Rabies surveillance in the United States during 2014

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During 2014, 50 states and Puerto Rico reported 6,033 rabid animals and 1 human case of rabies to the CDC, representing a 2.83% increase from the 5,865 rabid animals and 3 human cases of rabies reported in 2013. Of the 6,034 cases of rabies, 5,588 (92.61%) involved wildlife. Relative contributions by the major animal groups were as follows: 1,822 (30.20%) raccoons, 1,756 (29.10%) bats, 1,588 (26.32%) skunks, 311 (5.15%) foxes, 272 (4.51%) cats, 78 (1.29%) cattle, and 59 (0.98%) dogs. Compared with 2013, there was a substantial increase in the number of samples submitted for rabies testing. The 1 human case of rabies involved a 52-year-old male in Missouri. Infection was determined to be a result of a rabies virus variant associated with *Perimyotis subflavus*; however, no specific exposure event was identified.

The present report provides a detailed update on rabies epidemiology and events in the United States during 2014 as well as a brief summary of rabies events in 2015. Updates are also provided for Canada and Mexico.

Rabies is caused by neurotrophic viruses of the genus *Lyssavirus*. It is almost always fatal once clinical signs develop, but is preventable if appropriate postexposure prophylaxis is administered in a timely manner. The primary route of transmission is through the bite of an infected mammal, but rabies may also be transmitted when fresh saliva from an infected animal comes into contact with a wound or mucous membranes. For human patients who have never been vaccinated against rabies, postexposure prophylaxis consists of immediate cleansing of any bite wounds with soap and water, infiltration of the wounds with human rabies immune globulin, and administration of 4 doses of rabies vaccine over the next 14 days.[1,2]

Since 1980, wildlife has accounted for > 90% of all rabid animals reported in the United States. The 5 species considered primary reservoirs include raccoons, bats, skunks, foxes, and mongooses (in Puerto Rico). Although cross-species transmission of rabies does occur (eg, infection of domestic dogs with the raccoon rabies variant), rabies virus variants are primarily transmitted within a single species that is the reservoir of that variant. Rabies virus variants associated with the major mesocarnivore species (ie, raccoons, skunks, foxes, and mongooses) are distributed in distinct geographic regions **(Figure 1)**, whereas rabies virus variants associated with bat species are broadly distributed across the geographic ranges associated with specific bat species. Natural and anthropogenic factors (eg, drought

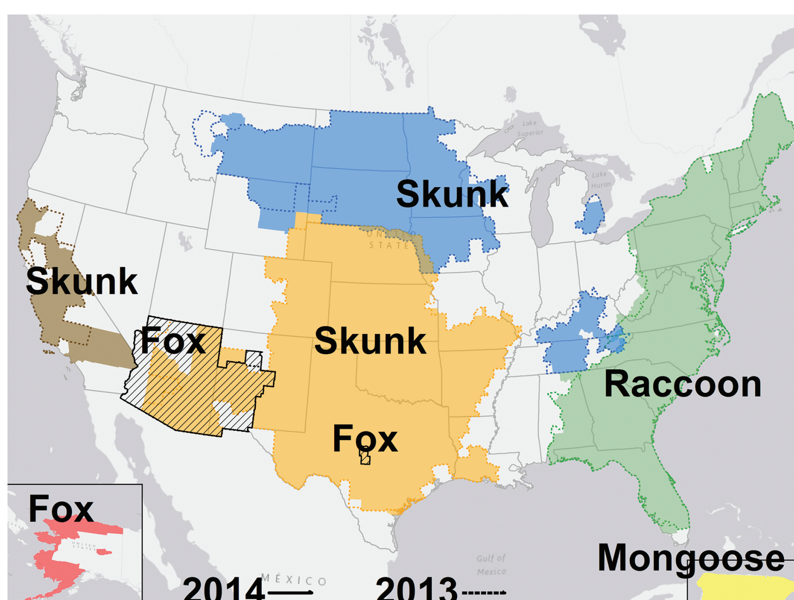

Figure 1—Distribution of major rabies virus variants among mesocarnivores in the United States and Puerto Rico for 2008 through 2014. Black diagonal lines represent fox rabies variants (Arizona gray fox and Texas gray fox). Solid borders represent 5-year rabies virus variant aggregates for 2009 through 2014; dashed borders represent the previous 5-year aggregates for 2008 through 2013.

and oral vaccination, respectively) may change the spatial boundaries of these rabies virus variants over time.[3]

The Wildlife Services department of the USDA's APHIS leads a large-scale program to control rabies in wildlife. Efforts are primarily focused on delivering oral rabies vaccine–laden baits targeted at raccoons along the East Coast of the United States. Oral vaccination of wildlife (primarily foxes and raccoons) has greatly reduced the spread of rabies in numerous countries in North America and Europe.[4–6] Rabies vaccination of bats is currently not feasible, and preventing infection of humans with bat rabies virus variants continues to rely on secondary intervention methods such as health education, exposure prevention, and postexposure prophylaxis.

Elimination of the canine rabies virus variant, vaccination of wildlife, appropriate and timely postexposure prophylaxis, and education of health-care professionals and the public have all led to a dramatic reduction in the number of human rabies cases in the United States over the past several decades. However, human deaths continue to occur, albeit infrequently, primarily as a result of exposure to bats.[7]

To prevent unnecessary administration of postexposure prophylaxis after exposure of a person to an animal suspected to be rabid, an appropriate risk assessment should be performed. When feasible, this risk assessment should include laboratory testing of the suspected rabid animal for rabies virus. However, in the case of a potential rabies exposure involving a cat, dog, or ferret, a 10-day confinement and observation period can be used, thereby potentially preventing unnecessary euthanasia of animals for testing.[8] In instances when people have been exposed to wildlife or other domestic species, immediate euthanasia and laboratory testing is the most prudent course of action.[8,9] Potential contact with bats can warrant additional precautions and more extensive risk assessment. For example, the Advisory Committee on Immunization Practices recommends evaluating not just those individuals who have come into direct contact with or been bitten by a bat but also individuals who may have had unacknowledged contact with a bat (eg, if a bat is found in the room with a deeply sleeping person, unattended child, or mentally disabled or intoxicated person).[1] Testing of bats implicated in presumptive human exposures remains the most definitive way to rule out the risk of rabies transmission in these situations.

Reporting and Analysis

Human and animal rabies have been nationally notifiable conditions in the United States since 1944.[10] Currently, > 130 state health, agriculture, and university laboratories in the United States perform routine rabies diagnostic testing on animals with a direct fluorescent antibody test.[11] In addition, as a component of oral rabies vaccination programs, the USDA Wildlife Services performs targeted, enhanced surveillance testing with a direct rapid immunohistochemical test.[5,12]

The USDA Wildlife Services and other reporting entities submit animal rabies data directly to the CDC Poxvirus and Rabies Branch on a monthly or annual basis. During 2014, a total of 104,313 samples were submitted for laboratory testing, of which 101,708 (97.5%) were considered suitable for testing. This represented a 7.8% increase in the number of animals tested, compared with the 94,359 animals tested during 2013. Of the animals submitted for testing, 5,843 (5.7%) were submitted by USDA Wildlife Services personnel as part of active surveillance efforts.

The CDC rabies program requests detailed information on animals submitted for rabies testing.[13] All states provided data on species, county, and date of testing or specimen collection for all animals submitted for rabies testing. Information on vaccination status of domestic animals and results of rabies virus variant typing for rabid animals (when performed) were also requested.

For the present report, percentages of rabid animals were calculated on the basis of total numbers of animals tested. These percentages are likely not reliable indicators of the true incidence of rabies within animal populations because most animals submitted for testing were selected on the basis of abnormal behavior or visible illness or were involved in a potential exposure incident, biasing the sample submitted for testing. In addition, any comparisons between states should take into account differences in available resources and submission protocols between jurisdictions. Per capita submission rates were calculated on the basis of 2010 population data available from the US Census Bureau.[14]

Geographic ranges of terrestrial rabies virus variant reservoirs in the United States were produced by aggregating counts of rabid animals from 2008 through 2014 by species.[13] Areas designated with potential host shift events signify regions where new rabies virus variants may be emerging.[15]

Data for Canada were provided by the Canadian Food Inspection Agency Centre of Expertise for Rabies, Ottawa, ON. Summary data for Mexico were provided by the Instituto de Salud del Estado de México.

Rabies in Wild Animals

Wild animals accounted for 92.61% (5,588/6,034) of the rabies cases reported in 2014, representing a 3.52% increase in the number of rabid wild animals reported, compared with the 5,398 rabid wild animals reported in 2013 **(Table 1)**. As has been the trend over the past 2 decades **(Figure 2)**, raccoons were the most frequently reported rabid wildlife species, representing 30.20% (n = 1,822) of all rabies cases during 2014, followed by bats (29.10% [1,756]), skunks (26.32% [1,588]), foxes (5.15% [311]), other wild animals (1.09% [66]), and rodents and lagomorphs (0.75% [45]). Bats were the animals most frequently tested (n = 28,154), followed by raccoons (12,297), skunks (5,058), and foxes (1,515).

Table 1—Cases of rabies in the United States, by location, during 2014.

Location	Reservoir	Total cases	Domestic animals	Wildlife	Domestic animals: Cats	Cattle	Dogs	Horses and mules	Sheep and goats	Other domestic*	Wildlife: Raccoons	Bats	Skunks	Foxes	Other wild†	Rodents and lagomorphs‡	Humans	% Pos 2014	2013 cases	Change (%)
AK	Arctic fox	3	1	2	0	0	1	0	0	0	0	1	0	1	0	0	0	7.5	9	−66.67
AL	Raccoon	86	4	82	1	0	2	1	0	0	55	16	1	8	2[b]	0	0	3.3	60	43.33
AR	Skunk	152	7	145	3	3	1	0	0	0	0	34	110	1	0	0	0	11.7	151	0.66
AZ	Skunk	157	0	157	0	0	0	0	0	0	0	87	61	8	1[c]	0	0	18.1	77	103.90
CA	Skunk	200	3	197	2	0	1	0	0	0	0	168	28	1	0	0	0	3.4	198	1.01
CO	Skunk	131	2	129	2	0	0	0	0	0	1	94	32	1	1[d]	0	0	8.6	187	−29.95
CT	Raccoon	183	8	175	5	1	0	0	2	0	96	25	41	9	1[e]	3[t]	0	7.9	150	22.00
DC	Raccoon	40	2	38	2	0	0	0	0	0	27	9	0	2	0	0	0	9.8	57	−29.82
DE	Raccoon	9	3	6	3	0	0	0	0	0	2	1	0	3	0	0	0	6.8	17	−47.06
FL	Raccoon	95	18	77	15	0	2	1	0	0	53	19	0	5	0	0	0	4.3	108	−12.04
GA	Raccoon	272	19	253	17	0	1	0	1	0	137	25	48	38	4[f]	1[u]	0	13.0	297	−8.42
HI	Bat only	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0.00
IA	Skunk	15	3	12	1	2	0	0	0	0	0	10	2	0	0	0	0	1.1	12	25.00
ID	None	12	0	12	0	0	0	0	0	0	0	11	1	0	0	0	0	3.2	26	−53.85
IL	None	40	0	40	0	0	0	0	0	0	0	40	0	0	0	0	0	1.0	54	−25.93
IN	Skunk	12	0	12	0	0	0	0	0	0	0	12	0	0	0	0	0	1.2	10	20.00
KS	Skunk	70	18	52	7	9	0	2	0	0	0	4	48	0	0	0	0	6.2	60	16.67
KY	Skunk	10	1	9	0	0	1	0	0	0	0	6	3	0	0	0	0	1.1	16	−37.50
LA	Skunk	5	2	3	1	0	1	0	0	0	0	3	0	0	0	0	0	0.9	8	−37.50
MA	Raccoon	148	4	144	4	0	0	0	0	0	48	40	39	0	2[g]	5[v]	0	5.3	100	48.00
MD	Raccoon	344	18	326	18	0	0	0	0	0	192	79	21	27	2[h]	5[w]	0	8.7	382	−9.95
ME	Raccoon	43	3	40	2	1	0	0	0	0	14	4	13	8	0	1[x]	0	7.0	54	−20.37
MI	Skunk	43	0	43	0	0	0	0	0	0	0	39	4	0	0	0	0	1.4	40	7.50
MN	Skunk	33	2	31	1	1	0	0	0	0	0	27	3	1	0	0	0	1.5	63	−47.62
MO	Skunk	28	2	25	2	0	0	0	0	0	0	16	9	0	0	0	1	1.4	40	−30.00
MS	Bat only	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0.3	5	−80.00
MT	Skunk	16	0	16	0	0	0	0	0	0	0	11	5	0	0	0	0	4.0	36	−55.56
MC	Raccoon	355	23	332	15	2	4	1	1	0	188	31	69	41	3[i]	0	0	8.2	385	−7.79
ND	Skunk	18	5	13	2	3	0	0	0	0	0	1	12	0	0	0	0	2.6	40	−55.00
NE	Skunk	21	4	17	0	4	0	0	0	0	0	10	7	0	0	0	0	2.0	33	−36.36
NH	Raccoon	23	1	22	1	0	0	0	0	0	8	6	2	5	0	1[y]	0	5.1	34	−32.35
NJ	Raccoon	349	24	325	22	2	0	0	0	0	193	77	37	9	1[j]	8[z]	0	9.8	315	10.79
NM	Skunk	12	0	12	0	0	0	0	0	0	0	7	4	1	0	0	0	2.6	11	9.09
NV	Bat only	14	1	13	0	0	1	0	0	0	0	13	0	0	0	0	0	4.3	9	55.56
NY	Raccoon	372	32	340	25	5	0	1	1	0	166	98	45	24	2[k]	5[aa]	0	5.9	335	11.04
NYC	Raccoon	12	0	12	0	0	0	0	0	0	10	0	1	0	1[l]	0	0	2.9	56	−78.57
OH	Bat only	28	0	28	0	0	0	0	0	0	7	20	1	0	0	0	0	0.7	60	−53.33
OK	Skunk	106	33	73	5	14	9	5	0	0	0	3	69	0	1[m]	0	0	9.4	85	24.71
OR	Bat only	13	0	13	0	0	0	0	0	0	0	10	0	3	0	0	0	4.4	10	30.00
PA	Raccoon	402	53	349	47	2	2	2	0	0	215	61	44	19	3[n]	7[ab]	0	6.0	361	11.36
PR	Mongoose	45	13	32	1	0	12	0	0	0	0	0	0	0	32[o]	0	0	40.2	54	−16.67
RI	Raccoon	27	2	25	1	0	0	1	0	0	9	5	5	3	0	3[ac]	0	3.9	28	−3.57
SC	Raccoon	140	17	123	12	0	4	0	0	1[a]	70	9	33	9	2[p]	0	0	8.6	124	12.90
SD	Skunk	21	3	18	1	1	0	0	1	0	0	6	12	0	0	0	0	3.6	28	−25.00
TN	Skunk	40	2	38	0	1	1	0	0	0	1	8	29	0	0	0	0	1.7	36	11.11
TX	Skunk	1,133	63	1,070	22	15	14	11	1	0	28	513	504	22	3[q]	0	0	8.7	937	20.92
UT	Bat only	22	0	22	0	0	0	0	0	0	0	21	1	0	0	0	0	7.7	12	83.33
VA	Raccoon	528	42	486	28	12	1	0	1	0	243	23	166	46	3[r]	5[ad]	0	13.2	506	4.35
VT	Raccoon	55	1	54	1	0	0	0	0	0	28	3	17	3	2[s]	1[ae]	0	12.4	50	10.00
WA	Bat only	15	0	15	0	0	0	0	0	0	0	15	0	0	0	0	0	3.6	12	25.00
WI	Skunk	27	0	27	0	0	0	0	0	0	0	26	0	1	0	0	0	1.3	30	−10.00
WV	Raccoon	50	5	45	2	0	1	0	2	0	31	2	11	1	0	0	0	6.6	91	−45.05
WY	Skunk	58	1	57	1	0	0	0	0	0	0	6	50	1	0	0	0	8.8	9	544.44
Total		**6,034**	**445**	**5,588**	**272**	**78**	**59**	**25**	**10**	**1**	**1,822**	**1,756**	**1,588**	**311**	**66**	**45**	**1**	—	**5,868**	—
	% 2014	100	7.37	92.61	4.51	1.29	0.98	0.41	0.17	0.02	30.20	29.10	26.32	5.15	1.09	0.75	0.02			
	% Pos 2014	5.93	0.90	10.80	1.14	6.07	0.27	3.33	1.64	2.56	14.82	6.24	31.40	20.53	2.80	1.96	—			
	Total 2013	**5,868**	**467**	**5,398**	**247**	**86**	**89**	**31**	**9**	**5**	**1,898**	**1,598**	**1,447**	**344**	**71**	**40**	**3**			
	% Change	2.83	−4.71	3.52	10.12	−9.30	−33.71	−19.35	11.11	−80.00	−4.00	9.89	9.74	−9.59	−7.04	12.50	−66.67			

*Other domestic includes [a]1 llama. †Other wild includes [b]1 bobcat, 1 coyote; [c]1 bobcat; [d]1 coyote; [e]1 bobcat; [f]4 bobcats; [g]2 bobcats; [h]1 deer, 1 opossum; [i]2 bobcats, 1 coyote; [j]1 coyote; [k]1 bobcat, 1 coyote; [l]1 opossum; [m]1 bobcat; [n]3 deer; [o]32 mongooses; [p]1 bobcat, 1 coyote; [q]1 bobcat, 1 coyote; [r]1 bobcat, 1 coyote, 1 otter; [s]2 bobcats. ‡Rodents and lagomorphs include [t]3 groundhogs; [u]1 beaver; [v]5 groundhogs; [w]5 groundhogs; [x]1 groundhog; [y]1 groundhog; [z]8 groundhogs; [aa]1 beaver, 4 groundhogs; [ab]7 groundhogs; [ac]3 groundhogs; [ad]5 groundhogs; [ae]1 groundhog.

— = Not applicable. NYC = New York City. Pos = Positive.

Total cases refers to the total number of rabies cases in domestic animals, wildlife, and humans. Reservoir refers to the major rabies virus variant terrestrial reservoir in the locality.

Seasonal trends for wildlife species were consistent with those for previous years. Numbers of rabid raccoons and skunks reported to the CDC peaked in April, with a moderate second peak around September. There were sharp peaks in the number of rabid foxes in July and in the number of rabid bats in August.

Raccoons

The 1,822 rabid raccoons reported in 2014 represented a 4.00% decrease, compared with the 1,898 reported in 2013 (Table 1). The percentage of raccoons submitted for testing that were found to be rabid decreased to 14.8%, compared with 16.3% in 2013 **(Table 2)**. However, this was not a significant change from the 5-year mean for percentage of tested raccoons found to be rabid (14.5%). Twelve of the 20 Eastern states where raccoon rabies is considered enzootic, the District of Columbia, and New York City reported fewer numbers of rabid raccoons, with 8 states (Delaware, Florida, Georgia, Maryland, Maine, New Hampshire, Rhode Island, and West Virginia), the District of Columbia, and New York City reporting decreases of > 10% in the number of rabid raccoons, compared with numbers reported in 2013. States in which raccoon rabies was considered enzootic accounted for 98.0% (n = 1,785) of all rabid raccoons reported in 2014 **(Figure 3)**. The remaining rabid raccoons were reported by states where the raccoon rabies virus variant is not enzootic: Texas (n = 28), Ohio (7), Colorado (1), and Tennessee (1). Rabies virus variant information was available for only 17.0% (310) of rabid raccoons **(Table 3)**, with the eastern raccoon virus variant identified in 283 of these 310 (91.3%) rabid raccoons. The south central skunk variant was found in 26 raccoons from Texas, and the north central skunk variant was found in 1 raccoon from Tennessee. Overall, states in which the raccoon rabies virus variant was considered enzootic, excluding Tennessee and Ohio, submitted 38.5 animals/100,000 persons for rabies testing during 2014, a slight increase from the

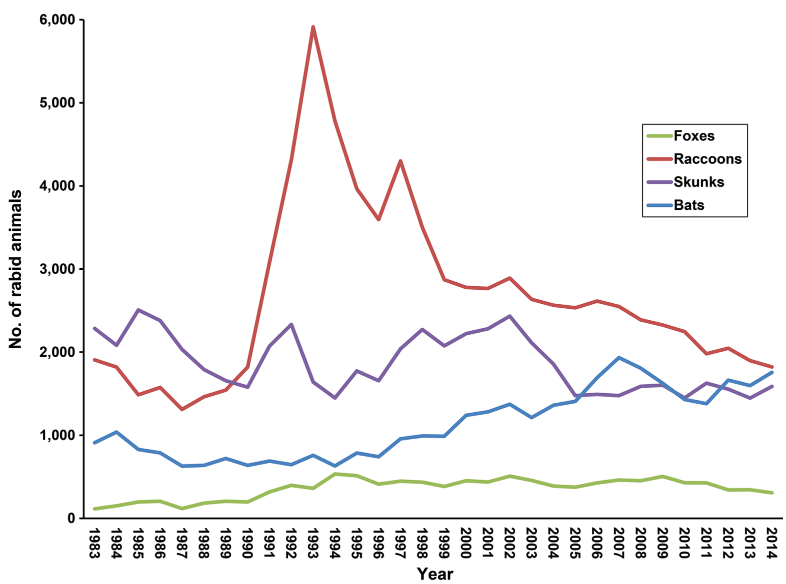

Figure 2—Cases of rabies among wildlife in the United States, by year and species, for 1983 through 2014.

Table 2—Number of animals reported to be rabid in the United States and percentages of samples tested for rabies that yielded positive results for 2009 through 2014.

	2014		2009–2013			
			No. of rabid animals		Percentage of samples with positive results	
Animals	**No. of rabid animals**	**Percentage of samples with positive results**	**Mean**	**95% CI**	**Mean**	**95% CI**
Domestic animals						
Cats	272	1.1	283	254–313	1.1	1.0–1.2
Cattle	78	6.1	82	60–104	6.7	5.4–7.9
Dogs	59*	0.3	79	69–88	0.3	0.3–0.4
Horses and mules	25*	3.3*	40	34–46	4.4	3.7–5.2
Sheep and goats	10	1.6	10	6–13	1.9	1.2–2.7
Wildlife						
Raccoons	1,822*	14.8	2,101	1,905–2,298	14.5	12.7–16.9
Bats	1,756*	6.2	1,547	1,396–1,698	6.1	5.7–6.5
Skunks	1,588	31.4	1,536	1,443–1,630	30.1	25.0–32.9
Foxes	311*	20.8	409	333–485	21.4	17.3–25.7
All rabid animals	6,033	5.9	6,213	5,874–6,551	6.0	5.7–6.3
Rabid domestic animals	445*	0.9	495	471–518	1.0	0.9–1.0
Rabid wildlife	5,588	10.8	5,717	5,394–6,042	10.9	10.3–11.6

*Significantly ($P < 0.05$) different from mean value for 2009 through 2013.
CI = Confidence interval.

37.9 animals/100,000 persons submitted for rabies testing during 2013.

Bats

There were 1,756 rabid bats reported during 2014, representing a 9.89% increase, compared with the 1,598 rabid bats reported in 2013 (Table 1). The percentage of bats submitted for testing that were rabid (6.2%) was not significantly higher than the mean percentage for the previous 5 years (6.1%; Table 2). All 48 contiguous states reported rabid bats **(Figure 4)**. No rabid bats were reported in New York City, Hawaii, or Puerto Rico. Four states (Illinois, Indiana, Mississippi, and Washington) reported that bats were the only rabid animal found in 2014. A ≥ 50% increase in the number of rabid bats was reported by 13 states (Alabama [129% increase], Massachusetts [122% increase], Alaska [100% increase], New Hampshire [100% increase], West Virginia [100% increase], Arizona [89% increase], South Carolina [80% increase], Utah [75% increase], Iowa [67% increase], Nebraska [67% increase], Nevada [63% increase], Maryland [55% increase], and Wyoming [50% increase]). Among the bats tested for rabies, 13,542 (48.1%) were identified beyond the taxonomic level of order **(Table 4)**. Overall, states for which bats were the only recognized reservoir for rabies submitted 22.7 animals/100,000 persons for rabies testing during 2014, compared with 21.5 animals/100,000 persons submitted during 2013.

Skunks

There was a 9.74% increase in the number of rabid skunks reported during 2014 (n = 1,588), compared with the number reported during 2013 (1,447; Table 1). The percentage of skunks tested during 2014 that were found to be rabid (31.4%) was slightly increased, compared with the previous 5-year mean (30.1%; Table 2). Three of the 22 states where skunk rabies virus variants were considered enzootic reported a ≥ 50% increase in the number of rabid skunks during 2014, compared with 2013 (Wyoming [1,150% increase], Arizona [177% increase], and Tennessee [71%]). Illinois has not reported any rabid skunks since 2005, and Indiana has not reported any rabid skunks since 2007. States in which the south central skunk rabies virus variant was enzootic reported 53.3% of all rabid skunks, states in which the north central skunk rabies virus variant was enzootic reported 7.4% of all rabid skunks, and states in which the California skunk rabies virus variant was enzootic reported 1.8% of all rabid skunks **(Figure 5)**. A total of 37.3% of all rabid skunks were from states where the raccoon rabies virus variant was enzootic. Rabies virus variant information was available for 745 of the 1,588 (46.9%) rabid skunks reported during 2014 (Table 3). The most common rabies virus variant was south central skunk (556 [74.6%]), followed by eastern raccoon (171 [23.0%]), north central skunk (14 [1.9%]), and

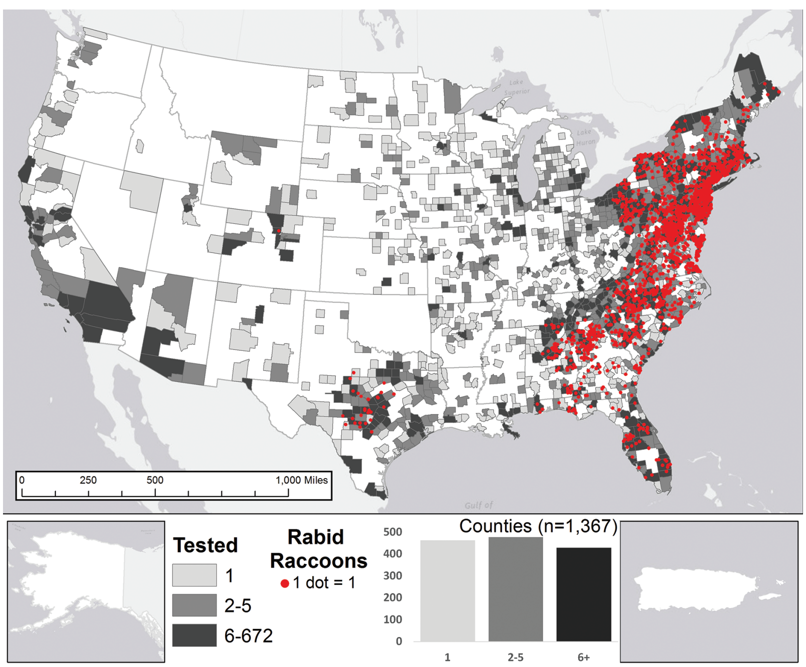

Figure 3—Reported cases of rabies involving raccoons, by county, during 2014. Histogram represents number of counties in each category for total number of raccoons submitted for rabies testing. Point locations for rabid raccoons were randomly selected within each reporting jurisdiction.

Table 3—Rabies virus variants identified in domestic and wild animals in 2014.

	Domestic animals						Wildlife						
Variant	**Cats**	**Cattle**	**Dogs**	**Horses and mules**	**Sheep and goats**	**Other domestic**	**Raccoons**	**Bats**	**Skunks**	**Foxes**	**Other wild†**	**Rodents and lagomorphs‡**	**Total**
Raccoon	38	14	7	1	1	1	283	0	171	63	7	7	**593**
South central skunk	26	24	14	13	1	0	26	0	556	21	3	0	**684**
North central skunk	0	5	2	0	0	0	1	0	14	0	0	0	**22**
California skunk	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Arctic fox	0	0	1	0	0	0	0	0	0	1	0	0	**2**
Arizona gray fox	0	0	0	0	0	0	0	0	0	1	0	0	**1**
Texas gray fox	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Bat	1	0	1	0	0	0	0	467	4	5	0	0	478
No variant reported	207	35	33	11	8	0	1,512	1,289	843	220	56	38	4,252
Total infected	**272**	**78**	**59**	**25**	**10**	**1**	**1,822**	**1,756**	**1,588**	**311**	**66**	**45**	**6,033**
Variant typed (%)	23.9	55.1	44.1	56.0	20.0	100.0	17.0	26.6	46.9	29.3	15.2	15.6	29.5

*One llama was reported to be infected with a raccoon variant. †Other wild included 2 coyotes and 1 bobcat infected with the south central skunk variant and 1 coyote, 3 deer, 1 otter, and 2 bobcats infected with the eastern raccoon variant. ‡Seven groundhogs were reported to be infected with a raccoon variant.

various bat variants (4 [0.5%]). Overall, states where skunks were the primary reservoir for rabies submitted 34.2 animals/100,000 persons for rabies testing during 2014, up from 29.5 animals/100,000 persons in 2013.

Foxes

There were 311 rabid foxes reported during 2014, which represented a 9.59% decrease, compared with the 344 reported in 2013 (Table 1). The percentage of foxes submitted for testing that were found to be rabid (20.8%) was slightly lower than the average for the previous 5 years (21.4%; Table 2). Most rabid foxes were reported from states where raccoon rabies was enzootic (n = 270 [86.8%]; **Figure 6**). Among the 91 rabid foxes for which variant typing results were available, 63 (69.2%) were infected with the raccoon rabies virus variant (Table 3). Other variants that were identified included the south central skunk rabies virus variant (n = 21 [23.1%]) and various bat rabies virus variants (5 [5.5%]). One rabid fox was reported to be infected

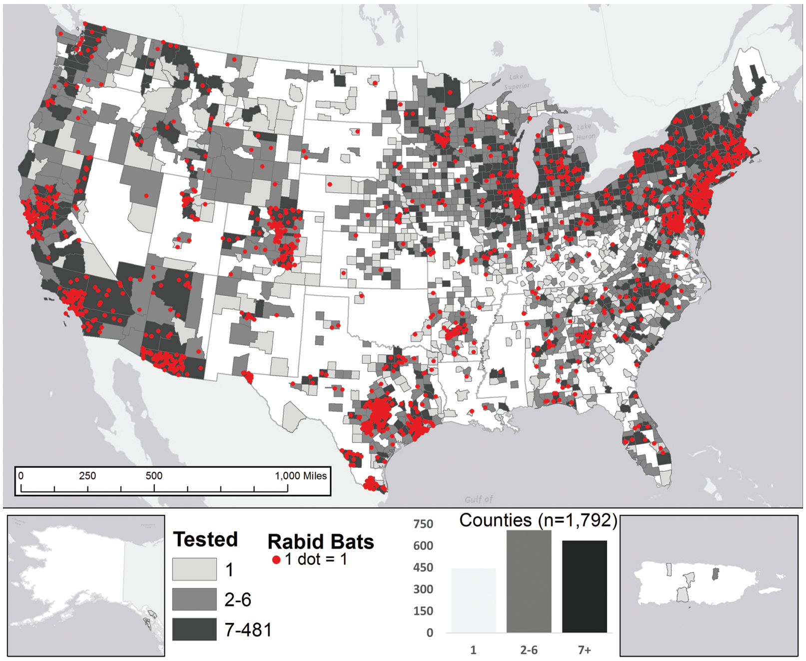

Figure 4—Reported cases of rabies involving bats, by county, during 2014. Histogram represents number of counties in each category for total number of bats submitted for rabies testing. Point locations for rabid bats were randomly selected within each reporting jurisdiction.

Table 4—Species of bats submitted for rabies testing in the United States during 2014.

Species (common name)	No. tested	No. positive	Percentage positive
Order Chiroptera (unspeciated)	14,612	815	5.6
Eptesicus fuscus (big brown bat)	11,440	426	3.7
Myotis lucifugus (little brown bat)	607	23	3.8
Tadarida brasiliensis (Mexican free-tailed bat)	605	388	64.1
Lasionycteris noctivagan (silver-haired bat)	207	17	8.2
Nycticeius humeralis (evening bat)	189	13	6.9
Lasiurus borealis (red bat)	177	25	14.1
Myotis californicus (California myotis)	84	5	6.0
Myotis yumanensis (Yuma myotis)	49	0	0.0
Myotis spp (not further differentiated)	43	12	27.9
Lasiurus cinereus (hoary bat)	38	15	39.5
Myotis evotis (long-eared myotis)	21	5	23.8
Myotis septentrionalis (northern long-eared myotis)	14	1	7.1
Molossidae spp (not further differentiated)	12	1	8.3
Perimyotis subflavus (tricolored bat)	11	3	27.3
Lasiurus seminolus (Seminole bat)	10	1	10.0
Myotis keenii (Keen myotis)	5	0	0.0
Antrozous pallidus (desert pallid bat)	4	0	0.0
Myotis thysanodes (fringed myotis)	4	0	0.0
Myotis velifer (cave myotis)	4	4	100.0
Lasiurus intermedius (northern yellow bat)	3	1	33.3
Pteropus giganteus (Indian flying fox)	3	0	0.0
Myotis austroriparius (southeastern myotis)	2	0	0.0
Myotis sodalis (Indiana bat)	2	0	0.0
Parastrellus hesperus (canyon bat)	2	0	0.0
Plecotus rafinesquii (Rafinesque big-eared bat)	2	0	0.0
Desmodus rotundus (common vampire bat)	1	0	0.0
Lasiurus ega (southern yellow bat)	1	1	100.0
Plecotus townsendii (Townsend big-eared bat)	1	0	0.0
Rousettus aegyptiacus (Egyptian rousette)	1	0	0.0
Total	**28,154**	**1,756**	**6.2**

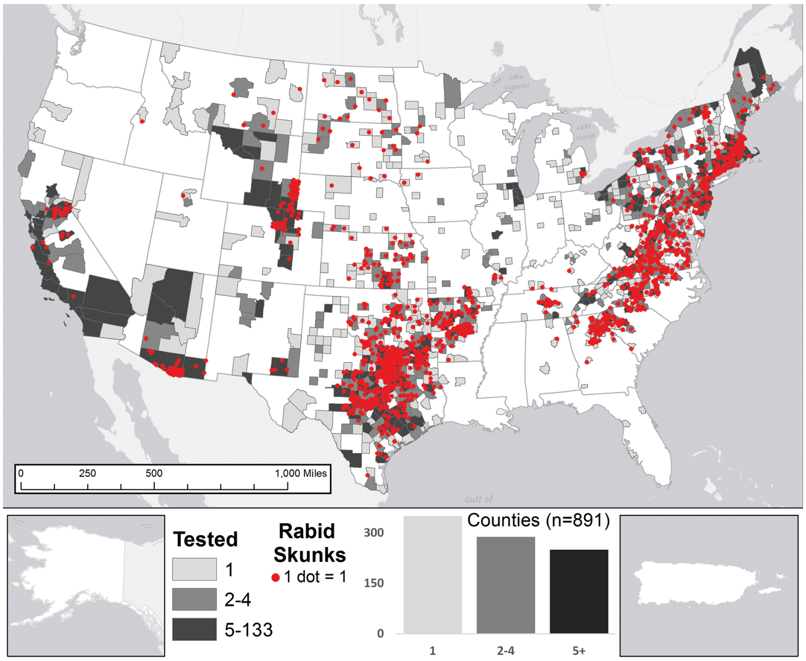

Figure 5—Reported cases of rabies involving skunks, by county, during 2014. Histogram represents number of counties in each category for total number of skunks submitted for rabies testing. Point locations for rabid skunks were randomly selected within each reporting jurisdiction.

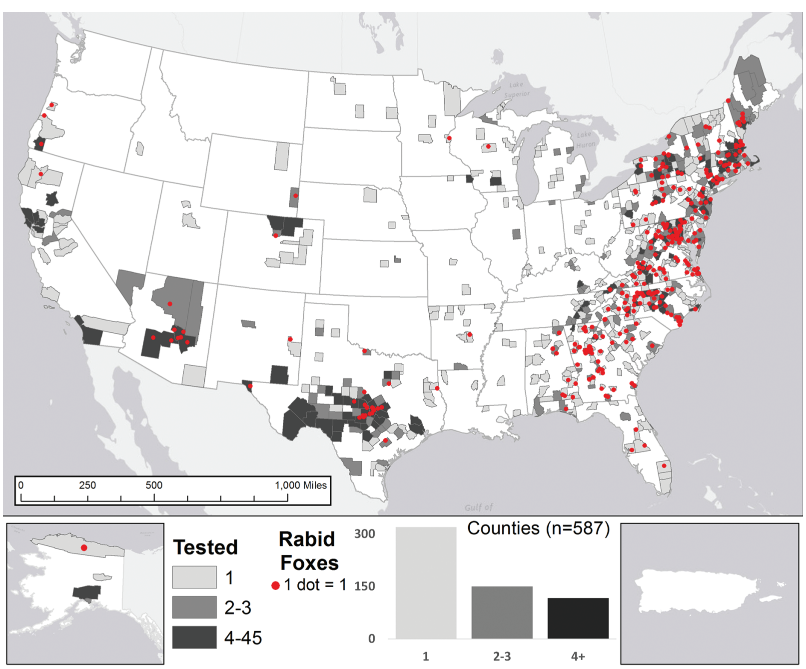

Figure 6—Reported cases of rabies involving foxes, by county, during 2014. Histogram represents number of counties in each category for total number of foxes submitted for rabies testing. Point locations for rabid foxes were randomly selected within each reporting jurisdiction.

with the Arctic fox rabies virus variant and another with the Arizona gray fox rabies virus variant. For 2 years in a row, no rabid foxes were found infected with the Texas gray fox rabies virus variant. The Texas gray fox variant was last detected in a cow in 2013.

Other wild animals

Puerto Rico reported 32 rabid mongooses during 2014, an 15.8% decrease from the 38 cases reported in 2013 (Table 1). Other reported rabid wildlife included 18 bobcats (*Lynx rufus*), 9 coyotes (*Canis latrans*), 4 deer (presumably *Odocoileus virginianus*), 2 opossums (*Didelphis virginiana*), and 1 otter (presumably *Lontra canadensis*). Rabid rodents reported in 2014 included 43 groundhogs (*Marmota monax*) and 2 beavers (*Castor canadensis*), all of which were reported from states in which the raccoon rabies virus variant was considered enzootic. No rabid lagomorphs were reported during 2014. Rabies virus variants were reported for 3 of the 9 rabid coyotes identified in 2014. This included 2 coyotes infected with the south central skunk rabies virus variant (Texas) and 1 coyote infected with the eastern raccoon rabies virus variant (Virginia). One bobcat was found to have south central skunk rabies variant (Texas), and 2 were found to have the raccoon rabies variant (Vermont and Virginia). Three deer from Pennsylvania and 1 otter from Virginia were also found to be infected with the eastern raccoon rabies virus variant. Seven groundhogs from states where the eastern raccoon rabies virus variant was enzootic were also found to be infected with that variant (Table 3).

Rabies in Domestic Animals

During 2014, domestic animals accounted for 47.9% of all animals submitted for testing but only 7.37% (n = 445) of all rabies cases reported, representing a decrease of 4.71%, compared with the 467 reported in 2013 (Table 1). More than half of all rabid domestic animals reported in 2014 were found in 5 states: Texas (n = 63), Pennsylvania (53), Virginia (42), Oklahoma (33), and New York (32).

Dogs

Fifty-nine rabid dogs were reported in 2014, representing a 33.71% decrease from the 89 reported in 2013. Most of the rabid dogs were reported from Texas (n = 14 [23.7%]), Puerto Rico (12 [20.3%]), and Oklahoma (9 [15.2%]; **Figure 7**). Overall, the percentage of dogs submitted for rabies testing that were found to be rabid (0.3%) was equal to the mean percentage for the previous 5 years (0.3%; Table 2). Vaccination status was reported for 44 (75%) of the dogs determined to be rabid. Of these, 43 had no record or verified report of previous vaccination, and 1 had a history of vaccination but was not in compliance with the recommended vaccination schedule at the time of death. Results of virus variant typing were available for 26 (44%) of the rabid dogs. Most (n = 14) were infected with the south central skunk rabies virus variant, the raccoon rabies virus variant (7), or the north central skunk rabies virus variant (2; Table 3). One dog each was infected with the Artic fox, California skunk, and a bat rabies virus variants.

Cats

Cats accounted for 61.1% (272/445) of the rabid domestic animals reported in 2014, a 10.12% increase, compared with the 247 reported in 2013 (Table 1). The percentage of cats submitted for rabies testing that were found to be rabid (1.1%) was not significantly different from the mean percentage for the previous 5 years (1.1%; Table 2). Rabies vaccination status was reported for 33 of the 272 (12.1%) rabid cats, of which 32 had no history of vaccination. One rabid cat was reported to have an up-to-date rabies vaccination status. Most of the rabid cats were reported from states where the raccoon rabies virus variant was considered enzootic (Pennsylvania, 47 [17.3%]; Virginia, 28 [10.3%]; New York, 25 [9.2%]; New Jersey, 22 [8.1%]; and Texas, 22 [8.1%]; **Figure 8**). Eighteen states and New York City did not report any rabid cats. Results of rabies virus variant typing were available for 65 (23.9%) of the rabid cats (Table 3). Most (n = 38 [58.5%]) were infected with the raccoon rabies virus variant, with the remainder infected with the south central skunk rabies virus variant (26 [40.0%]) or the *Tadarida basiliensis* bat rabies virus variant (1 [1.5%]).

Other domestic animals

A total of 78 rabid cattle were reported in 2014, representing a 9.30% decrease from the 86 reported in 2013 (Table 1). The percentage of cattle submitted for rabies testing that were found to be rabid (6.1%) was slightly decreased, compared with the mean percentage for the previous 5 years (6.7%; Table 2). Most of the rabid cattle were reported from Texas (n = 15 [19%]), Oklahoma (14 [18%]), Virginia (12 [15%]), and Kansas (9 [12%]).

Twenty-five rabid horses and mules were reported during 2014, a 19.35% decrease, compared with the 31 reported during 2013 (Table 1). The percentage of horses submitted for testing that were found to be rabid (3.3%) was significantly decreased, com-

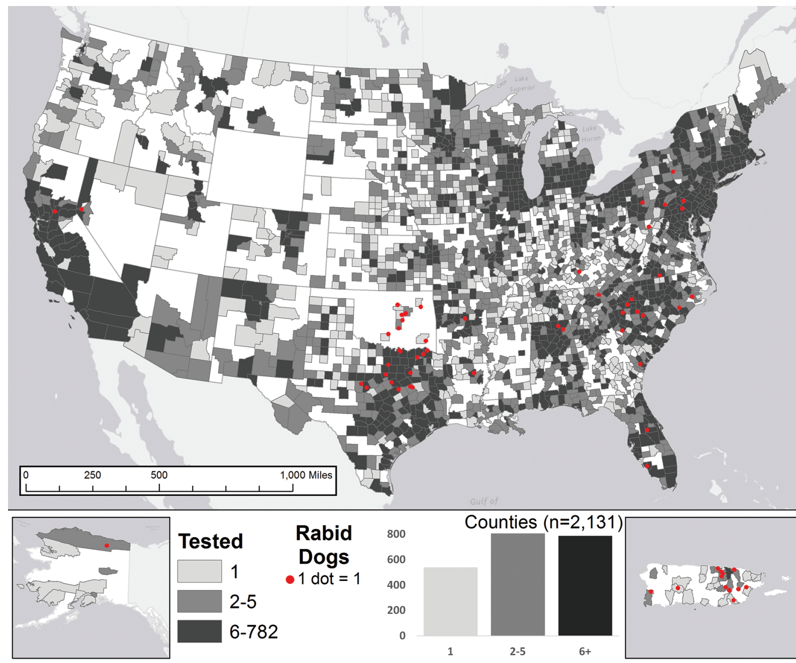

Figure 7—Reported cases of rabies involving dogs, by county, during 2014. Histogram represents number of counties in each category for total number of dogs submitted for rabies testing. Point locations for rabid dogs were randomly selected within each reporting jurisdiction.

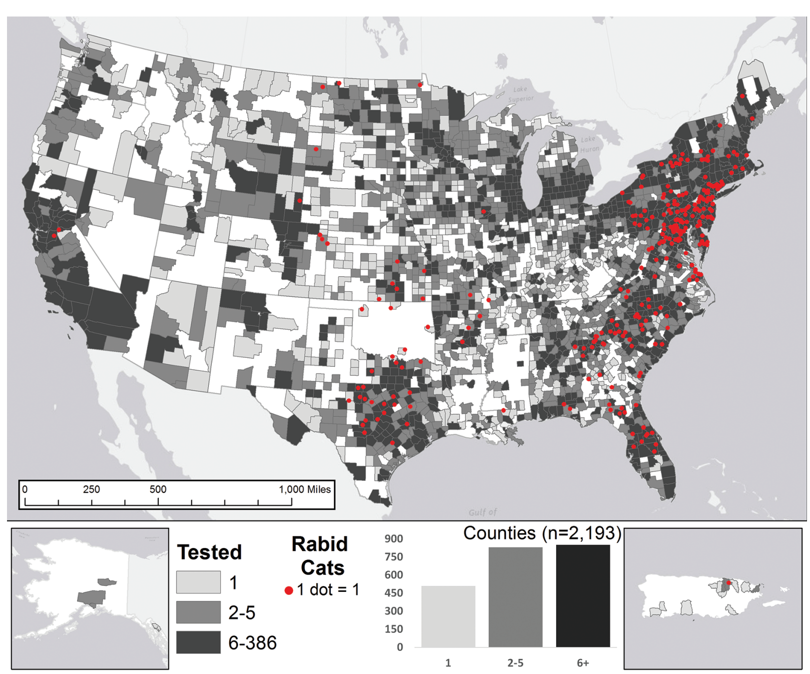

Figure 8—Reported cases of rabies involving cats, by county, during 2014. Histogram represents number of counties in each category for total number of cats submitted for rabies testing. Point locations for rabid cats were randomly selected within each reporting jurisdiction.

pared with the mean percentage for the previous 5 years (4.4%; Table 2). The states with the greatest number of rabid horses were Texas (11 [44%]), Oklahoma (5 [20%]), Kansas (2 [8%]), and Pennsylvania (2 [8%]).

Ten rabid sheep and goats were reported in 2014, compared with the 9 reported during 2013. A single rabid llama was reported from South Carolina.

Rabies in Humans

Diagnostic specimens (16 antemortem and 3 postmortem) from 19 human patients located in 16 states were submitted to the CDC for rabies diagnostic testing during 2014. Rabies virus infection was confirmed in 1. Rabies has been diagnosed in a total of 37 persons in the United States since 2003 **(Table 5)**. Twenty-six of the

Table 5—Cases of rabies in humans in the United States and Puerto Rico, 2003 through October 2015, by circumstances of exposure and rabies virus variant.

Date of onset	Date of death	Reporting state	Age (y)	Sex	Exposure*	Rabies virus variant†
10 Feb 03	10 Mar 03	VA	25	M	Unknown	Raccoon, eastern United States
28 May 03	5 Jun 03	PR	64	M	Bite Puerto Rico	Dog/mongoose, Puerto Rico
23 Aug 03	14 Sep 03	CA	66	M	Bite	Bat, Ln
9 Feb 04	15 Feb 04	FL	41	M	Bite, Haiti	Dog, Haiti
27 Apr 04	3 May 04	AR	20	M	Bite (organ donor)	Bat, Tb
25 May 04	31 May 04	OK	53	M	Liver transplant	Bat, Tb
27 May 04	21 Jun 04	TX	18	M	Kidney transplant	Bat, Tb
29 May 04	9 Jun 04	TX	50	F	Kidney transplant	Bat, Tb
2 Jun 04	10 Jun 04	TX	55	F	Arterial transplant	Bat, Tb
12 Oct 04	Survived	WI	15	F	Bite	Bat, unknown
19 Oct 04	26 Oct 04	CA	22	M	Unknown, El Salvador	Dog, El Salvador
27 Sep 05	27 Sep 05	MS	10	M	Contact	Bat, unknown
4 May 06	12 May 06	TX	16	M	Contact	Bat, Tb
30 Sep 06	2 Nov 06	IN	10	F	Bite	Bat, Ln
15 Nov 06	14 Dec 06	CA	11	M	Bite, Philippines	Dog, Philippines
19 Sep 07	20 Oct 07	MN	46	M	Bite	Bat, unknown
16 Mar 08	18 Mar 08	CA	16	M	Bite, Mexico	Fox, Tb related
19 Nov 08	30 Nov 08	MO	55	M	Bite	Bat, Ln
25 Feb 09	Survived	TX	17	F	Contact	Bat, unknown
5 Oct 09	20 Oct 09	IN	43	M	Unknown	Bat, Ps
20 Oct 09	11 Nov 09	MI	55	M	Contact	Bat, Ln
23 Oct 09	20 Nov 09	VA	42	M	Contact, India	Dog, India
2 Aug 10	21 Aug 10	LA	19	M	Bite, Mexico	Bat, Dr
24 Dec 10	10 Jan 11	WI	70	M	Unknown	Bat, Ps
30 Apr 11	Survived	CA	8	F	Unknown	Unknown
30 Jun 11	20 Jul 11	NJ	73	F	Bite, Haiti	Dog, Haiti
14 Aug 11	21 Aug 11	NY	25	M	Contact, Afghanistan	Dog, Afghanistan
21 Aug 11	1 Sep 11	NC	20	M	Unknown (organ donor)‡	Raccoon, eastern United States
1 Sep 11	14 Oct 11	MA	40	M	Contact, Brazil	Dog, Brazil
3 Dec 11	19 Dec 11	SC	46	F	Unknown	Bat, Tb
22 Dec 11	23 Jan 12	MA	63	M	Contact	Bat, My sp
6 Jul 12	31 Jul 12	CA	34	M	Bite	Bat, Tb
31 Jan 13	27 Feb 13	MD	49	M	Kidney transplant	Raccoon, eastern United States
16 May 13	11 Jun 13	TX	28	M	Unknown, Guatemala	Dog, Guatemala
12 Sep 14	26 Sep 14	MO	52	M	Unknown	Bat, Ps
02 Aug 15	23 Aug 15	MA	65	M	Bite, Philippines	Dog, Philippines
17 Sep 15	3 Oct 15	WY	77	F	Contact	Bat, Ln

*Data for exposure history are reported when plausible information was reported directly by the patient (if lucid or credible) or when a reliable account of an incident consistent with rabies virus exposure (eg, dog bite) was reported by an independent witness (usually a family member). Exposure histories are categorized as bite, contact (eg, waking to find bat on exposed skin) but no known bite was acknowledged, or unknown (ie, no known contact with an animal was elicited during case investigation). †Variants of the rabies virus associated with terrestrial animals in the United States and Puerto Rico are identified with the names of the reservoir animal (eg, dog or raccoon), followed by the name of the most definitive geographic entity (usually the country) from which the variant has been identified. Variants of the rabies virus associated with bats are identified with the names of the species of bats in which they have been found to be circulating. Because information regarding the location of the exposure and the identity of the exposing animal is almost always retrospective and much information is frequently unavailable, the location of the exposure and the identity of the animal responsible for the infection are often limited to deduction. ‡Infection was not identified until 2013, when an organ recipient developed rabies.

Dr = *Desmodus rotundus*. Ln = *Lasionycteris noctivagans*. My sp = *Myotis* species. Ps = *Perimyotis subflavus*. Tb = *Tadarida brasiliensis*.

37 (70%) individuals acquired the disease in the United States or Puerto Rico. Organ or tissue transplantation was identified as the source of infection for 5 of these 26 (19%) individuals. Bats were implicated as the source of infection in 17 of the 26 (65%) individuals who acquired the disease in the United States or Puerto Rico, with a bat bite reported in 7 cases, bat contact without a reported bite in 6 cases, and a rabies virus associated with bats without a known exposure identified in 4 cases. The remaining 4 individuals who acquired the disease in the United States or Puerto Rico consisted of 2 patients who were infected with the raccoon rabies virus variant, 1 who was infected with the mongoose rabies virus variant (Puerto Rico), and 1 (the only patient who survived) who was infected with an unknown rabies virus variant. Patients who acquired the disease in the United States or Puerto Rico from a source other than organ or tissue transplantation were predominantly male (15/21 [71%]) with a mean age of 38.7 years (range, 8 to 77 years). Imported cases represented 30% (11/37) of the human rabies cases reported in the United States since 2003. Phylogenetic analysis or epidemiological links indicated infection occurred in 8 different countries following a bite or contact with a dog in 7 cases, a fox bite in 1 case, a vampire bat bite in 1 case, and an unknown exposure involving a canine rabies virus variant in 2 cases. Imported cases were predominantly male (10/11) with a mean age of 34.7 years (range, 11 to 73 years).

The single human rabies virus infection that occurred in 2014 in the United States was reported in Missouri. In September 2014, a 52-year-old man presented to a Missouri emergency department with neck pain that radiated to his left arm and hand. A diagnosis of cervical muscle strain and radiculopathy was made, and the patient was treated and discharged. However, symptoms persisted and progressed to include left arm numbness and tingling, bilateral upper body tremors, anxiousness, and hallucinations, resulting in hospital admission. The patient's condition deteriorated rapidly, and he was transferred to a tertiary care hospital, where he required intubation. After extensive diagnostic testing failed to identify the etiology of the patient's illness, rabies was suspected given the patient's unexplained rapidly progressive encephalitis and self-reported hydrophobia. Samples collected antemortem were submitted to the CDC for rabies testing, which confirmed the diagnosis of rabies on September 24, 2014. Genetic sequencing identified a rabies virus variant associated with the tricolored bat, *Perimyotis subflavus*. Following the diagnosis, life support was withdrawn, and the patient died on September 26, 2014. Although the patient lived in a densely wooded area and had reportedly found a bat in his home on at least 1 occasion, no specific exposure events were identified.

Rabies in Canada and Mexico

In 2014, rabies management in Canada changed substantially, with many activities previously conducted by the federal government being assumed by provincial authorities. Submission of samples to Canadian Food Inspection Agency laboratories during this transition period varied from one province to the next, with an overall 44.6% decrease in the number of animals submitted for rabies testing in 2014 (n = 1,918), compared with the number submitted in 2013 (3,466). In 2014, 93 of the 1,918 (4.8%) samples submitted for rabies testing yielded positive results. Most samples were tested by means of the direct fluorescent antibody test, with a small number tested by use of a direct rapid immunohistochemical test (n = 4). Samples from 4 human patients suspected to have rabies were tested with a quantitative reverse transcription PCR assay, but results were negative for all 4. The province of Saskatchewan had the largest number of cases (n = 20), followed by Ontario (18) and Manitoba (15). Bats accounted for the highest proportion of cases (46 [49%]), followed by striped skunks (22 [24%]) and Arctic foxes (10 [11%]). In western Canada, skunk rabies virus variants were detected in 3 cattle, 1 horse, and 1 cat. In northern Canada, 4 dogs were found to be infected with fox rabies virus variants. One cat from the province of Quebec was infected with a bat rabies virus variant. A rabid fox was detected in Labrador, and 2 rabid raccoons were detected in New Brunswick, which had been free from raccoon rabies since 2002. These outbreaks continued into 2015 with 12 and 24 cases (as of October 31, 2015) in Labrador and New Brunswick, respectively. Since May 2012, only animals infected with bat rabies virus variants have been detected in southwestern Ontario, allowing this region to be declared free from both raccoon and fox rabies virus variants in 2014.

No human deaths from rabies were reported from Mexico in 2014. There were 10 reports of rabid dogs nationally. In the state of Chiapas, 9 rabid dogs were reported from 5 municipalities. In Yucatan, 1 dog was reported to have died of rabies after being attacked by a skunk. House-to-house vaccination campaigns were carried out in both states after these cases were reported.

Discussion

Since 2006, the CDC has annually requested information on all animals submitted for rabies testing. The 104,313 animals submitted for rabies testing during 2014 represented a significant increase, compared with the mean number submitted during the previous 5 years (n = 100,551; 95% confidence interval, 97,579 to 103,523). Laboratory testing of animals suspected to be rabid remains a critical public health function. Ruling out rabies reduces the number of individuals receiving postexposure prophylaxis unnecessarily, which can reduce adverse event rates and health-care costs related to rabies exposures.[16]

The national rabies surveillance system relies on routine passive investigation of animals suspected to be rabid by state and local health departments. Each year, 50 states and 3 jurisdictions (Puerto Rico, the District of Columbia, and New York City) report the results of these investigations to the CDC. That information was used to compile the present report. There is currently no unified national protocol for investigating animals suspected to be rabid or for reporting these results to federal public health authorities. This limitation often complicates the timely review and interpretation of national and regional trends in rabies activity. In 2012, the CDC provided 2 grants for states to develop electronic animal-bite management systems with the aim of improving data quality and timeliness of reporting. Georgia reported a 3-fold increase in bite case detection after the electronic management system was implemented.[17] Adoption of these types of electronic reporting systems by more reporting jurisdictions has the potential to improve patient care, data quality, and timeliness of reporting for national and regional analysis.

Although the canine rabies virus variant has been eliminated from the United States, management of potential rabies exposures in humans stemming from contact with wildlife remains critical. Most human cases that have occurred in the United States were due to bat exposures that were either unrecognized or not considered serious enough to merit medical attention. In those states where only bat rabies virus variants are found, submission rates for rabies testing are significantly lower than in states that have enzootic raccoon and skunk rabies virus variants. This may relate to differences in perceptions of rabies risk in areas that have low to negligible rates of terrestrial rabies.[16,18] However, any mammal is capable of acquiring and transmitting rabies; therefore, it is important for public health advocates to continue educational outreach efforts regarding the risk of rabies from contact with wildlife, regardless of the species of animal involved in the exposure. Appropriate risk assessment and judicious application of postexposure prophylaxis remain important focuses of rabies education for health-care providers in the United States.

The direct fluorescent antibody test is a highly sensitive and highly specific test for in vitro detection of rabies virus antigen in brain and submaxillary gland tissue. Results of this test have clinical and public health implications regarding appropriate and timely rabies postexposure prophylaxis. The reliability of the direct fluorescent antibody test depends on the availability of optimal reagents. During 2014 and 2015, multiple shortages of high-quality reagents and commercial conjugates increased the number of indeterminate rabies test results. These inconclusive results often required diagnostic testing laboratories to expend additional resources to verify test results or necessitated sending samples elsewhere for external confirmation. This places an additional burden on laboratories with minimal resources for rabies diagnostic testing, and the delay in reporting results can impede the proper public health response to a rabies case. In response to these problems, the National Working Group on Rabies Diagnosis drafted recommendations distributed to all laboratories performing rabies diagnostic testing in the United States regarding revalidation and emergency use of expired or suboptimal laboratory reagents and conjugates during periods of shortage.[19]

The passive rabies surveillance system in the United States is arguably one of the most robust in the world, with decades of data providing accurate information about the presence and absence of rabies on a geographic and animal-reservoir-species basis. This surveillance program has shown that in the United States, there are 5 distinct antigenic rabies virus variants associated with 8 terrestrial reservoir species and > 13 rabies virus variants associated with bats. Although the geographic distributions of these reservoir species and associated virus variants have generally remained consistent for the past decade, the introduction of a new variant or a shift in a rabies variant into a new host could have pronounced public health implications. Despite this, only 29% of rabies cases were variant typed in 2014, which was unchanged from the percentage typed in 2013. The virus variants associated with > 70% of rabid foxes and 75% of bats were not determined, despite the observation that these 2 host species have been associated with recent suspected host shift events.[20–23] Improvements in species identification and variant typing in high-risk animal species will improve the understanding of rabies virus variant distribution in the United States and risks associated with certain animals. Timely testing, typing, and reporting may also increase the chances of early detection of potential host shift events, allowing for rapid mitigation responses.

Despite the elimination of the canine rabies virus variant from the United States, 6 of the 8 terrestrial variants in circulation are closely related to the canine variant and likely spread to these wildlife reservoirs from dogs when the canine rabies virus variant was endemic. Therefore, reverse transmission of these canine-lineage viruses back to dogs may be a plausible threat and needs to be monitored. International importation of pets also poses a risk for reintroduction of the canine rabies virus variant or the introduction of novel rabies virus variants from abroad. Despite a slew of laws and regulations aimed at preventing the importation of rabid animals, a study[24] conducted in 2013 showed that > 2,800 dogs imported into the United States each year have no history of rabies vaccination notwithstanding the fact that they are from countries where rabies is endemic. There have been at least 3 dogs with rabies imported into the United States since 2007.[25–27] With the continuous risk that a rabies virus variant will be reintroduced into dogs, public health systems must remain vigilant of the variants affecting dogs. To maintain a canine rabies–free status and ensure timely detection of epidemiological changes, every dog in the United States in which rabies is diagnosed should undergo variant typing with results reported to the national surveillance program.

2015 Rabies Update

Two human rabies cases were reported in the United States in 2015. The first was detected in August 2015 when a 65-year-old man who had recently returned to Massachusetts following a trip to the Philippines was hospitalized with vomiting and epigastric pain. His clinical status deteriorated rapidly, and he died on August 23. Prior to death, it was discovered that the patient had been bitten by a dog on June 30 while in the Philippines and that the dog had died shortly after this exposure. Antemortem diagnostic testing confirmed infection with the rabies virus, and genetic sequencing identified a rabies virus variant associated with dogs in the Philippines. The second case was detected in September 2015 when a 77-year-old female was admitted to a hospital in Wyoming with progressive weakness, ataxia, dysarthria, and dysphagia. Her condition deteriorated, and she was transferred to a referral hospital in Utah for further care. The patient's family informed clinicians that the patient had had contact with a bat in her home in August 2015 but did not seek medical care for rabies postexposure prophylaxis. Rabies virus infection was confirmed, and a rabies virus variant associated with the silver-haired bat (*Lasionycteris noctivagans*) was identified. The patient died on October 3.

Acknowledgments

Use of trade names and commercial sources is for identification only and does not imply endorsement by the US Department of Health and Human Services. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the CDC. The authors declare no competing interests.

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