

EPIDEMIOLOGICAL ASPECTS OF DOG BITES CONSIDERING BITER DOGS AND VICTIMS

Daniel Sartore Buso¹
Luzia Helena Queiroz²
José Erisvaldo Silva³

ABSTRACT

The aim of this study was to characterize dog bites using data on biter dogs and victims. An exploratory cross-sectional study was performed using 203 records of individuals who had attended in public health services in 2009 in the municipality of Araçatuba, São Paulo, Brazil, after they had been bitten by a dog. Over 70% (92/129) of the biter dogs were male and most of them (71%) received as a gift. Dog owners reported companionship as the main reason for acquiring the dog. The victims who were children were predominantly male, while the victims who were elderly were predominantly female. Most children were bitten on the head/neck, while adults were bitten on the hands/feet and lower limbs ($p < 0.0001$). The owner of the dog was known in 83.2% of cases. However, rabies observation of the biter dog following the attack was only reported in 59.4% of cases. Situations involving aggression were related to dogs having escaped from their home (18.7%) or roaming free on the streets (17.0%). The analysis of biting dog characteristics using information obtained from dog bite victims and biting dog owners can help direct the medical treatment for dog bite victims. Moreover, concepts of responsible dog ownership can reduce the occurrence of bites.

Keywords: dogs, aggression, bites and stings, rabies, post exposure prophylaxis

ASPECTOS EPIDEMIOLÓGICOS DAS AGRESSÕES POR CÃES SOB O PONTO DE VISTA DO CÃO AGRESSOR E DAS VÍTIMAS.

RESUMO

O presente estudo buscou caracterizar as agressões por cães, envolvendo dados sobre o animal e sua vítima. Foi realizado um estudo exploratório transversal envolvendo 203 fichas de habitantes que procuraram a rede pública de saúde de Araçatuba, São Paulo, Brasil, em 2009, após sofrerem mordedura canina. Mais de 70% dos cães (92/129) eram machos, sendo a maioria (71%) recebida como presente. A busca por companhia foi o principal motivo de aquisição. Houve predomínio do sexo masculino em crianças e do sexo feminino em idosos. A maioria das crianças foi mordida na cabeça/pescoço, e dos adultos, nas mãos/pés e membros inferiores ($p < 0,0001$). O proprietário do animal era conhecido em 83,2% dos casos, sendo indicada apenas observação do cão em 59,4% dos casos. As principais situações que envolveram as agressões foram o cão ter escapado (18,7%) ou permanecer solto na rua (17,0%). A análise de características de cães agressores com informações obtidas junto às suas vítimas e proprietários pode auxiliar a conduta médica nesses casos. Além disso, há necessidade de maior responsabilidade na criação de cães, pois conceitos de posse responsável podem reduzir a ocorrência de mordeduras.

¹ Pós-Graduando em Ciência Animal – Faculdade de Medicina Veterinária - UNESP - Univ. Est. Paulista, Araçatuba, São Paulo, Brasil

² Professora adjunta da Faculdade de Medicina Veterinária de Araçatuba, da UNESP - Universidade Estadual Paulista Júlio de Mesquita Filho, na área de Medicina Veterinária Preventiva e Saúde Pública

³ Biólogo. Mestre em Ciência Animal. Programa de Pós-Graduação em Ciência Animal – Faculdade de Medicina Veterinária - UNESP - Univ. Est. Paulista, Araçatuba, São Paulo, Brasil.

Palavras-chaves: cães, agressão, mordeduras e picadas, raiva, profilaxia pós-exposição.

DESCRIPCIÓN DE LAS MORDEDURAS POR PERROS DESDE EL PUNTO DE VISTA DEL PERRO AGRESOR Y DE LAS VÍCTIMAS.

RESUMEN

El presente estudio tuvo como objetivo caracterizar los ataques de perros incluyendo datos sobre el animal y su víctima. Se realizó un estudio exploratorio de corte transversal a partir de las fichas médicas de 203 habitantes que procuraron los servicios de la red pública de salud de Araçatuba, São Paulo, Brasil, después de sufrir mordeduras de perros durante 2009. Más del 70% de los perros (92/129) eran del sexo masculino y la mayoría (71%) fue recibido como regalo. El principal motivo para la adquisición de los animales fue como animal de compañía. Dentro del perfil de personas agredidas, hubo predominio de niños del sexo masculino y de mujeres de edad avanzada. La mayoría de los niños fue mordido en la cabeza / cuello y los adultos en las manos, los pies y en las extremidades inferiores ($p < 0,0001$). El propietario del animal era conocido en el 83,2% de los casos, con la observación de que el perro se indica sólo en el 59,4% de los casos. Los principales escenarios de agresión entubieron relacionados con el perro escapando de casa (18,7%) o permaneciendo suelto en la calle (17,0%). El análisis de las características de los perros agresores, de las víctimas y de los dueños puede auxiliar en el tratamiento médico en estos casos. Además, existe la necesidad de mayor cuidado en la criación de los perros, dado que el concepto de propiedad responsable puede reducir la prevalencia de mordeduras.

Palabras clave: perros, agresión, mordeduras y picaduras, rabia, profilaxis post-exposición.

INTRODUCTION

Epidemiological studies on the occurrence of dog bites have been conducted in Brazil (1-6) and abroad (7, 8). However, the data recovered from a victim's medical and rabies prophylaxis records contain no information pertaining to the animal aggressors. Some studies discuss the dogs involved in the attack; however, the majority of these studies were conducted outside of Brazil (9-14).

In 2002 the reported number of individuals bitten by dogs in Brazil reached 424,092. Of these, 237,731 individuals required treatment against rabies, resulting in an expense of approximately R\$ 17 million (15).

Between January 1998 and June 2010, 8,283 admissions attributed to incidents involving dog bites were reported in Brazil. Of the 4,747 dog bite incidents that were reported in southeast Brazil, 62.1% occurred within the state of São Paulo. This high prevalence highlights the importance of an epidemiological study of dog bites in São Paulo and of increased prevention efforts for the control of this type of accident (16).

According to Beaver (17), dog aggression is not a final diagnosis, but a behavioral disorder that should be considered according to its causes. The predominant forms of dog aggression include dominance (i.e., competitive aggression), self-defense (i.e., induced by fear or pain), protection of objects or people (i.e., possessive aggression), territorial aggression (i.e., against strangers or unknown dogs), aggression during play, and protection of offspring (i.e., maternal aggression).

The body of literature pertaining to the situational and causal factors of dog bites is also limited (10, 12-14). However, the epidemiological study of aggression in dogs has evolved

because of the changing perception towards the importance of understanding the characteristics of the biting dog, in addition to the characteristics of victims.

The objective of this study was to characterize the epidemiological aspects of reported incidents of dog bites in São Paulo, Brazil. We sought to describe incident dog bite cases by victim demographics, biter dog demographics, information pertaining to the acquisition of the dog, the type of aggression, and any situational factors that may have contributed to the dog bite.

METHODS

The study was conducted in the city of Araçatuba, an 1167 km² area of land located in the northwestern region of São Paulo (21°12'41''S 50°25'34''W). In 2009, the estimated population of Araçatuba was 182,204 inhabitants (18).

For this exploratory study, we established a population sample of 203 individuals seeking post-exposure rabies treatment between January and December 2009. Data were obtained after consulting the Epidemiological Surveillance Service of the Health Department of Araçatuba. Information on dog bite victims was obtained from the W64 (CID10) form, an anti-rabies care service within the Information System for Notifiable Diseases (SINAN). Dog bite victims were contacted to complete a closed structured questionnaire administered by two interviewers. Three attempts were made to contact each victim and, if possible, the dog owner. In the event that the dog bite victim or dog owner was unable to be contacted, only the data that were already contained in the SINAN W64 form were recorded.

Evaluation of the 203 W64 forms resulted in 183 interviews with dog bite victims. For 99 of these cases, it was also possible to interview the owner of the biter dog, which in many cases was also the victim, to complete the interview. For 84 cases, it was not possible to contact the owner to obtain more details about the biter dog. For example, the biter dog may have been a stray dog with an unknown owner, or the victim may have been unwilling or unable to recall the address of the owner. In these cases, only basic information was obtained from the victim on the dog bite. Interviews were unable to be conducted for 20 cases. Therefore, only information obtained from the SINAN form was available for analysis for these cases. Reasons for a missing interview included refusal to participate in the study (n=6), inability to contact the victim due to an incorrect address (n=6), the victim moved from the given address (n=2), death of the victim for reasons other than a dog bite (n=2), or lack of response after several attempts of contact (n=4). Due to missing values, the total number of responses for each variable was not constant and did not consistently add up to the total number of records analyzed (n=203).

The research project was submitted and approved by the Ethics Committee of the Faculty of Dentistry of Araçatuba, São Paulo, UNESP (Case FOA-01065/09). Dog owners received an information form about the research objectives and signed a consent form agreeing to participate.

The variables analyzed pertaining to the biter dog included breed, sex, reproductive status, age, size, origin (way of acquiring the dog) and rabies vaccination status. The variable pertaining to the victim or to the dog owner included relation with the dog (e.g., victim, neighbor, stray dog), primary reason for acquiring the dog, sex of the victim, age range of the victim (e.g., child (0-12 years); adolescent (13 to 17 years); adult (18 to 59 years); and elderly (over 60 years)), location of the bite incident (e.g., street, residence), anatomical area affected by the bite of the biter dog, the victim's medical treatment, the situation that triggered the dog bite, provocation of attack, and biter dog aggression type. All information was recorded in a database.

Continuous variables were analyzed using measures of central tendency and dispersion. Categorical variables were analyzed using the Chi-square test or Fisher's exact test, depending on the sample characteristics for each variable. Statistical analyses were performed using BioEstat 5.0 (19).

RESULTS

Mixed-breed dogs were responsible for 58.4% (80/137) of bites, while pedigrees were responsible for 41.6% (57/137) of bites. Of the biter dogs, 19.3% (29/150) were considered large, 46% (69/150) were considered medium, and 34.7% (52/150) were considered to be small.

Among the 90 dogs whose age was reported, 48.9% (n = 44) were more than four years old, 36.7% (n = 33) were between one and four years, and 14.4% (n = 13) were less than one year old. The average age among biter dogs was 4.2 years.

Male dogs comprised 71.3% (92/129) of the biter dog population, while 28.7% (37/129) of biter dogs were female. Furthermore, 96.3% (78/81) of male biter dogs were not neutered. Among female biter dogs, 97.1% (34/35) were intact, while only one biter dog was spayed. Statistical analysis using Fisher's exact test showed no association between sex and reproductive status ($p = 0.6494$).

The receipt of puppies as a gift was the main origin, corresponding to 71% (71/100) of the total dogs for which origin was known. Fourteen dogs were purchased (14%), eight dogs were found in the street and subsequently adopted (8%), and six dogs were born to a female dog that had already belonged to the owner (6%). One owner did not know the origin of the dog (Figure 1a). The reason for acquisition of the dog was variable; the most frequently reported reasons for dog acquisition included companionship (n = 61/100; 61%) and protection of the house (n = 25/100; 25%) (Figure 1b).

The average age of the victims was 35.4 years old; ages ranged between one and 96 years old. Approximately half of victims were male (n = 104/203; 51.2%) and half were female (n = 99/203; 48.8%). Using the Chi-square test, the gender of the victims was significantly associated with their age ($p = 0.0431$), indicating that there were a greater proportion of younger males bitten (62.7%) than younger females (37.3%). Similarly, older victims were more likely to be female (n = 22/34; 64.7%) when compared to male victims (n = 12/34; 35.3%).

In children, the predominant areas of the body targeted by bites were head and neck (n = 25/51; 49%) and lower limbs (n = 9/51; 17.6%). In adults and older victims, areas of the body targeted by bites included extremities, including hands and feet (n = 65/139; 46.8%) and the lower limbs (n = 34/139; 38.9%). Age of the victim was significantly associated with the area of the body targeted by bites ($p < 0.0001$) - Figure 2.

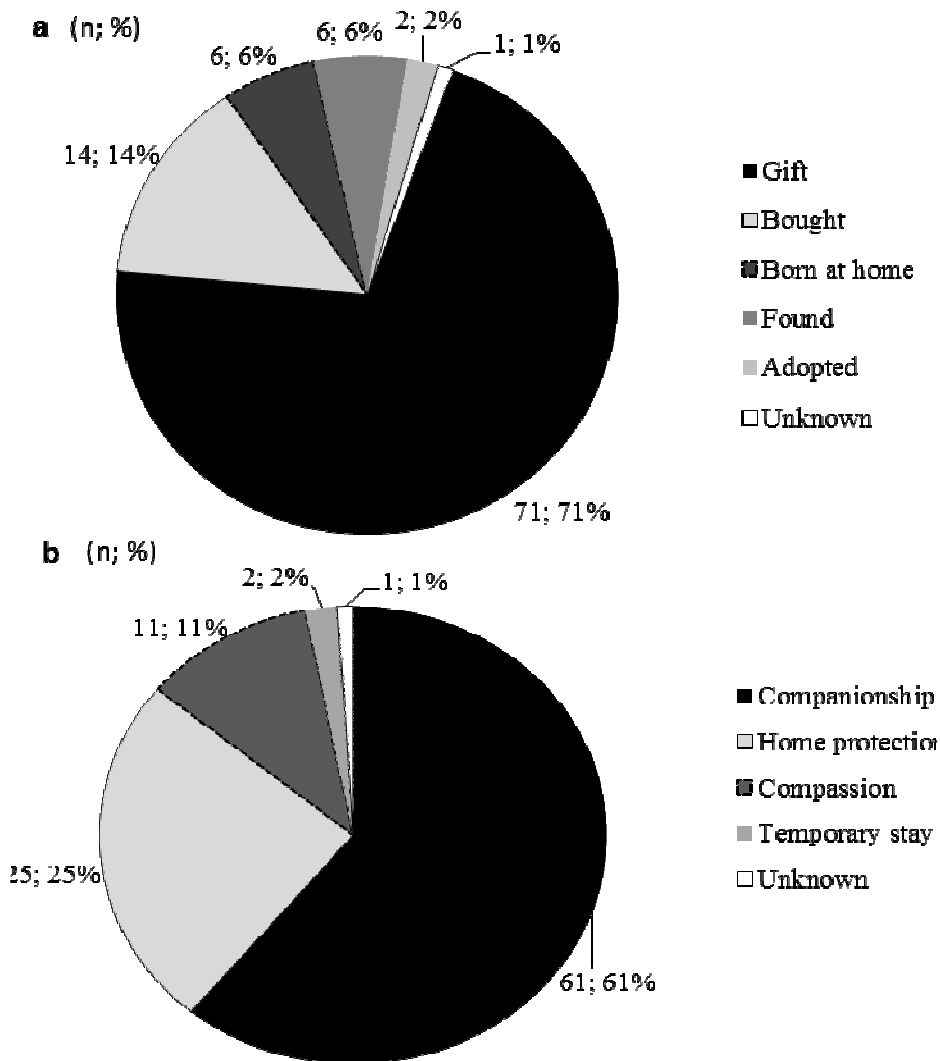


Figure 1. a) Origin of biter dogs in Araçatuba, SP, Brazil, 2009. b) Primary reason for acquiring biter dogs in Araçatuba, SP, Brazil, 2009.

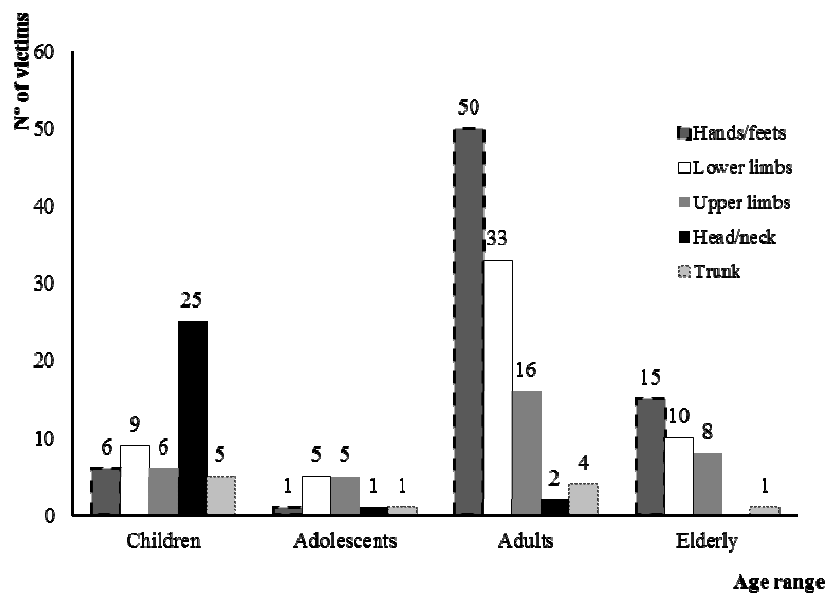


Figure 2. Anatomical areas directly affected by dog bites according to age range of victims in Araçatuba, SP, Brazil, 2009.

The owner of the biter dog was known in 83.2% of bite cases recorded in our study. The most frequently reported owner of the biter dog included a neighbor or the victim, accounting for 26.2% (n = 50/191) and 25.7% of cases (n = 49/191), respectively. The biter dog belonged to a relative or friend in 16.2% of cases (n = 31/191) and was a stray or free roaming animal in 16.7% of cases (n = 32/191). Six bites occurred while the victim was working; occupational bites included bites to community health workers, bites to mail delivery employees, bites to individuals leaving brochures through the gate of the dog's household, and bites to employees from a company guard dog.

Approximately half of the aggressions occurred in the residence of the biter dog (n = 92/186), while 45.2% (n = 84/186) occurred on the street, and 5.4% (n = 10/186) occurred in other locations.

The proportion of biter dogs that were vaccinated for rabies was 56% (n = 94/168); unvaccinated dogs accounted for 20.2% (n = 34/168) of biter dogs, while those with unknown vaccination status accounted for 23.8% (n = 40/168) of biter dogs.

When medical treatment of victim is concerned, observation of the biter dog was recommended in 59.4% (n = 120/202) of cases. Rabies vaccination was reported in 30.7% of people (n = 62). Of these, 28 (13.9%) were also responsible for observing the biter dog. Twenty people (9.9%) received rabies vaccine and serum.

The situations that triggered the dog bite can be found in Table 1. The most frequently reported situations included dogs that escaped from their homes (18.6%), dogs that were roaming free in the streets (16.9%), and dogs that attacked without provocation. An act from the victim that resulted in or encouraged the attack by the dog was recognized in 47% (n = 86/183) of cases.

The most frequently reported type of aggression was dominance. A sub-category of dominance included "addicted biter dogs", defined as dogs that bite as a compulsive behavior (Table 2).

Table 1. Situations that triggered dog bites in Araçatuba, SP, Brazil, 2009.

Situation	N	%
Dog escaped from its home	34	18.6
Dog was roaming free in the streets	31	16.9
Victim approached or enter the territory of the dog	24	13.1
Victim tried to separate a dog fight	15	8.2
Aversive handling by the victim	14	7.7
Victim played with or near the dog	11	6.0
Aggression over food	10	5.5
Victim intentionally hit the dog	7	3.8
Victim unwittingly hit the dog	6	3.3
Feral dog	6	3.3
Victim routinely manitulated the dog	6	3.3
Dog was jealous of a child or another dog	5	2.7
Trying to save injured dog in traffic	5	2.7
Another situation	9	4.9
Total	183	100.0

Table 2. Types of aggression exhibited in biter dogs in Araçatuba, SP, Brazil, 2009.

Type of aggression	N	%
Dominance	90	53.6
Self-defense (i.e. induced by pain or fear)	33	19.6
Territorial	30	17.9
Redirected (i.e. separating dog fight)	13	7.7
Protection (i.e. owner, puppies)	2	1.2
Total	168	100

DISCUSSION

This research identified a higher proportion of dog bites from mixed-breed dogs, a result corroborated by other research findings (12-14, 20). Among the pedigree dogs, the proportion was not detailed due to the potential bias in the information provided by the victim. While some breeds are considered dangerous and regulated by laws in many countries, they are not the most frequently reported dog breeds responsible for attacks and disorders committed against persons (12, 13, 21). The fact that many breeds are represented by only one individual also makes such analysis difficult (12).

Similar to our findings, attacks by medium to large dogs, compared to small dogs, were the most frequently reported attacks according to Gershman, Sacks and Wright (11), Schalamon et al. (14), Rosado et al. (13), and data obtained from the public health system. This finding, however, may be biased due to the underreporting of small dog attacks. Because small dogs are more likely to inflict only minor damage, attacks by small dogs are less likely to be reported and therefore may be underestimated (12). In this study, few biter dogs were less than one year old. A previous study conducted in Araçatuba, São Paulo (22), found that 45.5% of biter dogs sent for rabies diagnosis were less than one year old, while only 20.3% were over four years old. However, during that study period, an outbreak of rabies occurred in the study area (1993-1997). Therefore, any animal that had attacked a person during this time was submitted for rabies diagnosis. Because biting is a normal behavior for dogs less than one year old, especially when playing, it is possible that people do not find it important to seek medical care after being bitten by a dog less than one year old in the absence of a rabies outbreak.

The predominance of males among biter dogs in our study is consistent with the previous study conducted in the same geographic region, where 68.4% of biters were male dogs (22). The results of this study also agree with those published by Gershman et al. (11), who found higher rates of aggression by intact male dogs compared to female or neutered dogs in the United States. In other countries, however, research shows most aggressive dogs are neutered (12, 20, 23). This may be related to cultural and socio-economic differences between countries. For example, Brazil may not yet be able to afford or prioritize the sterilization of pets to preserve the health of humans and animals.

Similar to the present paper, the municipal kennel of Ibiúna, São Paulo (24), also found that the most common routes of dog acquisition were to receive the pet as a gift, to purchase it, or to find the abandoned animal on public streets. When the animal was purchased, the majority of participants indicated that the animal was under his or her care to provide security or company for the family. Approximately 90% of dog adoptions in the kennel occurred because the person enjoyed and sought the company of animals (25). Similar reasons have

been identified for the replacement of dogs in homes that previously had a dog euthanized due to a leishmaniasis outbreak that had recently occurred in the municipality of Araçatuba (26). Acquisition of animals that do not involve planning and agreement between all family members, such as the acceptance of animals as a gift, can increase the abandonment of dogs. Abandoned dogs are often not taken to the municipal kennels, but are set loose on the streets, increasing the risk of dog bites to people by stray dogs.

Studies conducted by Guy et al. (12) and Cornelissen and Hopster (10) indicate that adults were the most frequently reported victims of a dog attack. In addition, males have been identified in several other studies as the most common gender affected by animal attacks (1-5, 10, 27, 28). In this study, males were more frequently reported as victims of dog bites among children and adolescents, similar to findings reported in Brazil (3, 4, 6) and other countries (7, 13, 14, 27). Garcia et al. (4), Alonso (5), Frias, Lages and Carvalho (6), have attributed this fact to a growing percentage of children living with animals and increased activity between children and dogs that includes rough games, especially among boys. According to our records, some children who suffered bites had intentionally hit the dog while playing.

Among adults and the elderly, a greater proportion of victims were female, as also observed in age groups described by Carvalho, Soares and Franceschi (1), Frias, Lages and Carvalho (6). According to Frias, Lages and Carvalho (6), adult or elderly women may spend more time at home, thereby increasing exposure to potential dog bites from their own dogs.

In our study, children were most frequently bitten in the head and neck, while adults and elderly were most frequently bitten in the extremities. This may be due to the difference in height between age groups and increased defense capabilities of adults. The high prevalence of head and neck bites among children and extremities/limb bites among adolescents and adults are widely reported within the scientific literature (3, 4, 10, 13, 14).

One important factor we analyzed was the familiarity between the victim and the biter dog or biter dog's owner. In our study, we found 83.2% of dog bite victims knew either the biter dog or the biter dog's owner. This data varies considerably within the literature, and ranges from 71% to 88.5% (2, 14, 21, 22, 27). A victim that is familiar with the biter dog or biter dog's owner may have easier access to information regarding the vaccination history and health condition of the biter dog, which can directly influence rabies post-exposure treatment during medical care.

The percentage of victims bitten by their own dogs was similar to that observed by other authors. Schalamon et al. (14) found that 24% of victims were bitten by their own dogs, while 34% of victims were bitten by a dog belonging to a friend or relative. Fatjó et al. (20) reported that 38.5% of victims were bitten by their own dog, while Cornelissen and Hopster (10) found that only 28% of victims were bitten by their own dog. The highest percentage of victims who were bitten by their own dog was reported in a study conducted by Rosado et al. (13), in which 57% of biter dogs belonged to the immediate family of the victim, 28% to a neighbor, 12% to a relative, 3% to a friend, while 12% were stray dogs.

Approximately half of the dog bites examined in this study occurred within the residence that the biter dog lived (92/186), while 45.2% occurred in the streets, and 5.4% (10/186) occurred in other places. An increased number of dog bites in the household of the biter dog was reported in the state of São Paulo (4, 28) and in other countries, including the United States (9, 23), Thailand (8), Belgium (21) and the Netherlands (10).

Due to the lack of information contained in the SINAN records in Brazil, the analysis of rabies prophylaxis typically does not include variables related to the biter dog and the environment where the aggression took place, Rigo and Honer (29) and Fortes et al. (3) warn about the lack of such information, and suggest the inclusion of a new field in the SINAN records that describe the owner or the ownership condition of biter dogs.

According to the owners, 56% of biter dogs had a current rabies vaccination. This percentage is far below the Ministry of Health's goal to have 80% of dogs vaccinated in Brazil and is considered unsatisfactory. Other studies have identified that between 34.2% and 67.5% of biter dogs are vaccinated in Brazil (1, 4, 6, 22). Research conducted in other countries has also reported low rates of vaccination (8, 27).

In the cases where the victim requires medical treatment, the percentage of animals placed under rabies observation (59.4%) was similar to the studies of Garcia et al. (4) in São Paulo (50.6%) and Carvalho et al.(1) in Maringá, PR (59.1%). In Brazil, the highest rate of indication for treatment (91.3%) was reported in Araraquara, SP (5); the highest rate (81.6%) of post-exposure vaccination in Brazil was reported in Jaboticabal (6), which also reported the lowest proportion of animal observation (18.4%). However, the proportion of rabies serum indicated in the present study (9,9%) was higher than previously reported (1, 6, 28, 29).

Surveys in other countries reported that the situation that triggered the dog bite was often related to the interaction with the animal, including children playing with dogs or aversive handling, such as medication, vaccination, and cleaning ears, among others (13, 14, 20, 27). The results of these studies corroborate our findings in the present paper, in which we acknowledge the responsibility of the victim in nearly half of all cases.

Dominance aggression is the most common form of aggression (17), as verified in this study. A similar result was observed by Guy et al. (12) in Canada, where the majority of bites was due to dominance, followed by situations involving child games. It is important to know the circumstances that involve animal bites and to characterize the most common types of aggressive behavior. This information can be used to educate the population, establish prevention programs, and reduce the number of dog bites in the city.

We conclude that the analysis of the biter dogs, using information obtained from the owners' questionnaires, makes it possible to considerably expand the data extracted from the SINAN form. Therefore, we suggest that additional fields be added to the SINAN forms that pertain to biter dog characteristics. At the very least, inquiries pertaining to biter dog characteristics should be made by hospital employees and recorded in the "observations" field that is currently on the SINAN form. These actions will not only assist the course of medical treatment required as a result of the attack, but will also benefit future epidemiological studies and educational activities that target the population of dog bite victims.

Because pet dogs that had access to the streets were the most frequent aggressors in our study, we also conclude that there is a need for greater responsibility in raising dogs. In addition, many situations that resulted in dog bites could have been prevented if the principles of responsible ownership were followed, such as not interfering with eating, not separating dogfights, and not beating dogs.

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