



AUGUST 2010

RABIES CONTROL & PREVENTION EPIDEMIOLOGY REPORT RI 2008-2009

RI DEPARTMENT OF HEALTH
DIVISION OF INFECTIOUS DISEASE & EPIDEMIOLOGY

BACKGROUND

Since its arrival in 1994, the mid-Atlantic raccoon-adapted strain of the rabies virus has become enzootic (endemic) among the wild animal population throughout Rhode Island. Animals with the greatest susceptibility to this strain are raccoons, with spill over into the skunk, fox, woodchuck and other terrestrial mammal populations (**also called high-risk, target or vector species**). Unimmunized (therefore susceptible) pets such as cats, dogs and ferrets (**medium-risk or suspicious species**) and strays can acquire rabies through exposure to wildlife. Cattle, sheep, pigs, horses and other farm animals can also develop rabies. Animals such as rodents, rabbits, squirrels and opossums rarely acquire rabies and are considered (**low-risk species**). Bats in RI are also endemic for the bat strain of rabies virus.

Humans may be exposed to the rabies virus through a bite, scratch or direct contact, where there is contamination of a scratch, abrasion, mucous membrane, or fresh open wound with potentially infectious material such as saliva or central nervous system tissue from an animal. The majority of such exposures are from dog bites or cat bites/scratches. Often indirect exposures occur, such as when fresh saliva from a target species is carried passively in a wound or on the muzzle or fur of a pet animal. Exposure by inoculation of a mucous membrane (nose, eyes) or into an open skin lesion or wound of the human caretaker is, theoretically possible in such a situation. Of note, bat rabies strains are highly transmissible to humans, and prophylaxis is often recommended for exposure by proximity even without a visible wound, if the bat is not available for testing.

The clinical and public health management of a person who may have been exposed to rabies requires first the assessment of whether a significant bite or non-bite exposure has occurred, and then an assessment of the likelihood that the animal involved was rabid. To this end, it is extremely important to capture the exposing animal for quarantine, or euthanasia and testing. 10-day quarantine is the recommended option only in the case of a captive dog or cat or ferret, which appears healthy. This action is based on the biologic fact that cats, dogs and ferrets shed rabies virus in the saliva only for the 10-day period immediately prior to death. A dog, cat or ferret that is alive and well at the end of a 10-day period of observation counting from the date of exposure could not have transmitted rabies to the patient. The authority and operational enforcement of all animal control procedures occurs under regulations and guidelines from the RI State Veterinarian and the Governor's Rabies Control Board. The RI State Epidemiologist represents the Department of Health at this Board along with representatives from the RI Veterinary Medical Society, Association of Animal Control Officers, RI SPCA, RI Division of Fish and Wildlife, and Association of Livestock Farmers.

Target species (or pets with clinical rabies symptoms) should be euthanized and tested as soon as possible, with vaccination decisions based on results. Exposures by animals that escape capture, as well as all low-risk species, livestock and exotic animals should be assessed on a case-by-case basis in consultation with public health experts. The Division of Infectious Disease epidemiology maintains a 24/7 on call system to accept and case-manage animal exposure reports from health care providers and

other community sources, and provides expert consultation including pre-authorization for vaccine on a case-by-case basis. Post-exposure vaccination is recommended in accordance with national guidelines from the Advisory Council for Immunization Practice (<http://cdc.gov/mmwr/preview/mmwrhtml/rr5902a1.htm>). Also see the algorithm for management of a suspected rabid animal on last page of this document (**Appendix A**).

ANIMAL RABIES TESTING:

The RI Department of Health’s Division of Laboratories (Molecular Biology Lab) is the only lab in the state that performs animal rabies testing. Currently rabies testing is performed in response to animal-to-human exposure situations or animal-to-animal exposure such as pets and farm animals. Surveillance testing without human or pet exposure may be performed in special situations.

A total of 872 specimens were tested for rabies in 2008 and 2009 (460 in 2008 and 412 in 2009). There were 79 rabid animals (34 in 2008 and 45 in 2009) identified, with 9.0% of all animals examined were positive for rabies. Wild species (including bats) that tested positive for rabies accounted for 97.5% of the total while only 2.5% of domestic animals (1 cat and 1 horse) tested positive (**Table 1** and **Figure 1**).

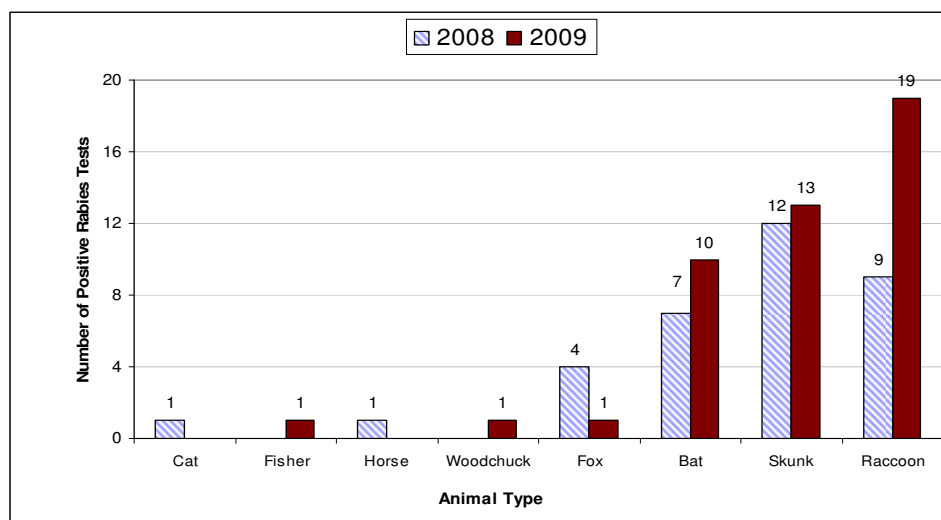
Data on animal rabies from 1994 to 2009 can be found archived at: <http://www.health.ri.gov/disease/communicable/rabies/surveillance.php>

Table 1. R. I. State Health Laboratory, Rabies Testing Results by Species, 2008 - 2009

Animal Species	2008			2009		
	Tested n (%)	Positive n (%)	Positivity- Rate	Tested n (%)	Positive n (%)	Positivity- Rate
Cat	108 (23.5%)	1 (2.9%)	0.9%	91 (22.1%)	0 (0.0%)	0.0%
Dog	34 (7.4%)	0 (0.0%)	0.0%	43 (10.4%)	0 (0.0%)	0.0%
Bat	209 (45.4%)	7 (20.6%)	3.3%	161 (39.1%)	10 (22.2%)	6.2%
Skunk	42 (9.1%)	12 (35.3%)	28.6%	40 (9.7%)	13 (28.9%)	32.5%
Raccoon	27 (5.9%)	9 (26.5%)	33.3%	48 (11.7%)	19 (42.2%)	39.6%
Fox	9 (2.0%)	4 (11.8%)	44.4%	10 (2.4%)	1 (2.2%)	10.0%
Woodchuck	13 (2.8%)	0 (0.0%)	0.0%	6 (1.5%)	1 (2.2%)	16.7%
Other*	18 (3.9%)	1 (2.9%)	5.6%	13 (3.2%)	1 (2.2%)	7.7%
Total	460 (100%)	34 (100%)	7.4%	412 (100%)	45 (100%)	10.9%

- Includes 1 coyote (2008), 1 fisher cat (2009), 7 goats (3 in 2008; 4 in 2009), 3 horses (1 in 2008; 2 in 2009), 1 mink (2009), 4 opossums (all in 2008), 6 rabbits (5 in 2008; 1 in 2009), 1 rat (2009), 2 sheep (1 in 2008; 1 in 2009), 3 squirrels (2 in 2008; 1 in 2009), 1 weasel (2009) and 1 wolf (2008)
- These numbers represent burden of public health laboratory work contributed to by rabies prevention efforts, and are not meant to represent systematic surveillance.

Figure 1. State Health Laboratory Positive Rabies Tests by Animal Species, RI 2008 - 2009



ANIMAL EXPOSURE TO HUMANS:

For the purpose of this report, animal exposures are defined as bites, proximity to bats, scratches or abrasions, or contact of animal saliva with a wound, lesion or mucous membrane. Animal exposures to humans are reportable to the Division of Infectious Disease Epidemiology (Rabies Control and Prevention Program) 24/7. Once an animal bite or suspect exposure is reported, public health staff provides case-management services until final resolution of the case. These services include exposure evaluation, confirmation of animal capture and quarantine or confirmation of animal capture and euthanasia, coordination with the laboratory for follow up on animal testing results, notification to the patient of the status of the investigation, rabies risk assessment and communication to the patient and release/referral for vaccine and RIG as indicated. Follow up on completion of treatment with dates is not monitored. Animal exposure reports and case management notes are collected on a standardized form and data is maintained in a database (NEDSS). A single animal may result in multiple persons being exposed (most commonly with household bat exposures). Each person is counted individually as an exposure.

Reported Animal Exposures in Rhode Island

The average age of reported animal exposure cases was 37.4 years (37.9 years in 2008 and 36.9 years in 2009; **Table 2**). The majority of the cases (57.9%) were women (58.4% in 2008 and 57.3% in 2009). For both years, low/no risk animal exposures comprised the majority of reports, while 29.1% of the reports were for high-risk animal exposures (29.1% in 2008 and 29.2% in 2009).

Table 2. Characteristics of Animal Exposure Reports, R.I. 2008 - 2009

	2008 n = 1471	2009 n = 1360	Total N = 2831
Age*, years			
mean (σ)	37.9 (39.0)	36.9 (37.1)	37.4 (38.1)
Gender†, n (%)			
Female	857 (58.4%)	778 (57.3%)	1635 (57.9%)
Male	611 (41.6%)	580 (42.7%)	1191 (42.1%)
Exposure risk‡, n (%)			
High risk	401 (29.1%)	366 (29.2%)	767 (29.1%)
Low risk	547 (39.7%)	852 (67.9%)	1399 (53.1%)
No risk	431 (31.3%)	36 (2.9%)	467 (17.7%)

* Exact age at the time of incident could not be calculated for 43 cases in 2008 and 51 cases in 2009

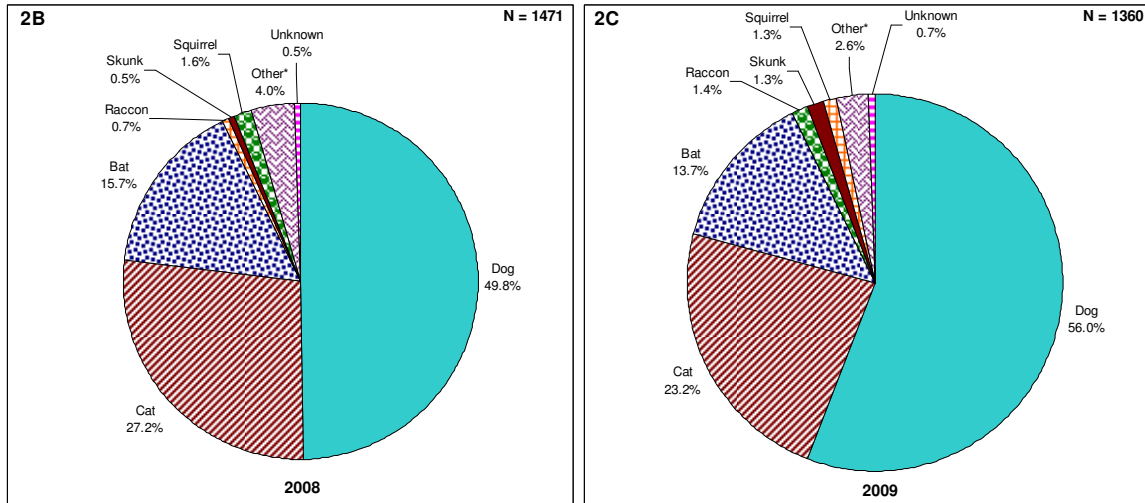
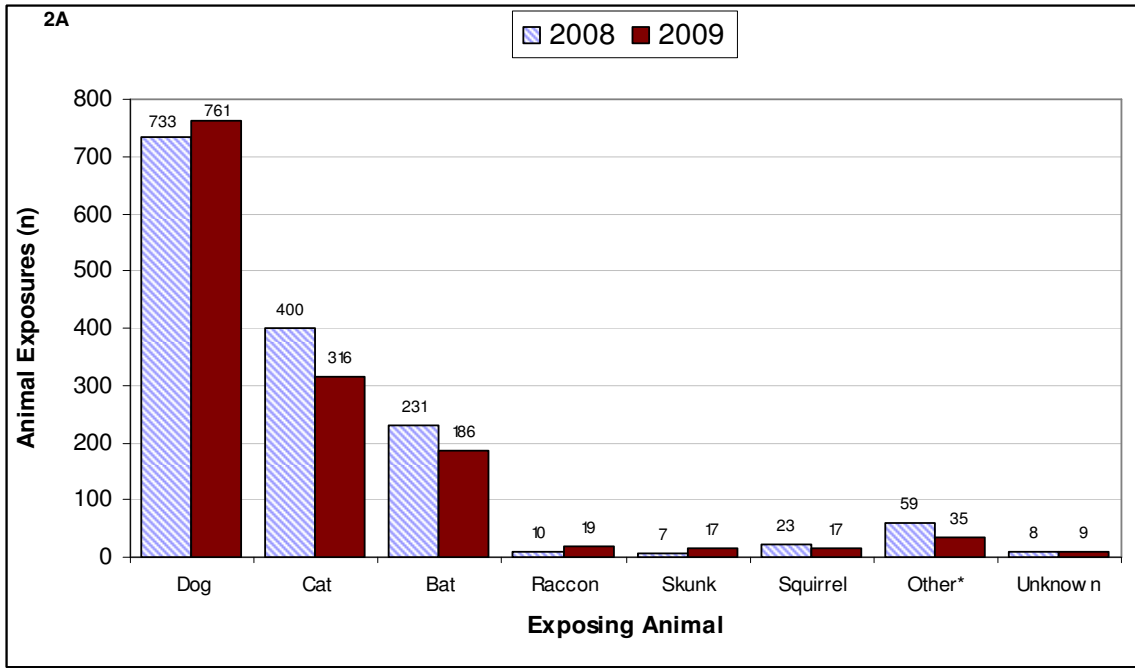
† Gender data was missing for 3 cases in 2008 and 2 cases in 2009

‡ Level of exposure risk was missing for 92 cases in 2008 and 106 cases in 2009

During 2008 and 2009, there were 2,831 reported cases of human animal exposures in Rhode Island (1,471 in 2008 and 1,360 in 2009; **Figure 2A**). Dogs were the most frequent exposing animals reported for 2008 and 2009 (**Figure 2B** and **2C**), at 49.8% and 56.0% for each respective year. Cats were the next most common, accounting for 27.2% of reported exposures in 2008 and 23.2% in 2009. Bats also represented a relatively sizeable proportion of the reported exposures, at 15.7% in 2008 and 13.7% in 2009.

Figure 2. Animal Exposures counts (A) and proportions (B and C) reported

by Animal Species, RI 2008 - 2009

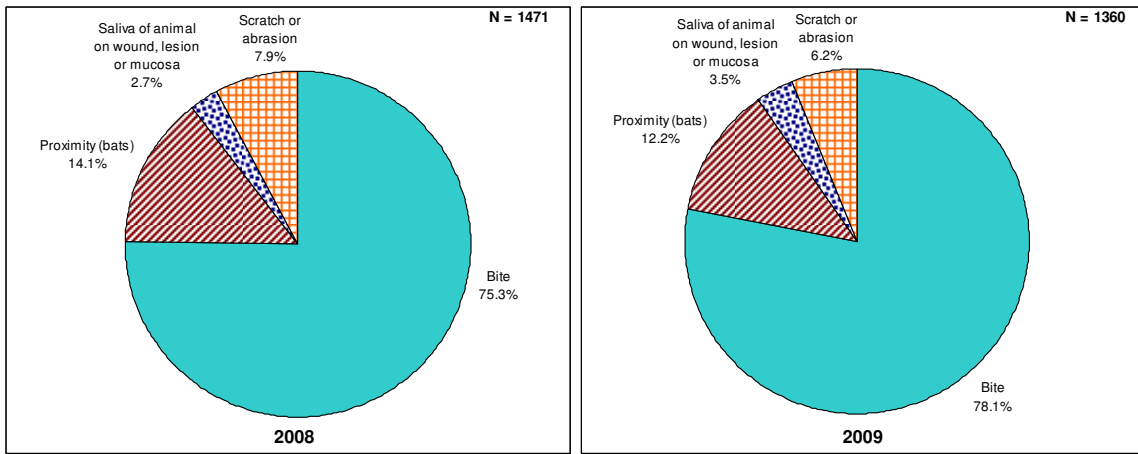


* For 2008, *other* includes 1 chinchilla, 4 chipmunks, 1 tamarin, 1 cow, 4 coyotes, 2 ferrets, 10 fox, 2 hamsters, 8 horses, 1 mole, 9 mice, 1 opossum, 4 rabbits, 4 rats, 1 snake, 1 snow leopard, 1 tenrec, 3 birds (1 parrot, 1 conure and 1 seagull) and 1 woodchuck; for 2009, *other* includes 4 chipmunks, 3 coyotes, 3 fox, 1 hamster, 4 horses, 1 iguana, 1 mink, 3 mice, 5 rabbits, 5 rats, 1 sheep and 4 woodchucks

More than 3 of every 4 reported animal exposures involved a bite in 2008 and 2009 (**Figure 3**). Proximity exposures to bats accounted for the next largest proportion of reports, with scratches or abrasions and saliva contact with a wound, lesion or mucosa making up the remainder.

Figure 3. Proportion of animal exposures to humans reported by exposure type,

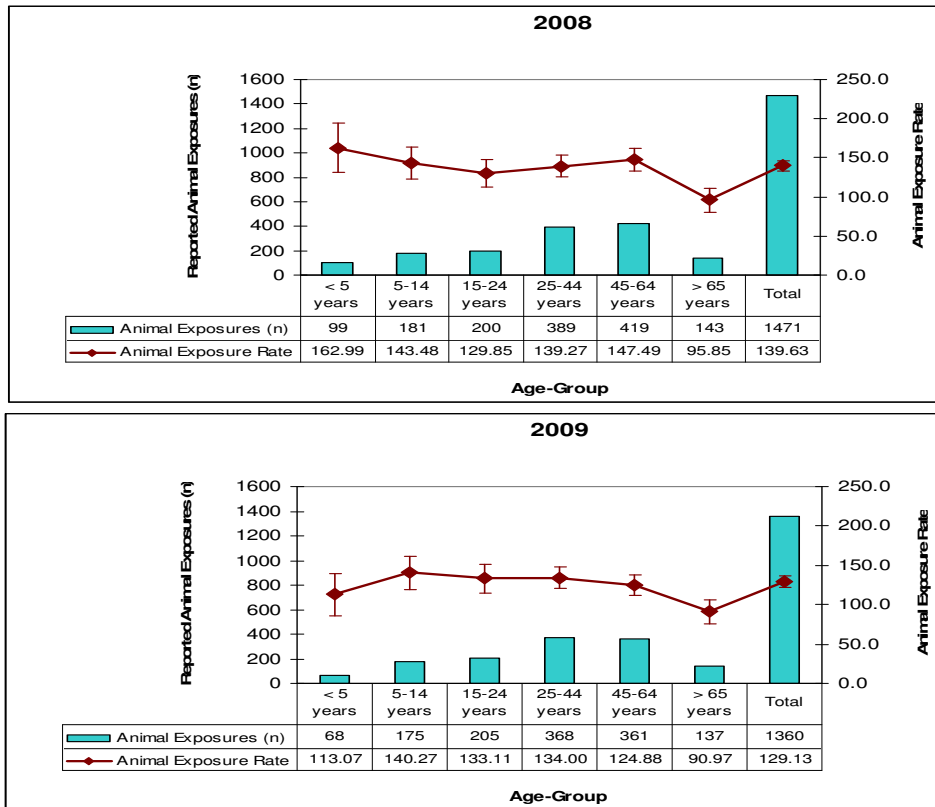
RI 2008-2009



Age-Specific Rates for Reported Exposures

The rates of reported animal exposures were consistent across age-groups in 2008 and 2009 (Figure 4), with the exception of the 65 years and older age-group, which had lower rates.

Figure 4. Reported animal bites and corresponding rates (per 100,000 residents) by age-group and year, RI 2008 - 2009

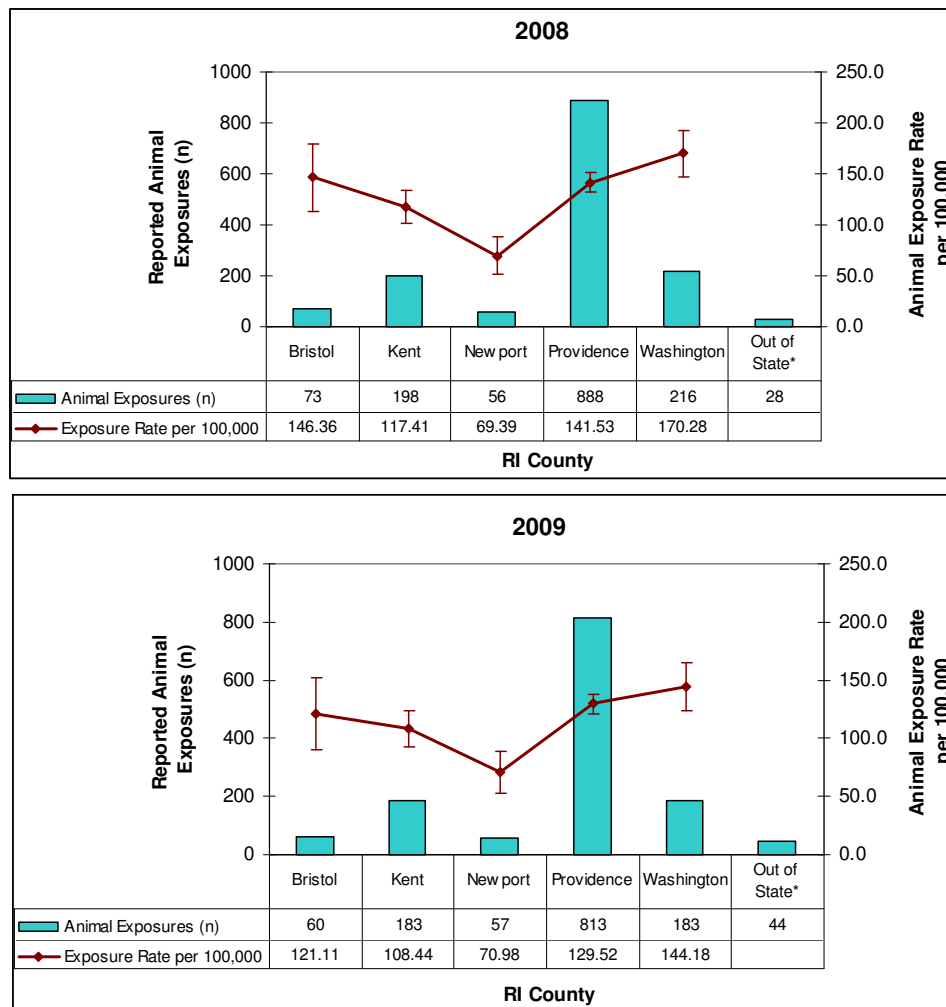


Note: Error bars represent 95% confidence intervals for exposure rates; Rates are based on U.S. Census population estimates for Rhode Island counties for the respective years 2008 and 2009; Age-group data was missing for 40 cases in 2008 and 46 cases in 2009

Animal Exposure Reports by County

The majority of animal exposure reports were for exposures occurring in Providence County (888 in 2008 and 813 in 2009), although when population density is taken into account, the rate for Providence County is comparable to other Rhode Island counties (**Figure 5**). Newport County had the lowest number of reported animal exposure incidents and also had the lowest rate of reported animal exposures in Rhode Island.

Figure 5. Reported animal exposures and corresponding rates by county of incident, RI 2008 - 2009



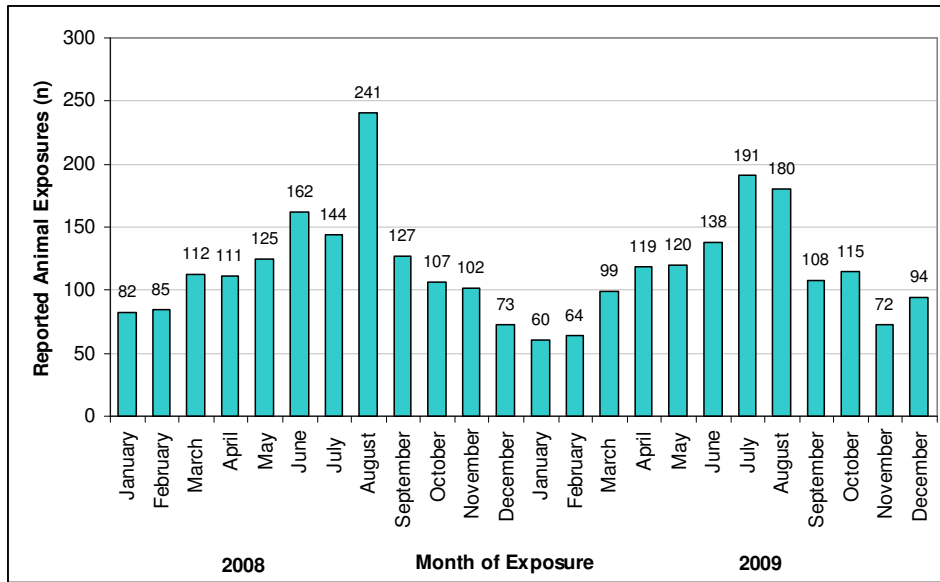
Note: Error bars represent 95% confidence intervals for post-exposure prophylaxis rates; Rates are based on U.S. Census population estimates for Rhode Island counties for the respective years 2008 and 2009; County of exposure data was missing for 12 cases in 2008 and 20 cases in 2009

* Population-based rates could not be calculated for out of state exposures

Seasonal Temporality of Animal Exposures

There is a clear seasonal distribution seen in human animal exposures, with peaks in the summer months (**Figure 6**). August was by far the most active month in 2008, with 241 reported animal exposures; in 2009, the peak month was July, with 191 reported exposures.

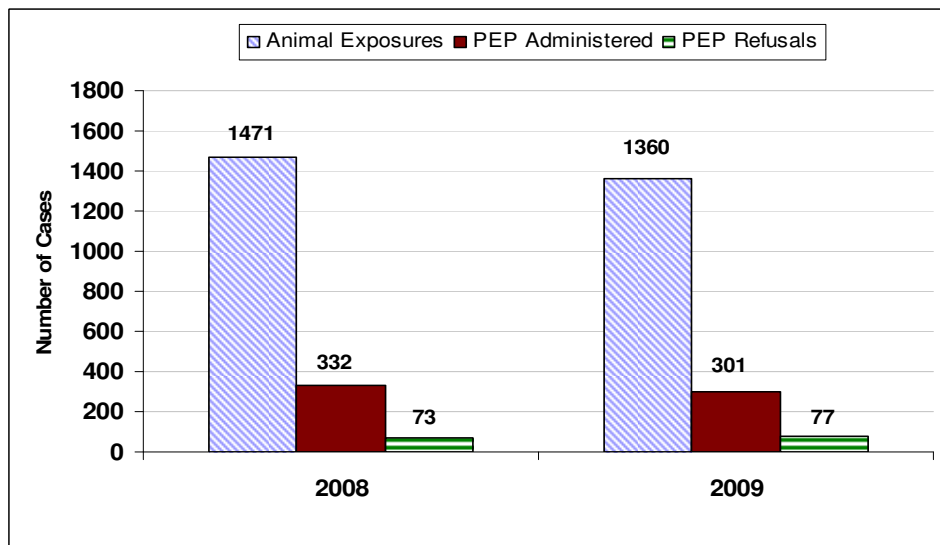
Figure 6. Animal Exposures by Month, RI 2008 - 2009



RABIES POST-EXPOSURE PROPHYLAXIS:

After assessing for risk thoroughly according to the Rhode Island algorithm for management of human exposure to a suspected rabid animal (**Appendix 1**) and in keeping with ACIP-CDC Guidelines, post-exposure prophylaxis (PEP) treatment was administered for 633 (22.4%) of these cases (332 in 2008 and 301 in 2009; **Figure 7**).

Figure 7. Total Reported Animal Exposures, PEP Courses Administered and PEP Refusals, R.I. 2008 - 2009



There were 150 cases where PEP was recommended but treatment was refused despite thorough risk counseling by public health clinicians (73 in 2008 and 77 in 2009). The average age of PEP refusals

was 43.9 years old, 59.3% of whom were women (**Table 3**). The exposing animal in the majority of treatment refusal cases were dogs (57.3%), while 22.0% of cases were due to cat exposures and 16.7% from bat exposures. Bites were the most common type of wound involved in PEP refusal cases (73.8%) followed by proximity to bats (16.1%).

Table 3. Characteristics of PEP Refusals R. I., 2008 – 2009

	2008 n = 73	2009 n = 77	Total N = 150
Age, years			
mean, σ	44.3 (20.5)	43.5 (21.3)	43.9 (20.8)
Gender, n (%)			
Female	43 (58.9%)	46 (59.7%)	89 (59.3%)
Male	30 (41.1%)	31 (40.3%)	61 (40.7%)
Exposing animal, n (%)			
Dog	41 (56.2%)	45 (58.4%)	86 (57.3%)
Cat	14 (19.2%)	19 (24.7%)	33 (22.0%)
Bat	16 (21.9%)	9 (11.7%)	25 (16.7%)
Other	2 (2.7%)	1 (1.3%)	3 (2.0%)
Unknown	0 (0.0%)	3 (3.9%)	3 (2.0%)
Type of wound, n (%)			
Bite	50 (69.4%)	60 (77.9%)	110 (73.8%)
Proximity (bats)	15 (20.8%)	9 (11.7%)	24 (16.1%)
Saliva on wound, lesion or mucosa	2 (2.8%)	3 (3.9%)	5 (3.4%)
Scratch or abrasion	5 (7.0%)	5 (6.5%)	10 (6.7%)

Animal Exposures Resulting in PEP

Of the cases resulting in post-exposure prophylaxis (PEP) treatment, 617 (97.5%) were categorized as high-risk (exposure to wild life, bats or stray cats) and thus PEP was recommended (328 in 2008 and 289 in 2009; **Table 4**). Another 16 cases were categorized as low risk (dogs, and other low risk species per algorithm) based on risk assessment (4 in 2008 and 12 in 2009).

Table 4. General Characteristics of PEP Recipients, RI 2008 – 2009

	2008 n = 332	2009 n = 301	Total N = 633
Age*, years			
mean (σ)	33.3 (34.9)	33.2 (32.3)	33.3 (34.1)
Gender†, n (%)			
Female	173 (52.6%)	155 (51.5%)	328 (52.1%)
Male	156 (47.4%)	146 (48.5%)	302 (47.9%)
Insurance status‡, n (%)			
Insured	291 (92.7%)	250 (93.3%)	541 (93.0%)
Uninsured	23 (7.3%)	18 (6.7%)	41 (7.0%)
Exposure risk, n (%)			
High risk	328 (98.8%)	289 (96.0%)	617 (97.5%)
Low risk	4 (1.2%)	12 (4.0%)	16 (2.5%)

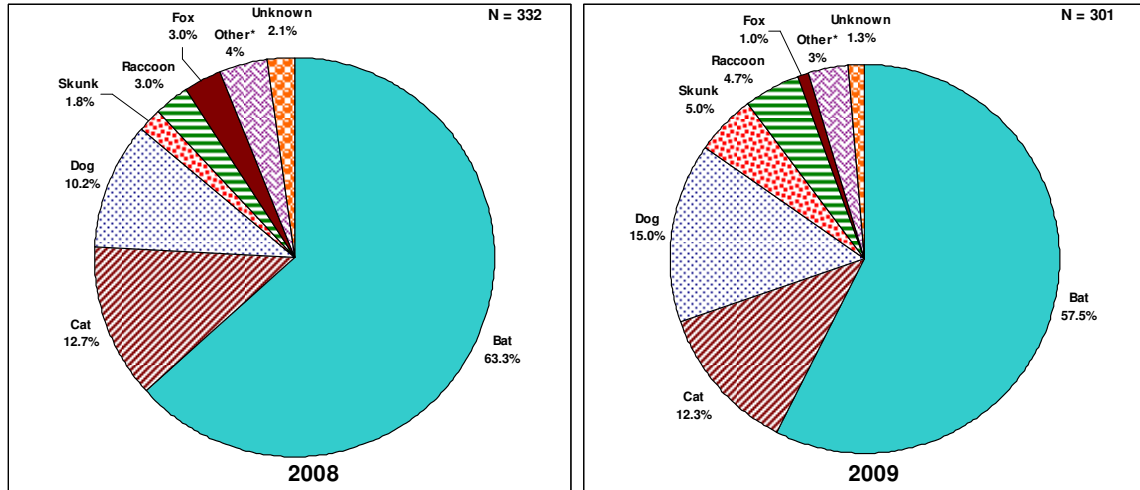
* Age data was missing for 4 cases in 2008 and 1 case in 2009

† Gender data was missing for 3 cases in 2008

‡ Insurance data was missing for 18 cases in 2008 and 33 cases in 2009

For both 2008 and 2009, the majority of cases resulting in PEP were due to bat exposures (63.3% in 2008 and 57.5% in 2009; **Figure 8**). Exposures to dogs and cats constituted the next highest proportions.

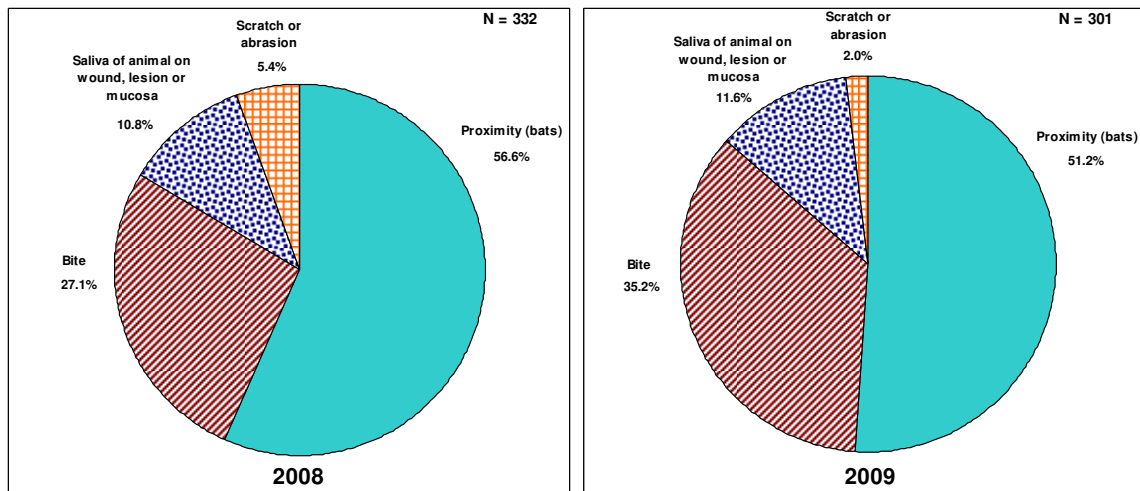
Figure 8. Proportion of PEP by Species, R.I. 2008 - 2009



* For 2008 *other* includes 1 ferret (0.3%), 1 woodchuck (0.3%), 3 coyotes (0.9%), 1 cow (0.3%) and 7 horses (2.1%); for 2009 *other* includes 3 squirrels (1.0%), 4 woodchucks (1.3%), 2 coyotes (0.7%) and 1 sheep (0.3%)

The most common types of exposures that put people at risk for rabies transmission are bite wounds, scratches, bat exposures by proximity, and saliva on a mucous membrane or an open wound or lesion. Exposure by proximity to a bat accounted for 56.6 % and 51.2% of PEP cases in 2008 and 2009, respectively. Bites were the next most common cause, implicated in 27.1% and 35.2% of the respective 2008 and 2009 PEP cases. Exposures by scratches or abrasions and saliva exposures accounted for the remainder (**Figure 9**).

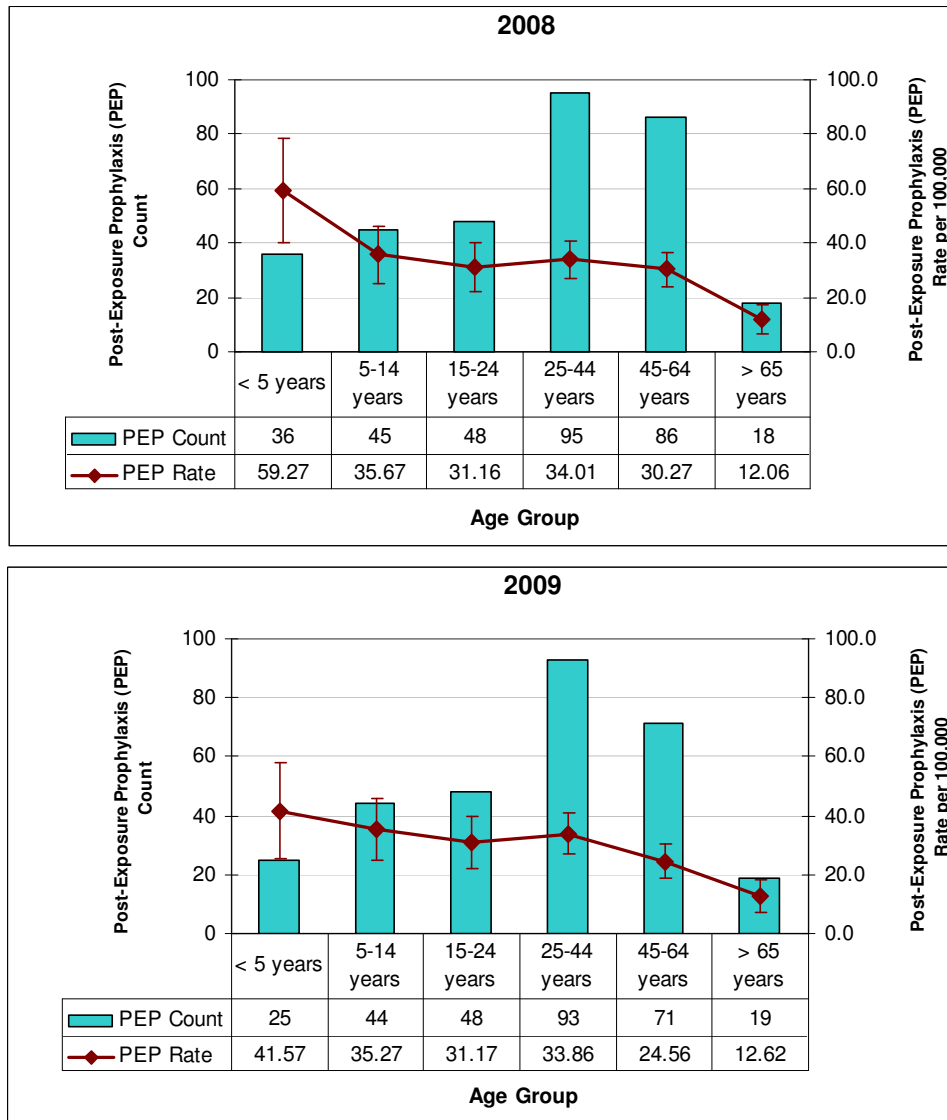
Figure 9. Proportion of PEP by Wound/Exposure Type, R.I. 2008 - 2009



PEP Age-Specific Rates

The estimated rate of PEP in 2008 and 2009 was 31.5 PEP per 100,000 RI residents in 2008 and 28.5 PEP per 100,000 RI residents in 2009. **Figure 10** shows the relative age distribution of persons receiving PEP compared to the age distribution of Rhode Island's population. The highest rate occurred among residents less than 5 years old for both 2008 and 2009, with respective rates of 59.3 and 41.6 PEP per 100,000. In contrast, residents 65 years and older had the lowest rates, with rates of 12.1 and 12.6 PEP per 100,000 RI residents, respectively, which were significantly lower than all other age groups.

Figure 10. PEP Numbers and Age Specific Rates (per 100,000 population) by Age Group, R.I. 2008-2009

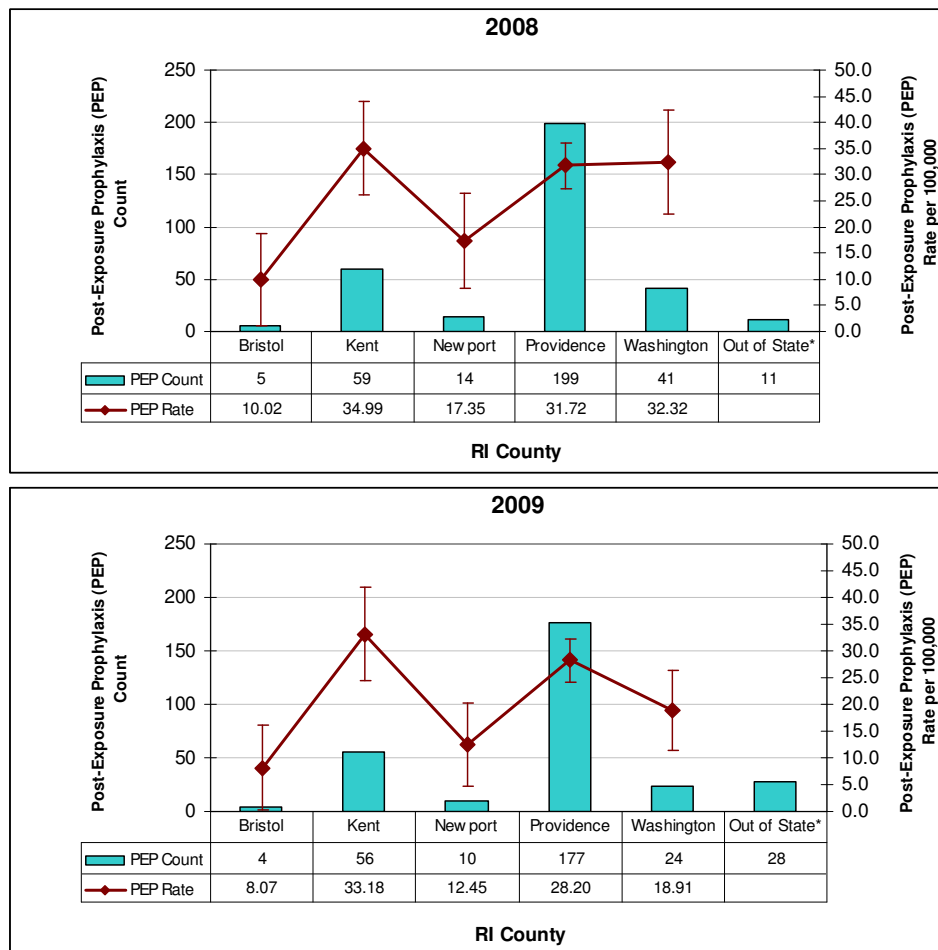


Note: Error bars represent 95% confidence intervals for post-exposure prophylaxis rates; Rates are based on U.S. Census population estimates for Rhode Island by age-group for the respective years 2008 and 2009; Age-group data was missing for 4 cases in 2008 and 1 case in 2009

PEP Distribution by County

Kent County had the highest rate of PEP in Rhode Island during 2008 and 2009 (**Figure 11**), with respective rates of 35.0 and 33.2 PEP per 100,000 county residents. Providence County had the next highest, following closely behind, with rates of 31.7 and 28.2 PEP per 100,000 county residents for 2008 and 2009, respectively. Bristol County had the lowest PEP rates in Rhode Island, with 10.0 PEP per 100,000 county residents in 2008 and 8.1 PEP per 100,000 county residents in 2009.

Figure 11. PEP by County and County Specific Rates (per 100,000 residents) by County of Exposure, R.I. 2008-2009

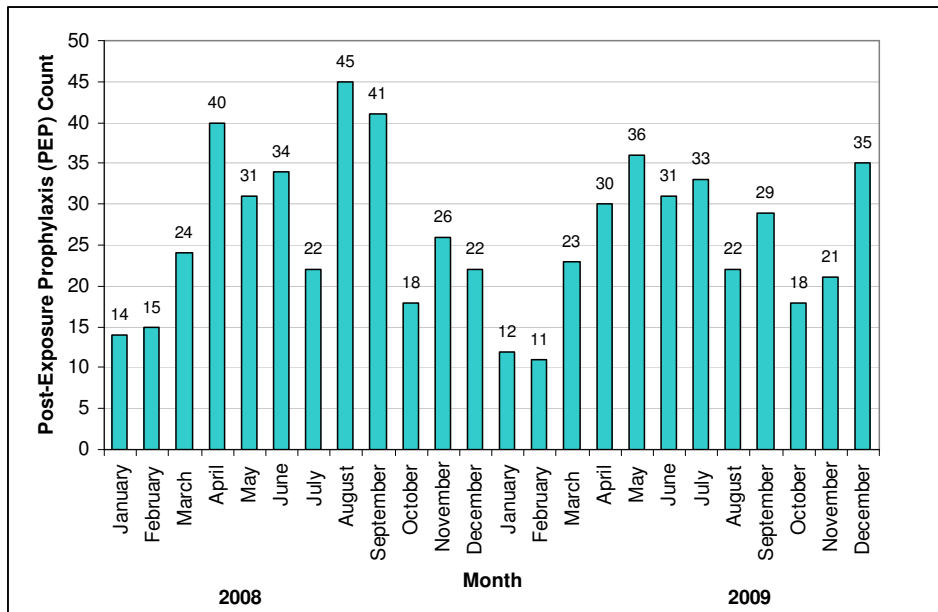


Note: Error bars represent 95% confidence intervals for post-exposure prophylaxis rates; Rates are based on U.S. Census population estimates for Rhode Island counties for the respective years 2008 and 2009; County of exposure was missing for 3 cases in 2008 and 2 cases in 2009

* Population-based rates could not be calculated for out of state exposures

Seasonal Distribution of PEP: Distribution of post-exposure prophylaxis (PEP) courses is predictably higher in the summer and early fall corresponding to the animal exposure seasonality mentioned earlier.

Figure 12. Post-exposure prophylaxis (PEP) for animal exposures among Rhode Island residents by month and year, 2008 - 2009



PEP by Facility & Insurance Status

The number of post-exposure prophylaxis (PEP) cases by the hospitals to which they were referred is provided in **Table 5**, along with the percentage of those patients with health insurance. Overall, Rhode Island Hospital saw the most cases both years, with 98 in 2008 and 81 in 2009; Kent hospital had the next highest PEP treatment volume, with 91 in 2008 and 70 in 2009. Overall, the percent of insured patients was 92.7% in 2008 (range: 83.3% - 100%) and 93.3% in 2009 (range: 75.0% - 100%).

Table 5. PEP by dispensing facility and insurance status, RI 2008 – 2009

Dispensing Facility	2008 [†]			2009 [‡]		
	PEP Administered	Percent of Cases	Percent Insured	PEP Administered	Percent of Cases	Percent Insured
Kent Hospital	91	27.7%	100.0%	70	24.3%	96.9%
Landmark Medical Center	16	4.9%	83.3%	17	5.9%	87.5%
Memorial Hospital	11	3.3%	90.9%	12	4.2%	75.0%
Miriam Hospital	47	14.3%	97.8%	35	12.2%	87.9%
Newport Hospital	18	5.5%	94.4%	12	4.2%	91.7%
Rhode Island Hospital [§]	98	29.8%	93.5%	82	28.5%	96.2%
Pediatric (≤ 18 years)	38		100.0%	43		94.9%
Adults (> 18 years)	59		88.9%	39		97.3%
Roger Williams Medical Center	14	4.3%	85.7%	13	4.5%	90.9%
South County Hospital	12	3.6%	100.0%	13	4.5%	91.7%
Our Lady of Fatima Hospital	9	2.7%	100.0%	18	6.3%	94.1%
Westerly Hospital	10	3.0%	90.0%	9	3.1%	100.0%
Other*	3	0.9%	100.0%	7	2.4%	100.0%
Total	329	100.0%		288	100.0%	

* In 2008, *other* includes 3 out of state facilities; in 2009, *other* includes 4 out of state facilities, 1 at Newport Naval Health, 1 at the Veterans Affairs Hospital (Providence, RI) and 1 at Lincoln Medical Services (Lincoln, RI)

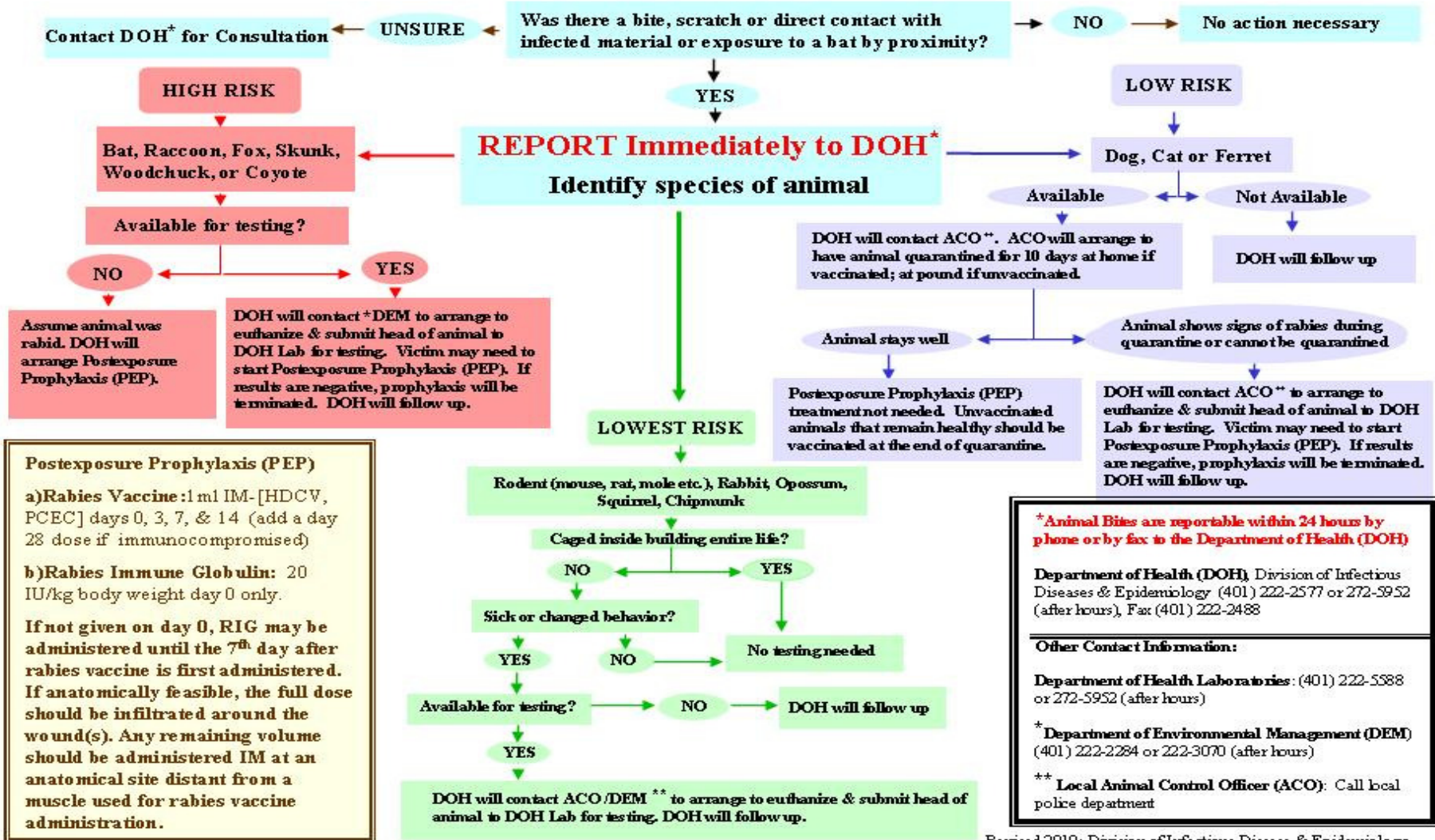
[†] Dispensing facility data was missing for 3 cases in 2008

[‡] Dispensing facility data was missing for 13 cases in 2009

[§] Age data was missing for 1 patient receiving PEP in 2008

Appendix 1.

**Rhode Island Department of Health
Management of Human Exposure to a Suspected Rabid Animal**



Contact Us:

**RI Department of Health (HEALTH)
Division of Infectious Disease and Epidemiology
3 Capitol Hill
Providence, RI 02908
Telephone: (401) 222-2577
Fax: (401) 222-2488
<http://www.health.ri.gov/contactus/>**

**David R. Gifford, M.D., M.P.H.....Director of Health
Robert Crausman MDMedical Director, Div of Infectious Disease & Epidemiology
Utpala Bandy, M.D., M.P.H. RI State Epidemiologist
Epidemiology Team:
Tara Cooper MPH, Diane Brady RN, Hsiu-Chin Shen RN, Casandra Calcione
Laboratory: Robert Ireland PhD.....Chief, Biological Sciences Laboratory
Summer Intern: Jeff Langevin PhD**