

# Animal Bites and Rabies

## 1. REPORTING AND FOLLOW-UP

### A. Purpose of Reporting and Surveillance

1. To assess the risk of rabies exposure in persons bitten or otherwise exposed to animal saliva, in order to recommend post-exposure rabies prophylaxis (PERP) to those who need it, and to provide counseling and reassurance to those who don't.
2. As necessary, to arrange for the capture and either confinement (10-day observation) of a live dog cat or ferret, or the laboratory examination of an animal head. This may involve coordination with other agencies, e.g., the Humane Society, county sanitarians, animal control, and local law enforcement.

### B. Reporting Requirements

1. Anyone with knowledge of humans being bitten by potentially rabid animals (e.g., physicians, veterinarians, animal control personnel, law enforcement officials, or animal owners) is required to report such incidents to the LHD within one working day.
2. Any confirmed case of rabies in animals and any suspected or confirmed case of human rabies must be reported immediately (day or night) to the LHD, or—if LHD staff cannot be contacted—to OHS.

### C. Local Health Department Reporting and Follow-Up Responsibilities

1. Whenever possible, animal bites should be investigated on the day of report.
2. No formal reporting of animal bites to the Communicable Disease Section is required. (Suspicions about human rabies cases should be phoned in immediately.)
3. Decisions about the disposition of animals who have bitten humans are the responsibility of the local health officer. CD Section epidemiologists are always available to consult on bite situations, and may make decisions under unusual circumstances or when local personnel are unavailable.
4. The OSPHL *must* be notified in advance of all heads being sent in for rabies testing.
5. The use of a standardized intake form for animal bite reports is encouraged. A sample form appears at the end of this chapter, but counties may prefer to use materials of their own design.
6. County or LHD personnel are responsible for the supervision of confined animals.
7. Any case of human rabies will be investigated by the local health department in cooperation with OHS epidemiologists.

## 2. RABIES AND ITS EPIDEMIOLOGY

### A. Etiologic Agent

The rabies virus, a member of the rhabdovirus family.

### B. Description of Illness

Rabid animals can show a range of symptoms, often described as either “dumb” or “furious” rabies; they may progress from one state to the other. Dumb rabies is characterized by reclusive behavior, drooling, anorexia, a startle response to sudden noise or light exposure, and irritation around the site of the bite, resulting in frequent licking and biting of the area. Furious rabies is marked by excitation and marked aggressiveness, notably biting of objects, animals, humans, or even self. Salivation is profuse and there is usually a change in voice. CNS signs of rabies may include an ascending paralysis, incoordination, convulsions and blindness. Wildlife often seem to lose their fear of people; nocturnal and crepuscular creatures may disport themselves during daylight hours. Infected bats may act strangely: crawling around, hissing, etc.

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It is important to remember that these signs and behaviors are not pathognomonic for rabies. Behavioral changes and clinical signs caused by a variety of infectious and non-infectious processes (e.g., pesticide exposure, heavy metal poisoning, trauma) can mimic those associated with rabies. Human rabies is not unlike rabies in other mammals. Prodromal symptoms include paresthesias, notably at or near the site of the original wound, irritability, and other disquieting neurological, behavioral, and mood changes. Rabies is virtually always fatal.

### C. Reservoirs

Infected mammals, particularly bats. Almost all terrestrial mammals can be infected in theory, but in practice only one or two species tend to be significant reservoirs in endemic areas. In Oregon, Washington, and Idaho, bats are the *only* reservoir species, and other animals—notably bat predators such as foxes or cats—are only rarely infected as “spillover” from rabid bat populations. In other parts of the U.S., skunks, raccoons, and foxes are important reservoirs (in addition to bats). In some parts of the world, dogs and other carnivores may be important reservoirs.

### D. Modes of Transmission

Rabies is spread by the inoculation of virus-containing saliva into broken tissue or onto mucous membranes—almost exclusively via animal bite. Person-to-person transmission of rabies has never been confirmed (except via corneal and organ transplants).

Thirty-four cases of human rabies were diagnosed in the U.S. between 1990 and 2000. (Most had no history of an animal bite, in some cases because the patients became uncommunicative before they could be questioned about possible exposures.) The use of standard precautions for all patients should all but eliminate the need for PERP among hospital staff.

### E. Incubation Period

Typically, two to eight weeks, but highly variable. Reports as short as 5 days and >1 year have been reported for non-human animals, and an incubation period of 7 years was inferred for one human. This variation may depend on the species exposed, the size of viral inoculum, and other factors. The proximity of the bite to the brain may also be a factor; virus inoculated into the head has a relatively short distance to travel. (This is why face bites are more urgent than toe nibbles.) *Do not confuse the incubation period with the period of communicability.*

### F. Period of Communicability

Infected animals can transmit rabies only after the infection has spread to the salivary glands, which typically occurs close to or after the time that CNS signs develop. In fact, many animals will die of rabies *before* they begin to shed virus. Laboratory studies have established that in dogs, shedding begins *at most* 3 days before signs occur—in cats, 1 day before. Shedding may persist until the animal dies—typically a few days. Little or nothing is known about other species.

The rationale for a 10-day confinement period for dogs, cats and ferrets rests on this observed [maximal] interval between viral shedding and onset—padded by a healthy margin of safety—and has nothing to do with incubation period *per se*. Confinement for animals other than dogs, cats or ferrets is not permitted because of a dearth of comparable information.

### G. Treatment

Treatment for rabies is essentially palliative. Once symptoms attributable to infection occur (in both humans and other animals), the chance of survival is virtually nil.

## 3. ASSESSING THE NEED FOR PROPHYLAXIS AND FOLLOW-UP

With respect to rabies concern, animal bites can be classified into three categories: high risk, low risk, and “no” risk. The boundaries between these categories can be fuzzy, and it is difficult to spell out exact definitions that cover all scenarios. Risk assessment hinges on the answers to two questions:

1. Was there a significant exposure to animal saliva?
2. Is there a significant risk that the animal in question was shedding rabies virus in saliva at the time of the bite/exposure?

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### A. Was there a Human Exposure?

Rabies virus does not penetrate intact skin or clothing. Thus, unless there is a history of a bite that broke the skin, or saliva contact with broken skin or mucous membranes (including the eyes), there was no exposure. Those who merely pet a dog or pick up a bat later found to be rabid, for example, have not had a significant exposure. If there was no exposure, then there is *no risk*. It's that simple.

*The OSPHL will not spend time and money testing animals unless there has been a human exposure.*

### B. Is There a Significant Risk the Animal was Rabid and Secreting Virus?

This question can be answered by a combination of knowledge about the natural history of rabies in Oregon, the circumstances of the exposure, knowledge and observation of the offending animal (if possible), and (sometimes) laboratory testing. A healthy dose of common sense is helpful, too. If there is no significant risk that the animal in question was secreting rabies virus, then it is a *no risk* exposure.

*Because of the prevalences of rabies in bats, all bat bites are considered high risk, regardless of circumstances.*

#### 1. Natural History

As noted above, only bats or animals that might have been exposed to infected bats are potential sources of transmission in Oregon (absent evidence that a biting animal has recently come from out-of-state). Bats are less active in Oregon during cold weather, so there is relatively little risk of animals being bitten by bats between, say, November and April. By the same token, indoor pets cannot be exposed unless a bat flies into the house, bites them, and escapes unnoticed—a scenario that is not very plausible.

While almost all mammals can be experimentally infected with the rabies virus, in real life many species are essentially rabies-free, due to both behavioral and dietary characteristics as well as innate resistance to the virus. Lagomorphs (e.g., rabbits, hares), small rodents (e.g., mice, rats, squirrels, gerbils, hamsters), and cervids (e.g., deer, elk) all fall into this category. Absent extraordinary circumstances (genuinely “unprovoked” bites—see next section), bites by these animals do not merit follow-up for rabies.

#### 2. Circumstances of the Bite

Talk to the person bitten and other witnesses to get a first-hand account of what was happening when the bite occurred. Differentiate “unprovoked” and “provoked” bites. In the technical sense used for rabies investigations, these terms do not imply anything about the rights or wrongs of human (or animal!) behavior.

A bite is considered *unprovoked* when an animal crosses neutral space and attacks “for no reason.” Such incidents are rare.

Almost all bites are provoked, meaning that—in context—the bite was understandable (if not strictly speaking normal) behavior. Typical provoked bite situations include:

- persons bitten by unfamiliar or non-domesticated animals they were interacting with (e.g., petting a stray cat, feeding squirrels, breaking up a fight between animals, cornering a raccoon on the porch, etc.);
- persons bitten by injured animals (e.g., dogs hit by cars);
- persons bitten by dogs protecting “their space,” (e.g., a front yard, their food).

Bites to the head or neck increase the urgency of the situation, as they decrease the time when prophylaxis is likely to be effective. Conversely, adequate first aid, especially thorough washing of the wound with soap and water, greatly decreases risk.

#### 3. Knowledge of the Offending Animal

*Previous history.* Bites by animals with a history of menacing or biting are less likely to reflect changes in behavior that might be attributable to rabies. (Such animals may be a nuisance or hazard in their own right, however.)

*Vaccination history.* Although vaccine failure is possible, dogs, cats, and ferrets with a documentable history of up-to-date rabies vaccinations are unlikely to be rabid. Vaccines given to other

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species, including hybrids such as wolf-dog crosses, are of unknown efficacy and should be disregarded as mitigating factors. They have no legal standing in Oregon.

*Observation and Confinement.* See §4 below.

### 4. Laboratory Testing

Animals can only be tested for rabies by killing them, cutting off their heads, and assaying brain tissue for the presence of virus. Testing is available only at the OSPHL or the Oregon State University Veterinary Diagnostics Laboratory (OSUVDL) (see §4 below).

Antemortem testing for humans, while relatively insensitive, is available. Required specimens will include serum, CSF, saliva, and a skin biopsy from the nape of the neck that contains one or more hair follicles. Contact the OHS on-call epidemiologist for instructions on collection, handling, and shipping of human specimens.

### C. Making a Decision

Make your own decision based on available information. Try to ignore the unfounded concerns of well-meaning but ill-informed persons, who may include physicians and veterinarians. *An important part of LHD responsibilities is to prevent the expense and trouble of unnecessary animal testing.* Communicable Disease Section epidemiologists are always available for consultation. LHD personnel are strongly encouraged to consult about all high risk bites other than bat bites.

 **If it is a no risk situation, then post exposure rabies Prophylaxis (PERP), confinement, and/or head testing are not indicated.**

## 4. CONFINEMENT AND HEAD TESTING

### A. Confinement

To avoid needless killing of pets—and to minimize the considerable expense of animal testing—confinement and observation (sometimes misleadingly referred to as “quarantine”) is the preferred follow-up for dogs and cats that have bitten people. Such animals should never be killed if they can be held under observation, preferably at the owner’s expense. Without the approval of local health officials, veterinarians and others are prohibited from killing possibly rabid animals that have bitten someone (OAR 333-019-0024 and 0027). Unfortunately, this rule is often honored in the breach.

If a dog, cat or ferret appears healthy and is eating and drinking normally 10 days after a bite occurred, there is no chance that rabies transmission occurred. (Most of this 10 days is padding, in fact—see §2F.) Should an animal that has been confined following a bite develop any signs of neurological/CNS disease, however, it should be killed immediately and the head submitted for testing. Such symptoms include: hind leg paralysis, aimless movement, seizures, unusual voice sounds, blindness, inability to swallow, and persistent dilation of pupils.

The mechanics of confinement are left to the discretion of the LHD. Confinement may be at a county animal pound or a local humane society. At the discretion of the LHD, *responsible* owners may be allowed to confine low-risk dogs or cats on their own premises. Generally speaking, unvaccinated pets are *prima facie* evidence of irresponsible owners.

### B. Head Testing

Head testing is time consuming and requires considerable set-up and reagent preparation. The OSPHL *must* be notified in advance (503-693-4100) of all heads being submitted for testing. Advise them of the mode of transportation and expected time of arrival for all specimens. Outside regular business hours, contact the on-call epidemiologist (971-673-1111).

#### 1. Lab Schedule

*Low Risk.* Heads from low risk situations are batched twice a week (currently on Mondays and Wednesdays; earlier if there is a Thursday or Friday holiday). Specimens for the batch run should arrive at the lab by noon on Wednesday—or later by special arrangement.

*High Risk.* Express tests for high risk situations are run as needed, with results available within 36 hours. Express testing can be expensive (air freight charges, etc.), so be sure you are dealing with a high-risk situation and not just a hysterical citizen. Contact the OSPHL (or, if unavailable, the on-call epidemiologist) *immediately* to coordinate arrangements for express testing.

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The main point of express testing is to save the patient some or all of the cost of unnecessary PERP. Coordinating the transportation of heads to the lab is often the most important step in assuring a satisfactory and timely result. Transportation alternatives include air freight, drive-in to the lab (by the person bitten, the animal owner, or a county employee, for example), bus service, or same- or next-day courier service (Airborne, FedEx, Express Mail, etc.). Your local hospital or medical lab is another potential source of information about emergency specimen transportation options. **Health departments that are outside the Portland area should investigate these alternatives before the need arises.** Collect the relevant information (route schedules, fees, payment options, phone numbers, etc.) and keep it current and available to the appropriate personnel.

*No risk.* “No risk” heads are not run at the OSPHL.

### 2. Specimen Handling and Shipping

Animals should be killed by lethal injection, gas or other means that do not damage the brain and that do not place people at risk of further exposure. Heads received in poor condition (e.g., riddled with bullet holes, frozen, or decomposed) often cannot be satisfactorily tested.

Send animal heads only (whole bats are acceptable). Caution should be exercised when decapitating animals—remember, the working assumption should be that the animal is rabid. Wear heavy gloves, and use goggles or a face shield to avoid splashing brain/CNS tissue into the eyes or mouth—if only for aesthetic reasons.

Pack the head in a leak-proof container and seal it with tape. If plastic bags are used, use at least two and make sure they are sealed. The sealed head should go into another leak-proof container with enough cold packs to maintain refrigerator temperatures until the specimen reaches the lab. Do not freeze heads!!! Dry ice is not recommended, as it may freeze the head.

Label the outside of the container with “REFRIGERATED SPECIMEN” and include the lab’s phone number (503-693-4100) and a notation to “CALL ON ARRIVAL.” Containers must be shipped prepaid, and addressed to:

Oregon State Public Health Laboratory  
3150 229th Ave., Ste. 100  
Hillsboro, OR 97124

### 3. Reporting of Results

The OSPHL will notify the LHD of all test results. Positive tests will also be reported to the Communicable Disease Section. It is the responsibility of the LHD to communicate results to the person bitten and other interested parties (docs, vets, etc.). For high risk situations, make sure you know how to contact these persons promptly.

### C. Veterinary Diagnostics Laboratory (VDL)

For a fee the Oregon State University Veterinary Diagnosis Laboratory (OSUVDL) in Corvallis will test animal heads for rabies. This alternative can be suggested to persons who are not satisfied with the determination that theirs is a “no risk” situation. Generally speaking, VDL will not test animals that have bitten people without the prior approval of Communicable Disease Section epidemiologists, but this approval is readily obtained for no risk situations.

Specimen preparation and shipping is best left to interested parties and/or their veterinarians. Requirements are similar to those outlined above for the OSPHL. Questions should be referred to the VDL (541-737-3261).

## 5. PROPHYLAXIS

### A. Wound Treatment

All bite wounds should be thoroughly and immediately washed with soap, water and copious flushing. Betadine® or similar disinfectants can be applied. If possible, the wound should be left open to heal. Animal bite wounds often become infected (especially cat bites), and may require antibiotic therapy. Check tetanus immunization status, and provide a booster to persons who are out of date (e.g., wearing bellbottoms or leisure suits). Patients should be encouraged to seek medical attention promptly should signs of wound infection occur.

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### B. Post-Exposure Rabies Prophylaxis (PERP)

LHD and OHS staff can only make recommendations to patients and physicians about the advisability of PERP. Rabies immune globulin (RIG) and rabies vaccine are freely available by prescription, and physicians are free to take or leave our advice.

For many lay persons (and not a few physicians), the prospect of PERP conjures up images of dozens of painful injections given with giant needles, often in the “stomach.” Understandably, these myths may contribute to the natural anxiety felt by many people after animal bites, and should be quickly debunked. Modern PERP is a simple, extremely effective, and relatively painless procedure, albeit not cheap. For many adults, the cost can exceed \$1500.

PERP can be given by anyone capable of giving IM injections; there is no good reason for patients being dispatched to distant emergency rooms. Therapy consists of passive immunization with rabies immune globulin (RIG, Imogam®; 20 IU/kg), given as soon as possible after exposure, combined with active immunization with human diploid cell vaccine (HDCV), purified chick embryo cell vaccine (PCEC) or rabies vaccine absorbed (RVA) administered in 1-ml doses on five days (days 0, 3, 7, 14 and 28).

These biologics are stocked at some local county health departments, hospital pharmacies and several emergency rooms in Oregon; they can be ordered for next-day delivery at most locations.

As many as 50% of vaccinees may experience local reactions including pain, erythema, and swelling or itching at the injection site, and/or systemic reactions such as headache, nausea, abdominal pain, myalgias, and dizziness. PERP should not be interrupted or discontinued because of side effects short of anaphylactic reaction. Pregnancy is not a contraindication.

### C. Pre-Exposure (Human)

Persons who live in an area with a high rate of terrestrial rabies and are at risk of being bitten or exposed to infected tissues (e.g., veterinarians, wildlife workers, laboratory personnel, animal control officers) may benefit from *pre*-exposure rabies prophylaxis. The regimen consists of three doses of HDCV (IM or ID) on days 0, 7, and 28. Should immunized persons subsequently be bitten by a possibly rabid animal, they will need only two 1-ml boosters of HDCV, three days apart.

### D. Rabies Vaccine for Animals

There are formulations of rabies vaccine licensed for cats, dogs, and ferrets, as well as horses, cows, sheep, and goats. Oregon laws require that dogs be vaccinated for rabies by the time they reach 6 months of age. (This vaccination is required for licensure in all Oregon counties.) Dogs that are immunized at <1 year of age must be revaccinated within the following year, and every 3 years thereafter. While there is no requirement for cat vaccination in Oregon (except in Multnomah County), it is highly recommended, because cats are bat predators. The schedule for cats is the same as for dogs. Only a 1-year vaccine is approved for ferrets.

## 6. FOLLOW-UP TO ANIMAL RABIES CASES; BAT-PROOFING

### A. Seizing the “Teachable Moment”

Publicity surrounding the identification of a rabid animal often provides an opportunity to educate citizens about the importance of ongoing animal control measures, including the following recommendations.

1. Avoid physical contact with bats—healthy, sick, alive, or dead. Bats are an important and interesting part of the natural world, providing many benefits (such as insect control). That said, there are ways to have bats around without necessarily having them in your house (see below).
2. Do not hand feed or otherwise handle stray animals and wildlife.
3. Report all animal bites promptly to the local health department.
4. Every effort should be made to capture stray or wild animals that have bitten people, if it can be done safely, in order that they can be tested for rabies if indicated.
5. Vaccinate all dogs and cats, in order to create an immune barrier between these frequently handled animals and wildlife.

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6. Control populations of stray or unwanted animals.

### B. Animals Exposed to Known or Suspected Rabid Animals

1. Unimmunized dogs, cats or ferrets with known contact with a rabid animal should be killed. If the owner will not permit this, the animal must undergo a supervised (not home) quarantine for 6 months, with vaccine administered 1 month prior to release.
2. A dog, cat or ferret with a current rabies vaccination that has had a known contact with a rabid animal should be revaccinated and confined at home for 45 days (indoors, in a fenced yard, or on a leash at all times).
3. See the American Veterinary Medical Association's *Compendium of Animal Rabies Prevention and Control*, (at OHS' web site, [http://www.oregon.gov/DHS/ph/acd/vets/RabiesCompendium\\_2008.pdf](http://www.oregon.gov/DHS/ph/acd/vets/RabiesCompendium_2008.pdf), or at the National Association of State Public Health Veterinarians (NASPHV) web site at: <http://www.nasphv.org/documentsCompendia.html> for information on animal confinement and other recommendations. In late 2004 or 2005, Oregon OARS 333-019-0027 was amended to bring Oregon rules in line with the National Association of Public Health Veterinarians and CDC guidelines (contained in the *Compendium*).

### C. Bat Control

1. Houses and out buildings can be bat-proofed by covering large openings with screen wire and caulking or closing holes to less than 1 cm (3/8 in.) in diameter. Doors and windows should be screened. Fireplace dampers should be closed during warm months.
2. For those interested in encouraging bat colonies, bat boxes are easily constructed (plans are available from various sources). They should be located away from human habitations.
3. With care, bats can be removed safely from a dwelling. Wait for the bat to settle on a reasonably flat surface, and trap it under a wide-mouthed jar or can. Use a piece of cardboard as a temporary cover. When the bat settles to the bottom of the jar, slide the cardboard off and immediately put the jar lid in place. Turn the bat loose in another location or if sick or injured humane euthanasia should be used; gas anesthesia, 4% CO<sub>2</sub>, or CO<sub>2</sub>. Please note that putting the jar or can in the freezer is not considered to be humane euthanasia.

## 7. MANAGING SPECIAL SITUATIONS

### A. Curious Animal Behavior

Rabies is only one of many conditions that can affect animal behavior. Trauma, pesticide and other poisons, and infectious diseases can all trigger rabies-like signs. Unless humans are bitten by these animals, there should be no public health concern about rabies.

Canine distemper, for example, often affects Oregon raccoons, causing muscle twitching, convulsions with salivation and chewing movements, and ascending paralysis with ataxia. Foxes, coyotes, mink, and skunks are also susceptible to canine distemper, but outbreaks in these species have not been reported in Oregon. Infected animals may come out during the day and may approach humans or domestic pets without fear. (A definitive diagnosis of distemper can be made, and public fears allayed, by sending fresh raccoon carcasses to the OSUVDL [541-737-3261] for necropsy and histopathology studies. Call to find out the cost per animal.)

### B. Wildlife Die-offs

Local Health Departments are often called because of an animal die-off (real or perceived—usually the latter). These seldom have public health significance, and are best handled by contacting the nearest area office of the Department of Fish and Wildlife. Their workers understand the ecology of the area and are trained in these investigations.

### C. Suspected Human Rabies

Contact the Communicable Disease Section immediately.

Antemortem confirmation of human rabies is often not possible. Nuchal skin biopsies, corneal impression smears, neutralizing antibody titers and other tests on human material must be performed at the CDC by arrangement through OSPHL. Postmortem testing is the same as for other animals.