

The Ecology of Dog Bite Injury in St. Louis, Missouri

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A GROWING AWARENESS of the possible serious public health implications of dog ownership is evident from recent reports (1-4). Most general reviews, however, fail to point out that the frequency and costs of dog bite injuries are a major medical problem. Some reports present the basic statistics for specific localities (5-10), and some present information concerning the behavior of the animal and the victim at the time of the bite incident (11,12).

Our report is concerned with the next level of insight into the epidemiology of dog bite injury—an analysis of the activity of the victim and the animal in the specific environmental context of the bite incident, that is, the ecology of dog bite injury.

We were able to perform this analysis because in St. Louis, Mo. (population about 566,000 in 1973) detailed information is gathered on each reported dog bite incident. When a dog bite is reported, a police officer is sent

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to interview the victim, the victim's parents (when appropriate), witnesses, and the dog's owner, if available. In addition to basic background information about the victim and the dog, a detailed description—at least 1 page long—of the incident is prepared in narrative form.

Although slightly more than 5,000 dogs are licensed in St. Louis each year, it has been estimated by means of various statistical estimating techniques (13) that the number of owned dogs is about 20 times that number.

Methods

We analyzed each dog bite report filed in 1972 and 1973 by coding the information into distinct categories. To minimize subjectivity and to maintain interpretative consistency, one of us (H.L.) coded all the narrative material. The potential for inaccuracies in interpretation of the narrative information is probably greatest when it is obtained from young children; however, in 1973 an adult witness was available for interview in 72 percent of the incidents affecting victims under age 5 and 35 percent of those affecting children 5 to 9 years old. For the other incidents occurring among these age groups, we could not determine if the adult interviewed was a true witness or the victim was clearly the sole witness.

Each bite case was entered on an IBM card for univariate analysis—cross-tabulating up to any four categories. Not every report was complete, but of 2,538

reported cases fewer than 100 reports in any one category were discarded in 1973. Most of the information presented here is from the 1973 reports, with comparison to 1972 where of interest.

Results

In St. Louis, 2,324 bites were reported in 1972 and 2,538 in 1973—an increase of 9.2 percent. The attack rates per 100,000 people, according to population estimates (14), were 396.3 for 1972 and 448.4 for 1973—an increase of 13.1 percent. The population decreased 3.5 percent. The rates are comparable to those for other urban areas during the same periods (3,5,7,9,10). The rate of dog bites reported in St. Louis from 1963 to 1973 almost doubled. In a survey of two hospitals (one private, one city), we found that approximately 1 of every 50 emergency room admissions was for dog bite injury; similar figures have been reported for other areas (6).

The dog bite rate (higher than that for most accidents and infectious diseases) is not truly appreciated as a medical care delivery problem—probably because the age structure, severity, and cost factors are not usually put into context. The attack rate for children 5 to 9 years old is 1,231.4 per 100,000 and for those 10 to 14 years old, 1,171.5. Dog bite is primarily an injury of childhood, as shown in the chart. Males and black persons were victimized in 1973 more than expected from chance alone; males—who comprised 45.3 percent of the population—received 65 percent of the bites, and blacks—who comprised 40.7 percent of the population—received more than 52 percent of the bites. The 1973 rates per 100,000 were 568.1 for males, 251.6 for females, 481.8 for blacks, and 304.8 for whites.

About 3.4 percent of all bites are classified as serious, and generally the victims are young. For example, the age group 5–9 years (8 percent of the population) received 27.4 percent of all bites and 32.5 percent of the

serious ones. Black males (28 percent of the population) received about 50 percent of all the serious bites. About 9.2 percent of all bites were multiple injuries. Other studies found that at least 10 percent of all bites required some suturing (12). Suturing, however, is often contraindicated for puncture wounds, and thus it may not be a good indicator of severity.

Another aspect of severity is the location of the bite. While almost half of all bites are on the legs, 13.2 percent are on the torso, 28 percent on the arms and hands, and 9.3 percent on the head and neck. The pattern for the victims under age 9 (941 bites in 1973) was 37.1 percent on the legs, 19.7 percent on the torso, 26.9 percent on the arms and hands, and 18.5 percent on the neck and face. More than 35 percent of the 245 bites in 1973 of children under age 4 were on the face. A face bite is traumatic and is a source of concern regardless of the extent of its severity. A number of reports deal with the surgical repair and infection following bite injury (15–20).

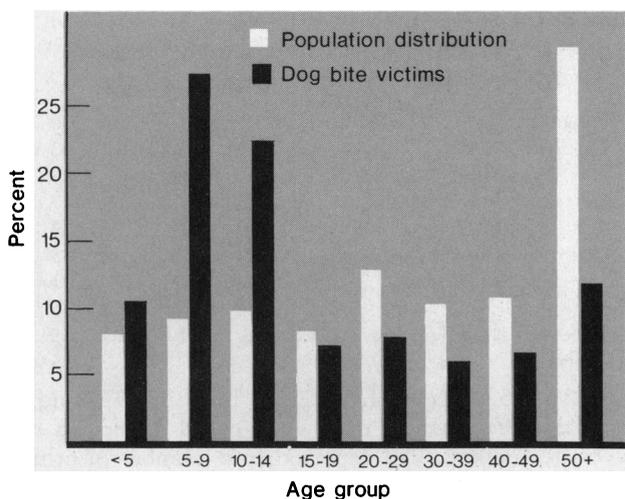
Although rabies in dogs had not been reported in St. Louis since 1954, about 3 percent of the dog bite victims each year in 1972 and 1973 were started on dosages of duck embryo vaccine following dog bite; about half received the entire series (16 doses), the remainder received an average of 5 doses before treatment was discontinued.

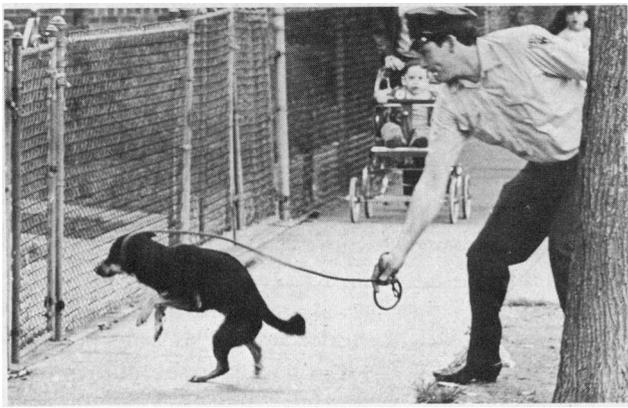
Only 36.8 percent of the biting dogs had been vaccinated against rabies (95.4 percent of all dogs that were licensed, but only 29.1 percent of the dogs were licensed). Regardless of the status of rabies in animals in any area, dog bite is the most common reason for post-exposure prophylaxis (personal communication from Dr. William G. Winkler, Bureau of Epidemiology, Center for Disease Control and 21), a medical care delivery problem that is often not appreciated by the general public and popular press.

According to J. Schilling, assistant health commissioner, the St. Louis Health Department estimates that each bite case—excluding medical treatment—costs at least \$30 for recordkeeping and holding the animal for observation (personal communication, 1974). Additionally, in 1973 the police department spent the equivalent of 145.7 full (24-hour) days or 39.9 percent of a year just investigating true bites; the cost for salaries alone was more than \$19,000. An additional 11.2 full days were spent investigating injured and reportedly “mad dogs” (a salary cost of \$1,490), and 9.1 days were spent investigating animal-at-large complaints (a salary cost of \$1,210). The additional costs for dispatching officers and equipment were not determined (personal communication from J. Taszarek, St. Louis City Police Department).

At the time of the bite injury, 35.2 percent of the victims had not been interacting with the dog or its owner, nor were they on the owner’s property. (We considered a victim to be “interacting” with the dog or its owner or the owner’s property if his behavior was directed toward the dog or owner or if the victim was on

Age distribution of general population and of dog bite victims, St. Louis, Mo. 1972





Agent for the American Society for Prevention of Cruelty to Animals captures loose dog

the owner's property before the bite). The activities of 2,537 victims in 1973 at the time they were bitten were as follows:

Activity	Number	Percent of total
Interacting with dog or owner or on owner's property	1,643	64.8
Not interacting with dog or owner and not on owner's property	894	35.2
Inactive or walking	471	18.6
Running	26	1.0
Playing	225	8.9
Bicycling	25	1.0
Eating	1	.0
Working	23	.9
Other	17	.6
Unknown	106	4.2

Of 2,376 victims in 1973 whose relationship with the biting dog was clearly reported, 74.6 percent did not interact with the dog. Of the 25.4 percent who did interact with the dog, playing with it was the most common activity. Examples of "other unintentional provocation," shown in the following table, are tried to catch dog, stepped on tail or paw, bothered dog while eating, tried to make dog sit, fell on dog, climbed on dog's back, put on leash, picked dog up, tried to confine dog, made a sudden movement toward dog, bathed dog, or administered medicine to dog.

Activity	Number	Percent of total
No interaction with dog	1,773	74.6
Direct interaction	603	25.4
Feeding dog	17	.7
Playing with dog	229	9.6
Petting dog	106	4.5
Walking dog	5	.2
Brushing dog or holding	10	.4
Aiding injured dog	13	.5
Untangling dog	5	.2
Separating fighting dogs	31	1.3
Other friendly activity	7	.3
Stepping over dog	1	.1
Observing or touching pups	14	.6
Walking near dog being teased by others	12	.5
Other unintentional provocation	104	4.4
Deliberate provocation	49	2.1

Of the total 2,538 victims in 1973, 67.2 percent did not interact with the owner (owner includes children of the owner). When interaction did occur, talking with or visiting the owner was the most common activity. As shown in the following table, in only 5.9 percent of the incidents did the dog bite a member of the owner's family.

Activity	Number	Percent of total
No interaction with owner	1,705	67.2
Victim is owner	151	5.9
Unknown	425	16.8
Actual interaction	257	10.1
Talking, visiting	164	6.5
Mistaken aggression (accidental push)	11	.4
Eating with owner	0	.0
Playing with owner	67	2.6
Verbal aggression	10	.4
Physical aggression	5	.2

Of the 2,538 bites reported in 1973, 18 percent occurred on the owner's property, and 27.6 percent occurred on public property immediately adjacent to the owner's property. Therefore, if we extend the owner's property to include the adjacent public property, we found that nearly half of the victims were bitten on or near the owner's property, as follows.

Victims location at time of bite	Number	Percent
Unknown or irrelevant (for example, stray dog)	1,378	54.3
On or near owner's property	1,160	45.7
Placing hand inside fence	59	2.3
Other approach to property	21	.8
Entry yard unfenced	44	1.7
Entry yard fenced	93	3.7
Entry porch	38	1.5
Entry inside	44	1.7
Working or playing inside (not with dog)	101	4.0
Working or playing on sidewalk (not with dog) or in adjacent alley	264	10.4
Walking on sidewalk or in adjacent alley	308	12.1
Running on sidewalk or in adjacent alley	15	.6
Bicycling on sidewalk or in adjacent alley	38	1.5
Playing on sidewalk or in adjacent alley	40	1.6
Other (for example, exciting dog)	36	1.4

Of the following 170 victims who were bitten while they were working (6.7 percent of all bites), more than one-third were letter carriers:

Letter carriers	50
Laborers	33
Delivery persons, outside (for example, paper boy)	17
Service persons, inside	17
Policemen	13
Other uniformed service persons	13
Salesmen, bill collectors, or insurance agents	11
Meter readers	6
Professionals on duty (physician, nurse, social worker)	5
Others	5

Only 14.5 percent of the 2,538 bites in 1973 came from dogs for which no owner could be found, a lower percentage than reported in a number of other studies (3-10). In St. Louis, nearly 2 percent of the

bites from stray dogs occurred in parks and 5 percent in schoolyards.

It is commonly believed that dog bites and rabies occur only in the summertime, especially during the "dog days" of August. We found, however, that the bite rate starts to increase in mid-April and reaches a peak in May that is sustained until August. More than 48 percent of the bites took place from April to July (one-third of the year) and 3 to 4 percent in the winter months. The warmer days in the winter and the cooler days in the summer are associated with increases in bite incidents. The patterns were similar for male and female dogs. More than half of all the bites occurred between 2 and 7 pm; during the warmer months, bite activity increased in the late afternoon. However, bites were reported for every hour of the day.

Discussion

Reported dog bites affect at least 0.45 percent of the entire population, and more than 1 percent of all children. Thus, more than 1 million bites a year are reported in the United States. However, only 25 to 50 percent of all bites are reported (8). From our modest estimate that each dog bite costs from \$30 to \$50, it seems that about \$50 million are spent annually out of municipal funds, excluding medical treatment. Bite injury was estimated to cost the average victim in Baltimore nearly \$50 (22).

We can only speculate on the reason for the high incidence of bites on the face. Of all the head and face bites, 61 percent were from small dogs and 39 percent from large ones (an unquantified notation on our reports), although only 36.6 percent of all the biters were classified as large. There is evidence that ownership of the larger breeds is increasing, which may further increase the seriousness of bites. Also, perhaps face biting is included in a dog's behavior pattern when playing or fighting with other dogs. The high incidence of face bites and the low level of compliance with rabies

vaccination requirements is a potentially serious situation.

Why male children in general and black male children in particular receive the greatest proportion of bites is also open to discussion. We have no evidence that males purposefully provoke dogs more than females do. Possibly, male children are more at risk because they are more likely than females to play in the streets until late afternoon; however, this outdoor activity cannot be considered to be provocation. The great number of bite incidents among the black population may reflect the fact that dog bite is more common in lower socioeconomic areas. The southern tip of St. Louis is an almost exclusively white, low income area, and it has the same higher incidence of bite injury as the black, low income areas in the northern section. Bite injury may be more frequent in low income areas in general for a variety of reasons, such as greater street use for recreation by resident children, fewer private homes with fencing, poorer dog control, and greater ownership of larger animals because of perceived crime.

Probably the best evidence of the severity of dog-associated problems comes from the people. In a recent survey by the National League of Cities, municipal leaders were asked "What do citizens frequently complain about?" "Dogs and other pet control problems" ranked number 1 (23).

According to our data, in the majority of bite cases the victims were behaving in a socially acceptable way in a socially acceptable place. Only 32.5 percent of the victims were over 19 years old, and nearly 21 percent of these persons were bitten on the job (7 percent of all bites). Dog bite as an occupational hazard, for example for letter carriers, is treated lightly by the popular press and the public in general.

Most popular accounts of stray (ownerless) dogs tend to exaggerate the actual numbers; most free-ranging dogs are actually straying pets (3,13,24-26).

Garbageman removes potential food source for dog



The term "stray" is often used inappropriately by the media, but true strays have few defenders; thus, blaming strays for the bite problem shifts responsibility to no one. In our field behavior studies, the truly stray animals were extremely shy of people, and we have never observed them acting aggressively toward people, even around their own homesites (25, 26). It is not surprising to us that strays are not responsible for many bites. Even the stray incidence of 14.5 percent may not represent true strays—rather, it may result from failure to find the owner.

Conclusions and Recommendations

Whenever the weather is conducive to outdoor activities, there is a potential for dog bite injury. It is therefore unwise to alert the public to only the "dog days" of August—these days actually occur during at least 4 months of the year, May through August.

Can the number of dog bite injuries be reduced? Most popular reports emphasize the importance of picking the right pet. But this seems to be only a partial solution to the question since fewer than 6 percent of the victims were bitten by their family dogs—although this aspect may be underreported. Perhaps the question to be asked is: The right pet for whom—the individual or society?

Male dogs accounted for about 70 percent of the bites, especially among the larger breeds, but this may reflect a pattern of permitting males more freedom. Since we do not know the numbers of each breed in the population, we cannot report breed-specific rates. It may be significant that 41.1 percent of all biters were of mixed breed and 36.7 percent were German Shepherds, but the shepherd breed is often listed for shepherd-like dogs of all ages; thus, the role of German Shepherds may not be accurately reflected in the bite rates.

The suggestions of several authors for avoiding bite injury (27,28) focus primarily on the victims' behavior and do not recognize that most victims are children who rarely have an opportunity to alter their behavior before they are bitten. We propose that it is time to stop studying and advising only victims and to start studying and advising dog owners.

The main obstacle to reducing bite incidence appears to be society's unconscious, or perhaps sometimes conscious, attempt to minimize the significance of bite injury by assuming dog bite to be so trivial that "it's not news," by assuming victim provocation, by blaming ownerless strays, and by ascribing it to a phenomenon of hot weather. This denial of the problem has made it difficult to gain the necessary support for the legislative and educational programs necessary to reduce bite injury. Curiously, the programs that are necessary are not at odds with responsible ownership and would, in fact, improve the quality of life for dogs as well as people. Loose dogs, which are the prime cause of dog bites, are exposed to accidents and diseases that greatly shorten their lives (3). Free-ranging dogs also add to the deterioration of the environment and expose people to a

wide variety of diseases (1-3). We believe that permitting dogs to run free should be viewed as a serious violation of the health and animal cruelty codes. We suggest that schools should provide information on dog management and behavior and the responsibilities of the dog owner. Much of the information now available from the schools or through the media promotes dog ownership but does not demonstrate "proper use of the product" or help the potential victim. Responsible ownership can enable people and dogs to live together peaceably.

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SYNOPSIS

BECK, ALAN M. (Bureau of Animal Affairs, New York City Health Department), LORING, HONEY, and LOCKWOOD, RANDALL: *The ecology of dog bite injury in St. Louis, Missouri*. *Public Health Reports*, Vol. 90, May-June 1975, pp. 262-267.

A detailed analysis of all the reported dog bites that occurred over a 2-year period in St. Louis, Mo., provided new insight not only into the severity of the problem, but also the environmental context for injury. Dog bite is a major medical problem that affects at least 1

of every 222 people and specifically 1 of every 83 children, 5 to 9 years old. Nearly 20 percent of all the children bitten were injured on the head or face, a source of concern and expense for all concerned. Nearly 10 percent of all bites were classified as serious.

In only 25 percent of all injuries did the victim's behavior involve the dog at the time of the bite, and in only 10 percent of the cases was the victim interacting with the dog's owner. The victim was on the dog owner's property in about 10 percent of the incidents, and

in about 48 percent of the cases the bite took place near the owner's property. Bite incidents go up whenever the weather is conducive to street activity.

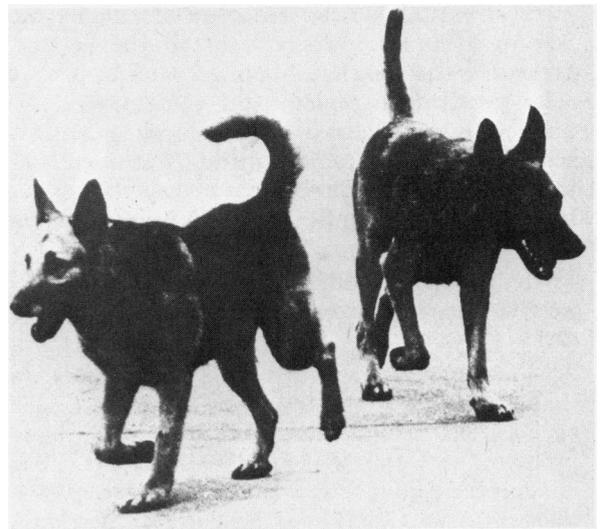
More than 85 percent of all the biting dogs had owners. These results indicate that society's views of dog bite injury, which tend to minimize the problem and find fault with the victim, must be re-evaluated. It is time to place less emphasis on the victim and even the animal and review the public health implications of dog ownership.

Dog Bites Among Letter Carriers in St. Louis

Subsequent to the preceding study, Randall Lockwood and Dr. Alan M. Beck carried out the following study to determine why letter carriers have more occupation-related dog bite injuries than other persons. Kent Hornberger of the St. Louis Postal Service Safety Unit made data available for this study.

THE U.S. POSTAL SERVICE reported that 6,708 of the nation's letter carriers were bitten by dogs in 1973. In St. Louis, letter carriers comprised more than 30 percent of all reported victims of occupation-related dog bite injuries in 1973.

For this study, information on letter carriers was obtained from two sources: (a) a questionnaire concerning bite history, attitudes toward dogs, dog ownership, and postal delivery problems because of dogs and (b) accident records of the St. Louis Postal Service for 1972 and 1973. The questionnaire was sent to a sample of 270 letter carriers in districts that represented a cross section of the postal routes in the city; 260 carriers responded. The accident records were analyzed by the same method used in the previous study. To determine if bite victims differed from accident victims in general or from the general letter carrier population, the bite victims were compared with a sample of victims of non-dog-related accidents (slips and falls) and with the general carrier population.



Results

Of a population of approximately 2,000 carriers in St. Louis, 132 were bitten in 1972 and 112 in 1973—an average rate of 6,120 per 100,000, which is more than 14 times the rate for the general population. (Fewer