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# 1 Children are victims of dog bites due to irresponsible 2 dog ownership, parenthood and managers of school 3 institutions in Serbia

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10

11 **Abstract:** The prevalence and the incidence of dog bite studies are mainly based on hospital  
12 records. However, in this study, the information about dog bites to children was obtained by  
13 searching Serbian online newspapers, between January 2008 and May 2018. Sixty-nine articles from  
14 Serbian online newspaper reports dog bites to 79 children between January 2008 and June 2018.  
15 Children over 6 years old (school class) constituted 65% of the sample and 51% were boys. Most  
16 commonly children were bitten by dogs of known owners (59%). Stray dogs were involved in  
17 fewer bites to children (41%;  $P < 0.05$ ). Children sustained the greatest number of dog bites during  
18 the spring months (37%) and the lowest in the summer (14%). Mongrels were involved in 37% of all  
19 bites followed by terriers in bull type (21%). Head, face and neck (32%) were the most common  
20 individual site of injury from dog bites. Most children (68%) sustained bites without previous  
21 interaction with dogs. Data collected from newspapers on dog bites to children cannot provide a  
22 real insight into the scale and severity of the problem. However, they can be the trigger for further  
23 studying of this problem by health workers, veterinarians and scientists and the warning to local  
24 authorities to tackle the problem of irresponsible dog ownership.

25 **Keywords:** children, dog bites, newspaper

## 26 1. Introduction

27 There are numerous definitions of epidemiology. The simplest of them defines epidemiology as  
28 „the basic science of public health“ (Kuller, 1991). Epidemiology can also be defined as „the study  
29 of the distribution and determinants of health-related states or events in specified populations, and  
30 the application of this study to control of health problems“ (Last, 2001) in such ways to „promote,

31 protect, and restore health" (Tapia Granados, 1999). This medical science also studies frequencies of  
32 health problems in a certain population by using measures such as prevalence and incidence  
33 (Rothman and Greenland, 1998). Insight into the frequency of a health problem is not the main goal  
34 of epidemiology. Its main objective is to elucidate the mechanisms of health problems occurrence  
35 aiming to develop preventive strategies. Dog bites are recognized as a public health problem in  
36 many societies. It is a main reason why a great number of authors who studied dog bites put these  
37 two words in titles and texts of their published papers (Beck, 1975; Maetz, 1979; Voelker, 1997;  
38 Beaver et al., 2001; Mengistu, 2011; Orritt, 2015) emphasizing that dog bites are really a public health  
39 problem. The population pattern of this health problem is not solely dependent on the characteristic  
40 of dog bite victims or dogs who injured victims, but also on the interaction between these  
41 individuals with each other and a great number of other factors in a social setting, including  
42 behavior, knowledge and responsibility of dog owners, the general interest of the society for this  
43 problem and many others. Numerous of these epidemiological factors are comprehensively  
44 summarized, analyzed and explained by Overall and Love (2001).

45 Dog bites to children are still the main public health and animal welfare problem and the  
46 interesting topic that attracts an attention in many scientific journals and media. Because dog bites  
47 were recognized as a public health problem (Beck, 1975; Maetz, 1979; Voelker, 1997; Mengistu, 2011;  
48 Orritt, 2015), they are the subject of epidemiology - basic science of public health (Parrish et al, 1959;  
49 Agarwal and Reddajah, 2004; Overall and Love, 2001; De Keuster et al., 2006). Therefore,  
50 epidemiology of dog bites studies the frequency of bites in a certain population using measures such  
51 as a prevalence and incidence (Schalamon et al., 2006; Georges and Adesiyun, 2008; Venkatesan et  
52 al., 2017; Westgarth et al., 2018) and their determinants such as causes and risk factors (Gershman et  
53 al. 1994, Overall and Love, 2001; Messam et al. 2008, 2012, 2018; Nahlik et al., 2010; Davis et al. 2012,  
54 Watson et al. 2012). Such studies aim to control bites by effective measures in order to prevent their  
55 occurrence (Ozanne-Smith et al., 2001; Champan et al., 2000; Duperrex et al., 2009; Meints and de  
56 Keuster, 2009; De Keuster and Overall, 2011; Gielen et al., 2012; Lakestani and Donaldson, 2015; Shen  
57 et al., 2017) or the threat health-related consequences such as bite wounds and their complications,  
58 transmission of zoonotic diseases, dysfunctionality of injured body parts (Morgan and Palmer, 2007)  
59 and the long-term effects like psychological or emotional issues including post-traumatic stress  
60 disorders (Peters et al., 2004). Preventive interventions range from conducting of animal control  
61 measures (Clarke and Fraser, 2013) to specific education programmes for children (Champan et al.,  
62 2000; Duperrex et al., 2009; Meints and de Keuster, 2009; De Keuster and Overall, 2011; Lakestani  
63 and Donaldson, 2015; Shen et al., 2017) and their parents (Gielen et al., 2012).

64 Some authors collected and analyzed all epidemiological aspects of dog bites (Gershman et al.  
65 1994, Overall and Love 2001) with special emphasis on risk factors. The recent study by Messam et

66 al. (2018) equally emphasized child- and dog-related factors contributing to a bite. Although there is  
67 a large amount of data on all epidemiological aspects of dog bites, we still do not really know why  
68 dog bite children (Love and Overall, 2001, Oxley et al., 2018). While 17 years ago Love and Overall  
69 (2001) pointed to the lack of demographic data on dogs involved in bites, nowadays Oxley et al.  
70 (2018) point to the lack of factors and contexts surrounding dog bite incidents. Aiming to better  
71 understand the context in which bites occur and to analyze of humane and dog behaviors before  
72 bites Owczarczak-Garstecka et al. (2018) analyzed in detail online videos of dog bites. This study  
73 presents the improvement in the methodology of analysis of dog bites. After the identification of  
74 different contexts in which dog bites occur Oxley et al. (2018) pointed out that a number of different  
75 prevention measures are required.

76 Data on dog bites received attention in all countries (Arhant et al., 2017; Messam et al., 2018;  
77 Oxley et al., 2018, Ramgopal et al., 2018; Westgarth et al., 2018). In some of the developed societies,  
78 dog bites have been noted to be increasing (Oxley et al., 2018). Although many authors try to collect  
79 the real number of dog bites to children, it is impossible. Sources for collecting data on dog bites to  
80 children are mainly hospital and clinical records or veterinary caseloads, although newspaper  
81 reports or cross-sectional studies by telephone surveys, questionnaires or interviews may be used  
82 (Oxley et al, 2018; Westgarth et al., 2018). However, a large number of dog bites to children remains  
83 unreported. It has been estimated that children were 36 times more bitten than reported to health  
84 institutions (Beck and Jones, 1985). There are many reasons why people do not report all dog bites to  
85 health institutions. Some owners of biting dogs may afraid of guilt and financial punishment.  
86 However, it may be presumed the same fears may exist in victims especially in those who provoked  
87 biting dogs. Further, these reasons include the fear of breaking up of various social relationships that  
88 exist between dog owners, their family members or friends and fear that a biting dog may be taken  
89 away from the owner, relinquished to a shelter and euthanized. There is also the possibility that  
90 children themselves do not report that they have been bitten by dogs because of they afraid of  
91 parental punishments or medical interventions. However, many parents and children, in particular,  
92 are not aware that dog bites can pose a life threat. Recently, Westgarth et al (2018) using a  
93 cross-sectional study confirmed that the real burden of dog bites is considerably larger than those  
94 estimated from hospital records and that many bites do not require medical treatment.

95 Reports on dog bites to children are very attractive to readers of newspapers and favorite titles  
96 for journalists. Moreover, such reports are more interesting for readers and particularly sensational  
97 when bites come from dogs categorized as "dangerous dog" (Tarver, 2013; McCarthy, 2015;  
98 Bleasdale-Hill and Dickinson, 2016) and stray dogs. In some societies, stray dogs present the  
99 persistent problem (Bhattacharjee et al, 2017; Narayanan, 2017; Guilloux et al., 2018). There are a  
100 great number of nongovernmental organizations that protect stray dogs all around the world. It

101 could be possible to read about social conflicts between animal protectionists and municipal  
102 authorities/governments. Such circumstances mean that dog bites may be a political issue  
103 (Westgarth and Watkins, 2015). Local authorities may be exposed to special pressure to adopt new  
104 or to change existing legislation on pet ownership (Clarke and Fraser, 2013; Raghavan et al., 2013;  
105 Rock et al., 2015; Bleasdale-Hill and Dickinson, 2016; Mora et al., 2018). Stray dogs are one of the  
106 main topics for discussion between citizens, members of NGOs and journalists on the one side and  
107 municipal politicians on the other.

108 Online media are increasingly being used for disseminating information on public health issues  
109 and animal welfare. Online media may be used to study the epidemiology of dog bites. Collecting  
110 data from newspapers or other media sources is not a recent idea. Studying data on dog bites by  
111 newspapers and other media were used by Winkler (1977), Patronek et al. (2013), Kikuchi and Oxley  
112 (2017) and some epidemiologists who studied other public health problems (Rainey and Runyan,  
113 1992, Dubey et al. 2014). Basically, newspapers cannot inform readers about all cases of accidents  
114 that have occurred at a specific time in the certain population, but it has been observed that  
115 newspapers may provide more data than medical examiner records (Rainey and Runyan, 1992).  
116 These deficiencies in medical records are especially emphasized by Oxley et al. (2018) who state that  
117 relevant information on dog bites within emergency departments may not always be recorded, or  
118 may be poorly documented. The first reason involves the time constraints. The second may be the  
119 lack of initial direct effect on a victim's treatment. Online media available for viewing by the  
120 community may be very useful sources of information on public health issues if they were  
121 previously verified by authorized healthcare professionals (Dubey et al. ,2014). However, it was also  
122 estimated that some of the online sources contain misleading information, primarily anecdotal, that  
123 contradicts the reference health standards (Madathil et al., 2015).

124 When media report on accidents, diseases, disasters and other hazards then these reports have a  
125 form of information about events, immediate consequences and harms. They inform the public  
126 about injuries, deaths and property destructions. Informing the public about disasters, diseases and  
127 accidents media usually use violent language to exaggerate their consequences and to attract  
128 readers' attention to the titles and text of reports. Media do not inform about issues of accidents and  
129 also excluded discussion about the risks of accidents. Usually, a moral or ethical approach to  
130 accidents is absent. Really, readers are attracted by the consequences of accidents but remain limited  
131 for the information on the real causes, long-term consequences and accident prevention. Often, the  
132 earliest accident reports also contain erroneous information about the consequences or actors who  
133 participated in the accident. Taking into account dog bites these mistakes may relate to breeds of  
134 biting dogs or to consequences of bites. Frequently consequences of dog bites are overemphasized in  
135 the report title, while that's not the case in the text (Singer and Endrenu, 1994). It can be said that

136 journalists like to sensationalize accidents. Many authors previously noticed that newspaper media  
137 reporting on accidents generally does not include injury prevention messages, so it is a lost  
138 opportunity for public education (Heng and Vasu, 2010). It would be very useful that media reports  
139 of dog bites disseminate public health messages that raise awareness of sources of risk and  
140 preventive message.

141 Therefore, the aim of the paper was to examine how online newspapers reported on dog bites in  
142 children in Serbia and what newspapers decide to tell the public.

## 143 **2. Materials and Methods**

144 Data for this study were collected from the online format of eight national daily newspapers  
145 Blic, Novosti, Kurir, Informer, Politika, Telegraf, Danas and Alo. These newspapers regularly report  
146 the occurrence of accidents, hazards and disasters from the different parts of the country including  
147 dog bites. Reports related to dog bites vary in details given in their texts from very brief to extensive  
148 details of the circumstance of the accident. The archived reports on dog bites from these 8 online  
149 newspapers were searched between January 2008 and May 2018, online newspapers were searched  
150 using the following terms in Serbian language: "dog attack to child/boy/girl", "dog bite to  
151 child/boy/girl", "bitten child/boy/girl" and "child/boy/girl sustained dog bite/injury". The total  
152 number of 83 online reports on dog bites to children was found. Only those reports that contained  
153 sufficient information (N=69; 83%) necessary for the purposes of this study were taken into account  
154 (gender and age of victims, injury location, a place where child sustained dog bite, a circumstance  
155 under which children sustained dog bites, dog breed and ownership status of a dog). Based on the  
156 date of reports, the season when a child sustained a dog bite was also taken into account. Titles and  
157 text of chosen reports in the online newspaper were searched for the presence of following words in  
158 the Serbian language: "horror", "dread", "creeps", "dog lacerated", "dog disfigured", "furious dog".  
159 After many years of reading selected newspapers, we have noticed that these are the most  
160 commonly used terms in the title of reports on dog bites in order to attract readers' attention.

161 In order to systematize all data on dog bites to children from the available information of bites  
162 in online newspapers, we developed our own "report form" and abstracted information on bites that  
163 we analysed in the study. We use this form to exclude duplicated data on bites that overlapped in a  
164 different newspaper.

165 According to their age, bitten children were grouped in the following age classes: preschool and  
166 school class. Based on the ownership pattern of biting dogs, animals which bit children were also  
167 classified into two groups: dogs of known owners and stray dogs.

168 Statistical analysis of obtained data was performed using Social Science Statistics ©Jeremy  
169 Stangroom 2018 (<http://www.socscistatistics.com/>). Where data were compared, the chi-square test  
170 was used and the level of statistical significance was set at  $P < 0.05$ .

### 171 3. Results

172 The total number of 69 articles on dog bites to children was found in Serbian online newspapers  
173 from January 2008 to May 2018. These selected articles contained all information that was the subject  
174 of the analysis in this study (gender and age of victims, injury location, a place where the child  
175 sustained dog bite, a circumstance under which children sustained a dog bite, a dog breed and the  
176 ownership status of a dog). The rest of the 14 reports did not contain complete information in which  
177 we were interested in for the purpose of the study. These excluded articles were in a form of very  
178 brief information about dog bites occurrence without any demographic data on children, dog breed  
179 and a rest information that were the subject of the study. Based on the data of such brief article  
180 publishing we only may conclude of a season when dog bites occurred. However, we completely  
181 excluded them from the study.

182 Among these 69 reports analyzed in the study, there are 66 reports related to dog attack to an  
183 individual child. Three articles reported an attack of a single dog to a group of children (Table 1). In  
184 the observed period, 79 children sustained dog bites according to the reports included in the study.  
185 Twenty-two articles (32%) in their titles contained words of terrifying meaning. These articles did  
186 not contain these words in the text.

187

188 Table 1

189

190 Analyzing contents of articles, it was easy to notice that dogs bit 40 (51%) boys and 39 (49%)  
191 girls (Table 2). Thirty-five percent of all bitten children were of preschool age and 65% of school age  
192 ( $P < 0.05$ ). Dogs of known owners were involved in 59% of all bite accidents ( $P < 0.05$ ) comparing to  
193 stray dogs (41%).

194

195 Table 2

196

197 The age of bitten children ranged from two to seventeen years (Table 3). Taking into account the  
198 gender, the mean age of all injured children, boys and girls was 8.34, 8.53 and 8.15 years,  
199 respectively. However, the mean age was 4.46 years for preschool children and 10.47 years for school  
200 children.

201



202 Table 3

203

204 The greatest number of children sustained dog bites during spring months (37%) and the lowest  
205 during the summer season (14%). The number of dog bites rose again in the autumn and winter  
206 seasons and reached the maximum value in the spring months (Figure 1).

207

208 Figure 1. Number of bitten children according to seasons

209

210 Comparing the number of dog bites among the group of preschool and school children (Table 4)  
211 during the warm (spring and summer) and the cold season (autumn and winter) the statistically  
212 significant difference was estimated ( $p < 0.05$ ). Children of preschool age were frequently more  
213 bitten during the warm season (68%). Contrary, children of school age sustained more bites during  
214 the cold season (59%).

215

216 Table 4

217

218 Mongrels (N=33; 42%) more frequently bit children than other breeds of dogs (Figure 2),  
219 followed by terriers in Bull type (N=17; 21%). Among bull type terriers children were bitten ten times  
220 by American Staffordshire terriers, five times by pit bulls and two times by bull terriers. All other  
221 dog breeds together were involved in 37% (N=29) of bites to children. Beside mongrels, children in  
222 Serbia sustained bites by 14 different dog breeds. Among them, in the second place were bull type  
223 terriers. We deliberately used this term because we are not sure that the victims, bite witnesses, and  
224 journalists knew to make the difference between breeds in these dogs. Furthermore, children were  
225 bitten by Akitas, German hunting terriers, Rottweilers, golden retrievers and many other dog  
226 breeds. A referral population of dogs that bit children is not likely representative of the entire  
227 population of dogs but may relate to the most popular breeds among dog owners in Serbia.

228

229 Figure 2. Dog breeds

230

231 The most common site of injuries from dog bites was the lower extremity (32%), followed by  
232 upper extremity (19%). Head, face and neck were injured in 15% of bitten children (Table 5).  
233 Twenty-four percent of children (N=19) suffered from multiple bite injuries on different body  
234 regions (24%).

235

236 Table 5



237

238 Children sustained more bites from dogs of known owners (59%) than from stray dogs (Table 1,  
239 6). School children sustained more bites from stray dogs (49%) comparing with preschool children  
240 (25%) who were most commonly bitten ( $P < 0.05$ ) by dogs of known owners (75%).

241

242 Table 6

243

244 The great number of victims of school age (36%) was attacked by stray dogs without previous  
245 interaction when an animal entered in a schoolyard (Figure 3). Twenty-four percent of  
246 schoolchildren sustained bites by a pack of dogs or were attacked by a single dog (28%) without  
247 previous interaction in a school surrounding. In 8% of cases, school children intentioned to interact  
248 with stray dogs before they sustained injuries. Only one child of preschool age was bitten by a stray  
249 dog intending to interact with an animal (Figure 4). Nineteen percent of children ( $N=9$ ) sustained  
250 dog bites in a direct interaction with own dogs or with dogs of their close relatives, friends or  
251 neighbours (Figure 5). Their interaction with well-known dogs was not supervised by parents or  
252 caretakers. Thirty-two percent of children sustained bites by unfamiliar dogs without previous  
253 interaction with animals in the presence of dog owners who walked unleashed or unmuzzled dogs  
254 in public places. Fourteen children were injured by dogs of known owners who allowed their  
255 animals to roam freely (29.5%). Children were motivated to interact with dogs in 15.25% of all cases  
256 of sustained bites by dogs of known owners.

257

258 Figure 3. The circumstance under which stray dogs bit school children

259

260 Figure 4. The circumstance under which stray dogs bit preschool children

261

262 Figure 5. The circumstance under which dogs of known owners bit children

263

#### 264 4. Discussion

265 The aim of the study was to demonstrate the extent to which the online newspaper reports  
266 about dog bites to children are useful for studying and preventing this problem in Serbia. The first  
267 thing we noticed is that the topic of dog bites to children is not such favorite for Serbian journalists  
268 because we found only 83 reports for the searching period longer than 10 years. Some reports (17%)  
269 were in a form of only scant information about injuries by dogs without sufficient data about the  
270 circumstance under which they occurred and demography of victims and dogs. It was not clear from

271 the information whether the dogs just attacked a child, injured or bit him/her. Such articles were not  
272 useful for the purpose of the study and we discarded them. At the same time, the topic of dog bites  
273 to children in Serbia is not covered in the scientific and professional literature. Two articles on dog  
274 bites previously were published by Serbian authors (Vučinić et al., 2008; Kržanović, 2010). Therefore,  
275 all newspaper reports with sufficient data on dog bites can be useful in the initial phase of research  
276 on this problem. Sixty-nine reports on dog bites to children in Serbia gave us enough data on gender  
277 and age of victims, body location of injuries, seasons, circumstances and places where the incident  
278 occurred. However, it should be kept in mind that data from the newspaper cannot provide a real  
279 insight into a burden of dog bites and cannot be used to investigate the epidemiology of this  
280 problem in children. On the other hand, they can point out that this problem exists in one society.

281 Approximately one-third of the reports in their titles contained frightening words that  
282 brutalized and sensationalized dog bites. Recently, Arluke et al. (2018) strictly criticize accuracy and  
283 negative rhetoric of dog bites reports in medical literature. Similarly to the observation of these  
284 authors so in 32% of online newspapers in Serbia, it is possible to clearly recognize sensationalistic  
285 approach in reports and their titles on dog bites that the incidents were reported as catastrophes.  
286 Such reports horrify citizens. Moreover, these reports are particularly sensational when bites come  
287 from dogs categorized as "dangerous dog" and stray dogs. It is previously were explained by many  
288 authors (Tarver, 2013; McCarthy, 2015; Bleasdale-Hill and Dickinson, 2016).

289 The facts we learned from online newspapers referred to the gender and age of children who  
290 were the victims of dog bite and the seasons when they were injured. Further, we learned about the  
291 anatomical location of the injuries, the origin or ownership status of the dogs and the place where  
292 the incident occurred. Finally, on the basis of statements by children or witnesses, parents or  
293 caretaker, it was possible to be superficially informed about the way in which the bites occurred. It  
294 means journalists gave very scant information to readers about the previous interaction between the  
295 dog and the child. They are not able to look back on an analysis of the conditions under which the  
296 bite occurred. However, it is very important because contexts in which dog bites occur vary widely.  
297 Recently, (Oxley et al., 2018) pointed out that, preventive measures against dog bites depend on the  
298 conditions under which bites can occur. That's exactly why Owczarczak-Garstecka et al. (2018) used  
299 YouTube videos to study thoroughly human and dog behavior preceding dog bites and the context  
300 in which bites occur. No data on dog behavior and their health status can be collected from the  
301 reports from Serbian online newspapers. This suggests that journalists are not interested to  
302 interview veterinarians and investigate cases of dog bites in-depth. For example, behavioral  
303 screening of dogs conducted by Reisner et al. (2007) revealed a high percent of dogs with behavioral  
304 disorders and medical conditions. It is very important not only for children safety but for dog  
305 owners and dog welfare. Ignoring behavioral disorders and medical conditions in dogs indicates

306 either irresponsible or inexperienced dog owners. By detecting the causes of behavioral disorders  
307 and medical conditions in dogs, it is possible to avoid their consequences, such as bites.

308 Data collected from the Serbian online newspaper do not differ much from the results  
309 published by Georges and Adesiyun (2008) for school children and Davis et al. (2012) for preschool  
310 children regarding gender and age of victims. Boys were predominantly injured by dogs comparing  
311 to girls. Our results also confirmed this statement although only one boy more than girls was bitten  
312 in the studied period. The study conducted by Reisner et al. (2007) estimated that half of dog bite  
313 victims were boys and half were girls.

314 Reports from Serbian online newspapers clearly show that children over 6 years were more  
315 frequently bitten by dogs than children up to 6 years old. The mean age of all injured children,  
316 preschool children and school children was 8.34, 4.46 and 10.47 years, respectively. Reisner et al.  
317 (2007) also found that the victims of dog bites were children mostly older than 6 years contrary to the  
318 investigation by Horswell and Chahine (2011) who estimated children less than 5 years were most  
319 frequently bitten by dogs than children 5 to 9 years old. In the study conducted on primary school  
320 children by Georges and Adesiyun (2008) the mean age to be bitten was 9.0 years for boys and 8.5  
321 years for girls. The mean age of children calculated on the basis of data from Serbian online  
322 newspapers is approximate to these values. However, our research also included secondary school  
323 children. Nevertheless, the mean age of bitten children in our study and the study of Georges and  
324 Adesiyun (2008) is similar. This confirms that the greatest number of bite victims in our study was  
325 among school children aged 10 to 11 years.

326 Our result confirmed some of the previously reported results related to the seasonal  
327 distribution of dog bites. Approximately the same seasonal distribution was reported by Tenzin et  
328 al. (2011) who found the highest dog bite incidents during the spring months and the lowest during  
329 the summer. Our investigation also estimated similar seasonal fluctuation in dog bites. The majority  
330 of children sustained dog bites during the spring months but not summer. For many people in  
331 Serbia, spring means the possibility to go outside and to enjoy the warm weather after the long cold  
332 winter. Therefore, it is easy to understand that the warm-up attracts not only children and their  
333 parents to be active outside but, at the same time dog owners with their pets to use same pleasurable  
334 places and areas and also unowned dogs to leave their shelters and to freely roam. Therefore, the  
335 possibility of interaction between children and dogs increases. During the summer months, children  
336 spend their holidays at swimming pools and other bathing areas, where access to dogs is not  
337 allowed. Many children temporarily leave their homes alone or with parents and spend their  
338 holidays outside living places. That's why the possibility of interaction between children and dogs in  
339 public places decreases during the summer months. However, one case of a dog attack to a boy on a  
340 city beach was reported indicating irresponsible dog ownership. The owner accessed to the beach

341 with two dogs in the Bull type without leashes and muzzles. He allowed curious children to pet  
342 dogs claiming animals were calm and dressed. Suddenly, the boy was bitten by one of the dogs to  
343 the face. However, schoolchildren were more frequently bitten during the cold seasons. This class of  
344 children frequently more came into contact with stray dogs than preschool children. Many children  
345 of school age were injured by stray dogs in schoolyards or in school surrounding. It is the main  
346 reason for the estimated difference between these two classes of children. One of the main reasons  
347 why stray dogs entered schoolyards is that they may obtain food from children. Even though  
348 Bhattacharjee et al. (2017) estimated that stray dogs prefer petting over food in repeated interactions  
349 with unfamiliar humans, collected data from Serbian online newspapers could not confirm this  
350 finding. Moreover, our results are contrary to the findings of Corrieri et al. (2018) who estimated that  
351 stray dogs were less active, less excitable, and less aggressive towards humans than dogs living as  
352 human companions. Our results showed that in some cases of attacks on children, stray dogs were  
353 organized in packs attacking children in the school surrounding. On the other hand, our results are  
354 also the confirmation of the results of Corrieri et al. (2018) because many children in Serbia were  
355 bitten by dogs of known owners, not by stray dogs. In our study, 52% of children were not  
356 interacting with the dogs of known owners when they sustained bites. It means that dogs of known  
357 owners were more excitable and aggressive toward children than stray dogs but, strays, too. Also,  
358 our results confirm the findings of Reisner et al. (2011) who estimated that older bitten children  
359 sustained bites by unfamiliar dogs without any interaction.

360 Reports from Serbian online newspapers disclosed that the lower extremity was the most  
361 common individual site of injury from dog bites in children followed by upper extremities. This  
362 finding is in agreement with results obtained by Ogundare et al. (2017) who estimated the similar  
363 injury pattern in bitten children.

364 Children were most frequently bitten by mongrels (40.5 %). All other breeds were involved in  
365 other 59.5 % of bites. It is very popular to adopt mongrels from many municipal and private shelters  
366 in Serbia because they are full of unwanted strays who are housed in shelter environments. Many  
367 countries worldwide possed regulationd on so-called "Dangerous dogs". Some of these acts relate  
368 to breed-specific legislation by banning pit-bull type dogs. Similarly, the Republic of Serbia also  
369 possesses a dangerous dogs act (Official Gazette, 65/2010). This act embraces as dangerousdogs  
370 animals in the type of pit bull terriers, bull terriers, Staffordshire terriers, American Staffordshire  
371 terriers and miniature bull terrier. Dogs of the bull type terriers are commonly kept as companion  
372 animals but the pit bull terrier is not recognized as a specific breed and is restricted by breed-specific  
373 legislation in many parts of the world. Many people are unable to distinguish among various  
374 bull-type terrier breeds and use only dogs "physical features" to determine breed. Many people,  
375 especially in Serbia, may not differ pit bull type dogs from American Staffordshire terriers.

376 Therefore, we are not sure that the data related to dog breeds in Serbian online newspapers are  
377 correct. We found 17 bites originating from American Staffordshire terriers (ten bites), pit bulls  
378 (five bites) and bull terriers (two bites) classified into the group of bites from bull-type terriers. The  
379 problem in the identification of dogs from bulltype group is also reported in scientific literature  
380 (Hoffman et al., 2014). Recently, it was confirmed that the public in the United Kingdom is unable to  
381 distinguish pit bull terrier types from similar types of dogs (Webster and Farnworth, 2018). Webster  
382 and Farnworth (2018), Oxley et al. (2012) estimated that the knowledge of dog owners on banned  
383 breed dogs is low. Data on dog breeds involved in bites differ significantly across the world.  
384 Popularity of specific breeds varies in different countries, and this popularity affects statistics on dog  
385 bites which often tracks the breed popularity (Creedon and Ó'Súilleabháin, 2017), yet breeds are  
386 blamed (Arluke et al., 2018).

387 Analyzing dog bites to children in Serbia according to data collected from online newspapers, it  
388 is easy to notice that two populations of dogs that exist in the country were involved in case reports  
389 in media: strays or unowned dogs (41%) and dogs of known owners (59%). However, dog bites  
390 from the population of known owners exceeds that from strays. These facts point to the conclusion  
391 that Serbia has a problem with irresponsible dog ownership. There also seem to be problems that  
392 relate to the responsibility of parents and managers in Serbian schools.

393 Irresponsible dog ownership has several consequences. The first of them is the existence of the  
394 stray dog population pointing to an illegal abandonment of pet dogs. All citizens may be exposed to  
395 attacks and injuries from these dogs and become victims of their bites. The Serbian society as a  
396 whole has not yet solved the problems resulting from the presence and activity of stray dogs. It is  
397 especially worrying that the stray dogs enter the schoolyards and attack children. This pattern  
398 indicates that the schoolyards are not fenced or if they are fenced than the gates on fences are open.  
399 Therefore, children are not safe in schoolyards. This is the question for school managers. Also, stray  
400 dogs attack children in a surrounding of schools as well as on a path "home-school-home".

401 The second consequence of irresponsible dog ownership arises from non-compliance of  
402 regulations on keeping dogs in own yard. There are a number of regulations that dog owners in  
403 Serbia should be aware of. Legally, dog owners are required to securely confine their dog to the  
404 property. However, dog owners do not comply with them. Reports in Serbian media on dog bites to  
405 children show that many dog owners keep their dogs in yards whose gates are open allowing dogs  
406 to leave yards and to roam freely. Their dogs can attack and injure people who are passing near  
407 private yards. Our study clearly points to this consequence. This means that irresponsible owners do  
408 not provide adequate conditions for keeping dogs in their yards nor dogs are constantly under their  
409 supervision. The result of such behavior of dog owners is a large number of bitten children from  
410 dogs who suddenly ran out from private yards and injured children who passed near or played in

411 surrounding of private yards. There is a report in an online newspaper about a bitten girl who put  
412 her hand through a fence of a private yard to pet a dog. The case indicates the urgent need for  
413 children education on dog bite prevention. Moreover, two of the analyzed cases referred to the entry  
414 of dogs of known owners into a kindergarten yard and in a schoolyard. These cases again disclosed  
415 irresponsibility of owners who allowed their dogs to roam freely and managers of children's  
416 institutions who ignore children safety. One of the cases in our study related to the dog attack on a  
417 cyclist. The dog also had an irresponsible owner who allowed his pet animal to roam freely.  
418 Recently, this type of the interaction is also reported in the professional literature. The authors  
419 estimated that approximately 1% of injuries to bicyclists are associated with dogs of which one-half  
420 sustained a bite (Loder and Yaacoub, 2018).

421 The third consequence of irresponsible ownership relates to bites to children in public places,  
422 children's playgrounds and shared paths by unleashed and unmuzzled or leashed but unmuzzled  
423 dogs of known owners. Although owners are legally obliged to walk a dog on a leash in public  
424 places and to use a muzzle on types of dogs that may present "danger" to humans, they do not  
425 comply with this request.

426 Our study also disclosed irresponsible parents or relatives who allowed children to interact  
427 with own dogs without their supervision and inexperienced dog owners who were not familiar with  
428 the behavior of their pets. The first of them allowed children to be alone with animals. The second of  
429 them allowed children to interact with unmuzzled and unfamiliar dogs of known owners in public  
430 places. Research carried out by Reisner and Shofer (2008) disclosed that dog owners frequently had  
431 only limited knowledge of dog behavior and often were unaware of factors that increased the risk of  
432 dog bites to children. The simplest but the best advice on dog bites preventions in small children was  
433 given by Arhant et al. (2016) and Arhant et al. (2017). The primary measure of preventing injuries to  
434 children from dogs is parental or caregiver supervision of the interaction between children and  
435 dogs. But above all, it is essential that parents be previously educated about potentially unsafe  
436 behaviors of dogs and children, the dogs' needs, safety measures, dog body language and the  
437 manner how to supervise the interaction. The ideal time for parent education is before a child is born  
438 or a dog is acquired. Prevention of dog bites is not the only obligation for parents but for those who  
439 take care of a child and a dog. Education is also required for dog owners, and the need for  
440 controlling and sanctioning of irresponsible dog owners is implied.

441 The irresponsible dog ownership, the irresponsible parenthood and the lack of fences around  
442 the schoolyard are not causes of dog bites. First of all, they are closely correlated with the occurrence  
443 of dog bites. Moreover, the irresponsible dog ownership cannot be the cause of dog bites but may be  
444 the main source of risk factors for dog bites. One of the consequences of the irresponsible dog  
445 ownership is an intact male or female dog which may roam. Such dogs may present a risk factor



446 for dog bites, but here neuter status may not be a cause. We still do not know the real causes of dog  
447 bites. In another words, it is not known why dogs bite children. It could be said that the behavior of  
448 irresponsible dog owners, irresponsible parents and irresponsible preschool/school managers  
449 facilitates the direct interaction between children and dogs. Within this interaction, we need to try to  
450 find the cause of of dog bites.

## 451 **5. Conclusions**

452 Data from online Serbian newspapers clearly indicate that in this society, dog bites to children  
453 present a persistent problem. Based on ownership patterns of biting dogs, children in Serbia were  
454 bitten by strays and dog of known owners. Dogs and children were not responsible for the problem,  
455 but irresponsible dog ownership, irresponsible parenthood and irresponsible managers of  
456 preschool/school institutions do have responsibility. Bites of children from stray dogs point to the  
457 neglect of the problem by Serbian society as a whole, and especially by municipal authorities who  
458 are obliged to take care of stray dogs. Newspaper data cannot provide a real insight into the scale  
459 and severity of the problem referring to dog bites to children. They can, however, be the trigger for  
460 further studying of this problem by health workers and scientists and the warning signal to local  
461 authorities to tackle the problem of irresponsible dog ownership. At the same time, those  
462 responsible for the education in Serbia should urgently start the process of teaching children about  
463 the prevention of dog bites. The general picture of dog bites to children, which was obtained by  
464 analyzing newspaper articles, corresponds to the image of the same problem around the world. This  
465 refers to the demographic data of children, the anatomical location of the bites and places where the  
466 bite occurred as well as the seasons. However, newspaper articles cannot inform the reasons for the  
467 bites that originate from the dogs themselves or about the fate of biting dogs. This is another  
468 challenge for veterinarians in Serbia to engage in the study and solution of this problem by  
469 examining biting dogs and educating dog owners on bite prevention.

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472 The idea for the paper was conceived by Marijana Vucinic and Milos Vucicevic. The experiments were designed  
473 by Marijana Vucinic and Milos Vucicevic. The experiments were performed by Marijana Vucinic and Milos  
474 Vucicevic. The data were analyzed by Marijana Vucinic and Milos Vucicevic. The paper was written by  
475 Marijana Vucinic and Milos Vucicevic.

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- 663

664 Table 1. Number of articles according to their contents and titles

Article content	Number N (%)
Total number of found articles on dog bites to children	69 (100)
Articles related to a dog attack to an individual child	66 (96)
Articles related to a dog attack to a group of children	3 (4)
Articles which titles contain words "horror" ("užas"/"horor"), "dread" ("strava"/"strašno"), "creeps" ("jeza"/"jezivo"), "lacerate" ("rastrgnuti"), "disfigure" ("unakaziti"), "furious" ("razjaren"/"pobesneo")*	22 (32)

665 \* Words in brackets are on the Serbian language

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Table 2. Gender and age class of bitten children and origin of dogs that bit children

	N (%)	P Value
Gender of children		
Boys	40 (51)	NS
Girls	39 (49)	$\chi^2= 0.063$ ; DF=1
Age class of children		
Preschool age (2-6 years old)	28 (35)	$P = 0.0002$
School age (7-17 years old)	51 (65)	$\chi^2= 14.13$ ; DF=1
Ownership patterns of biting dogs		
Stray dogs	32 (41)	$P = 0.0241$
Dogs of known owners	47 (59)	$\chi^2= 5.087$ ; DF=1

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670 Table 3. The mean age of children who sustained dog bites

Gender and age class of injured children	Number	%	Age			
			Mean	Standard deviation	Minimum	Maximum
Injured children	79	100.00	8.34	3.65	2	17
Boys	40	51.00	8.53	3.53	3	17
Girls	39	49.00	8.15	3.61	2	15
Pre-school children	28	35.00	4.46	1.23	2	6
School children	51	65.00	10.47	2.64	7	17
Pre-school boys	14	17.70	4.86	0.95	3	6
Pre-school girl	14	17.70	4.07	1.38	2	6
School boys	26	32.90	10.50	2.72	7	17
School girl	25	31.70	10.44	2.61	7	15

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673 Table 4. Dog bites to children in warm and cold season

Children group	Warm season	Cold season	P Value
	(Spring + Summer)	(Autumn + Winter)	
	N (%)	N (%)	
Pre-school children	19 (68)	9 (32)	P = 0.0002
School children	21 (41)	30 (59)	$\chi^2= 14.13$ ; DF=1
Total	40 (51)	39 (49)	NS

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676 Table 5. Location of injuries from dog bites on the body

<b>Body region</b>	<b>N (%)</b>
Head, face, neck	12 (15)
Upper extremities	15 (19)
Lower extremities	25 (32)
Other regions of the body (Genitalia, belly, back)	8 (10)
Multiple injuries of different body regions	19 (24)
Total	79 (100)

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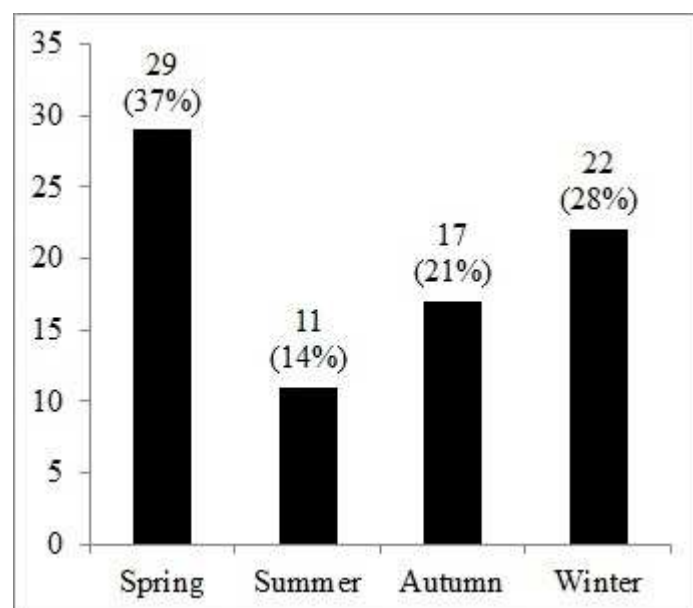
678

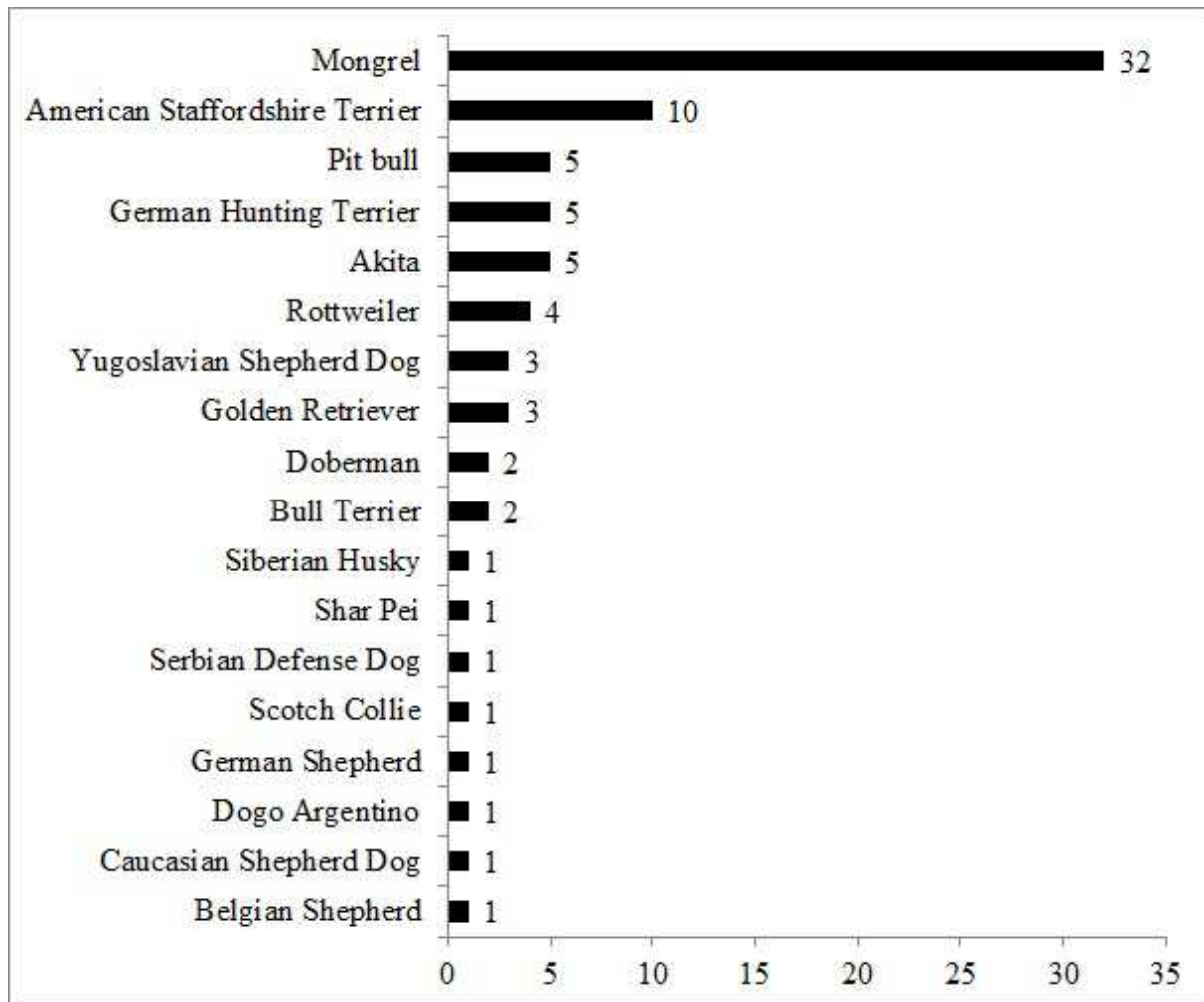
679 Table 6. Differences between children of preschool and school age in sustained bites by stray  
 680 dogs and dogs of a known owner

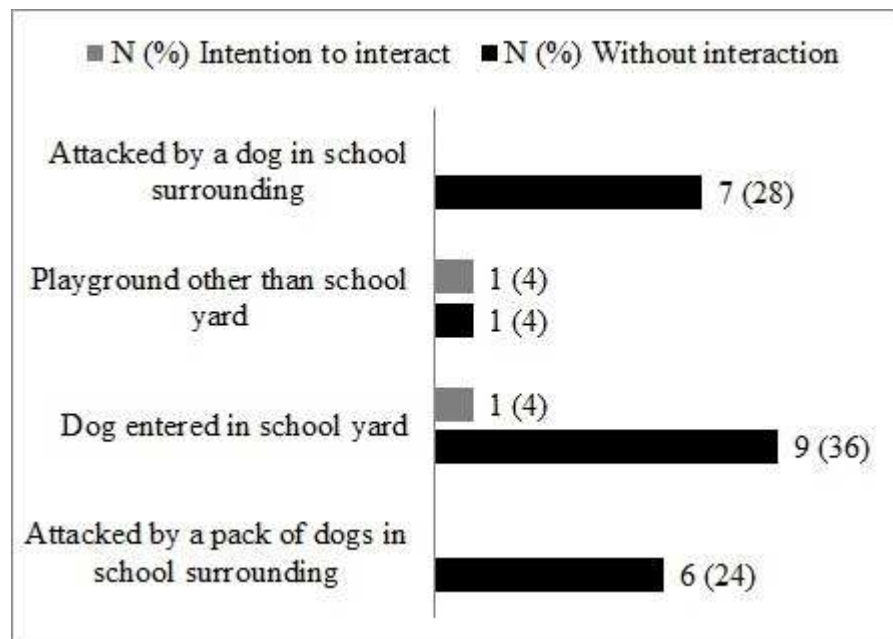
Children group	N (%)	Stray dogs	Dogs of known	P Value
		N (%)	owners N (%)	
Pre-school children	28 (100)	7 (25)	21 (75)	P = 0.0375
School children	51 (100)	25 (49)	26 (51)	$\chi^2= 4.33$ ; DF=1
Total	79 (100)	32 (41)	47 (59)	P = 0.0241 $\chi^2= 5.087$ ; DF=1

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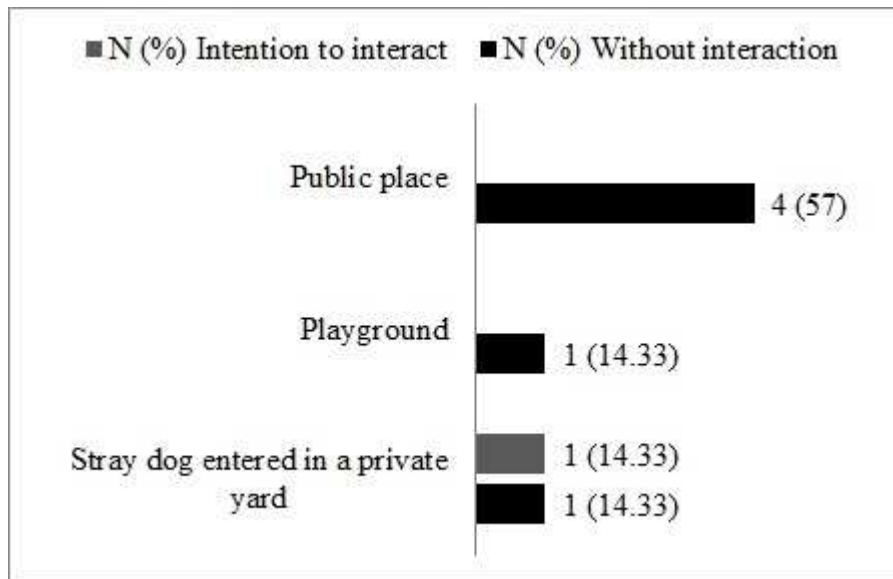
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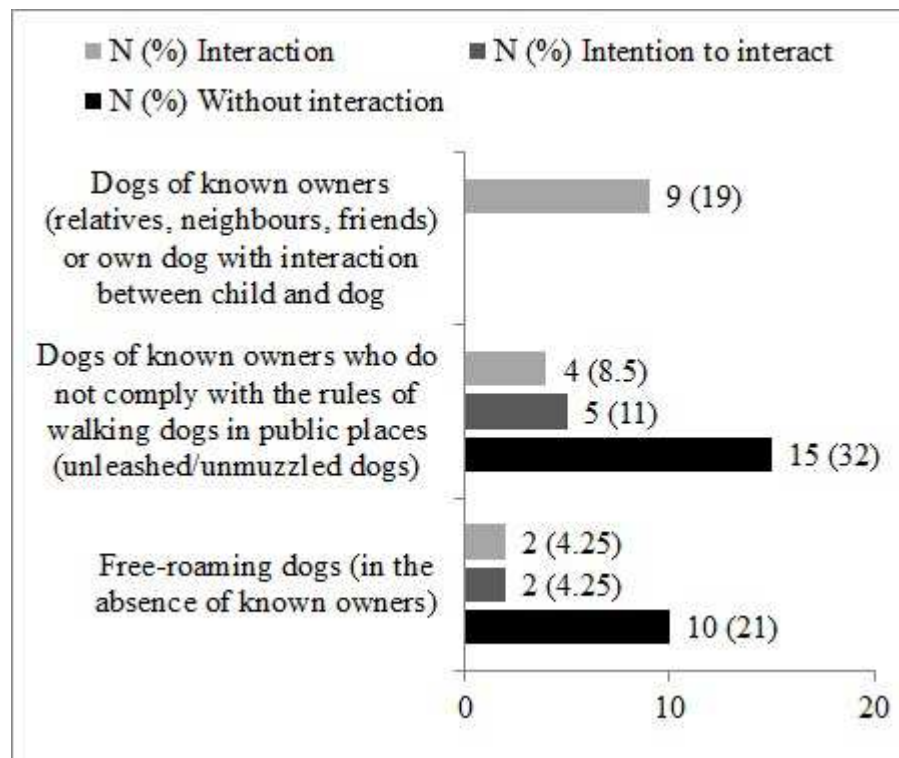












- Dog bites occur due to irresponsible dog owners
- Dog bites occur due to inexperienced parents
- Dog bites occur due to irresponsible managers of preschool/school institutions
- Dog bites to children present a persistent problem in Serbian society
- Newspapers cannot provide real insight into the scale and severity of the problem

ACCEPTED MANUSCRIPT