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# Burden of Bites by Dogs and Other Animals in Los Angeles County, California, 2009-2011

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## Abstract

**Objectives:** The objective of this study was to analyze all animal-to-human bite reports during a 3-year period from a regional surveillance database. Results helped to inform local efforts to reduce and prevent animal-to-human bites.

**Methods:** We reviewed all cases of animal-to-human bites occurring from 2009 through 2011 that were reported to the Los Angeles County Department of Public Health's Animal Bites Database. We collected data on the bite victim's date of birth, age, and address; bite circumstances (ie, date, time, location, how bite occurred); anatomic site and treatment of bite; type of reporting facility; and breed and management of biting animal.

**Results:** From 2009 through 2011, 26 169 animal-to-human bites were reported, of which 23 103 (88%) were dog bites. Most animal-to-human bites ( $n = 7673$ , 29%) occurred between 4 PM and 8 PM and peaked during the month of July ( $n = 2663$ , 10%). Most animal-to-human bites occurred outdoors ( $n = 8772$ , 34%) and while victims engaged in recreational activities ( $n = 4353$ , 17%). The hands were the most common injury site ( $n = 9130$ , 35%), and only 1% of animal bites ( $n = 267$ ) resulted in hospitalization. A total of 4115 bite victims (16%) received tetanus vaccinations. Of all animal-to-human bite cases, medical organizations reported 13451 (51%), and animal control agencies reported 10682 (41%).

**Conclusions:** Animal-to-human bites can often lead to medical complications. Surveillance is essential in helping to identify, manage, and reduce these highly preventable injuries and direct public health actions and policies on animal bite risk and prevention.

## Keywords

animal bites, dog bites, epidemiology, public health surveillance

Bites from dogs and other animals in the United States are relatively common, making them an important public health problem. A 2001-2003 survey estimated that 4.5 million people were bitten by dogs each year in the United States.<sup>1</sup> A 2008-2010 study in North Carolina of 38 971 animal bites estimated a 1-in-60 lifetime risk of sustaining a cat bite or scratch injury requiring an emergency department visit.<sup>2</sup> The same study reported that the incidence of nondog, noncat animal bites ranged from <1 to 10 per 100 000 person-years. Dog bites are generally more common in children, particularly boys, whereas cat bites are more common in adult women.<sup>3-8</sup>

Animal bites can lead to disfigurement, functional disability, and infectious complications, particularly if they are left untreated or treatment is delayed.<sup>9,10</sup> A 1999 report found

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that *Pasteurella* species are the most common bacteria isolated from wound infections resulting from dog bites (50% of 50 infected wounds) and cat bites (75% of 57 infected wounds).<sup>11</sup> Infection with these bacteria can manifest as an acute, intense, localized inflammatory response. If left untreated, it can progress to metastatic spread and severe sequelae, including sepsis.<sup>12</sup> The other well-known infection transmitted through animal bites is rabies, which is caused by a neurotropic virus of the genus *Lyssavirus* and can be lethal without appropriate and timely postexposure treatment.<sup>13</sup>

Despite the potential public health and social consequences of animal bites, bite injuries in the United States have not been routinely tracked at the local or regional level. In addition, a limited number of animal bite studies are available, most of which describe calculated estimates or retrospective reviews of hospital records rather than databases of cases that have been reported by qualified sources.<sup>1</sup> However, coordinated surveillance and proper documentation of animal bites are necessary to strengthen risk education about animal bites and support prevention strategies.

We analyzed all reports of bites by dogs and other animals during a 3-year period from a regional surveillance database. Our objective was to use this database to formulate a better understanding of the incidence and timing of animal bites, the sex and age of victims and the site of their injuries, the activities and locations associated with animal bites, the treatments used and hospitalizations required for animal bites, the types of facilities reporting on animal bites, and the management of biting animals. This analysis could provide valuable information to enhance the animal bite literature and inform future public health efforts that focus on education about animal bite risk and prevention.

## Methods

In California, by law, all animal-to-human bites must be reported to a local health officer.<sup>14</sup> Squirrel, rodent, and rabbit bites or scratches with a claw are exceptions to this mandate because these injuries do not typically result in rabies transmission.<sup>15</sup> Once bites are reported, domestic animals that have bitten a person and any animal exposed to potentially rabid animals must be quarantined.<sup>16</sup> The Los Angeles County Department of Public Health Institutional Review Board reviewed the Animal Bites Database (ABD) surveillance protocols and study materials and approved the study as exempt from full research review.

### *ABD Information Sources and Animal Bite Procedures*

In Los Angeles County, animal bites may be reported by telephone, fax, email, or online with an "Animal Bite Reporting Form."<sup>17</sup> Reports are made by medical facilities (including hospitals, physicians, and other medical providers), animal control agencies, veterinary clinics and hospitals, private citizens, schools, and other entities that house animals (eg, zoos, animal shelters). These reports are entered

into the ABD, which is maintained by the Veterinary Public Health and Rabies Control (VPH) program of the Los Angeles County Department of Public Health. As part of routine surveillance, after a bite is reported, VPH staff members enter the initial information into the ABD. In certain cases, VPH staff members conduct an investigation to obtain additional information about the bite from the victim, using questions from the VPH's internal *Bite Investigation Manual*.<sup>18</sup> The investigation often focuses on ascertaining the health status of the biting animal, if known.

The following data elements are included in the "Animal Bite Reporting Form": bite victim's personal information (date of birth, age, and address), circumstances of the bite (ie, the injury date, time, and location of bite and how bite occurred), anatomic site and treatment of bite, and reporting facility. If the animal's owner can be identified, he or she is contacted to begin the animal's state-mandated 10-day postbite quarantine and to obtain more information about the animal, such as its condition, species, breed, color, sex, sterilization status, age, and rabies vaccination and licensure status. If the biting animal is ill or dies before the end of the quarantine period, the VPH usually obtains the body and tests it for rabies. If the biting animal cannot be found, the case is kept open for at least 10 days after the bite, before closure.

## Study Variables

In this study, we referred to each ABD bite report and the associated investigation as a case. We reviewed all bites occurring in Los Angeles County from January 1, 2009, through December 31, 2011. However, we excluded any bites reported in 3 of the 88 incorporated cities of Los Angeles County (Pasadena, Long Beach, and Vernon), because these cities have their own health departments and rabies control protocols.

The original data that we abstracted from the ABD were in the form of free text and numeric variables. For our analysis, we converted the free-text data in the "circumstances of the bite," "description of injury" (body injury site), and "treatment of injury" categories into several binary (yes/no) variables. For example, for the body injury site, we created a new variable by asking, "Were the hands bitten?" with response categories of yes and no. We did the same for all body locations, resulting in several new binary variables from the original free-text field.

We divided age into 7 groups (0-4, 5-9, 10-17, 18-24, 25-44, 45-64,  $\geq 65$  years), similar to those used in previously published studies on dog and cat bites.<sup>1,6</sup> Because data on the bite victim's sex were not included in the database, 2 independent reviewers inferred sex from the victim's first name and personal pronouns used in the database. If the reviewers disagreed or the sex could not be resolved, the project's principal lead made the decision. We listed sex as unknown if victims' names were too ambiguous to determine their sex. We based cat and dog breed data primarily on the reporting

**Table 1.** Characteristics of victims of animal-to-human bites, Los Angeles County, California, 2009-2011<sup>a</sup>

Characteristic	All Bites, No. (%)	Dog-to-Human Bites, No. (%)				Other Animal-to-Human Bites, <sup>b</sup> No. (%)			
		2009-2011	2009	2010	2011	2009-2011	2009	2010	2011
Total	26 169 (100)	23 103 (88 <sup>c</sup> )	7503 (100)	7797 (100)	7803 (100)	3066 (12 <sup>c</sup> )	1042 (100)	1019 (100)	1005 (100)
Sex									
Male	12 674 (48)	11 619 (50)	3871 (52)	3897 (50)	3851 (49)	1055 (34)	339 (33)	389 (38)	327 (33)
Female	12 019 (46)	10 166 (44)	3318 (44)	3399 (44)	3449 (44)	1853 (60)	631 (61)	596 (58)	626 (62)
Unknown	1476 (6)	1318 (6)	314 (4)	501 (6)	503 (6)	158 (5)	72 (7)	34 (3)	52 (5)
Age, y									
0-4	2007 (8)	1924 (8)	646 (9)	654 (8)	624 (8)	83 (3)	39 (4)	22 (2)	22 (2)
5-9	2297 (9)	2229 (10)	757 (10)	723 (9)	749 (10)	68 (2)	21 (2)	25 (2)	22 (2)
10-17	2956 (11)	2807 (12)	953 (13)	918 (12)	936 (12)	149 (5)	54 (5)	54 (5)	41 (4)
18-24	2459 (9)	2177 (9)	681 (9)	742 (10)	754 (10)	282 (9)	117 (11)	80 (8)	85 (8)
25-44	6281 (24)	5411 (23)	1756 (23)	1833 (24)	1822 (23)	870 (28)	281 (27)	305 (30)	284 (28)
45-64	5855 (22)	4961 (21)	1520 (20)	1659 (21)	1782 (23)	894 (29)	281 (27)	294 (29)	319 (32)
≥65	2125 (8)	1716 (7)	560 (7)	562 (7)	594 (8)	409 (13)	127 (12)	139 (14)	143 (14)
Unknown	2189 (8)	1878 (8)	630 (8)	706 (9)	542 (7)	311 (10)	122 (12)	100 (10)	89 (9)

<sup>a</sup>Data source: Los Angeles County Department of Public Health, Veterinary Public Health and Rabies Control animal bites surveillance data, 2009-2011. Excludes bites reported in the cities of Pasadena, Long Beach, and Vernon, which have their own health departments and rabies control protocols.

<sup>b</sup>Includes bat, bear, cat, cattle, coyote, donkey, elephant seal, ferret, horse, monkey, opossum, orangutan, pig, raccoon, sea lion, seal, and skunk.

<sup>c</sup>Percentage of all animal-to-human bites.

parties' descriptions and referenced the International Cat Association and American Kennel Club websites for breed names.<sup>19,20</sup>

### Data Analysis and Statistical Methods

We calculated the number of bites by dogs and other animals per 100 000 population, by victim sex and age group, using standard population estimates from the Los Angeles County Internal Services Department (unpublished data, population estimates for July 1, 2009, and July 1, 2010, prepared by Hedderson Demographic Services for the Los Angeles County Internal Services Department). We performed trend analyses with Poisson regression. We used an interaction model to test for the presence of an increasing linear trend during the 3-year period. We treated year as a categorical variable in the regression model and set 2009 as the reference. For variables in which more than 1 category was applicable to a single bite case (eg, treatment of bite, anatomic site of bite), we fitted separate Poisson regression models for each category. We considered  $P \leq .05$  significant. We used SAS 9.3 to clean, manage, and analyze the data.<sup>21</sup>

### Results

From 2009 through 2011, 26 169 animal-to-human bites were reported to the ABD, of which 23 103 (88%) were dog bites. Of 23 103 dog bites, 11 619 (50%) victims were male, and 10 166 (44%) victims were female. Of 3066 bites from other animals, females sustained 1853 (60%) bites, and males sustained 1055 (34%) bites (Table 1). The number of dog bites per 100 000 population varied significantly by year (72 in 2009, 79 in 2010, and 79 in 2011;  $P < .001$ ). The number of male and female dog bite victims per

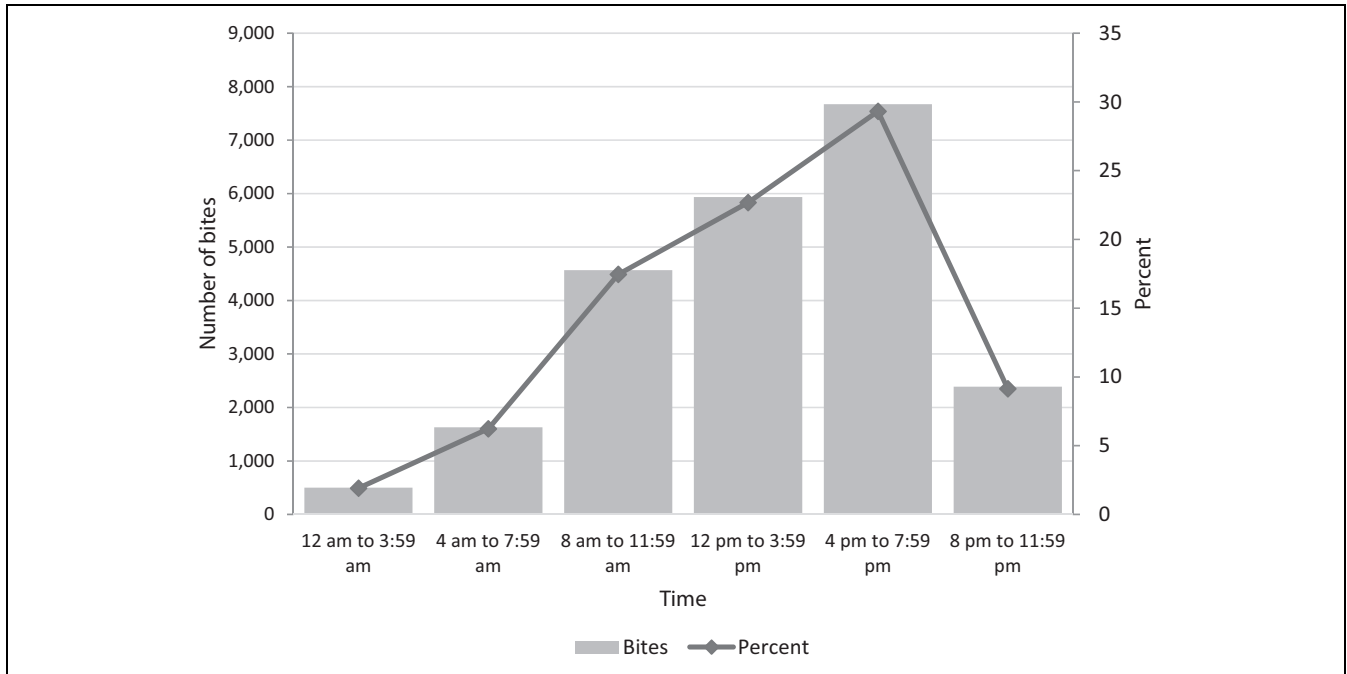
100 000 population also varied by year: 75 in 2009, 80 in 2010, and 79 in 2011 for males ( $P = .02$ ) and 63 in 2009, 68 in 2010, and 69 in 2011 for females ( $P < .01$ ). The number of bites from other animals per 100 000 population was consistent at 10 per year ( $P = .68$ ). The number of male and female victims of other animal bites per 100 000 population did not vary significantly by year (range: 7-8 for males, 12-13 for females).

Most animal-to-human bites occurred among adults aged 25-44 ( $n = 6281$ , 24%) and 45-64 ( $n = 5855$ , 22%); the fewest bites were among children aged 0-4 ( $n = 2007$ , 8%) and adults aged 65 or older ( $n = 2125$ , 8%). Most dog bites occurred in adults aged 25-44 ( $n = 5411$ , 23%), and most bites from other animals occurred in adults aged 45-64 ( $n = 894$ , 29%) and 25-44 ( $n = 870$ , 28%; Table 1).

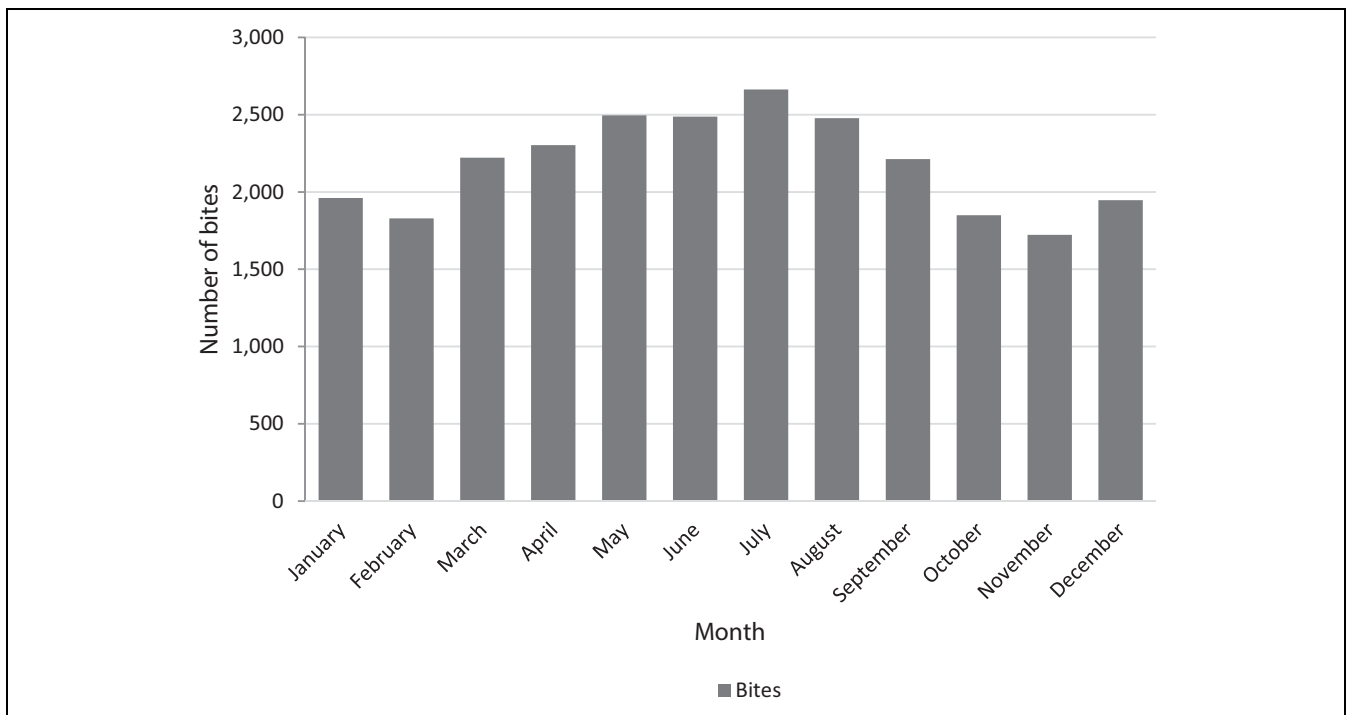
### Characteristics of Bites

Most of the 26 169 animal-to-human bites ( $n = 7673$ , 29%) occurred between 4 PM and 8 PM (Figure 1). The number of animal-to-human bites peaked during the month of July ( $n = 2663$ , 10% of total bites; Figure 2), and this temporal pattern was similar by year for bites from dogs ( $P = .82$ ) and other animals ( $P = .32$ ). Animal bites occurred most often for unknown reasons ( $n = 6544$ , 25%) and during recreational activity ( $n = 4353$ , 17%; Table 2).

Of the 23 103 dog bites, most occurred for unspecified reasons ( $n = 5894$ , 26%) or during recreational activities ( $n = 4320$ , 19%), whereas bites from other animals occurred most often while the victim was trying to grab, restrain, or hold the animal ( $n = 1094$  of 3066, 36%). Only 404 (2%) dog bites were reported to have occurred while the animal was on a leash. The location where animal-to-human bites occurred was most often unknown ( $n = 16 008$ , 61%), but when this



**Figure 1.** Number and percentage of all animal-to-human bites ( $n = 26\ 169$ ), by time of day, Los Angeles County, California, 2009-2011. Excludes bites reported in the cities of Pasadena, Long Beach, and Vernon, which have their own public health departments and rabies control protocols. Data source: Los Angeles County Department of Public Health, Veterinary Public Health and Rabies Control animal bites surveillance data, 2009-2011.



**Figure 2.** Number of all animal-to-human bites ( $n = 26\ 169$ ), by month, Los Angeles County, California, 2009-2011. Excludes bites reported in the cities of Pasadena, Long Beach, and Vernon, which have their own public health departments and rabies control protocols. Data source: Los Angeles County Department of Public Health, Veterinary Public Health and Rabies Control animal bites surveillance data, 2009-2011.

**Table 2.** Circumstances and locations associated with animal-to-human bites, Los Angeles County, California, 2009-2011<sup>a</sup>

Variable	Dog-to-Human Bites, No. (%)				Other Animal-to-Human Bites, <sup>b</sup> No. (%)				
	All Bites, No. (%)	2009-2011	2009	2010	2011	2009-2011	2009	2010	2011
Total	26 169 (100)	23 103 (100)	7503 (100)	7797 (100)	7803 (100)	3066 (100)	1042 (100)	1019 (100)	1005 (100)
Circumstances associated with bite									
Unspecified	6544 (25)	5894 (26)	2119 (28)	2170 (28)	1605 (21)	650 (21)	254 (24)	206 (20)	190 (19)
Recreational physical activity	4353 (17)	4320 (19)	1262 (17)	1436 (18)	1622 (21)	33 (1)	12 (1)	7 (1)	14 (1)
Other reason	3366 (13)	3070 (13)	894 (12)	905 (12)	1271 (16)	296 (10)	80 (8)	102 (10)	114 (11)
Grabbed/held the animal	2701 (10)	1607 (7)	521 (7)	516 (7)	570 (7)	1094 (36)	363 (35)	359 (35)	372 (37)
Tried to break up fight	2575 (10)	2370 (10)	807 (11)	803 (10)	760 (10)	205 (7)	66 (6)	72 (7)	67 (7)
Playing with the animal	1784 (7)	1648 (7)	546 (7)	547 (7)	555 (7)	136 (4)	59 (6)	42 (4)	35 (3)
Approached animal's property	1657 (6)	1643 (7)	762 (10)	412 (5)	469 (6)	14 (<1)	7 (1)	5 (<1)	2 (<1)
Pet, hugged, or kissed the animal	1551 (6)	1334 (6)	417 (6)	412 (5)	505 (6)	217 (7)	75 (7)	64 (6)	78 (8)
On the job	984 (4)	874 (4)	268 (4)	278 (4)	328 (4)	110 (4)	35 (3)	18 (2)	57 (6)
Near a source of food or water	822 (3)	684 (3)	241 (3)	226 (3)	217 (3)	138 (5)	47 (5)	50 (5)	41 (4)
Near a sick or injured animal	668 (3)	469 (2)	155 (2)	180 (2)	134 (2)	199 (6)	59 (6)	83 (8)	57 (6)
Grooming the animal	216 (1)	137 (1)	52 (1)	38 (0)	47 (1)	79 (3)	22 (2)	22 (2)	35 (3)
Took away an item from the animal	201 (1)	192 (1)	88 (1)	45 (1)	59 (1)	9 (<1)	5 (<1)	2 (<1)	2 (<1)
Fell, tripped, or stepped on animal	189 (1)	158 (1)	50 (1)	58 (1)	50 (1)	31 (1)	11 (1)	11 (1)	9 (1)
Protecting another person	91 (<1)	89 (<1)	29 (<1)	34 (<1)	26 (<1)	2 (<1)	0 (0)	0 (0)	2 (<1)
Near the animal's offspring	85 (<1)	63 (<1)	28 (<1)	15 (<1)	20 (<1)	22 (1)	5 (<1)	5 (<1)	12 (1)
Other circumstances									
Animal was on leash	404 (2)	404 (2)	113 (2)	102 (1)	189 (2)	0 (0)	0 (0)	0 (0)	0 (0)
Animals attacked in a pack	353 (1)	351 (2)	152 (2)	100 (1)	99 (1)	2 (<1)	1 (<1)	1 (<1)	0 (0)
Police dog	46 (<1)	46 (<1)	14 (<1)	9 (<1)	23 (<1)	NA <sup>c</sup>	NA <sup>c</sup>	NA <sup>c</sup>	NA <sup>c</sup>
Location where bite occurred									
Outside	8772 (34)	8340 (36)	2664 (36)	2414 (31)	3262 (42)	432 (14)	171 (16)	112 (11)	149 (15)
Inside	1389 (5)	1012 (4)	394 (5)	178 (2)	440 (6)	377 (12)	146 (14)	61 (6)	170 (17)
Unknown	16008 (61)	13751 (60)	4445 (59)	5205 (67)	4101 (53)	2257 (74)	725 (70)	846 (83)	686 (68)

<sup>a</sup>Data source: Los Angeles County Department of Public Health, Veterinary Public Health and Rabies Control animal bites surveillance data, 2009-2011. Excludes bites reported in the cities of Pasadena, Long Beach, and Vernon, which have their own public health departments and rabies control protocols.

<sup>b</sup>Includes bat, bear, cat, cattle, coyote, donkey, elephant seal, ferret, horse, monkey, opossum, orangutan, pig, raccoon, sea lion, seal, and skunk.

<sup>c</sup>Not applicable—police departments generally train only dogs to be part of their workforce.

information was available, bites occurred primarily in the outdoors ( $n = 8772$ , 34%; Table 2).

### **Treatment of Bites, Anatomic Sites of Injury, and Hospitalizations**

Information about treatment received by victims of bites from dogs and other animals was unavailable in 8298 of 26 169 (32%) animal-to-human bite cases. When treatment information was available, victims most often reported oral antibiotic therapy ( $n = 6890$ , 26%), wound cleaning ( $n = 6660$ , 25%) or other wound care ( $n = 5257$ , 20%), and tetanus vaccination ( $n = 4115$ , 16%). The most common victim anatomic bite sites were the hands ( $n = 9130$ , 35%) and lower extremities ( $n = 7501$ , 29%; Table 3).

The number of dog bites to the hand varied significantly from year to year ( $P = .01$ ). Most of the 23 103 dog bites occurred in the lower extremities ( $n = 7220$ , 31%) and on the hands ( $n = 7148$ , 31%). Most of the 3066 bites from other animals occurred on the hands ( $n = 1982$ , 65%) and upper extremities ( $n = 684$ , 22%). Of all animal-to-human bites, 3710 (14%) involved victims' heads (including their faces). A total of 267 animal bites (1%) resulted in hospitalizations (Table 3).

### **Characteristics and Management of Animals**

For the 23 103 biting dogs, the breed was unknown for 5722 (25%); this finding was consistent for all 3 years ( $P = .50$ ). Dogs (5091 of 23 103, 22%) and cats (2103 of 2815, 75%) were most frequently reported to be mixed breeds, a consistent finding throughout the sampled period ( $P = .65$  and  $P = .55$ , respectively). Exposure to bats, with presumed risk of bites, was the second most common type of nondog bite after cat bites (51 of 3066, 2%).

Of the 26 169 animal-to-human bites, 4740 (18%) animals were impounded; 611 (2%) were euthanized; and 10 866 (42%) were quarantined for 10 days. However, for 13 741 (53%) of all animal-to-human bite cases, the animal was not located, and quarantine was not possible. The number of biting animals that were strays varied significantly by year ( $P < .001$ ).

### **Reporting of Bites**

Of the 26 169 animal-to-human bite cases, 13 451 (51%) entered into the ABD were reported by hospitals or medical organizations, and 10 682 (41%) were reported by animal control agencies. Only 630 (2%) were reported by veterinary clinics or hospitals.

### **Discussion**

In Los Angeles County from 2009 through 2011, dog bites were more common than bites from other animals. The annual number of bites from dogs and other animals did not vary during the 3-year study period, although the number of

dog bites did vary significantly by year. These findings are similar to those reported in studies of animal bites in other large population centers.<sup>22,23</sup>

Animal bites in Los Angeles County occurred most frequently between 4 PM and 8 PM and in the outdoors. This pattern correlates with the time of day when most people engage in after-school and after-work recreational activities, such as hiking, jogging, biking, and walking a dog. Dog bites most often occurred during recreational activities. Bites from dogs and other animals in Los Angeles County were most common from May to August, when outdoor activity peaks, which is a pattern similar to what was reported in a study of animal bites in Dallas, Texas.<sup>8</sup>

Although differences in dog or cat breed may play a role in animal aggression and animal bites,<sup>4,24</sup> the results of our analysis neither supported nor refuted this notion. Most reports in the Los Angeles County ABD listed biting animal breed as either mixed or unknown. Breed identification by the general population may not be reliable: 2 reports suggest low accuracy rates in breed identification, even among trained dog professionals.<sup>24,25</sup>

Most bite victims in our study reported some form of treatment, the most common of which included oral antibiotics, wound cleaning, and other unspecified wound care. The high percentage of treatment and low percentage of hospitalization (1% of all bite cases) reported in our study may reflect a high degree of compliance by victims and reporting agents (eg, hospitals) with recommendations on the treatment of animal bites.<sup>12,26-28</sup> This finding is consistent with the fact that most animal bite reports in our study came from agents that are most likely to know these guidelines (eg, hospitals, medical practices, animal control agencies). In contrast, we found that in more than half of dog bite cases, the biting animals were never located and only 16% of animal bite victims received a tetanus vaccination. This percentage, however, was higher than that reported in a study of 38 971 animal bite-related emergency department visits in North Carolina, which found that 4.3% of animal bite victims received a tetanus vaccination.<sup>2</sup> Additional studies might help determine whether animal capture and tetanus vaccinations are animal control or public health issues that warrant further attention.

Hands were the most common injury site for victims of animal bites, particularly for bites from nondog animals. The high number of hand injuries in people bitten by dogs and the high proportion of hand injuries among people bitten by other animals suggest the need for better public health education about how to reduce the risk of these injuries. This finding is particularly important because these types of hand injuries can cause substantial functional disability, permanent disfigurement, and financial harm to victims and society.<sup>9,10,26</sup> Although animal bites involving the head (including the face) are not nearly as common, the 14% represented in our study reinforce the importance of public health education on animal bites.

In ABD reports that identified how animal bites occurred, the most common scenarios involved engaging in

**Table 3.** Treatments and anatomic sites of animal-to-human bites, Los Angeles County, California, 2009-2011<sup>a</sup>

Variable	Dog-to-Human Bites, No. (%)				Other Animal-to-Human Bites, <sup>b</sup> No. (%)			
	2009-2011	2009	2010	2011	2009-2011	2009	2010	2011
Total	23 103 (100)	7503 (100)	7797 (100)	7803 (100)	3066 (100)	1042 (100)	1019 (100)	1005 (100)
Treatment of bite								
Unknown	8298 (32)	2525 (34)	2695 (35)	2188 (28)	890 (29)	309 (30)	331 (32)	250 (25)
Oral antibiotics	6890 (26)	1969 (26)	1926 (25)	2134 (27)	861 (28)	302 (29)	277 (27)	282 (28)
Cleaned wound	6660 (25)	2038 (27)	1646 (21)	2130 (27)	846 (28)	273 (26)	275 (27)	298 (30)
Unspecified wound care	5257 (20)	1226 (16)	1745 (22)	1690 (22)	596 (19)	202 (19)	194 (19)	200 (20)
Tetanus vaccination	4115 (16)	1322 (18)	1175 (15)	1204 (15)	414 (14)	161 (15)	134 (13)	119 (12)
Sutures	2277 (9)	733 (10)	727 (9)	780 (10)	37 (1)	8 (1)	8 (1)	21 (2)
Dressed wound	2152 (8)	579 (8)	433 (6)	936 (12)	204 (7)	52 (5)	56 (5)	96 (10)
Antibiotic ointment	1331 (5)	412 (5)	312 (4)	437 (6)	170 (6)	58 (6)	61 (6)	51 (5)
Unspecified medication	1070 (4)	238 (3)	327 (4)	402 (5)	103 (3)	33 (3)	18 (2)	52 (5)
Pain medication	783 (3)	200 (3)	233 (3)	305 (4)	45 (1)	13 (1)	16 (2)	16 (2)
X-ray	577 (2)	159 (2)	164 (2)	209 (3)	45 (1)	19 (2)	11 (1)	15 (1)
Examined wound	377 (1)	106 (1)	61 (1)	180 (2)	30 (1)	13 (1)	6 (1)	11 (1)
Other, including splints	370 (1)	87 (1)	50 (1)	191 (2)	42 (1)	7 (1)	8 (1)	27 (3)
None	360 (1)	91 (1)	83 (1)	125 (2)	61 (2)	18 (2)	19 (2)	24 (2)
Treatment by victim	247 (1)	43 (1)	39 (1)	113 (1)	52 (2)	8 (1)	10 (1)	34 (3)
Surgery	133 (1)	37 (<1)	39 (1)	45 (1)	12 (<1)	4 (<1)	5 (<1)	3 (<1)
Rabies postexposure prophylaxis	77 (<1)	6 (<1)	7 (<1)	9 (<1)	55 (2)	12 (1)	19 (2)	24 (2)
Emergency room	73 (<1)	32 (<1)	20 (<1)	15 (<1)	6 (<1)	0 (0)	2 (<1)	4 (<1)
Basic laboratory work	35 (<1)	6 (<1)	5 (<1)	14 (<1)	10 (<1)	1 (<1)	2 (<1)	7 (1)
Victim refused treatment	29 (<1)	3 (<1)	11 (<1)	8 (<1)	7 (<1)	0 (0)	1 (<1)	6 (1)
Sedation	14 (<1)	3 (<1)	4 (<1)	5 (<1)	2 (<1)	0 (0)	2 (<1)	0 (0)
Anatomic site of bite								
Hands	9130 (35)	2260 (30)	2457 (32)	2431 (31)	1982 (65)	664 (64)	689 (68)	629 (63)
Lower extremity (legs)	7501 (29)	2330 (31)	2466 (32)	2424 (31)	281 (9)	102 (10)	81 (8)	98 (10)
Upper extremity (arms)	5011 (19)	1409 (19)	1467 (19)	1451 (19)	684 (22)	225 (22)	220 (22)	239 (24)
Head	3710 (14)	1147 (15)	1263 (16)	1196 (15)	104 (3)	35 (3)	26 (3)	43 (4)
Body, torso	961 (4)	315 (4)	317 (4)	304 (4)	25 (1)	10 (1)	7 (1)	7 (1)
Unknown	861 (3)	340 (5)	116 (1)	259 (3)	146 (5)	58 (6)	38 (4)	50 (5)
Feet	564 (2)	165 (2)	187 (2)	156 (2)	56 (2)	19 (2)	18 (2)	19 (2)
Other (eg, scrotum)	440 (2)	133 (2)	135 (2)	166 (2)	6 (<1)	1 (<1)	3 (<1)	2 (<1)
Hospitalizations	267 (1)	57 (1)	72 (1)	105 (1)	33 (1)	7 (1)	12 (1)	14 (1)

<sup>a</sup>Data source: Los Angeles County Department of Public Health, Veterinary Public Health and Rabies Control animal bites surveillance data, 2009-2011. Excludes bites reported in the cities of Pasadena, Long Beach, and Vernon, which have their own public health departments and rabies control protocols.

<sup>b</sup>Includes bat, bear, cat, cattle, coyote, donkey, elephant seal, ferret, horse, monkey, opossum, orangutan, pig, raccoon, sea lion, seal, and skunk.



recreational physical activity, grabbing or holding the animal, trying to break up an animal fight, playing with an animal, approaching an animal's property, and petting or hugging an animal. By far the most common activity related to a nondog bite was grabbing or holding the animal. In contrast, only 2% of all animal bites involved an animal on a leash. These findings point to the types of activities that may place victims at a higher risk of bites, and this information may inform the instructions that should be included in public health education curricula on animal bites.

Numerous public health education efforts focused on animal bites are underway in Los Angeles County. Based in part on our data, the Healthy Pets, Healthy Families Initiative supported a number of community and educational outreach efforts in 2014, with a focus on animal bite prevention.<sup>29</sup> The initiative uses ABD data to identify communities with the highest number of dog bites (particularly bites involving hands). These geographic areas are referred to as "hot spots." The initiative promotes various health education activities in dog-bite hot spots throughout the county. The resources used in these educational activities include dog-bite prevention handouts (distributed at veterinary offices, animal shelters, and pediatric clinics), videos showing how to interpret dog body language and look for signals of bite risk, animal obedience classes to help socialize and train dogs, and school-based bite prevention programs to educate children about ways to be safe around dogs and other animals.

### Limitations

This study had several limitations. First, our analysis was based on the ABD, a robust database that may be prone to underreporting or incomplete reporting. Because reporting of animal bites is mandated by law in California, most severe bites (which would have necessitated interactions with medical or animal control personnel) were likely included in the database. However, this database may not have captured data on many less severe bites or bites sustained by pet owners in their homes. Thus, the data from the ABD may have underestimated the overall incidence of animal bites or overestimated the severity of animal bites. Second, incomplete reporting was a problem in several variables or fields (eg, sex of victim, how and where bites occurred, types of treatment) and resulted in large numbers in the "unknown" categories, which may have affected our results. Third, tests of significance for trends were not robust, in part because of the small number of years reviewed, and they may have been affected by confounding factors not considered in the database (eg, reporting bias because of inconsistent outreach and bite-reporting education at hospitals and animal care facilities from year to year).

### Conclusion

We used the Los Angeles County ABD to formulate a better understanding of the incidence and timing of animal bites, the sex and age of victims and the anatomic site of their bites,

the activities and locations associated with animal bites, the treatments used and hospitalizations required for animal bites, the types of facilities reporting on animal bites, and the management of biting animals. Because bite injuries can lead to medical complications, effective surveillance is essential and can be instrumental in identifying, managing, and reducing these highly preventable injuries and directing public health actions and policies on animal-bite risk and prevention.

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