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

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ABSTRACT

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

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Introduction

There are numerous definitions of epidemiology. The simplest of them defines epidemiology as “the basic science of public health” (Kuller, 1991). Epidemiology can also be defined as “the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control of health problems” (Last, 2001) in such ways to “promote, protect, and restore health” (Tapia Granados, 1999). This medical science also studies frequencies of health problems in a certain population by using measures such as prevalence and incidence (Rothman and Greenland, 1998). Insight into the frequency of a health problem is not the main goal of epidemiology. Its main objective is to elucidate the mechanisms of health problems occurrence aiming to develop preventive strategies. Dog bites are recognized as a public health problem in many societies. It is a main reason why a great number

of authors who studied dog bites put these two words in titles and texts of their published articles (Beck, 1975; Beaver et al., 2001; Maetz, 1979; Mengistu, 2011; Orritt, 2015; Voelker, 1997), emphasizing that dog bites are really a public health problem. The population pattern of this health problem is not solely dependent on the characteristic of dog bite victims or dogs who injured victims, but also on the interaction between these individuals with each other and a great number of other factors in a social setting, including behavior, knowledge, and responsibility of dog owners, the general interest of the society for this problem, and many others. Numerous of these epidemiological factors are comprehensively summarized, analyzed, and explained by Overall and Love (2001).

Dog bites to children are still the main public health and animal welfare problem and the interesting topic that attracts an attention in many scientific journals and media. Because dog bites were recognized as a public health problem (Beck, 1975; Maetz, 1979; Mengistu, 2011; Orritt, 2015; Voelker, 1997), they are the subject of epidemiology—basic science of public health (Agarwal and Reddajah, 2004; De Keuster and Overall, 2011; Overall and Love, 2001; Parrish et al, 1959). Therefore, epidemiology of dog bites studies the frequency of bites in a certain population using measures such as a prevalence and incidence (Georges and Adesiyun,

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2008; Schalamon et al., 2006; Venkatesan et al., 2017; Westgarth et al., 2018) and their determinants such as causes and risk factors (Davis et al. 2012; Gershman et al. 1994; Messam et al. 2008, 2012, 2018; Nahlik et al., 2010; Overall and Love, 2001; Watson et al. 2012). Such studies aim to control bites by effective measures to prevent their occurrence (Champan et al., 2000; Duperrex et al., 2009; De Keuster and Overall, 2011; Gielen et al., 2012; Lakestani and Donaldson, 2015; Meints and de Keuster, 2009; Ozanne-Smith et al., 2001; Shen et al., 2017) or the threat health-related consequences such as bite wounds and their complications, transmission of zoonotic diseases, dysfunctionality of injured body parts (Morgan and Palmer, 2007) and the long-term effects such as psychological or emotional issues including post-traumatic stress disorders (Peters et al., 2004). Preventive interventions range from conducting of animal control measures (Clarke and Fraser, 2013) to specific education programs for children (Champan et al., 2000; Duperrex et al., 2009; De Keuster and Overall, 2011; Lakestani and Donaldson, 2015; Meints and de Keuster, 2009; Shen et al., 2017) and their parents (Gielen et al., 2012).

Some authors collected and analyzed all epidemiological aspects of dog bites (Gershman et al. 1994; Overall and Love 2001) with special emphasis on risk factors. The recent study by Messam et al. (2018) equally emphasized child- and dog-related factors contributing to a bite. Although there is a large amount of data on all epidemiological aspects of dog bites, we still do not really know why dog bite children (Love and Overall, 2001, Oxley et al., 2018). While 17 years ago Love and Overall (2001) pointed to the lack of demographic data on dogs involved in bites, nowadays Oxley et al. (2018) point to the lack of factors and contexts surrounding dog bite incidents. Aiming to better understand the context in which bites occur and to analyze of humane and dog behaviors before bites Owczarczak-Garstecka et al. (2018) analyzed in detail online videos of dog bites. This study presents the improvement in the methodology of analysis of dog bites. After the identification of different contexts in which dog bites occur, Oxley et al. (2018) pointed out that a number of different prevention measures are required.

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

Reports on dog bites to children are very attractive to readers of newspapers and favorite titles for journalists. Moreover, such reports are more interesting for readers and particularly sensational when bites come from dogs categorized as "dangerous dog" (Bleasdale-Hill and Dickinson, 2016; McCarthy, 2015; Tarver, 2013) and stray dogs. In some societies, stray dogs present the persistent problem (Bhattacharjee et al. 2017; Guilloux et al., 2018; Narayanan, 2017). There are a great number of nongovernmental organizations that protect stray dogs all around the world. It could be possible to read about social conflicts between animal protectionists and municipal authorities/governments. Such circumstances mean that dog bites may be a political issue (Westgarth and Watkins, 2015). Local authorities may be exposed to special pressure to adopt new or to change existing legislation on pet ownership (Bleasdale-Hill and Dickinson, 2016; Clarke and Fraser, 2013; Mora et al., 2018; Raghavan et al., 2013; Rock et al., 2015). Stray dogs are one of the main topics for discussion between citizens, members of NGOs, and journalists on the one side and municipal politicians on the other.

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

When media report on accidents, diseases, disasters, and other hazards, then these reports have a form of information about events, immediate consequences, and harms. They inform the public about injuries, deaths, and property destructions. Informing the public about disasters, diseases, and accidents, media usually use violent language to exaggerate their consequences and to attract readers' attention to the titles and text of reports. Media do not inform about issues of accidents and also excluded discussion about the risks of accidents. Usually, a moral or ethical approach to accidents is absent. Really, readers are attracted by the consequences of accidents but remain limited for the information on the real causes, long-term consequences, and accident prevention. Often, the earliest accident reports also contain erroneous information about the consequences or actors who participated in the accident. Taking into account dog bites, these mistakes may relate to breeds of biting dogs or to consequences of bites. Frequently consequences of dog bites are overemphasized in the report title, whereas that is not the case in the text (Singer and Endrenu, 1994). It can be said that journalists like to sensationalize accidents. Many authors previously noticed that newspaper media reporting on accidents generally does not include injury prevention messages, so it is a lost opportunity for public education (Heng and Vasu, 2010). It would be very useful that media reports of dog bites disseminate

public health messages that raise awareness of sources of risk and preventive message.

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

Materials and methods

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

To systematize all data on dog bites to children from the available information of bites in online newspapers, we developed our own “report form” and abstracted information on bites that we analyzed in the study. We use this form to exclude duplicated data on bites that overlapped in a different newspaper.

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

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

Results

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

bites occurred. However, we completely excluded them from the study.

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

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

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

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

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

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

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

Children sustained more bites from dogs of known owners (59%) than from stray dogs (Tables 1 and 6). School children sustained

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”) ^a	22 (32)

^a Words in brackets are on the Serbian language.

Table 2

Gender and age class of bitten children and origin of dogs that bit children

Data on children and dogs	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

more bites from stray dogs (49%) compared with preschool children (25%) who were most commonly bitten ($P < 0.05$) by dogs of known owners (75%).

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

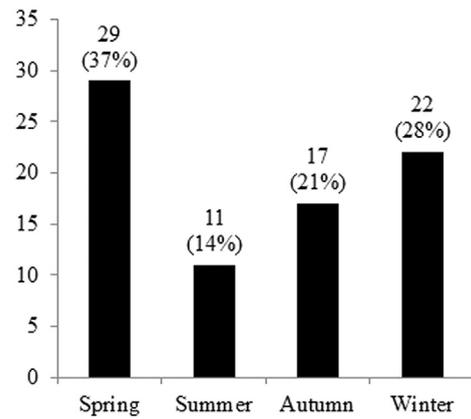
Discussion

The aim of the study was to demonstrate the extent to which the online newspaper reports about dog bites to children are useful for studying and preventing this problem in Serbia. The first thing we noticed is that the topic of dog bites to children is not such favorite for Serbian journalists because we found only 83 reports for the searching period longer than 10 years. Some reports (17%) were in a form of only scant information about injuries by dogs without sufficient data about the circumstance under which they occurred and demography of victims and dogs. It was not clear from the information whether the dogs just attacked a child, injured, or bit him/her. Such articles were not useful for the purpose of the study

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
Preschool children	28	35.00	4.46	1.23	2	6
School children	51	65.00	10.47	2.64	7	17
Preschool boys	14	17.70	4.86	0.95	3	6
Preschool 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

**Figure 1.** Number of bitten children according to seasons.

and we discarded them. At the same time, the topic of dog bites to children in Serbia is not covered in the scientific and professional literature. Two articles on dog bites previously were published by Serbian authors (Kržanović, 2010; Vučinić et al., 2008). Therefore, all newspaper reports with sufficient data on dog bites can be useful in the initial phase of research on this problem. Sixty-nine reports on dog bites to children in Serbia gave us enough data on gender and age of victims, body location of injuries, seasons, circumstances and places where the incident occurred. However, it should be kept in mind that data from the newspaper cannot provide a real insight into a burden of dog bites and cannot be used to investigate the epidemiology of this problem in children. On the other hand, they can point out that this problem exists in one society.

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

The facts we learned from online newspapers referred to the gender and age of children who were the victims of dog bite and the seasons when they were injured. Furthermore, we learned about the anatomical location of the injuries, the origin or ownership status of the dogs and the place where the incident occurred. Finally, on the basis of statements by children or witnesses, parents or caretaker, it was possible to be superficially informed about the way in which the bites occurred. It means journalists gave very scant information to readers about the previous interaction between the dog and the child. They are not able to look back on an analysis of the conditions under which the bite occurred. However,

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 (%)	
Preschool 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

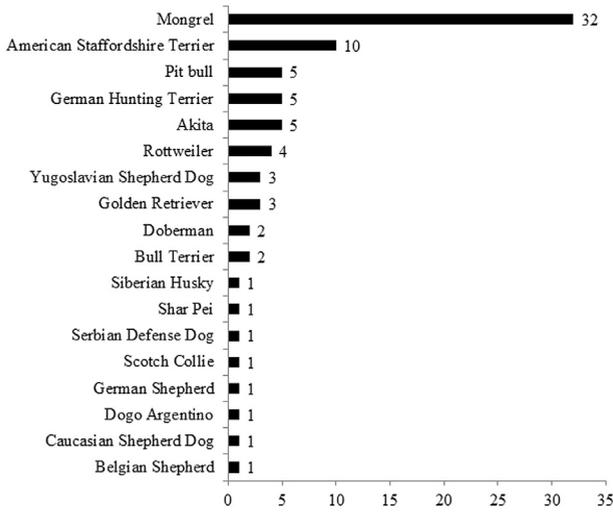


Figure 2. Dog breeds.

Table 6

Differences between children of preschool and school age in sustained bites by stray dogs and dogs of a known owner

Children group	N (%)	Stray dogs N (%)	Dogs of known owners N (%)	P value
Preschool 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)	$P = 0.0241$
				$\chi^2 = 5.087; DF = 1$

children less than 5 years were most frequently bitten by dogs than children 5 to 9 years old. In the study conducted on primary school children by Georges and Adesiyun (2008), the mean age to be bitten was 9.0 years for boys and 8.5 years for girls. The mean age of children calculated on the basis of data from Serbian online newspapers is approximate to these values. However, our research also included secondary school children. Nevertheless, the mean age of bitten children in our study and the study of Georges and Adesiyun (2008) is similar. This confirms that the greatest number of bite victims in our study was among school children aged 10 to 11 years.

Our result confirmed some of the previously reported results related to the seasonal distribution of dog bites. Approximately the same seasonal distribution was reported by Tenzin et al. (2011) who found the highest dog bite incidents during the spring months and the lowest during the summer. Our investigation also estimated similar seasonal fluctuation in dog bites. Most children sustained dog bites during the spring months but not summer. For many people in Serbia, spring means the possibility to go outside and to enjoy the warm weather after the long cold winter. Therefore, it is easy to understand that the warmup attracts not only children and their parents to be active outside but, at the same time dog owners with their pets to use same pleasurable places and areas and also unowned dogs to leave their shelters and to freely roam. Therefore, the possibility of interaction between children and dogs increases. During the summer months, children spend their holidays at swimming pools and other bathing areas, where access to dogs is not allowed. Many children temporarily leave their homes alone or with parents and spend their holidays outside living places. That is why the possibility of interaction between children and dogs in public places decreases during the summer months. However, one case of a dog attack to a boy on a city beach was reported indicating irresponsible dog ownership. The owner accessed to the beach with two dogs in the bull type without leashes and muzzles. He allowed curious children to pet dogs claiming animals were calm and dressed. Suddenly, the boy was bitten by one of the dogs to the face.

it is very important because contexts in which dog bites occur vary widely. Recently, Oxley et al., 2018 pointed out that, preventive measures against dog bites depend on the conditions under which bites can occur. That's exactly why Owczarczak-Garstecka et al. (2018) used YouTube videos to study thoroughly human and dog behavior preceding dog bites and the context in which bites occur. No data on dog behavior and their health status can be collected from the reports from Serbian online newspapers. This suggests that journalists are not interested to interview veterinarians and investigate cases of dog bites in-depth. For example, behavioral screening of dogs conducted by Reisner et al. (2007) revealed a high percentage of dogs with behavioral disorders and medical conditions. It is very important not only for children safety but for dog owners and dog welfare. Ignoring behavioral disorders and medical conditions in dogs indicates either irresponsible or inexperienced dog owners. By detecting the causes of behavioral disorders and medical conditions in dogs, it is possible to avoid their consequences, such as bites.

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

Reports from Serbian online newspapers clearly show that children over 6 years were more frequently bitten by dogs than children up to 6 years old. The mean age of all injured children, preschool children, and school children was 8.34, 4.46, and 10.47 years, respectively. Reisner et al. (2007) also found that the victims of dog bites were children mostly older than 6 years contrary to the investigation by Horswell and Chahine (2011) who estimated

Table 5 Location of injuries from dog bites on the body

Body region	N (%)
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)

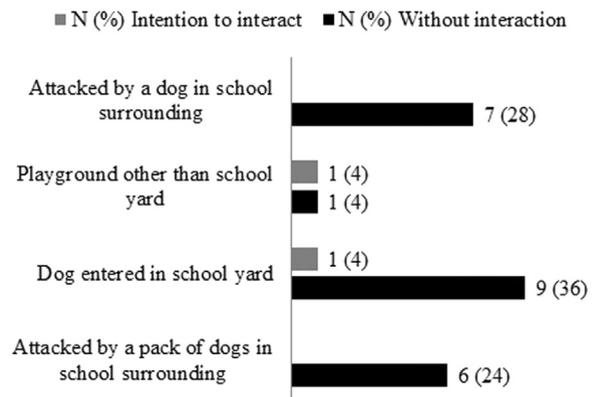


Figure 3. The circumstance under which stray dogs bit school children.

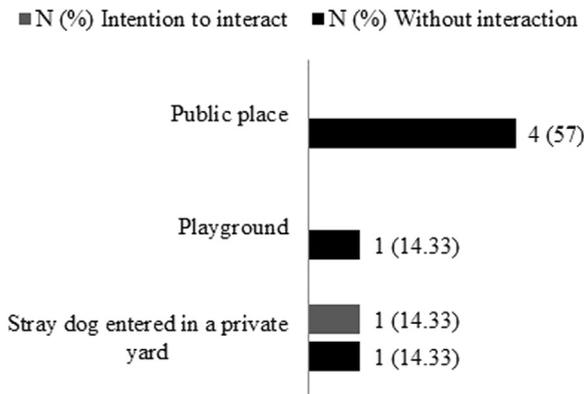


Figure 4. The circumstance under which stray dogs bit preschool children.

However, school children were more frequently bitten during the cold seasons. This class of children frequently more came into contact with stray dogs than preschool children. Many children of school age were injured by stray dogs in schoolyards or in school surrounding. It is the main reason for the estimated difference between these two classes of children. One of the main reasons why stray dogs entered schoolyards is that they may obtain food from children. Even though [Bhattacharjee et al. \(2017\)](#) estimated that stray dogs prefer petting over food in repeated interactions with unfamiliar humans, collected data from Serbian online newspapers could not confirm this finding. Moreover, our results are contrary to the findings of [Corrieri et al. \(2018\)](#) who estimated that stray dogs were less active, less excitable, and less aggressive toward humans than dogs living as human companions. Our results showed that in some cases of attacks on children, stray dogs were organized in packs attacking children in the school surrounding. On the other hand, our results are also the confirmation of the results of [Corrieri et al. \(2018\)](#) because many children in Serbia were bitten by dogs of known owners, not by stray dogs. In our study, 52% of children were not interacting with the dogs of known owners when they sustained bites. It means that dogs of known owners were more excitable and aggressive toward children than stray dogs but, strays, too. In addition, our results confirm the findings of [Reisner et al. \(2011\)](#) who estimated that older bitten children sustained bites by unfamiliar dogs without any interaction.

Reports from Serbian online newspapers disclosed that the lower extremity was the most common individual site of injury

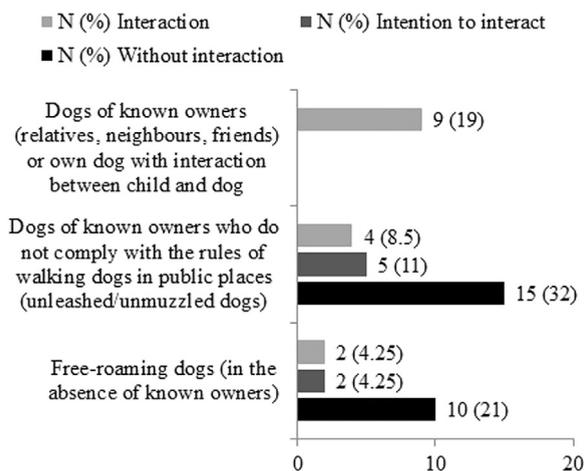


Figure 5. The circumstance under which dogs of known owners bit children.

from dog bites in children followed by upper extremities. This finding is in agreement with results obtained by [Ogundare et al. \(2017\)](#) who estimated the similar injury pattern in bitten children.

Children were most frequently bitten by mongrels (40.5 %). All other breeds were involved in other 59.5 % of bites. It is very popular to adopt mongrels from many municipal and private shelters in Serbia because they are full of unwanted strays who are housed in shelter environments. Many countries worldwide possessed regulations on so-called “Dangerous dogs”. Some of these acts relate to breed-specific legislation by banning pit bull-type dogs. Similarly, the Republic of Serbia also possesses a dangerous dogs act ([Official Gazette Republic of Serbia, 65/2010](#)). This act embraces as dangerous dogs animals in the type of pit bull terriers, bull terriers, Staffordshire terriers, American Staffordshire terriers, and miniature bull terrier. Dogs of the bull-type terriers are commonly kept as companion animals but the pit bull terrier is not recognized as a specific breed and is restricted by breed-specific legislation in many parts of the world. Many people are unable to distinguish among various bull-type terrier breeds and use only dogs “physical features” to determine breed. Many people, especially in Serbia, may not differ pit bull-type dogs from American Staffordshire terriers. Therefore, we are not sure that the data related to dog breeds in Serbian online newspapers are correct. We found 17 bites originating from American Staffordshire terriers (ten bites), pit bulls (five bites), and bull terriers (two bites) classified into the group of bites from bull-type terriers. The problem in the identification of dogs from bull-type group is also reported in scientific literature ([Hoffman et al., 2014](#)). Recently, it was confirmed that the public in the United Kingdom is unable to distinguish pit bull terrier types from similar types of dogs ([Webster and Farnworth, 2018](#)). [Webster and Farnworth \(2018\)](#) and [Oxley et al. \(2012\)](#) estimated that the knowledge of dog owners on banned breed dogs is low. Data on dog breeds involved in bites differ significantly across the world. Popularity of specific breeds varies in different countries, and this popularity affects statistics on dog bites which often tracks the breed popularity ([Creedon and Súilleabháin, 2017](#)), yet breeds are blamed ([Arluke et al., 2018](#)).

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

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

The second consequence of irresponsible dog ownership arises from noncompliance of regulations on keeping dogs in own yard. There are a number of regulations that dog owners in Serbia should be aware of. Legally, dog owners are required to securely confine their dog to the property. However, dog owners do not comply with them. Reports in Serbian media on dog bites to children show that many dog owners keep their dogs in yards whose gates are open

allowing dogs to leave yards and to roam freely. Their dogs can attack and injure people who are passing near private yards. Our study clearly points to this consequence. This means that irresponsible owners do not provide adequate conditions for keeping dogs in their yards nor are dogs constantly under their supervision. The result of such behavior of dog owners is a large number of bitten children from dogs who suddenly ran out from private yards and injured children who passed near or played in surrounding of private yards. There is a report in an online newspaper about a bitten girl who put her hand through a fence of a private yard to pet a dog. The case indicates the urgent need for children to have education on dog bite prevention. Moreover, two of the analyzed cases referred to the entry of dogs of known owners into a kindergarten yard and in a schoolyard. These cases again disclosed irresponsibility of owners who allowed their dogs to roam freely and managers of children's institutions who ignore children safety. One of the cases in our study related to the dog attack on a cyclist. The dog also had an irresponsible owner who allowed his pet animal to roam freely. Recently, this type of the interaction is also reported in the professional literature. The authors estimated that approximately 1% of injuries to bicyclists are associated with dogs of which one-half sustained a bite (Loder and Yaacoub, 2018).

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

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

The irresponsible dog ownership, the irresponsible parenthood, and the lack of fences around the schoolyard are not causes of dog bites. First of all, they are closely correlated with the occurrence of dog bites. Moreover, the irresponsible dog ownership cannot be the cause of dog bites but may be the main source of risk factors for dog bites. One of the consequences of the irresponsible dog ownership is an intact male or female dog which may roam. Such dogs may present a risk factor for dog bites, but here neuter status may not be a cause. We still do not know the real causes of dog bites. In another words, it is not known why dogs bite children. It could be said that the behavior of irresponsible dog owners, irresponsible parents, and irresponsible preschool/school managers facilitates the direct interaction between children and dogs. Within this interaction, we need to try to find the cause of dog bites.

Conclusions

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

Authors' contributions The idea for the article was conceived by Marijana Vucinic and Milos Vucicevic. The data collection was designed by Marijana Vucinic and Milos Vucicevic. The data were analyzed by Marijana Vucinic and Milos Vucicevic. The article was written by Marijana Vucinic and Milos Vucicevic.

Conflicts of interest

The authors declare no conflict of interest.

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