

Epidemiology of Hospitalizations Resulting From Dog Bites in California, 1991–1998

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We used population-based hospital discharge data to describe hospitalizations resulting from dog bites in California from 1991 through 1998, when there were 6676 such hospitalizations (average 835 per year; range 732 to 930), and the annual cumulative incidence for all ages was 2.6 per 100 000. Children had more than twice the risk of adults, and Asians had lower rates than Whites. Children aged 0 to 9 years were more likely to suffer wounds to the head and face. (*Am J Public Health*. 2004;94:1940–1941)

Dog bites are a poorly understood and complex public health problem. The incidence and emergency department treatment of dog bites have been reported,^{1,2} but there is little information on hospitalizations resulting from dog bites. We used population-based hospital discharge data to describe hospitalizations in California from 1991 through 1998.

The California Office of Statewide Health Planning and Development provided hospital discharge data, coded according to the *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)*.³ Hospitals report the principal diagnosis (the condition causing the hospitalization) and up to 24 other diagnoses (contributing conditions to the length of stay or charges). Since 1991, California hospitals are required to report the external cause of injury (E-codes) for the first hospitalization for an injury, permitting tabulation of incident cases without duplication. By law, discharge records involving an injury must be assigned an E-code with an error tol-

erance of 0.1%, or the submitting hospital can be fined.

Records with E-code E906.0 (dog bite) were extracted for years 1991 through 1998. Ethnicity (Hispanic origin) was added in 1995; race/ethnicity data after 1995 was recoded to the earlier coding scheme. Descriptive statistics were calculated using SAS version 8 (SAS Institute Inc, Cary, NC) and EpiInfo 6.04 (Centers for Disease Control and Prevention, Atlanta, Ga). California Department of Finance intercensal population estimates were used as the denominator (the average of the 1991 and 1998 populations) data to calculate cumulative incidences per 100 000 California residents.⁴ Cumulative incidence ratios, 95% confidence intervals, and relative risks were calculated.

The 3-digit prefix of the principal diagnosis was analyzed; for the 10 most frequent diagnoses, the anatomic injury locations were analyzed using the *ICD-9* subcode. The first diagnosis involving an infectious agent (*ICD-9* codes 020 to 041) within the first 8 additional diagnoses was extracted. For 1998 only (the most recent year analyzed and therefore the most relevant to the current economy), total hospitalization charges were calculated.

In California from 1991 through 1998, there were 6676 hospitalizations resulting from dog bites (average 835 per year; range 732 to 930). The overall average annual cumulative incidence was 2.6 per 100 000; no temporal trends were detected over this period. Cumulative incidences per 100 000 per year were greatest for young children (Table 1). The overall average annual cumulative incidences per 100 000 by race were greatest for Blacks and Whites: White, 3.0; Black, 3.1; Hispanics, 2.3; Asians, 0.8. Asian race was highly protective (cumulative incidence ratio=0.3, 95% confidence interval [CI]=0.2, 0.3) relative to White race. Males accounted for a greater proportion (58%, $P<.0001$) of hospitalizations, and males were significantly younger than females (mean 28.2 vs 33.8 years, $P<.0001$). Males had a higher average annual cumulative incidence for all age categories.

Ten principal diagnosis categories accounted for 75% of hospitalizations (Table 2). The remaining 25% comprised over 200 categories. Of those hospitalized with the 10

TABLE 1—Annual Cumulative Incidence and Cumulative Incidence Ratios, by Age Group of Hospitalizations Resulting From Dog Bites: California, 1991–1998

Age Group, y	Annual Cumulative Incidence per 100 000 population	Cumulative Incidence Ratio ^a (95% CI)
0–4	5.5	2.8 (2.6, 3.0)
5–9	4.3	2.2 (2.0, 2.4)
10–14	2.3	1.2 (1.1, 1.3)
15–19	1.2	0.6 (0.5, 0.7)
20–39	2.0	Referent
≥ 40	2.4	1.2 (1.2, 1.3)
Overall	2.6	

Note. CI = confidence interval.

^aRelative to age group 20 through 39 years.

most frequent diagnoses, 74% of children aged 0 to 9 years suffered wounds to the head and face, compared with 10% of people aged 10 years or older (relative risk [RR]=7.6, 95% CI=6.8, 8.5). Seventy-one percent of people aged 10 years or older suffered wounds to the forearm, hand, and fingers, compared with 18% of children aged 0 to 9 years (RR=3.9, 95% CI=3.5, 4.3). Of the 6676 hospitalizations, 606 (9%) listed an infectious condition in the principal or first 8 “other” diagnoses (Table 2). The mean length of stay was 3.5 days (median 3 days, range 1 to 117 days), and increased with increasing age (2.7 days for children aged 0 to 4 years compared with 4.2 days for those aged 40 years and older).

Charges reported in hospital discharge data include daily hospital, ancillary, and patient care services, but not hospital-based physician fees or preadmission or postdischarge charges. In 1998, hospitalizations with charges reported (n=828) totaled \$9 373 019. When the median charge of \$7374.50 was added for each hospitalization not reporting charges (n=102), charges totaled \$10 125 218.

This is the first epidemiological report of hospitalizations resulting from dog bites in the United States using population-based data, collected over 8 years. Coding for dog bites is unambiguous, and the diagnosis of dog bite is

TABLE 2—The 10 Most Frequently Reported Principal Diagnosis Categories and the 3 Most Commonly Reported Associated Infections for Hospitalizations Resulting From Dog Bites: California, 1991–1998

ICD-9 Category (3-Digit Prefix)	Description	Percentage of Total
10 Most frequently reported principal diagnosis categories (n = 6676)		
682	Cellulitis and abscess (not of finger or toe)	18.2
873	Open wound of head	16.3
882	Open wound of hand except finger(s) alone	10.1
881	Open wound of elbow, forearm, and wrist	8.0
891	Open wound of knee, leg (except thigh), and ankle	6.1
883	Open wound of finger(s)	4.9
870	Open wound of ocular adnexa	4.5
816	Fracture of 1 or more phalanges of hand	2.6
880	Open wound of shoulder and upper arm	2.0
681	Cellulitis and abscess of finger and toe	1.9
3 most commonly reported associated infections (n = 606)		
041.1	Bacterial infection in conditions classified elsewhere, <i>Staphylococcus</i>	29.5
027.2	Other zoonotic bacterial diseases, pasteurellosis	22.4
041.0	Bacterial infection in conditions classified elsewhere, <i>Streptococcus</i>	14.7

Note: ICD-9 = International Classification of Diseases, 9th Revision.

sensitive and specific; we are therefore confident that our data reflect all California hospitalizations resulting from dog bites. Findings reported here confirm discharge rates and length of stay reported using sampled data⁵ and provide new information regarding diagnoses, anatomic location, and differences among races.

Most dog bite injuries in the United States result from owned pets,⁶ and thus there is a large population at which to target interventions. The American Veterinary Medical Association Task Force on Canine Aggression and Human-Canine Interactions published a model community prevention program.⁷ Interventions might include education of dog owners by health care, veterinary, and animal care professionals. Improved surveillance of dog bites and better implementation of strict animal control laws should also be priorities. Local control ordinances targeting specific breeds are unlikely to be effective and are not recommended for reducing dog bite incidences.^{7,8} Although it is impossible to prevent all dog bites, it should be possible to reduce the number of bites and the significant associated morbidity, mortality, and costs. ■

About the Authors

At the time of the study, Katherine A. Feldman and Michele T. Jay were with the Veterinary Public Health Section, Disease Investigations and Surveillance Branch, and Roger Trent was with the Injury Surveillance and Epidemiology Section, Epidemiology and Prevention for Injury Control Branch, of the California Department of Health Services, Sacramento, Calif.

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Contributors

K. A. Feldman designed the study, obtained and analyzed the data, and interpreted the results. M. T. Jay provided supervision and contributed to the conception and design of the study and the interpretation of results. R. Trent contributed to the conception and design and to the interpretation of results. All authors contributed to the writing of the article.

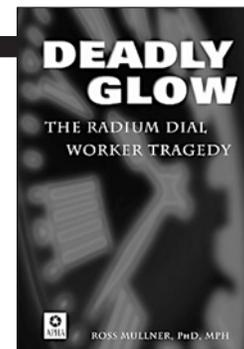
Human Participant Protection

No protocol approval was needed for this study.

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