
Descriptive Epidemiology of Animal Bites in Indiana, 1990–92

—A Rationale for Intervention

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Synopsis

Animal bites are a reality of life throughout the world. They arise out of an imperfect relationship with domestic animals and wildlife. Most bite injuries are preventable. The principal approaches to community-wide bite prevention programs include reducing the number of domestic animals roaming in the community (animal control) and teaching people to refrain from behaviors likely to provoke bites. This article addresses the epidemiologic basis and justifi-

cation for a bite prevention program targeted toward children.

Animal bite data from Indiana for the years 1990, 1991, and 1992 were analyzed for trends that might suggest opportunities for preventive intervention. Bites inflicted by humans were not included in this data base. Children of all age groups were disproportionately affected, with the highest incidence in the 5–9 year age group. The dog and the cat were the most commonly reported biting animals. Wild and pet rodents were the next most frequent biting group. The bites most frequently reported from nonrodent wild animals were inflicted by raccoons.

The incidence of animal bites in children peaked during the spring (April–June). Boys were bitten at a higher rate than girls, but this difference between the sexes narrows with age and was not noted in the adult population. Residents of urban counties (population greater than 100,000) had higher reported bite rates than residents of nonurban counties.

THE EFFECTS OF ANIMAL BITES on the victim and the community are many, and include trauma, wound infection, potential exposure to rabies, and psychological problems.

Animal bite injuries account for 0.5–1.5 percent of emergency room visits (1,2). Most bite wounds involve lacerations or puncture wounds to the limbs. The extremities are the most common anatomical site of injury (3). Among small children, however, head injury and serious damage to the eyes, ears, and lips are not uncommon. Several children in the United States die each year from bite injuries.

Bite wounds may become infected by a variety of microorganisms. Cat bites are particularly prone to infection, especially by anaerobic bacteria. Bite victims should receive medical attention. Persons with special risk factors for wound infection such as immunocompromising conditions, history of splenectomy, diabetes, circulatory problems, or other chronic illness require careful monitoring after a bite injury (4–7).

Health care providers should contact the local health department for recommendations regarding the need for postexposure rabies immunization of bite

victims. These recommendations are based on the species of biting animal, rabies activity in the local area, availability of the animal for testing or observation, circumstances surrounding the incident, behavior of the animal, and State and local public health regulations (8).

Serious bite incidents can have profound effects on victims, especially children. Children showing behavior problems following a bite incident should be evaluated by a mental health professional. Persons who have provoked a bite by cruelty to an animal may be candidates for mental health counseling. Certain types of personality disorders include cruelty to an animal as a diagnostic feature (9).

Methods

In Indiana, animal bites treated by health care providers must be reported by law to the Indiana State Department of Health (ISDH), which maintains an animal bite data base. Its main purpose is to provide epidemiologic information such as demographic characteristics of victims, species of biting animals, and geographic distribution of bite incidents.

Data are processed on a mainframe computer using custom COBOL-based software.

Marion County (Indianapolis area) maintains a separate data base linked to a system for following up on bite incidents and animal quarantine. Since Marion County data are not kept in a format compatible with the State system, certain aspects of this study were conducted without using data from this county.

Census data from 1990 were used in computing incidence rates. Average incidence was defined as the total number of reported bites per 100,000 persons during the 3-year period 1990–92, divided by 3 years.

Counties were placed into one of three population tiers: “urban”—a population of more than 100,000 residents; “metropolitan”—a population between 10,000 and 100,000; and “rural”—a population of fewer than 10,000 persons. The six urban counties each include a city and its suburban environs. Most metropolitan counties are agricultural communities with at least one small city. Rural counties are primarily farmland or forest. They comprise about 16 percent of the State’s population (10).

Findings

The biting animal. Table 1 shows the distribution of total bite cases by species category for 1990–92. The proportional relationships were similar for each of the three study years. The dog was by far the most common biting animal. The cat was the second most commonly reported biting species. The “all other species” category consists of rodents, farm animals, and wild mammals. Within the rodent category, the squirrel was the species most likely to cause a reported bite injury.

Bites from wildlife, although infrequent, can be quite serious. They often cause considerable injury and stress, and may require postexposure rabies immunization. Table 1 shows the frequency of reported wildlife bites by type of animal. The raccoon (*Procyon lotor*), with 202 reports, was by far the most commonly reported biting wildlife species. Many of these were kept as pets. The bat, fox, and skunk (in that order) were the next most frequently reported biting wildlife species. In the United States, these are high risk species for transmission of rabies (11).

Bite victim characteristics. Table 2 shows the average statewide incidence rate of animal bites by age group and sex. Children were more likely than adults to be the victim of an animal bite. Incidence was highest in children ages 5–9 years. Figure 1 summarizes seasonal incidence of bites in children by

Table 1. Animal bites reported in all Indiana counties, 1990–92, by type of animal

Animal	Number	Percent
Dogs	18,452	78
Cats	3,746	16
All other species	1,574	6
Squirrels	187	...
Mice, rats	227	...
Pets	247	...
Raccoons	202	...
Bats	64	...
Foxes	8	...
Skunks	5	...
Horses	38	...
Other farm animals	58	...
All other species or not specified	538	...
Total	23,772	100

Table 2. Average annual incidence of animal bites by age group and sex, Indiana, 1990–92¹

Age group (years)	Male	Female	Total
Younger than 5	245	230	475
5–9	360	253	613
10–14	283	179	462
15–18	82	69	151
19–25	126	108	234
26–40	79	73	152
41–60	55	56	111
Older than 60	43	38	81

¹ Average annual incidence = reported cases per 100,000 persons for 3 years.

age group. Bites are more likely to occur during the spring and summer months, with peak incidence in the 5–9-year age group.

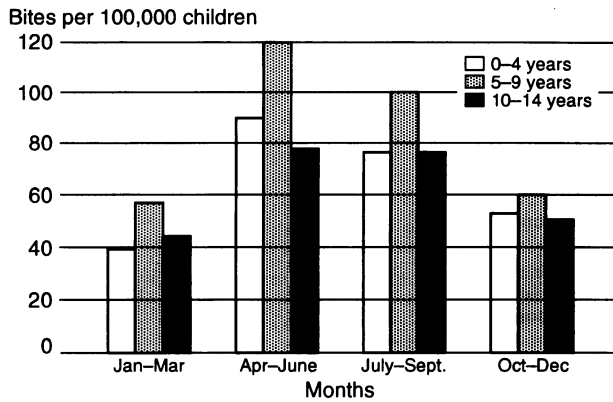
The data in table 2 suggest that boys are more likely to be bitten than girls. This observation may relate to whether the biting animal belonged to the victim’s family or was an animal “on the loose” (12). The sex disparity appears to narrow with increasing age.

Data from 1990–92 suggest that those living in urban counties are at greater risk of bite injury than people who live in small towns or in rural counties. Reports were compiled by county of residence of the victim. Residents of urban counties were significantly more likely to have reported a bite injury than those in metropolitan or rural counties ($\chi^2 = 562$, 2 df, $P < .001$). These findings are summarized in figure 2.

Discussion

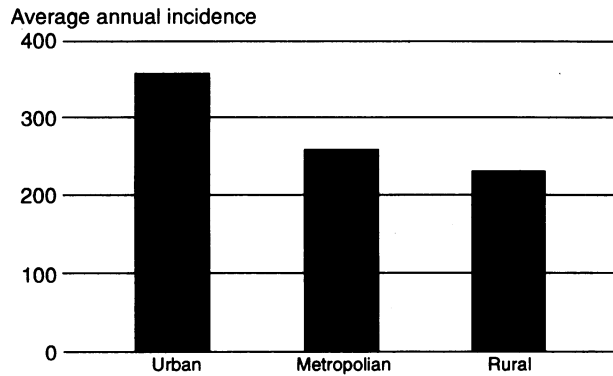
Most bite injuries are minor, self-treated, and greatly underreported (3,12). Bites that come to the attention of health care providers in Indiana (and

Figure 1. Average annual incidence of reported animal bites of children by age group and season, Indiana, 1990-92



Note: Marion County excluded.

Figure 2. Average annual incidence of reported animal bites per 100,000 population by county population category, Indiana, 1990-92



Note: Urban county—more than 100,000. Metropolitan county—10,000-100,000. Rural county—less than 10,000.

many other States) are reportable to the State health department. Reporting bias would tend to favor bites inflicted by large dogs and wildlife as well as unusually vicious or traumatic attacks. Such injuries are more likely to be treated by a physician and reported to public health authorities. A retrospective study of dog bite occurrence based on interviews with children ages 4 to 18 years indicated that 45 percent had been bitten by dogs in their lifetimes (12). In the study year 1980, 13.5 percent of these children had been bitten by a dog—36 times the reported rate.

The dog was by far the most commonly reported species of biting animal, reflecting their great abundance in the United States, their close relationship with people, and their potential for aggressiveness and for causing serious wounds. Data from other sources (5,13,14) reflect similar trends. The incidence of cat bites may be gradually increasing nationwide

because of their increasing popularity as pets (15). These results indicate that vaccination of dogs and cats against rabies is still very important in rabies prevention.

We are frequently asked to discuss bite incidence rates by breed of dog. While some studies have been conducted to address this question, findings are inconsistent and are usually flawed by the fact that the “denominator” (number of dogs of each breed in the community) is often unknown. Accurate identification of dog breeds by those making the report is also likely to be a problem. In general, however, the most serious bites are inflicted by the larger breeds.

Of the rodent bites, those inflicted by squirrels were most frequently reported. Many of these incidents are associated with hand-feeding. Interestingly, many people seem to associate squirrels with rabies, which might be a factor in better reporting of those bites. Rabies in rodents in the United States is rare (16).

Obviously, there are regional variations throughout the United States and Canada in local fauna. Bites by wildlife at high risk of rabies (bat, fox, raccoon, and skunk) are serious and always should be investigated by public health authorities (8,11).

Children in the 5-9-year age group are at considerable behavioral risk because of their mobility, curiosity, lack of inhibition, their lack of knowledge about animal behavior, their short stature, and their frequent association with animals. Clearly, children in kindergarten through fourth grade need more education about animal safety.

These data show that boys are bitten more frequently than girls. The incidence of bites in men and women was similar. However, the sex difference in bite rates was especially clear with respect to dog bites (data not shown). The cause of this difference may relate to the way children are socialized to animals and the type of play engaged in with pets. In studies by Beck and Jones (12,17), suburban children in Pennsylvania were asked to recall and report animal bites they had received. In that study, children reported being bitten more frequently by dogs owned by neighbors, followed by their own dogs. While the bite rate from family dogs was identical in both sexes, boys were bitten more frequently by neighbors’ dogs and by strays.

Reporting bias tends to favor underreporting in rural areas since many of Indiana’s rural counties are “medically underserved.” Bite victims may be less likely to obtain medical attention in all but the most serious injuries. In addition, some rural counties do not offer animal control services—another potential source of animal bite reports. However, nearly all

urban and metropolitan counties have at least one hospital and adequate primary care medical services. Most of these counties also have animal control services.

The marked difference in incidence between urban and metropolitan counties is less subject to reporting bias than the difference between rural and metropolitan counties and probably reflects a real difference in bite incidence. This difference may be accounted for in part by lower human and animal population densities in metropolitan counties compared with urban population centers.

Intervention Strategies

The principal intervention strategies suggested by these findings are

1. There is a clear need to educate children about safety around animals and bite prevention. While most parents probably talk to their children about avoiding animal bites, it would be prudent if this information were reinforced in the school health and safety curriculum. This knowledge is especially important for children in kindergarten through grade four—the peak age group for bites. The training would be best offered in the springtime months in anticipation of the peak period of animal bite activity. Monthly variation may, of course, be different in regions of the United States that are warm year-round.

2. Discourage the keeping of wildlife, especially raccoons, as pets. We specify raccoons because of their popularity as pets, the relatively large number of bites compared with those inflicted by other wildlife, and the rabies risk in many parts of the United States. The raccoon rabies epizootic in the New England and Middle Atlantic States is spreading westward. Rabies is also found frequently in raccoons in the South. Raccoons are also the definitive host of *Baylisascaris procyonis*, a zoonotic nematode parasite (18).

The keeping of wildlife as pets can be discouraged by vigorous enforcement of conservation statutes regarding the possession of wildlife species by unlicensed persons. However, public education about the potential health hazards and the impact of private possession on the well-being of the animal would be most beneficial (11).

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