

Epidemiology of Human Exposure to Rabid Animals in Illinois

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RABIES has long been a serious public health problem in the United States, with 47 deaths of human beings reported in 1938. This number was reduced to two in 1967 and one in 1968, with both 1967 exposures occurring in Africa. Consequently, this country's primary rabies problem is no longer cases in human beings, but rather the emotional trauma experienced when a suspected exposure occurs and the possibility that vaccine may be administered without cause.

Therefore, it is important to define the circumstances precipitating administration of rabies vaccine to man. This information could suggest methods of reducing the number of exposures and vaccinations. This paper is a report of a preliminary epidemiologic investigation into incidents of rabies exposure.

Materials and Methods

The study period extended from January 1, 1963, through December 31, 1968. Each time a specimen of animal brain tissue was found to be positive for rabies in the laboratories serving the State of Illinois and each time a practicing veterinarian submitted a clinical diagnosis of rabies to the Illinois Department of Agriculture, a questionnaire was sent to the attending veterinarian. Information was requested on the number of persons receiving rabies vaccine, and the age, sex, and extent of exposure for each person.

The completed questionnaire was then returned to the Illinois Department of Public Health.

Each case of animal rabies resulting in one or more persons receiving rabies vaccine is referred to in this report as an exposure incident. Persons 15 years of age or older were classified as adults in this study. Dogs that had encountered rabid skunks and weapons used to destroy rabid animals were considered fomites. Fomite contact does not include the cleansing of water containers; this cleansing was considered saliva contact.

Results

From January 1, 1963, through December 31, 1968, a total of 1,272 cases of animal rabies were reported in Illinois (table 1). These cases resulted in 332 exposure incidents (26.1 percent of all cases) and led to vaccination of 856 persons. An average of 67 persons were vaccinated

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per 100 cases of rabies, or 258 per 100 exposure incidents.

Species. Skunks accounted for 62 percent of the cases of rabies, but only 19.6 percent of the exposure incidents and 11.9 percent of the persons vaccinated (see chart). As shown in table 1, skunks had the lowest rate of exposure incidents, eight per 100 cases of rabies, and the lowest rate of persons vaccinated per 100 incidents (157). Cats accounted for only 10.8 percent of the cases, but 31.9 percent of the exposure incidents and 39 percent of the persons receiving vaccine (see chart).

The exposure incident rate was lowest for wildlife, 12 per 100 cases. Only 20 of the 109 incidents resulted in more than two persons receiving vaccine, for an average of 21 vaccinees per 100 cases of rabies in wildlife. The exposure incident rate per 100 cases in farm animals was 44.2, with 16 of the 61 incidents involving more than two persons for an average of 94 persons vaccinated per 100 cases.

Dogs and cats had the highest incident rate, with exposures in 72.6 percent of the cases. More than two persons were involved in 68 of the 162 incidents, giving a rate of 240 persons vaccinated for each 100 cases in dogs or cats. These relative positions of the three groups persisted for the number of persons vaccinated per 100 incidents. The rate for wildlife was 175; for

farm animals, 213; and for dogs and cats, 330 (table 1). Eighteen veterinarians received vaccine because of cattle exposure compared with 14 because of exposure to dogs and cats (seven each).

Age and sex. Of the persons receiving rabies vaccine, 31.9 percent were adults, 27.2 percent were children, and the ages of 40.9 percent were not reported (table 2). The greatest age difference was in the group vaccinated because of rabid farm animals; 53.1 percent of these vaccinees were adults and only 4.6 percent were children. Adults also predominated in exposures to wildlife; 39.8 percent of those exposed were adults and 30.4 percent were children. Children were more commonly exposed to dogs and cats; 31.6 percent of such exposures were of children and 23.9 percent were of adults.

The distribution of the vaccinees by sex was 46 percent male, 24.4 percent female, and 29.6 percent not reported (table 2). The difference in rates by sex was most marked among persons vaccinated because of exposure to farm animals—78.5 percent males and 12.3 percent females—followed by persons exposed to wildlife—62.8 percent males and 19.4 percent females. Little difference was noted in persons receiving vaccine as a result of exposure to dogs and cats—32.1 percent males and 29.2 percent females.

Table 1. Persons vaccinated because of exposure to rabid animals, Illinois, 1963-68

Species	Number of rabies cases	Exposure incidents	Incidents per 100 cases	Persons vaccinated per incident						Total persons vaccinated	Vaccinations per 100 incidents	Vaccinations per 100 cases
				1	2	3-6	7-10	11-19	20-27			
Wildlife.....	911	109	12.0	75	14	18	1	1	0	191	175	21
Skunk.....	789	65	8.2	49	7	8	1	0	0	102	157	13
Fox.....	76	19	25.0	11	5	3	0	0	0	33	174	43
Bat.....	26	13	50.0	9	0	4	0	0	0	23	177	88
Raccoon.....	12	6	50.0	3	1	1	0	1	0	21	350	175
Squirrel.....	6	4	66.7	2	1	1	0	0	0	7	175	117
Coyote.....	1	1	100.0	0	0	1	0	0	0	4	400	400
Mouse.....	1	1	100.0	1	0	0	0	0	0	1	100	100
Farm.....	138	61	44.2	27	18	15	1	0	0	130	213	94
Cow.....	125	55	44.0	25	15	15	0	0	0	113	205	90
Horse.....	10	4	40.0	0	3	0	1	0	0	15	375	150
Sheep.....	2	1	50.0	1	0	0	0	0	0	1	100	50
Pig.....	1	1	100.0	1	0	0	0	0	0	1	100	100
Pet.....	223	162	72.6	67	27	46	17	3	2	535	330	240
Cat.....	137	106	77.4	44	22	29	7	2	2	334	315	244
Dog.....	86	56	65.1	23	5	17	10	1	0	201	359	234
Total.....	1,272	332	26.1	169	59	79	19	4	2	856	258	67

Type of exposure. Among the persons given vaccine, the specific type of exposure most frequently recorded (29.8 percent) was handling rabid animals. Eighteen percent of the vaccinees had been bitten, 7.4 percent had saliva contact, 6.9 percent had been scratched, 2 percent had handled fomites, 6 percent had other types of exposures, and the type of exposure for 30 percent was not reported (table 2). Wildlife contributed the highest percentage of bites, 36.1 percent, and contacts with fomites, 7.3 percent. Farm animals were the source of most saliva contacts, 22.3 percent, and dogs and cats contributed the highest percentage of scratches, 10.3 percent. The three categories had approximately equal percentages of persons receiving vaccine as a result of handling rabid animals.

Head bites accounted for 2.1 percent (five of 233) of the exposures of children but only 0.4 percent (one of 273) of adults. The relative frequency of hand and arm bites was reversed in the two age groups, 6.4 percent of those in children compared with 11.4 percent of those in adults. Saliva exposure was experienced by 2.6 percent (six of 233) of the children, and 13.2 percent (36 of 273) of the adults. The only im-

portant sex-related exposure was scratches, which accounted for 13.9 percent (29 of 209) of the exposures of females and 4.8 percent (19 of 394) of those of males.

Exposures listed as "other" include "spattered with skunk's blood," "in the same yard," "walking barefoot through the yard," "skinning fox," "dressing squirrel," "butchering cattle," "saliva on shoe," "autopsy," "removing the brain with tear in glove," and "had a cold while treating animal." Three persons were vaccinated although the exposure was described as "none." Also three persons were vaccinated whose exposure consisted of drinking tea prepared from water which had been boiled in a saucepan used the previous day to bathe the eyes of a rabid dog. A blacksmith shod a pony the day before it became ill with rabies, and as a result four persons received vaccine—the blacksmith, his wife, who brushed his clothes that evening, and two friends he visited the following day.

Month. As shown in table 3, March and April had the highest percentage of total cases (26.9 percent). Cases in wildlife were most frequent March through May (42.8 percent), 33.3 percent of the cases among farm animals were

Percent distribution of reported cases of rabies, incidents of human exposure, and persons vaccinated against rabies, by category of animal involved, Illinois, 1963–68

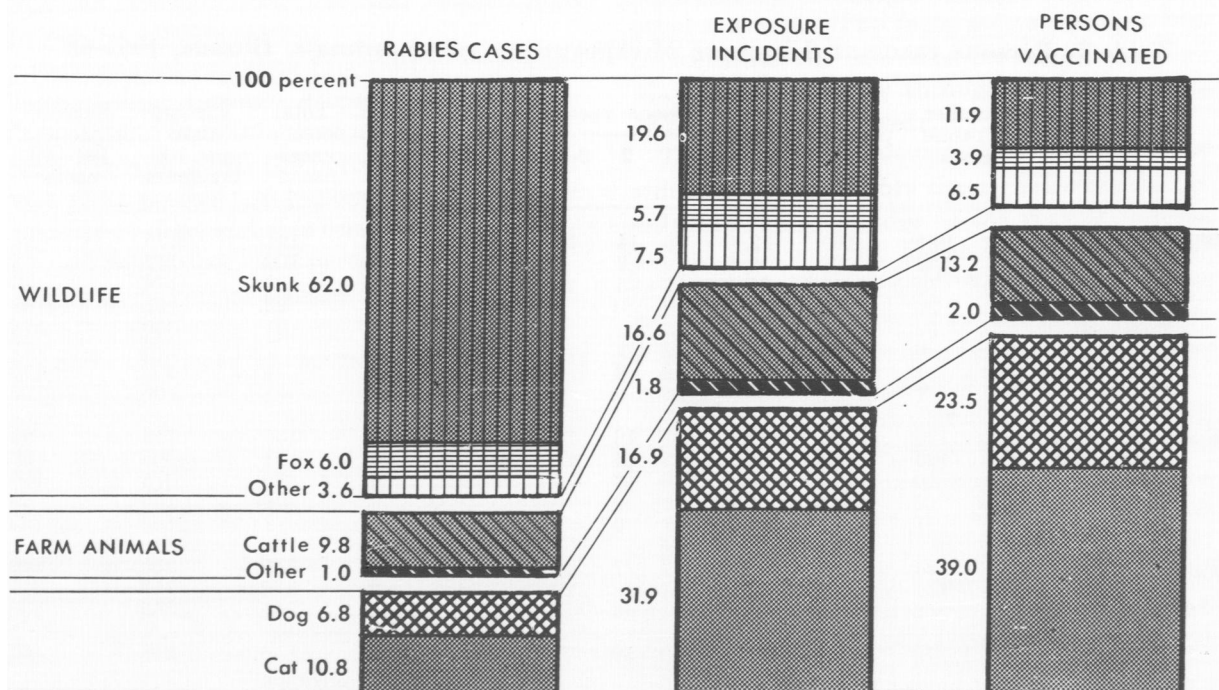


Table 2. Age, sex, and type of exposure of 856 persons exposed to rabid animals, by category of animal involved, Illinois, 1963-68

Characteristics of vaccinee and type of exposure	Wildlife		Farm		Dog or cat		All persons	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent of total
<i>Age (years)</i>								
Under 15.....	58	30.4	6	4.6	169	31.6	233	27.2
15 and over.....	76	39.8	69	53.1	128	23.9	273	31.9
Not reported.....	57	29.8	55	42.3	238	44.5	350	40.9
<i>Sex</i>								
Male.....	120	62.8	102	78.5	172	32.1	394	46.0
Female.....	37	19.4	16	12.3	156	29.2	209	24.4
Not reported.....	34	17.8	12	9.2	207	38.7	253	29.6
<i>Exposure</i>								
Total bites.....	69	36.1	3	2.3	82	15.3	154	18.0
Head or neck.....	2	1.0	0	0	4	.7	6	.7
Hand or arm.....	31	16.2	2	1.5	36	6.7	69	8.1
Foot or leg.....	18	9.4	0	0	14	2.6	32	3.7
Trunk.....	1	.5	1	.8	0	0	2	.2
Not reported.....	17	8.9	0	0	28	5.2	45	5.3
Scratch.....	4	2.1	0	0	55	10.3	59	6.9
Saliva.....	2	1.0	29	22.3	32	6.0	63	7.4
Handled.....	51	26.7	48	36.9	156	29.2	255	29.8
Fomite.....	14	7.3	2	1.5	1	.2	17	2.0
Other.....	17	8.9	14	10.8	20	3.7	51	6.0
Not reported.....	34	17.8	34	26.2	189	35.3	257	30.0
Total.....	191	100.0	130	100.0	535	100.0	856	100.0

reported February through April, and cases in dogs and cats were most prevalent July through September (46.6 percent).

Incidents of exposure to wildlife were most frequent June through August (51.4 percent). Farm animal incidents were most common February through April (36 percent) with another peak (13.1 percent) in September. Incidents of exposure to dogs and cats occurred mostly July through September (49.5 percent).

Most vaccinations because of wildlife exposure (57.6 percent) occurred June through August while vaccinations due to farm animal exposures were most common February through April (43.1 percent). Vaccinations due to dog and cat exposures were most common July through September (57.8 percent).

The June through October average was 21 incidents per 100 cases of rabies in wildlife in contrast to six per 100 cases for the remainder of the year. The seasonal difference was less marked for the other species groups, with dogs and cats having a rate of 79 incidents per 100

cases for July through September and December through February in contrast to 62 for the other 6 months. The farm animal average was 55 incidents per 100 cases for March through May and September through November with 35 for the rest of the year.

There were 201 persons vaccinated per 100 wildlife incidents July through December but only 136 the remainder of the year. The farm animal rate was 263 December through April and 163 for May through November. The rate for dogs and cats peaked June through August, with 404 vaccinations per 100 incidents in contrast to 269 for the other 9 months.

The vaccination rate per 100 cases also varied markedly by month, especially as related to wildlife, with 39 vaccinees per 100 rabies cases June through October, in contrast to 10 per 100 cases the remainder of the year. The rate associated with dogs and cats had a peak of 288 for May through September, compared with 167 the rest of the year. There was no seasonal trend in farm animals.

The percentage of male vaccinees was higher October through April (78.8 percent) than in the rest of the year (56.6 percent). Seventy-seven of the 156 males whose ages were known were children, compared with 65 of 152 females.

Pet wildlife. Fourteen of the 911 rabid wild animals had been kept as pets. Eleven of the 14 cases resulted in exposure incidents with 39 persons being vaccinated. This was a rate of 279 vaccinations per 100 pet wildlife cases, in contrast to 17 per 100 for all other wildlife cases. Eight of the 11 incidents involved more than two persons, compared with 12 of 98 for all other wildlife. Six of the 11 incidents and 23 of the 39 vaccination series were in July. Pet wildlife as a group accounted for a lower than

average percentage of bites, with more persons receiving vaccine as a result of handling.

Stray dogs and cats. Stray dogs and cats accounted for 38 incidents involving 126 persons. The 332 vaccinations per 100 incidents approximates the 330 rate for all dogs and cats.

Discussion

Interpretation of the data in this paper is complicated by the large number of unreported elements in each category. However, it is apparent that many factors are operating to influence the number of persons exposed to rabid animals. On preliminary examination, it would seem that a major factor is the species of animal infected with the disease. Efforts should continue toward

Table 3. Monthly distribution of rabies cases, exposure incidents, and persons vaccinated, by category of animal involved, Illinois, 1963-68

Month	Wildlife		Farm		Pet	
	Number	Percent ¹	Number	Percent ¹	Number	Percent ¹
Rabies cases.....	911	100.0	138	100.0	223	99.8
January.....	25	2.7	11	8.0	11	4.9
February.....	51	5.6	16	11.6	17	7.6
March.....	116	12.7	16	11.6	10	4.5
April.....	170	18.7	14	10.1	16	7.2
May.....	104	11.4	7	5.1	13	5.8
June.....	90	9.9	12	8.7	19	8.5
July.....	99	10.9	9	6.5	36	16.1
August.....	64	7.0	12	8.7	48	21.5
September.....	49	5.4	11	8.0	20	9.0
October.....	54	5.9	10	7.2	17	7.6
November.....	58	6.4	8	5.8	8	3.6
December.....	31	3.4	12	8.7	8	3.6
Exposure incidents.....	109	100.1	61	100.0	162	100.2
January.....	3	2.8	5	8.2	9	5.6
February.....	2	1.8	6	9.8	14	8.6
March.....	7	6.4	8	13.1	7	4.3
April.....	9	8.3	8	13.1	9	5.6
May.....	8	7.3	3	4.9	13	8.0
June.....	15	13.8	3	4.9	9	5.6
July.....	27	24.8	3	4.9	27	16.7
August.....	14	12.8	4	6.6	38	23.5
September.....	10	9.2	8	13.1	15	9.3
October.....	7	6.4	5	8.2	10	6.2
November.....	4	3.7	4	6.6	4	2.5
December.....	3	2.8	4	6.6	7	4.3
Persons vaccinated.....	191	100.0	130	100.1	535	100.0
January.....	4	2.1	11	8.5	35	6.5
February.....	2	1.0	14	10.8	34	6.4
March.....	8	4.2	19	14.6	10	1.9
April.....	16	8.4	23	17.7	14	2.6
May.....	10	5.2	3	2.3	43	8.0
June.....	20	10.5	3	2.3	39	7.3
July.....	56	29.3	8	6.2	124	23.2
August.....	34	17.8	7	5.4	136	25.4
September.....	15	7.9	12	9.2	49	9.2
October.....	13	6.8	12	9.2	15	2.8
November.....	6	3.1	4	3.1	14	2.6
December.....	7	3.7	14	10.8	22	4.1

¹ Total may be more or less than 100 because of rounding.

developing disease control techniques for wildlife, since this is the primary reservoir in the United States.

However, further efforts are needed to reduce the number of cases in domestic animals, since each rabid dog or cat results in approximately 22 times as many human vaccinations as a rabid skunk. This is probably a minimum figure in view of the disparity in reporting of the domestic animal and wildlife cases. The natural defense of the skunk discourages human contact and could account in part for the low rate of incidents and vaccinations associated with skunks.

There was a marked difference between the months in which rabies cases were most common and the months in which most of the exposures occurred. Cases in wildlife were most common in spring, but human exposures to these animals were most frequent in the summer when recreational and occupational activities take people into wild animals' habitats.

Adults were exposed more commonly than children to wildlife species, suggesting either that adults' activities bring them into wild animals' habitats or that adults handle the situation when wild animals enter human habitations. On the other hand, children seem more likely to contact rabid dogs and cats.

Although there were fewer vaccinations per incident for wild animals than for dogs and cats, the difference vanished when only wild animals kept as pets were considered, strongly suggesting that the human-pet relationship was more important than the species of animal involved in the exposure. Human exposure to rabid farm animals would seem to be an occupational hazard in view of the high percentage of adult males vaccinated. A major proportion of these exposures was the result of examining or treating sick farm animals, thus accounting for the age distribution of saliva contacts.

It has been suggested that their short stature predisposes children to head or neck bites (1). This theory is supported by the present study.

It is disturbing that more than one-third of the vaccine series were administered for reasons which are not consistent with recommended immunization practices (2). Possibly a certain percentage of these persons actually were exposed, and insufficient information was submitted to

document the incident. On the other hand, there were numerous instances in which the situation was described adequately and there obviously was no saliva contact, suggesting that some series might be administered as psychotherapy. This practice is deplorable in view of the dangers associated with the indiscriminate use of any biological product. This same consideration should preclude administration of vaccine to unexposed persons for legal rather than medical reasons.

The importance of the human factors in exposures to rabies illustrates that educational programs for the general public are needed urgently. Persons should be cautioned to avoid wild animals which act tame. Further, persons should be discouraged from making pets of wild species. Elimination of this practice alone would have effected a 22 percent reduction in the number of persons exposed to rabid wildlife.

Exposure to rabid farm animals should be approached as an occupational hazard to farmers and veterinarians. These persons should have a greater index of suspicion towards rabies in farm animals and wear protective covering on the hands and arms during examination and treatment.

Thirty-two of the 856 vaccinees were veterinarians, an exposure rate which is 312 times higher than for the general population. This confirms the value of preexposure immunization of veterinarians (3).

Although rates were no higher following exposure to stray dogs and cats than for pets, stray animals still accounted for approximately one-fourth of the persons exposed to dogs and cats and one-seventh of the total vaccinees, documenting the need for improved control of stray dogs and cats.

Summary

All cases of animal rabies occurring in Illinois from 1963 through 1968 were investigated to determine the number of persons receiving rabies vaccine. There were 856 persons vaccinated because of exposure to 332 of the 1,272 reported rabid animals.

Dogs and cats posed the greatest hazard, with 240 persons vaccinated per 100 animal cases in contrast to 13 per 100 rabid skunks. When wild animals were kept as pets, the vaccination

rate was similar to the rate following cases associated with dogs and cats. Exposure to rabid farm animals appeared to be occupational.

One-third of the vaccine series were administered in instances where a true exposure was unlikely. Public education should be intensified in an effort to reduce the number of persons exposed.

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Tearsheet Requests

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Survey of Drug Use Among Michigan Students

A survey of University of Michigan students indicated that approximately eight out of 10 have never tried a nonmedically prescribed narcotic, amphetamine, tranquilizer, or hallucinogen. Well under 1 percent of the student population used such drugs regularly, but 44.1 percent had used marihuana or hashish at least once.

The university's drug education committee, made up of faculty and students, reported on a survey of drug usage and educational needs in September 1969. A random selection of 1,000 students was given an opportunity to respond anonymously, with no threat or detection or self-incrimination. About 600 responded.

Percentages of those with no experience with various drugs were as follows: medically prescribed narcotics (83.1 percent), amphetamines (75.3 percent), tranquilizers (87.8 percent), or hallucinogens (87.8 percent). A majority (55.9 percent) have never tried marihuana or hashish, while 43 percent have never tried tobacco and 10.1 percent have never tried alcohol.

Usage appears to be predominantly experimental. Those using drugs only once or seldom were as follows: narcotics—16.2 percent; tranquilizers—10.9 percent; hallucinogens—9.9

percent; amphetamines—21 percent; marihuana or hashish—28.7 percent; tobacco—23.4 percent, and alcohol—45.5 percent.

The percentage of students who have used marihuana or hashish at least once is considerably higher than the figure reported in most surveys of drug use by college students. This percentage indicates that the use of marihuana has increased or is increasing rapidly or that students responding anonymously in the Michigan sample were more willing to report their usage of this substance.

Analysts of the survey data found a general tendency for drug usage to increase as students progress from freshman to senior year. However, at the graduate level there is a drop in usage of all substances except tranquilizers which increases and alcohol which remains stable.

More than 80 percent of all students responding said there was a need for a campus drug education program, which offers (a) current and objective information about the physical and psychological consequences of drug use, (b) information on resources available to assist students with problems relating to the use of drugs, and (c) information on the legal aspects of drug use.