since other breeds such as German Shepherd proved to be much more frequently involved, targeting only DB also poses a problem of under-inclusiveness because it obviates that any dog regardless of the breed may occasionally bite (Bandow, 1996). Moreover, this might lead to a false

373 sensation of security with respect to the risk of causing an incident when owning an
374 outlawed breed (Boillat, 2003).

375 However, extending the number of regulated breeds to continue with breed- based
376 regulations should not be the solution to adequately deal with the problem. Even
377 though it has been proven that some breeds have a higher tendency to behave more
378 aggressively than others, a high intra-breed variation has also been denoted (Scott and
379 Fuller, 1965; Hart and Miller, 1985; Hart and Hart, 1985; Bradshaw et al., 1996;
380 Bradshaw and Goodwin, 1998; Takeuchi and Mori, 2006; Svartberg, 2006). This makes
381 breed -genetic factor- less reliable in order to predict aggression and denotes the
382 importance of other causative factors such as early environment, learning and physical
383 and mental health (Heath, 2005). In addition, it is suggested that the domestication of
384 the dog is an ongoing process and therefore changes in aggressiveness might be
385 possible in few generations as selection pressure changes (Trut, 2001; Gulevich et al.,
386 2004; Svartberg, 2006). This again shows the relatively poor power of breed in
387 predicting aggression and underlines the temporary scope of breed-based regulations.
388 It moreover stresses the importance of behavioural considerations in dog breeding
389 (Svartberg, 2006), which might be neglected when breeds become very popular
390 (Overall and Love, 2001).

391 In this study, the nBSL measures also proved to be ineffective in decreasing the
392 incidence of dog bite-related incidents. However, the Spanish legislation at first was
393 ambiguous and vague at defining the concept of "dangerous dogs" which indeed led to
394 the inclusion of the subsequent DB list. Thus, it is likely that these early measures were
395 not suitable enough to achieve their goal. In fact, most experts on the subject uphold
396 nBSL (Sacks et al., 2000; Ledger et al., 2005; Overall and Love, 2001; De Keuster et
397 al., 2006; Schalamon et al., 2006) but acknowledge the need for a co-ordinated
398 approach to the investigation of dog bites in order to elaborate accurate and effective
399 measures (AVMA, 2001; Mills and Levine, 2006).

In conclusion, the present results suggest that the Spanish Dangerous Animals Act (50/1999, RD 287/2002) was not effective in protecting people from dog bites in a significant manner. Differences in the incidence of dog bites between the high and the low-populated areas should be considered when carrying out awareness raising about the problem in major cities but also in towns and villages where a higher frequency of bite incidents was registered. On the other hand, this study shows that the main biting breeds -which were not included in the DB list- continued to be the same after the implementation of legislation whereas so-called DB accounted for a minor part of the incidents. To the authors' best knowledge, this is the first study that assesses the impact of a dangerous dogs legislation over long periods of time both before and after its implementation. We hope these results contribute to create a scientific base on the investigation of dog bites with which current regulation measures can be improved.

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555

556 **Legends**

557 **Table 1.** Weighted least square means (standard error) from dog bite-related
558 incidents in relation to legislation in force (L) and to population density (D).

559 $\bar{x}$ expressed as the number of bite incidents per 100,000 inhabitants.

560 nL: non-Legislation (1995-1999); nBSL: non-Breed Specific Legislation (2000-2001); BSL:
561 Breed Specific Legislation (2003-2004).

562 **Table 2.** Bites distribution (percentage) according to the animal breed during
563 both five-year periods.

564 *Breeds belonging to the DB (Dangerous Breeds) group.

565 **Table 3.** Breed† -related risk assesment.

566 †Only breeds where valid results were obtained in the risk factor analysis are listed.

567 *n*= number of biting dogs in the main urban areas during the period 2000-2004.

568 *OR*= Odds Ratio; CI= Confidence Interval. *: *P*<0.05; **:*P*<0.001; ***: *P*<0.0001.

569

570 **Figure 1**. Annual incidences of dog-bite related incidents (per 100,000
571 inhabitants) (left scale) and evolution of canine population within the study area
572 according to the number of vaccinated dogs againts rabies (right scale) accross the
573 period of study†.

574 The broken line shows the division between the non-legislated and the legislated period.

575 †Only post-1997 data were available in the high-populated area.

576 **Figure 2.** Breeds† distribution (percentage) according to their involvement in
577 bite incidents during the periods 1995-1999 and 2000-2004 and to the representation in
578 a canine population (census reference).

579 †The seven most popular breeds (sorted by decreasing popularity) along with Mastiff and
580 shepherd-type dogs.