

# The Epidemiology of Animal Bite, Scratch, and Other Potential Rabies Exposures, Louisiana

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The authors conducted a review of 318 investigative reports of animal exposures recorded from November 2004 through April 2008. These reports were gathered as components of the rabies surveillance program in Louisiana.

The reports were recorded by employees of the Louisiana Office of Public Health. Results were summarized and analyzed using the Centers for Disease Control and Prevention's (CDC) *EpiInfo* statistical software.

The most common victims were children, most often exposed to a pet that was familiar. In children victimized by pets, males were much more likely to be involved. Children most often suffered injuries to the head and upper torso. Exposures to bats and skunks characterized the greatest risks for rabies transmission, but potential for exposure to rabies from pet species remained a reality. Pit bull type dogs were most frequently involved in dog bite exposures. Requests for animal rabies testing peak in the summer months.

The increased risk to children demonstrates a need for public education, animal control programs, and evaluation of risk from certain breeds. Promotion of rabies vaccine compliance is of utmost importance to public health.

## BACKGROUND

Animal bites are a major public health problem. It is estimated that about 50% of all Americans are bitten by an animal at some time during their lives, and, from the 1970s to late 1990s, dog bite incidence in the United States (US) was estimated at 3.5 to 4.7 million bites per year.<sup>1,2</sup> Bite wounds are responsible for as many as 1.5% of all emergency room visits, and up to 30% of dog bites and 50% of cat bites may result in infection.<sup>1,2</sup> Although the annual incidence of fatal dog bites in the US seems to remain constant, occurrences of non-fatal bites appear to be on the rise.<sup>3,4</sup>

A recent estimate of total direct medical care costs from dog bites alone is approximately \$164.9 million annually. In the first half of the 1990s, roughly 33% of all liability claims for homeowners were due to dog bites and US insurance companies paid mean annual claims totaling over \$1 billion for dog bite related injuries.<sup>2</sup> Approximately 17%-18% of dog bites require medical attention. One study estimated that only 17% of all dog bites are reported to health officials, illustrating the difficulty in estimating the true incidence of

and parameters associated with animal bites.<sup>1,2</sup> Data on the frequency of post-exposure rabies prophylaxis in Louisiana is unavailable, since administration of these vaccinations and biologicals is not reportable.

The Office of Public Health (OPH), Louisiana Department of Health and Hospitals, is often called upon to investigate animal related injuries. Cases that involve both wild and domestic animal exposures are investigated for potential transmission of rabies virus, as part of the passive rabies virus surveillance system. These exposures are reported to OPH by medical practitioners or through animal control agencies, veterinarians, or other state agencies. A small number of cases are reported directly from the public. Investigations are carried out by OPH parish and regional sanitarians with assistance from the Infectious Disease Epidemiology Section (IDE) and the State Public Health Veterinarian (SPHV). The State Public Health Sanitary Code serves as the guide to these investigations and the provisions of the code are enforced by local animal control or law enforcement entities on the advice of public health authorities. Investigated animals that do not escape are

either confined for observation or are tested for rabies.<sup>5</sup> Three laboratories perform immune fluorescent antibody assays for rabies virus diagnosis on brain tissue, the OPH laboratories in Shreveport and Lake Charles and the Louisiana Animal Disease Diagnostic Laboratory (LADDL) located on the campus of Louisiana State University in Baton Rouge.

MATERIALS AND METHODS

IDE, the SPHV, and the OPH Laboratory have developed several forms intended to gather information relevant to bite investigations. Examples of such instruments are laboratory submission forms and case investigation worksheets. However, submission of the documents to IDE is inconsistent. Furthermore, several investigations are carried out without documentation.

This paper summarizes the information collected from 318 worksheets/forms from October 2004 through April 2008. In order to better reflect the true incidence of rabies in animals processed through the rabies passive surveillance system and to give a clearer picture of the temporal distribution of human-animal interactions, data from OPH "routine laboratory surveillance" was also analyzed for comparison. Due to inconsistent submission of exposure reports, the temporal analysis was restricted to this routine surveillance data. Only those rabies tests submitted as a result of a human bite or scratch exposure from terrestrial animals were included in the analysis, however, all exposures from bats were included. The data were analyzed using *EpiInfo* version 3.4.3. Statistical significance was assigned at the 95% confidence level.

RESULTS

Most of the investigations involved incidents in the general public. Only 8.3% indicated occupational exposure. The results of the analysis are summarized in Tables 1 and 2. Table 1 illustrates characteristics of victims while Table 2 illustrates characteristics of animals responsible for the exposure.

There were no significant differences in gender when stratified by type of animal (pet, wild animal, bat, or other) causing the exposure (Table 1). However, boys were over three times as likely to be involved in incidents involving children 14 years of age or less, than in incidents involving boys or men over 14 (OR: 3.70, 95% CI: 1.92-7.13)(Figure 1).

Most victims of pet exposures were children and young adults. Exposures from pets were over ten times as likely

to involve children 0-14 years of age than exposures to wild animals (OR:12.53, 95% CI: 1.69-93.18). Although the most frequent anatomic location of bite or scratch wounds were the hands and arms, persons 19 years of age or younger were ten times as likely to suffer wounds of the head, ears and upper torso than persons over 19 years of age (OR: 10.11, 95% CI: 3.26-31.35). The most frequently reported circumstance of injury was children "playing with familiar animals." In fact, the majority of exposures involved pets, many familiar to the victim. Nevertheless exposure to strays and wild animals occurred with some frequency (Table 1).

The most common potential exposures were bites (226/280 or 80.7%), while scratches were recorded in lower numbers (23/280 or 8.2%). Other exposures include touches, licks, and other types of exposure to saliva or nervous tissue. In bats, 11 of 21 exposures (52.4%) did not involve a bite or scratch. Examples of non-bite or non-scratch related exposures include persons waking in rooms where bats were present, small children alone in rooms where bats were present, and contact with containers that may have been contaminated with the saliva or other secretions of a bat (Table 2).

Most of the pet species, wild terrestrial animals, and bats identified as the aggressors in these investigations were euthanized and the brains were submitted for laboratory diagnosis of the rabies virus. Among the cases investigated by OPH, eight skunks, seven bats and one dog were found to be positive for rabies (Table 2).

Of the animals that are required by the Louisiana State Sanitary code to be vaccinated for rabies, 22 of 206, or 10.68%, were either not in compliance, could not provide proof of vaccination, or were strays with unknown vaccination histories.<sup>5</sup> Of the animals causing exposures that were known to be house pets, only 11 of 50, or 22% were in



Figure 1. Gender of victims by age.



**Table 1: Characteristics of victims (gender, wounds, and circumstances of exposures).**

Victim classification	Frequency	percent
General Public	219	90.5
Veterinarians and Veterinary Technicians	20	8.3
Other	3	1.2
Gender	Frequency	percent
Male	146	52.1
Female	134	47.9
Gender (exposed to pet species)	Frequency	percent
Male	110	50.7
Female	107	49.3
Gender (exposed to wild terrestrial species)	Frequency	percent
Male	16	55.2
Female	13	44.8
Gender (exposed to bats)	Frequency	percent
Male	14	55.2
Female	8	44.8
Gender (exp. to farm animal, exotic, unknown)	Frequency	percent
Male	14	55.2
Female	8	44.8
Wound location	Frequency	percent
Hands and arms	153	60.0
Legs and feet	54	21.2
Head, ears and upper torso	42	16.5
Lower torso	6	2.4
Circumstances of exposures	Frequency	percent
Children playing with familiar animals	35	16.2
Unprovoked attacks by strays	31	14.4
Attempting to handle pets	22	10.2
Unprovoked attacks by familiar animals	19	8.8
Accidental bat exposures	19	8.8
Attempting to handle wild animals	17	7.9
Separating a fight between animals	16	7.4
Providing professional veterinary care	15	6.9
Non-professional first aid to animal	14	6.5
Attack of stranger entering premises	13	6.0
Other	9	4.2
Unprovoked attacks of infants	6	2.8

compliance with rabies vaccination requirements. Pit bull type dogs and "mixed breed dogs" were the breeds or dog types most frequently identified in bite cases where canines were involved (Table 2).

The exposure incidents were analyzed by month of occurrence through a review of routine OPH laboratory surveillance. OPH routine laboratory surveillance indicated that rabies tests conducted as a result of human exposures to all category animals were submitted most frequently in the summer months (Figure 2).

## DISCUSSION

Most severe animal bites in children involve facial or cervical injuries. The results of this study tend to agree with other studies that indicate adults are more frequently bitten on the extremities, while children are more at risk of facial or cervical injuries.<sup>1</sup> The greater likelihood of injuries to the upper face and torso in victims 19 years of age or younger, evidenced in this study, illustrates the need for parental supervision and/or educational programs geared to youth.

The association between pet related exposures and youth implies that the greatest risk of animal inflicted wounds in children is from exposure to household pets. This information is substantiated by previous studies that indicated that most children have been bitten by a dog, usually one known to the child, by 11 years of age.<sup>2</sup> Other studies have indicated a significantly increased risk for male human victims of all age groups. In this analysis this predilection for male children was only observed in the very young<sup>2</sup> (Figure 1). The information regarding circumstances of exposure, among the most common situations were those of a child "attempting to handle or play with animal(s)" and "unprovoked attacks by non-stray animals," supports previous studies that indicate that exposures most often involve pets familiar to the child. Therefore, the need for supervision of children "handling or playing with animals," even familiar animals, is evident.<sup>2</sup> However, circumstances such as "unprovoked attacks by stray animals," "accidental bat exposures," "handling wild animals," and "separating two or more animals involved in a fight," are testimony that education pursuant to avoiding contact with strays and wildlife, as well as proper confinement of pets remain important components of public health education.

**Table 2.** Characteristics of animals involved (exposure type, disposition of animals, rabies diagnosis, and vaccination history).

<b>Types of exposures</b>		
<b>Dogs</b>	Frequency	percent
Bite	138	87.3
Other	12	7.6
Scratch	8	5.1
<b>Cats</b>	Frequency	percent
Bite	56	80.0
Scratch	10	14.3
Other	4	5.8
<b>Bats</b>	Frequency	percent
Bite	8	38.1
Other	8	38.1
Touch/Pat	3	14.3
Scratch	2	9.5
<b>Wild terrestrial animals</b>	Frequency	percent
Bite	24	77.4
Scratch	3	9.7
Touch/Pat	3	9.7
Other	1	3.2
<b>Final Disposition of Animals</b>		
<b>Dogs</b>	Frequency	percent
Euthanasia and testing	87	54.4
Observation for 10 days	57	35.6
Uncaptured strays or loss to follow up	16	10
<b>Cats</b>	Frequency	percent
Euthanasia and testing	56	76.7
Uncaptured strays or loss to follow up	10	13.7
Observation for 10 days	7	9.6
<b>Wild Terrestrial Animals</b>	Frequency	percent
Capture, euthanasia and testing	32	74.4
Uncaptured	11	25.6
<b>Bats</b>	Frequency	percent
Capture, euthanasia and testing	21	84
Uncaptured	4	16
<b>Diagnosis of rabies (statistics in parentheses are from routine laboratory surveillance)</b>		
<b>Dogs</b>	Frequency	percent
Positive	1, (1)	1.1%, (0.1%)
Negative	86 (1209)	98.9%, (97.9%)
Indeterminate	0 (25)	0%, (2.0%)
<b>Cats</b>	Frequency	percent
Negative	55 (974)	98.2% (98.7%)
Indeterminate	1 (13)	1.8% (1.3%)
<b>Skunks</b>	Frequency	percent
Positive	8, (8)	88.9%, (30.8%)
Negative	1, (17)	11.1%, (69.2%)
<b>Other terrestrial wild animals</b>	Frequency	percent
Negative	23, (173)	100% (95.6%)
Indeterminate	0, (8)	0% (4.4%)
<b>Bats</b>	Frequency	percent
Positive	7 (14)	33.3% (12.3%)
Negative	13 (94)	61.9% (82.5%)
Indeterminate	1 (6)	4.8% (5.3%)
<b>Evidence of rabies vaccination in all pets</b>		
<b>Dogs</b>	Frequency	percent
Evidence of rabies vaccination	20	14.6%
No evidence of rabies vaccination	117	85.4%
<b>Cats</b>	Frequency	percent
Evidence of rabies vaccination	2	3.0%
No evidence of rabies vaccination	65	97%
<b>Ferrets</b>	Frequency	percent
Evidence of rabies vaccination	0	0%
No evidence of rabies vaccination	2	100%
<b>Evidence of rabies vaccination in HOUSE pets</b>		
<b>Dogs</b>	Frequency	percent
Evidence of rabies vaccination	11	26.2%
No evidence of rabies vaccination	31	73.8%
<b>Cats</b>	Frequency	percent
Evidence of rabies vaccination	0	0%
No evidence of rabies vaccination	8	100%
<b>Dog breeds involved in bite cases</b>		
<b>Dogs</b>	Frequency	percent
Pit bull type dog	17	29.3%
Dog of unknown breed (mixed or "mutt")	10	17.2%
Rotweiler	5	8.6%
Labrador retriever	4	6.9%
Beagle	3	5.2%
Boxer or boxer mix	2	3.4%
Bulldog	2	3.4%
Chow chow or chow chow mix	2	3.4%
Great Dane	2	3.4%
Mastiff	2	3.4%
Many breeds with one case	9	15.5%



Most of the investigated exposures to bats did not involve bites. To the uninformed, investigation of these non-bite cases may appear to be an unnecessary utilization of public health resources. Nevertheless, evidence associated with human cases of bat variant rabies in the US over the past 50 years shows that many of these cases did not report bites, which justifies consideration of what may be considered casual contact with bats.<sup>6,7</sup>

The Louisiana State Public Health Sanitary Code permits a ten day observation period under confinement for dogs, cats, or ferrets that bite or otherwise potentially expose a person to rabies virus.<sup>5</sup> A minority of dogs and cats identified in OPH investigations were confined and observed for the ten day period. The failure to confine animals for observation may result in unnecessary euthanasia of animals and is often due to a lack of awareness of observation procedures by local animal control, medical, veterinary, or public health authorities. However, many of the animals implicated may be deemed "aggressive" and considered a risk to caretakers, thus rendering the confinement process unfeasible.

The high percentage of skunks and bats found to be positive for rabies reflects the present ecology of rabies virus in Louisiana. The only terrestrial variant in Louisiana is the south central skunk variant, which cycles in skunks in all of north Louisiana and in south Louisiana from the Texas state line east to the Atchafalaya River basin.<sup>8</sup> Approximately 11 species of bats can be found in Louisiana.<sup>9</sup> Bat variants are specific to species and not geography, therefore one can assume that at least 11 variants of bat rabies exist in Louisiana.<sup>10</sup> The high percentage of positive bats and skunks in proportion to those bats and skunks tested may also indicate a greater proclivity for human contact when these animals are infected with rabies. Thus the greatest risk for human infection with rabies virus in Louisiana is interaction with bats and skunks. The lone reported positive pet animal in Louisiana was a dog from the southwestern region of the state infected with the south central skunk variant, the first positive pet species discovered in Louisiana in over ten years.<sup>11</sup> Although bats and skunks present the greatest risk of exposure to rabies in the state, this case in a dog serves as a reminder that pet species can be infected by wild animals and can be a risk to public health.

Although the extremely low percentage of pet species with proof of immunization is certainly enhanced by the large number of stray animals involved in animal exposures, the low

level of compliance with rabies vaccination requirements in house pets confirms public ignorance of regulations and is testimony to the potential public health risk. The success of rabies prevention programs has historically involved influencing the capacity of animals to serve as reservoirs, which is frequently accomplished through animal vaccination programs.<sup>12</sup> One study indicated that failure to comply with vaccination requirements and other suggestions for good pet ownership may reflect owner attitudes that tolerate or encourage aggressive behavior by the animal.<sup>2</sup> In addition, the identification of the rabid Louisiana dog in 2007 illustrates the danger to unvaccinated pets. The lack of adherence to regulations illustrates the need for public education, continuity of rabies vaccination programs around the state, and educational programs fostering responsible pet ownership.

Various studies have identified German Shepherds, German Shepherd crossbreeds, Rottweilers, pit bull type dogs, Siberian Huskies, Siberian Husky crossbreeds, Labrador Retrievers, Akitas, Doberman Pinschers, Australian Shepherds, and Chow Chows as the breeds most often involved in dog bites treated in emergency departments. Studies also have indicated that, although not the breeds or dog types most commonly involved in bite incidents, pit bull type dogs and Rottweilers are most often associated with dog bite fatalities. The frequency of association of these breeds with severe bites and death may be influenced by the current popularity of the breeds. The increase in absolute numbers of these dogs certainly would elevate reported numbers of incidents in which they are involved.<sup>2,3</sup> The relatively large proportion of pit bull type

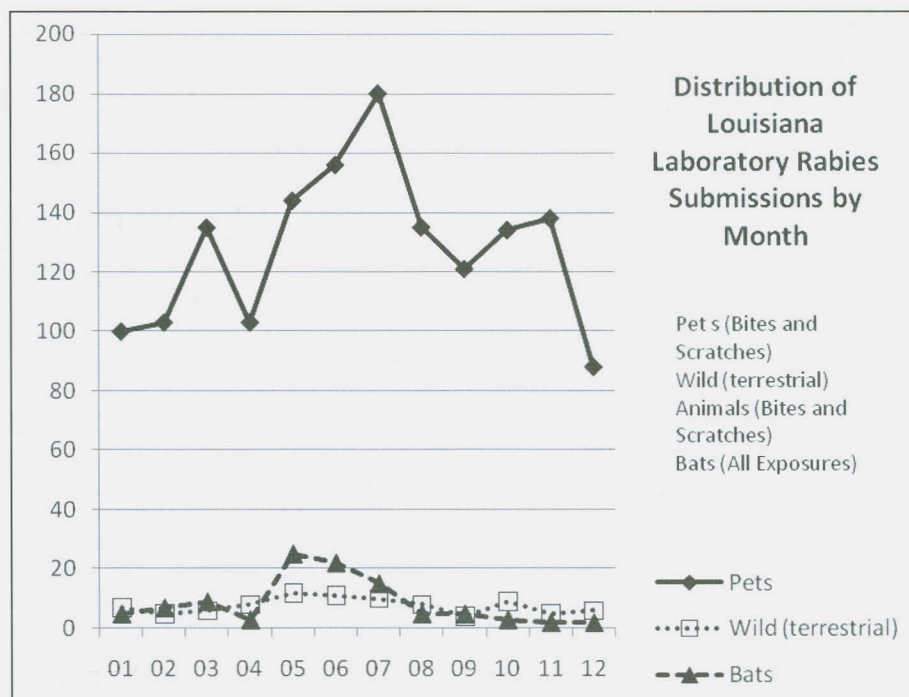


Figure 2. Distribution of Louisiana laboratory rabies test submissions by month.



dogs implicated in the OPH investigations seems to reaffirm the association of these dogs with cases requiring medical attention, since health authorities are more likely requested to investigate more serious bites.<sup>2</sup> Although the sample number in this study is small, a need to somehow address the association of pit bull type dogs with severe medical consequences of animal attacks is evident. However, one is reminded that individual conditions of husbandry may indicate that generalization of this aggressiveness to all dogs phenotypically related to pit bull types may oversimplify the epidemiology of the problem. It is also important to realize that categorization of a dog as a pit bull often lacks biological basis, thus the term, "pit bull type" dog. These dogs are not an officially recognized breed, and the term defines often poorly described conformational characteristics.<sup>2,3</sup>

It is evident from routine laboratory surveillance that rabies test submissions from wild terrestrial animal and pet bite or scratch exposures peak from late spring to late summer. Other studies have indicated that most dog bites occur in the summer due to increased opportunities for contact with animals.<sup>2</sup> The peak in submissions of bat samples during the summer months is more likely related to birthing in May and June and the increased presence of immature bats, increases in foraging activity, and the return of species that over-winter in equatorial latitudes.<sup>13</sup>

## CONCLUSIONS

This work illustrates the importance, and possibly the failure, of several public health initiatives related to community and animal health. In Louisiana, as in other parts of the United States, small children remain the most likely victims of animal trauma, especially by pets that are familiar. Efforts to educate parents, guardians and children as to animal safety and proper pet choices should be considered by veterinarians, physicians, public health practitioners, and educational authorities. Proper restraint and confinement of pets, as well as separation from wildlife, especially skunks and bats, should also be stressed and may be addressed by stronger animal control programs, enforcement of leash laws, and enactment of vicious animal ordinances.<sup>3</sup> Efforts by animal control and public health officials to enforce "rabies" observation of animals involved in bites and other potential rabies exposures should serve to conserve public health resources, specifically packaging, shipping and laboratory costs, and limit unwarranted loss of animal life.

Perhaps the most obvious failure in a historically successful public health effort is woeful public compliance with rabies vaccination requirements in pet species. Rabies vaccination of animals has successfully changed the epidemiology of rabies in the United States. In the early 20th century, human rabies cases were most commonly

associated with exposure to dogs that had been infected by stray canines or wildlife. Animal vaccination efforts have significantly reduced human rabies mortality rates.<sup>14,15</sup> Transmission of rabies from a domestic pet to a human being in the United States is now an extremely rare event. Unwillingness of the public to comply with pet vaccination requirements has the potential to reverse many years of success in reducing the number of human rabies cases in the United States.<sup>15</sup>

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