Today, one only has to read the eloquently written introduction to Bill Wasik and Monica Murphy’s book, *Rabid: A Cultural History of the World’s Most Diabolical Virus* (Viking, 2012), to be reminded of the impact the rabies virus has had on wildlife, domestic animals, and humans for thousands of years.

Two facts make this infection particularly noteworthy:
1. Rabies virus is well known for its ability to be transmitted from an infected animal to humans.
2. With rare exception, infection is 100% fatal in susceptible species.

**Rabies Statistics**

Currently, the World Health Organization estimates that between 50,000 and 60,000 human fatalities from rabies occur annually. According to the Centers for Disease Control and Prevention:

- Over 90% of rabies exposure in humans is due to exposure to rabid dogs.
- Exposure to rabid dogs is the cause of more than 99% of human deaths from rabies worldwide.

In North America, routine vaccination of pet dogs, cats, and even ferrets, has played a critical public health role in mitigating human risk for exposure to rabies virus.

- For example, in the last decade in the U.S., only 2 to 3 human infections have been typically confirmed each year. Most of those infections were acquired outside the U.S. or resulted from exposure to bats.
- However, in Africa, India, and several locations in Asia, where dogs are rarely vaccinated against rabies, its prevalence in animals and risk for human exposure through dogs is significant.

However, even in the U.S., rabies virus exposure, whether known or suspected, carries a significant cost, particularly when an unvaccinated pet that has been potentially exposed to a rabid animal has contact with humans. It is estimated that 40,000 people undergo rabies post-exposure prophylaxis (PEP) per year, at a potential cost of thousands of dollars per person.

**Immunization Requirements**

In states and local municipalities (cities or counties) where rabies vaccination is required, it is the:

- **Pet owner’s responsibility** to comply with rabies law and ensure a pet is vaccinated at the appropriate age and interval
- **Veterinarian’s responsibility** to ensure that rabies vaccines are administered in accordance with existing laws or ordinances.

Following are 9 questions that address rabies and rabies immunization. This information should be in your “must know” category of knowledge.

- Because rabies laws vary significantly among states, and even within states, the following responses provided are not universally applicable. They are, however, representative of what many states recognize or require.
- If answers to any of the questions are unclear, contact the appropriate agency to determine the most suitable action needed to comply with state or local law.
1 In your state or city/county, which agency is responsible for developing and enforcing rabies laws, including vaccination requirements?
The answer varies considerably throughout the U.S. In fact, for some states, the agency responsible for developing rabies law may be different from the agency charged with enforcing rabies law. Furthermore, cities and counties may impose rabies regulations for pets that are stricter, but never more lenient, than state law.

Having the contact information for the appropriate agency or individual is critical when the need arises to address difficult questions or take specific action, especially when it concerns possible human or pet exposure to rabies.

2 What constitutes exposure to rabies virus?
Circumstances defining exposure to rabies virus vary among states and may even vary among cities or counties within a state. Although regulatory descriptions of rabies exposure are typically limited to humans, some locations have specific ordinances in place for pets exposed to a potentially rabid animal.

Exposure to rabies virus constitutes any known or suspected bite, scratch, or other incident in which saliva, central nervous system (brain or spinal cord) tissue, or cerebrospinal fluid of a potentially rabid animal enters an open, fresh wound or comes in contact with mucous membranes by entering the eye, mouth, or nose.

When characterizing human exposure due to an encounter with a pet dog, cat, or ferret, other factors may be considered, such as:
• Was the bite incidence provoked or non-provoked?
• Is the animal involved available?
• If available, can the animal’s vaccination status be confirmed?

3 What constitutes a currently vaccinated versus unvaccinated dog, cat, or ferret?
This is an important question—most states and local municipalities conform to recommendations outlined in the Compendium of Animal Rabies Prevention and Control.

This publication states: an animal is currently vaccinated, and is considered immunized, if the initial vaccination was administered at least 28 days previously or booster vaccinations have been administered in accordance with the product label (ie, either as a 1- or 3-year product).

Consider this: A dog or cat that bites a human within 28 days following its initial rabies inoculation is not considered to be immunized. Additionally, a dog or cat can be considered unvaccinated if only 1 day overdue for a 3-year booster.

4 Which of the following tests can be used in the U.S. to confirm a diagnosis of rabies virus infection? Identify all that you consider confirmatory.
A. Routine histopathology of formalin-fixed brain tissue
B. Direct fluorescent antibody (DFA) on whole blood
C. Fluorescent antibody virus neutralization (FAVN) test
D. Direct fluorescent antibody (DFA) of intact brain tissue
E. Direct rapid immunohistochemical test (DRIT) of brain tissue
F. Rapid fluorescent foci inhibition test (RFFIT)

The correct answer is D: the DFA test performed on intact brain tissue by a qualified laboratory constitutes a diagnosis of rabies. When feasible, isolation of rabies virus from tissue may also be performed to confirm infection.

The DRIT has been used as a screening test but currently must be confirmed by DFA. The FAVN test measures serum levels of rabies virus neutralizing antibody in vaccinated animals traveling to rabies-free countries/regions.

5 What is the youngest age a dog or cat residing in the U.S. should be vaccinated against rabies?
Currently, in the U.S., rabies vaccines may be administered to dogs and cats as early as 12 weeks of age, but not younger. This applies to all states and all rabies vaccines, regardless of manufacturer. Some cities/counties, however, may require owners to have pets vaccinated at an age other than 12 weeks of age (eg, 16 weeks).

6 Under what circumstances can a rabies antibody titer be used to establish immunity in a dog or cat?
Rabies serology (antibody titer), regardless of the methodology used, does not directly correlate with
If presented with a dog that is several months overdue for a 3-year rabies booster, what is the most appropriate vaccination recommendation? The answer varies, as one might expect, from one state or location to another.

In the U.S., states that do address this issue (many don’t), tend to conform with booster recommendations published in the *Compendium of Animal Rabies Prevention and Control*. These recommendations state: **an animal is considered immediately vaccinated after a booster vaccine, even if overdue.** The duration of immunity is dictated by the product label (ie, either a 1- or 3-year rabies vaccine). When in doubt, contact the appropriate agency for a definitive legal perspective.

**KEY POINT:** Even in states/locations that recognize a veterinarian’s authority to exempt (for health reasons) a dog/cat from rabies vaccination requirements, dogs and cats that have exceeded the duration of immunity for the vaccine administered (ie, 1 or 3 years) are considered **unvaccinated** (not immunized), even if the patient has a “positive” rabies titer.

Is it appropriate to discontinue routine rabies vaccination for a strictly indoor pet dog or cat? Where rabies vaccination is required, it cannot be discontinued, no matter what the pet’s age or lifestyle. Rabies vaccines should be administered, at appropriate intervals (usually every 3 years), for the life of the pet.

Vaccines are specifically recommended for administration to healthy animals (by the manufacturer). Does a veterinarian have the authority to exempt an individual dog or cat that has a significant illness (eg, chronic renal failure) from rabies vaccination? A veterinarian licensed to practice in the U.S. must not assume he or she is authorized to grant a rabies vaccination exemption on the grounds an animal has been diagnosed with any illness (ie, is not “healthy”). Today, most states do not specifically address rabies exemption for veterinarians, although cities or counties within a state may. Individual cities or counties within a state that recognizes rabies vaccination exemptions may specifically deny that authority.

In locations that do grant rabies exemption authority to veterinarians, the terms of that authority must be clearly understood before implementing a waiver. For example, veterinarians practicing in localities where rabies exemptions are recognized may be required to submit supporting documentation to the appropriate agency (public health) and wait for official approval, a process that can take days to weeks to complete.

**Footnotes**

1. In the U.S., the latest human fatality was attributed to exposure to a bat in Contra Costa County, California, in 2012.
2. In the U.S., some states do not require rabies vaccination of dogs and cats (although certain cities/counties may).

**Suggested Reading**


**Resources**

The Rabies Laboratory, College of Veterinary Medicine, Kansas State University; available at vet.k-state.edu/depts/dmp/service/rabies/index.htm.

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