

Use of Rabies Postexposure Prophylaxis Supplied by the Alaska Section of Epidemiology, Alaska, 2002–2007

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SYNOPSIS

Objective. The aim of this study was to summarize the Alaska experience in centralizing distribution of rabies postexposure prophylaxis (PEP).

Methods. Data were collected from standard treatment sheets used to track doses and notes related to the exposure investigations.

Results. From 2002 to 2007, the annual PEP usage rate was 2.2 per 100,000. Dogs were involved in 79% (68/86) of exposures. More than 50% (49/87) of people were exposed to a confirmed rabid animal; 31 (63%) of those people experienced nonbite exposures. Conversely, of the remaining 38 people exposed to an animal for which rabies status could not be confirmed, 35 (92%) sustained a bite or puncture. Direct and indirect costs averaged more than \$3,000 per person.

Conclusions. The Alaska PEP usage rate was lower and the proportion of people exposed to confirmed rabid animals was higher when compared with other states. Alaska public health personnel invested significant time to ensure that PEP was only given when indicated. Without this gatekeeper approach, PEP would likely be administered at a much higher rate because medical facility staff lacks the time or ability to investigate animal exposures to rule out rabies. In Alaska, centralizing rabies PEP not only serves the patient's best interest, but it also makes efficient use of a potentially scarce product and supports rabies surveillance efforts by guaranteeing animals for testing. Such a program might not be feasible for a more populous state or jurisdiction, or areas with different rabies epizootiology; however, that may change if the supply of rabies biologics changes in the future.

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Since the 1970s, the Alaska State Section of Epidemiology (SOE) has supplied Alaska health-care providers with free rabies postexposure prophylaxis (PEP) for any patient for whom it is indicated. SOE maintains a supply of PEP in Anchorage, and after consultation with staff epidemiologists, health-care providers statewide are shipped PEP to be administered to patients who have been, or are suspected to have been, exposed to rabies virus.

METHODS

Although records of every animal bite consultation are not stored centrally, case records are maintained on each patient for whom SOE recommends PEP. A standard treatment sheet to track the doses given is faxed to the health-care provider to be placed in the patient’s chart. Once completed, SOE requests that treatment sheets are returned to SOE. Data were gathered from treatment sheets and notes related to the investigations.

RESULTS

From 2002 to 2007, SOE supplied some portion of rabies PEP for 129 people. This number included 42 people who were exposed to a non-Alaska animal, i.e., Alaskans exposed out of state, non-Alaskans traveling through the state while in the middle of a series, or Alaskans exposed to traveling animals.¹ The remainder of the analysis focused on the 87 people who were exposed to Alaska animals. The annual PEP usage rate was 2.2 per 100,000 (based on mean mid-year populations of 2004/2005).

The exact age was known for 94% (82/87) of people: the mean age was 18.5 years, median age was 15.5 years, and range was 1 to 56. Males accounted

for 56% (49/87) of people. Race was not systematically recorded.

Dogs were involved in 79% (68/86) of exposures. The 87th exposure involved a young child who gave conflicting reports about being bitten by a fox or a dog. Other animals involved included foxes (red and arctic) at 14% (12/86) of exposures; and bats, cats, and wolves each at 2% (2/86). A total of 53 animals were involved in all 87 exposures. The mean number of people receiving PEP per animal was 1.6, the median was 1, and the range was 1 to 14.

PEP courses were administered in every month of the year. Seasonal differences could not be reliably demonstrated because several group exposure events skewed the distribution. Similarly, PEP courses were administered primarily to people who lived in regions of Alaska known to be enzootic for rabies; therefore, regional PEP usage rates were not calculated.

Most people (49/87 or 56%) received PEP for exposure to a confirmed rabid animal (Table). Of those 49 people, 31 (63%) had nonbite exposures, 13 (27%) had a known bite, and four (8%) had a laboratory exposure. The remaining person reported lacerations on his hand after reaching into a doghouse where a fox was hiding. A fox, subsequently killed near his property, tested positive for rabies. Of the 38 people receiving PEP for exposure to an animal for which rabies status could not be confirmed, 35 (92%) sustained a bite or puncture; two (5%) had small marks that could have been attributed to a bat; and one person had an open wound exposure to an unvaccinated, ill, salivating puppy that died and was unable to be tested. For the bat exposures, one person had seen bats near his house, slept with the window open, and awoke subsequently to find small puncture marks on his arm. The other person was removing a bat from a chimney and believed it bit her before flying away.

Table. Indication for recommending rabies postexposure prophylaxis courses (n=87) by the Alaska Section of Epidemiology, Alaska, 2002–2007

<i>Indication</i>	<i>N (percent of all)</i>
Bite or nonbite exposure to a confirmed rabid animal	49 (57)
Lab exposure	4 ^a (5)
Animal was a stray/unidentifiable dog or cat ^b	22 (26)
Animal was wildlife and escaped after exposure ^b	10 (12)
Unidentified animal (either fox or dog) escaped after exposure ^b	1 (1)
Animal was destroyed and unable to be tested ^b	5 (6)

^aThree exposures were to people not wearing adequate personal protective equipment while necropsying animals subsequently confirmed to be rabid. One exposure was a cut from a scalpel that may have been used to necropsy a rabid animal.

^bThe Alaska Section of Epidemiology recommended postexposure prophylaxis in consultation with the patient’s health-care provider and in the context of other factors (e.g., if the bite was provoked, if the incident occurred in a rabies enzootic area, or depending on what species of animal was involved).

Exact time from exposure to initiation of PEP was available for less than half the people receiving PEP. Almost 90% (42/49) of people exposed to a confirmed rabid animal could not pinpoint a defined time of exposure. Conversely, more than half (20/38) who were exposed to animals that were not available for testing or observation received PEP within 48 hours.

Only one person receiving PEP was hospitalized. This young child crawled into a cage containing a dog and sustained serious injuries to the head/neck region. The dog was destroyed before it could be tested. The animal was not known to be ill at the time of the attack and its rabies vaccination status was unclear.

Minor deviations from the recommended dosing schedule were not assessed. However, three PEP series were not fully completed; none involved exposure to a confirmed rabid animal. In one instance, the dog was found alive after 10 days had elapsed. In the second instance, a (prevaccinated) person reported myalgias after the first dose and declined to receive the second and final dose. In the third instance, a person failed to present for the final three doses even after numerous private and public attempts were made to reach her.

SOE spent approximately \$100,000 for rabies biologics for all 129 people during the six-year period. Almost 70% (89/129) received a full course of PEP, including human rabies immune globulin (HRIG). Of the remaining 40 people who did not receive HRIG, five had previously been vaccinated against rabies and 35 were only in Alaska for part of the four-week treatment course. A greater cost to SOE and partners was indirect, including personnel time to provide a consultation, locate an animal for testing, perform testing, track down all exposed people and their guardians (if applicable), package and ship PEP, and ensure people completed the entire four-week course. These costs varied depending on the region of occurrence and local infrastructure, among other factors, but were estimated to be \$2,000 per exposure. These costs were beyond any costs incurred at the treatment facility (if not a public health clinic) or indirect costs incurred by the patient.

Other indirect costs included the resources spent locating the animals that exposed humans, but tested negative for rabies. Based on records from the Alaska State Virology Laboratory (ASVL), during the six-year period, approximately 200 animals—which had cumulatively exposed at least 250 people—tested negative for rabies, thus averting numerous courses of unneeded PEP. Additionally, resources were spent mainly by regional animal control or environmental health program personnel locating animals and following them through a 10-day quarantine. Data were not available

to completely tabulate all of these services, but without them, the default course of action for many animal exposure victims would have been to receive PEP.

DISCUSSION

Rabies is a well-known public health challenge in Alaska. For several decades, the Alaska State SOE has provided rabies PEP for free as one element of a larger rabies control program;² there are no counties or local health authorities in Alaska. Furthermore, Alaska emergency rooms or health-care providers do not routinely stock PEP for sporadic use.

Rabies is enzootic among the fox populations in northern and western coastal Alaska. Epizootics occur every few years and follow the population cycles of the rodents upon which the foxes feed. During 2002–2007, a mean of 19 animals were confirmed with rabies (range 4 to 45); epizootics were seen in 2001 and 2007. Because submission practices vary and just one rabid puppy can expose numerous people, more rabies activity does not always translate into more PEP courses. During the same six-year time frame, the mean annual PEP usage rate in Alaska for local exposures was relatively low at 2.2 per 100,000 compared with other state estimates, which ranged from 5 to 52 per 100,000 (Personal communication, Michael Auslander, Kentucky Department for Public Health, September 2007).^{3–6} Interestingly, this rate was similar to an estimate calculated state by state for 1995 that collectively was believed to underestimate actual national usage by threefold.⁷

More than 50% of the people in Alaska receiving PEP were exposed to a rabid animal. Comparison with other states was difficult because, in general, a small proportion of animals is available for testing, especially in areas where bats are one of the wildlife reservoirs.^{4,8} One state calculated that 16% of PEP courses were given for exposure to a confirmed rabid animal (Personal communication, Michael Auslander, Kentucky Department for Public Health, September 2007). Although maximizing this proportion is desirable because it means that PEP was potentially lifesaving, the Alaska figure may be skewed. For example, the majority of cases involving exposure to confirmed rabid animals had nonbite exposures. This has been found in other studies and may relate to the heightened anxiety among people who discover they have been in close proximity to a rabid animal.⁴ Additionally, in Alaska this was also the result of having unattended small children, in possible contact with rabid dogs/puppies, who could not give reliable histories to rule out exposure. The predominance of younger children

receiving PEP has been noted in other studies.⁸ Finally, it may also indicate that individuals have a higher threshold for reporting a nonbite exposure to an animal that could not be located for testing. Regardless, the substantial time that SOE and partners spent tracking down and testing animals contributed significantly to the predominance of PEP courses administered to people exposed to confirmed rabid animals and the minimization of courses administered in circumstances where animals were not identified.

The remaining 44% (38/87) of people were exposed to animals for which no follow-up information was available. Most of these were stray dogs that could not be reliably identified; some instances involved wildlife that fled after the incident. The most effective way to reduce these types of exposures is to ensure that communities decrease stray or loose dogs and nuisance wildlife in close proximity to residents.

Other indications for treatment included people exposed to animals that were destroyed before being tested, and exposure to rabies virus in laboratory settings. The ASVL is the only in-state location that performs rabies virus testing; however, other Alaska university or research laboratories also handle tissues from potentially infected wildlife. All laboratory personnel working with rabies virus should be vaccinated against rabies prior to processing specimens. Efforts to increase training or troubleshoot for potential injuries should be ongoing in any laboratory handling tissues potentially infected with rabies virus.

Most animals exposed a single person; however, only dogs were involved in exposures of more than one person. This finding is not surprising as dogs and puppies often have access to entire households of people. The finding also underscores a central tenant of human rabies prevention: vaccinate pets to prevent them from acquiring rabies from wildlife and transmitting it to humans. Puppies cannot be legally vaccinated until age 12 weeks; however, they should be prevented from interacting with wildlife until they can be immunized.

Several notable differences in Alaska PEP usage relate to the local epizootiology of rabies. In other studies, cats are as likely as or more likely than dogs to be the main animal involved in exposures, whereas cats were rarely involved in Alaska.^{4,5,8} Data were not available to assess whether this is a result of differences in pet ownership in Alaska compared with other states or some other factors. Similarly, while bats account for significant proportions of PEP courses in other states, Alaska has documented only two cases of rabies in bats in 30 years and correspondingly small numbers of people have received PEP for exposure to bats.⁹

Although rabies is routinely documented in red and arctic foxes year-round in certain regions of Alaska, there is a substantial portion of the state (mainly urban areas) where rabies has never been detected, which greatly impacts rabies exposure assessments.¹⁰

Calculations regarding duration of time from exposure to initiation of treatment were difficult to interpret because many people, especially those with nonbite exposures, did not recall a precise moment of exposure. Because SOE had to ship PEP from Anchorage, there was usually a delay based on flight schedules, regardless of having an around-the-clock SOE consultation service. The delay was minimized if the animal was not available for testing. When an animal was available to test, PEP was most often sent pending the test result, which was usually available within 24 hours of the specimen reaching the laboratory. However, depending on circumstances, such as the specifics of the human and animal interaction (e.g., if the animal was being provoked or handled at the time) and the anatomic site of the bite, PEP was preemptively started before a result was available. Other studies not stratified by animals' rabies status have demonstrated shorter durations depending on the type of exposure (e.g., bite vs. nonbite) or animal (e.g., wild vs. domestic).^{4,6} In one state, one-third of PEP courses that were considered inappropriate were initiated within 24 hours of exposure, implying that a delay to collect information could have averted some PEP courses.¹¹ Delays may also relate more to the patient's motivation and ability to report the incident, which was not assessed with the Alaska data.

Only one exposure was associated with hospitalization; no people with exposure to a confirmed rabid animal were hospitalized for an injury. In some SOE consultations, health-care providers appeared more concerned about rabies exposure if the victim had suffered a severe dog bite injury. Given SOE's data, this sentiment highlights two very important issues. The first is that assuming a severe mauling is the result of rabies minimizes the importance of factors related to the humans involved (e.g., a child petting a dog with new puppies). More importantly for rabies prevention, minor bites/exposures may be trivialized, which could have disastrous consequences. For complete prevention of human rabies, any and all dog bite injuries should be completely investigated to ensure that PEP can be administered when indicated.

There were few incomplete series documented. One was indicated because the dog was identified and found to be healthy. Two others were personal choice decisions made by adults about the desire to continue receiving doses of vaccine. Because animals were not

located for these exposures, perhaps the threat of rabies did not seem imminent. SOE and health-care providers can make strong recommendations, but ultimately it is the patient's choice to receive PEP. No deaths from human rabies have been reported in Alaska since the 1940s.

Personal choice has also weighed in on rare situations in which SOE has determined that a credible exposure did not occur based on Advisory Committee on Immunization Practices guidance,¹² yet health-care providers and/or their patients have insisted on receiving PEP. SOE has provided its recommendations in writing; it is unknown whether these patients ultimately received PEP purchased privately. Because SOE supplies PEP for free, and ASVL performs all in-state rabies testing, the data presented in this review likely represent the vast majority of all PEP given in the state. However, a survey of the vaccine manufacturers or statewide pharmacies was not performed.

Direct costs incurred by the SOE were not insignificant, especially because SOE has no specific budget for rabies biologics. Additionally, indirect costs to SOE and partner agencies, although ill-defined, were significant. More comprehensive cost analyses have been performed elsewhere;¹³ however, the current perceived benefits of maintaining SOE's PEP program outweigh the potential costs.

CONCLUSIONS

The Alaska usage rate for PEP was lower and the proportion of people exposed to confirmed rabid animals was higher when compared with other states. One reason may be that Alaska SOE staff working with partners invested significant time to locate animals and ensure that PEP was only given when truly indicated. Without this gatekeeper approach, emergency rooms would likely be administering PEP at a much higher rate because medical facility staff lacks the time or ability to rapidly investigate a case and rule out exposure to rabies.

SOE believes that the program of centralizing rabies PEP in Alaska not only serves the patient's best interest, but also makes efficient use of a potentially scarce product and supports rabies surveillance efforts by guaranteeing animals for testing. Such a program might not be feasible for a more populous state or jurisdiction, given constraints on staff time, or areas with different rabies epizootiology (e.g., prevalent rabies in bats); however, that may change if the supply of rabies biologics changes in the future.

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