

Public Veterinary Medicine: Public Health

Compendium of Animal Rabies Prevention and Control, 2005

Rabies is a fatal viral zoonosis and a serious public health problem.¹ The recommendations in this compendium serve as the basis for animal rabies-prevention and -control programs throughout the United States and facilitate standardization of procedures among jurisdictions, thereby contributing to an effective national rabies-control program. This document is reviewed annually and revised as necessary. Principles of rabies prevention and control are detailed in Part I; Part II contains recommendations for parenteral vaccination procedures; all animal rabies vaccines licensed by the USDA and marketed in the United States are listed in Part III.

Part I: Rabies Prevention and Control

A) PRINCIPLES OF RABIES PREVENTION AND CONTROL

- 1) **RABIES EXPOSURE:** Rabies is transmitted only when the virus is introduced into bite wounds, open cuts in skin, or onto mucous membranes from saliva or other potentially infectious material such as neural tissue.² Questions about possible exposures should be directed to state or local health authorities.
- 2) **HUMAN RABIES PREVENTION:** Rabies in humans can be prevented either by eliminating exposures to rabid animals or by providing exposed persons with prompt local treatment of

wounds combined with the administration of human rabies immune globulin and vaccine. The rationale for recommending preexposure and postexposure rabies prophylaxis and details of their administration can be found in the current recommendations of the **Advisory Committee on Immunization Practices (ACIP)**.² These recommendations, along with information concerning the current local and regional epidemiology of animal rabies and the availability of human rabies biologics, are available from state health departments.

- 3) **DOMESTIC ANIMALS:** Local governments should initiate and maintain effective programs to ensure vaccination of all dogs, cats, and ferrets and to remove strays and unwanted animals. Such procedures in the United States have reduced laboratory-confirmed cases of rabies in dogs from 6,949 in 1947 to 117 in 2003.³ Because more rabies cases are reported annually involving cats (321 in 2003) than dogs, vaccination of cats should be required. Animal shelters and animal-control authorities should establish policies to ensure that adopted animals are vaccinated against rabies. The recommended vaccination procedures and the licensed animal vaccines are specified in Parts II and III of the Compendium.
- 4) **RABIES IN VACCINATED ANIMALS:** Rabies is rare in vaccinated animals.⁴ If such an event is suspected, it should be reported to state public health officials, the vaccine manufacturer, and the USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (www.aphis.usda.gov/vs/cvb/ic/adverseeventreport.htm), by telephone at 800-752-6255, or by e-mail to CVB@usda.gov. The laboratory diagnosis should be confirmed and the virus characterized by a rabies reference laboratory. A thorough epidemiologic investigation should be conducted.
- 5) **RABIES IN WILDLIFE:** The control of rabies among wildlife reservoirs is difficult.⁵ Vaccination of free-ranging wildlife or selective population reduction might be useful in some situations, but the success of such procedures depends on the cir-

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cumstances surrounding each rabies outbreak (see Part I.C: PREVENTION AND CONTROL METHODS RELATED TO WILDLIFE). Because of the risk of rabies in wild animals (especially raccoons, skunks, coyotes, foxes, and bats), the AVMA, the National Association of State Public Health Veterinarians (NASPHV), and the Council of State and Territorial Epidemiologists (CSTE) strongly recommend the enactment and enforcement of state laws prohibiting the importation, distribution, and relocation of such animals.

- 6) **RABIES SURVEILLANCE:** Laboratory-based rabies surveillance is an essential component of rabies-control and -prevention programs. Accurate and timely information is necessary to guide human postexposure prophylaxis decisions, determine the management of potentially exposed animals, aid in emerging pathogen discovery, describe the epidemiology of the disease, and assess the need for and effectiveness of oral vaccination programs for wildlife.
- 7) **RABIES DIAGNOSIS:** Rabies testing should be performed by a qualified laboratory designated by the local or state health department⁶ in accordance with the established national standardized protocol for rabies testing (www.cdc.gov/ncidod/dvrd/rabies/Professional/publications/DFA_diagnosis/DFA_protocol-b.htm). Euthanasia⁷ should be accomplished in such a way as to maintain the integrity of the brain so that the laboratory can recognize the anatomical parts. Except in the case of very small animals, such as bats, only the head or brain (including brain stem) should be submitted to the laboratory. Any animal or animal specimen being submitted for testing should be kept under refrigeration (not frozen or chemically fixed) during storage and shipping.
- 8) **RABIES SEROLOGY:** Some “rabies-free” jurisdictions may require evidence of vaccination and rabies antibodies for importation purposes. Rabies antibody titers are indicative of an animal’s response to vaccine or infection. Titers do not directly correlate with protection because other immunologic factors also play a role in preventing rabies, and our abilities to measure and interpret those other factors are not well developed. Therefore, evidence of circulating rabies virus antibodies should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations in animals.⁸

B) PREVENTION AND CONTROL METHODS IN DOMESTIC AND CONFINED ANIMALS

- 1) **PREEXPOSURE VACCINATION AND MANAGEMENT:** Parenteral animal rabies vaccines should be administered only by or under the direct supervision of a veterinarian. Rabies vaccinations may also be administered under the supervision of a veterinarian to animals held in animal-control shelters prior to release. Any veterinarian signing a rabies certificate must

ensure that the person administering vaccine is identified on the certificate and is appropriately trained in vaccine storage, handling, administration, management of adverse events, etc. This practice ensures that a qualified and responsible person can be held accountable to ensure that the animal has been properly vaccinated.

Within 28 days after primary vaccination, a peak rabies antibody titer is reached and the animal can be considered immunized. An animal is currently vaccinated and considered immunized if the primary vaccination was administered at least 28 days previously and vaccinations have been administered in accordance with this Compendium.

Regardless of the age of the animal at initial vaccination, a booster vaccination should be administered 1 year later (see Parts II and III for vaccines and procedures). There are no laboratory or epidemiologic data to support the annual or biennial administration of 3-year vaccines following the initial series. Because a rapid anamnestic response is expected, an animal is considered currently vaccinated immediately after a booster vaccination.

a) DOGS, CATS, AND FERRETS

All dogs, cats, and ferrets should be vaccinated against rabies and revaccinated in accordance with Part III of this Compendium. If a previously vaccinated animal is overdue for a booster, it should be revaccinated. Immediately following the booster, the animal is considered currently vaccinated and should be placed on an annual or triennial schedule depending on the type of vaccine used.

b) LIVESTOCK

Consideration should be given to vaccinating livestock that are particularly valuable or that might have frequent contact with humans (eg, in petting zoos, fairs, and other public exhibitions; see *The compendium of measures to prevent disease and injury associated with animals in public settings* at www.nasphv.org).⁹ Horses traveling interstate should be currently vaccinated against rabies.

c) CONFINED ANIMALS

1) WILD

No parenteral rabies vaccines are licensed for use in wild animals or hybrids. Wild animals or hybrids should not be kept as pets.¹⁰⁻¹³

2) MAINTAINED IN EXHIBITS AND IN ZOOLOGICAL PARKS

Captive mammals that are not completely excluded from all contact with rabies vectors can become infected. Moreover, wild animals might be incubating rabies when initially captured; therefore, wild-caught animals susceptible to rabies should be quarantined for a minimum of 6 months

before being exhibited. Employees who work with animals at such facilities should receive preexposure rabies vaccination. The use of pre- or postexposure rabies vaccinations for employees who work with animals at such facilities might reduce the need for euthanasia of captive animals. Carnivores and bats should be housed in a manner that precludes direct contact with the public.

2) **STRAY ANIMALS:** Stray dogs, cats, and ferrets should be removed from the community. Local health departments and animal-control officials can enforce the removal of strays more effectively if owned animals have identification and are confined or kept on leash. Strays should be impounded for at least 3 business days to determine if human exposure has occurred and give owners sufficient time to reclaim animals.

3) **IMPORTATION AND INTERSTATE MOVEMENT OF ANIMALS**

a) **INTERNATIONAL**

The CDC regulates the importation of dogs and cats into the United States. Importers of dogs must comply with rabies vaccination requirements (42 CFR, Part 71.51[c], www.cdc.gov/ncidod/dq/animal.htm) and complete the CDC form 75.37 (www.cdc.gov/ncidod/dq/pdf/cdc7537-05-24-04.pdf). The appropriate health official of the state of destination should be notified within 72 hours of the arrival into his or her jurisdiction of any imported dog required to be placed in confinement under the CDC regulation. Failure to comply with these requirements should be promptly reported to the Division of Global Migration and Quarantine, CDC, (404) 498-1670.

Federal regulations alone are insufficient to prevent the introduction of rabid animals into the country.^{14,15} All imported dogs and cats are subject to state and local laws governing rabies and should be currently vaccinated against rabies in accordance with this Compendium. Failure to comply with state or local requirements should be referred to the appropriate state or local official.

b) **INTERSTATE**

Before interstate (including commonwealths and territories) movement, dogs, cats, ferrets, and horses should be currently vaccinated against rabies in accordance with the Compendium's recommendations (see Part I.B.1: PREEXPOSURE VACCINATION AND MANAGEMENT). Animals in transit should be accompanied by a currently valid NASPHV Form 51, Rabies Vaccination Certificate (www.nasphv.org/83416/106001.html). When an interstate health certificate or certificate of veterinary inspection is required, it should contain the same rabies vaccination information as Form 51.

c) **AREAS WITH DOG-TO-DOG RABIES TRANSMISSION**

The movement of dogs from areas with dog-to-dog rabies transmission for the purpose of adoption or sale should be eliminated. Rabid dogs have been introduced into the United States from areas with dog-to-dog rabies transmission.^{14,15} This practice poses the risk of introducing canine-transmitted rabies to areas where it does not currently exist.

4) **ADJUNCT PROCEDURES:** Methods or procedures that enhance rabies control include the following:

a) **IDENTIFICATION**

Dogs, cats, and ferrets should be identified (eg, metal or plastic tags, microchips) to allow for verification of rabies vaccination status.

b) **LICENSURE**

Registration or licensure of all dogs, cats, and ferrets may be used to aid in rabies control. A fee is frequently charged for such licensure, and revenues collected are used to maintain rabies- or animal-control programs. Evidence of current vaccination is an essential prerequisite to licensure.

c) **CANVASSING**

House-to-house canvassing by animal-control officials facilitates enforcement of vaccination and licensure requirements.

d) **CITATIONS**

Citations are legal summonses issued to owners for violations, including the failure to vaccinate or license their animals. The authority for officers to issue citations should be an integral part of each animal-control program.

e) **ANIMAL CONTROL**

All communities should incorporate stray animal control, leash laws, and training of personnel in their programs.

5) **POSTEXPOSURE MANAGEMENT:** Any animal potentially exposed to rabies virus (see Part I.A.1: RABIES EXPOSURE) by a wild, carnivorous mammal or a bat that is not available for testing should be regarded as having been exposed to rabies.

a) **DOGS, CATS, AND FERRETS**

Unvaccinated dogs, cats, and ferrets exposed to a rabid animal should be euthanized immediately. If the owner is unwilling to have this done, the animal should be placed in strict isolation for 6 months. Rabies vaccine should be administered upon entry into isolation or 1 month prior to release to comply with preexposure vaccination recommendations (see Part I.B.1.a: DOGS, CATS, AND FERRETS). Protocols for the postexposure vaccination of previously unvaccinated domestic animals have not been validated, and there is evidence that the use of vaccine alone will not prevent the disease.¹⁶ Animals with expired vaccinations need to be evalu-

ated on a case-by-case basis. Dogs, cats, and ferrets that are currently vaccinated should be revaccinated immediately, kept under the owner's control, and observed for 45 days. Any illness in an isolated or confined animal should be reported immediately to the local health department.

b) **LIVESTOCK**

All species of livestock are susceptible to rabies; cattle and horses are among the most frequently diagnosed. Livestock exposed to a rabid animal and currently vaccinated with a vaccine approved by the USDA for that species should be revaccinated immediately and observed for 45 days. Unvaccinated livestock should be slaughtered immediately. If the owner is unwilling to have this done, the animal should be kept under close observation for 6 months. Any illness in an animal under observation should be reported immediately to the local health department.

The following are recommendations for owners of livestock exposed to rabid animals:

- 1) If the animal is slaughtered within 7 days of being bitten, its tissues may be eaten without risk of infection, provided that liberal portions of the exposed area are discarded. Federal guidelines for meat inspectors require that any animal known to have been exposed to rabies within 8 months be rejected for slaughter.
- 2) Neither tissues nor milk from a rabid animal should be used for human or animal consumption.¹⁷ Pasteurization temperatures will inactivate rabies virus; therefore, drinking pasteurized milk or eating cooked meat does not constitute a rabies exposure.
- 3) Having more than 1 rabid animal in a herd or having herbivore-to-herbivore transmission is uncommon; therefore, restricting the rest of the herd if a single animal has been exposed to or infected by rabies might not be necessary.

c) **OTHER ANIMALS**

Other mammals bitten by a rabid animal should be euthanatized immediately. Animals maintained in USDA-licensed research facilities or accredited zoological parks should be evaluated on a case-by-case basis.

6) **MANAGEMENT OF ANIMALS THAT BITE HUMANS**

a) **DOGS, CATS, AND FERRETS**

Rabies virus may be excreted in the saliva of infected dogs, cats, and ferrets during illness and for only a few days prior to illness or death.¹⁸⁻²⁰ A healthy dog, cat, or ferret that bites a person should be confined and observed daily for 10 days.²¹ During the observation period, administration of rabies vaccine to the animal is not recommended to avoid confusing signs of rabies with possible adverse effects of vaccine administration.

Animals should be evaluated by a veterinarian at the first sign of illness during confinement. Any illness in the animal should be reported immediately to the local health department. If signs suggestive of rabies develop, the animal should be euthanatized and the head shipped for testing as described in Part I.A.7. Any stray or unwanted dog, cat, or ferret that bites a person may be euthanatized immediately and the head submitted for rabies examination.

b) **OTHER BITING ANIMALS**

Other biting animals that might have exposed a person to rabies should be reported immediately to the local health department. Management of animals other than dogs, cats, and ferrets depends on the species; the circumstances of the bite; the epidemiology of rabies in the area; and the biting animal's history, current health status, and potential for exposure to rabies. Prior vaccination of these animals may not preclude the necessity for euthanasia and testing.

C) **PREVENTION AND CONTROL METHODS RELATED TO WILDLIFE:**

The public should be warned not to handle or feed wild mammals. Wild mammals and hybrids that bite or otherwise expose persons, pets, or livestock should be considered for euthanasia and rabies examination. A person bitten by any wild mammal should immediately report the incident to a physician who can evaluate the need for antirabies treatment (*see* current rabies prophylaxis recommendations of the ACIP²). State-regulated wildlife rehabilitators may play a role in a comprehensive rabies-control program. Minimum standards for persons who rehabilitate wild mammals should include rabies vaccination, appropriate training, and continuing education. Translocation of infected wildlife has contributed to the spread of rabies^{22,23}; therefore, the translocation of known terrestrial rabies reservoir species should be prohibited.

1) **TERRESTRIAL MAMMALS:** The use of licensed oral vaccines for the mass vaccination of free-ranging wildlife should be considered in selected situations, with the approval of the state agency responsible for animal rabies control.⁵ The distribution of oral rabies vaccine should be based on scientific assessments of the target species and followed by timely and appropriate analysis of surveillance data; such results should be provided to all stakeholders. In addition, parenteral vaccination (trap-vaccinate-release) of wildlife rabies reservoirs may be integrated into coordinated oral rabies vaccination programs to enhance their effectiveness. Continuous and persistent programs for trapping or poisoning wildlife are not effective in reducing wildlife rabies reservoirs on a statewide basis. However, limited population control in high-contact areas (eg, picnic grounds, camps, and suburban areas) may be

indicated for the removal of selected high-risk species of wildlife.⁵ State agriculture, public health, and wildlife agencies should be consulted for planning, coordination, and evaluation of vaccination or population-reduction programs.

- 2) **BATS:** Indigenous rabid bats have been reported from every state except Hawaii and have caused rabies in at least 40 humans in the United States.²⁴⁻²⁸ Bats should be excluded from houses, public buildings, and adjacent structures to prevent direct association with humans.^{29,30} Such structures should then be made bat-proof by sealing entrances used by bats. Controlling rabies in bats through programs designed to reduce bat populations is neither feasible nor desirable.

Part II: Recommendations for Parenteral Rabies Vaccination Procedures

- A) **VACCINE ADMINISTRATION:** All animal rabies vaccines should be restricted to use by, or under the direct supervision of, a veterinarian,³¹ except as recommended in Part I.B.1. All vaccines must be administered in accordance with the specifications of the product label or package insert.
- B) **VACCINE SELECTION:** Part III lists all vaccines licensed by the USDA and marketed in the United States at the time of publication. New vaccine approvals or changes in label specifications made subsequent to publication should be considered as part of this list. Any of the listed vaccines can be used for revaccination, even if the product is not the same brand previously administered. Vaccines used in state and local rabies-control programs should have a 3-year duration of immunity. This constitutes the most effective method of increasing the proportion of immunized dogs and cats in any population.³² There are no laboratory or epidemiologic data to support the annual or biennial administration of 3-year vaccines following the initial series.
- C) **ADVERSE EVENTS:** Currently, no epidemiologic association exists between a particular licensed vaccine product and adverse events, including vaccine failure.^{33,34} Adverse events should be reported to the vaccine manufacturer and the USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics.
- D) **WILDLIFE AND HYBRID ANIMAL VACCINATION:** The safety and efficacy of parenteral rabies vaccination of wildlife and hybrids (ie, the offspring of wild animals crossbred to domestic animals) have not been established, and no rabies vaccines are licensed for these animals. Parenteral vaccination (trap-vaccinate-release) of wildlife rabies reservoirs may be integrated into coordinated oral rabies vaccination programs as described in Part I.C.1. to enhance their effectiveness. Zoos or research institutions may establish vaccination programs, which attempt to protect valuable animals, but these should not replace appropriate public health activities that protect humans.⁹
- E) **ACCIDENTAL HUMAN EXPOSURE TO VACCINE:** Human exposure to parenteral animal rabies vaccines listed in Part III does not constitute a risk for rabies infection. However, human exposure to vaccinia-vectored oral rabies vaccines should be reported to state health officials.³⁵
- F) **RABIES CERTIFICATE:** All agencies and veterinarians should use the NASPHV Form #51, "Rabies Vaccination Certificate," which can be obtained from vaccine manufacturers or the NASPHV Web site (www.nasphv.org). The form must be completed in full and signed by the administering or supervising veterinarian. Computer-generated forms containing the same information are acceptable.

Product name	Produced by	Marketed by	For use in	Dosage	Age at primary vaccination ^a	Booster recommended	Route of inoculation
A) MONOVALENT (Inactivated)							
DEFENSOR 1	Pfizer, Incorporated License No. 189	Pfizer, Incorporated	Dogs Cats	1 mL 1 mL	3 months ^b 3 months	Annually Annually	IM ^c or SC ^d SC
DEFENSOR 3	Pfizer, Incorporated License No. 189	Pfizer, Incorporated	Dogs Cats Sheep Cattle	1 mL 1 mL 2 mL 2 mL	3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually Annually	IM or SC SC IM IM
RABDOMUN	Pfizer, Incorporated License No. 189	Schering-Plough	Dogs Cats Sheep Cattle	1 mL 1 mL 2 mL 2 mL	3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually Annually	IM or SC SC IM IM
RABDOMUN 1	Pfizer, Incorporated License No. 189	Schering-Plough	Dogs Cats	1 mL 1 mL	3 months 3 months	Annually Annually	IM or SC SC
RABVAC 1	Fort Dodge Animal Health License No. 112	Fort Dodge Animal Health	Dogs Cats	1 mL 1 mL	3 months 3 months	Annually Annually	IM or SC IM or SC
RABVAC 3	Fort Dodge Animal Health License No. 112	Fort Dodge Animal Health	Dogs Cats Horses	1 mL 1 mL 2 mL	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC IM
RABVAC 3 TF	Fort Dodge Animal Health License No. 112	Fort Dodge Animal Health	Dogs Cats Horses	1 mL 1 mL 2 mL	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC IM
PRORAB-1	Intervet, Incorporated License No. 286	Intervet, Incorporated	Dogs Cats Sheep	1 mL 1 mL 2 mL	3 months 3 months 3 months	Annually Annually Annually	IM or SC IM or SC IM
PRORAB-3F	Intervet, Incorporated License No. 286	Intervet, Incorporated	Cats	1 mL	3 months	1 year later & triennially	IM or SC
IMRAB 3	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats Sheep Cattle Horses Ferrets	1 mL 1 mL 2 mL 2 mL 2 mL 1 mL	3 months 3 months 3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially 1 year later & triennially Annually Annually Annually	IM or SC IM or SC IM or SC IM or SC IM or SC SC
IMRAB 3 TF	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats Ferrets	1 mL 1 mL 1 mL	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC SC
IMRAB Large Animal	Merial, Incorporated License No. 298	Merial, Incorporated	Cattle Horses Sheep	2 mL 2 mL 2 mL	3 months 3 months 3 months	Annually Annually 1 year later & triennially	IM or SC IM or SC IM or SC
IMRAB 1	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats	1 mL 1 mL	3 months 3 months	Annually Annually	SC SC
B) MONOVALENT (Rabies glycoprotein, live canary pox vector)							
PUREVAX Feline Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1 mL	8 weeks	Annually	SC
C) COMBINATION (Inactivated rabies)							
Equine POTOMAVAC	Merial, Incorporated License No. 298	Merial, Incorporated	Horses	1 mL	3 months	+ IMRAB Annually	IM
MYSTIQUE II	Intervet, Incorporated License No. 286	Intervet, Incorporated	Horses	1 mL	3 months	Annually	IM
D) COMBINATION (Rabies glycoprotein, live canary pox vector)							
PUREVAX Feline 3/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1 mL	8 weeks	Annually	SC
PUREVAX Feline 4/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1 mL	8 weeks	Annually	SC
E) ORAL (Rabies glycoprotein, live vaccinia vector)—RESTRICTED TO USE IN STATE AND FEDERAL RABIES-CONTROL PROGRAMS							
RABORAL V-RG	Merial, Incorporated License No. 298	Merial, Incorporated	Raccoons Coyotes	N/A	N/A	As determined by local authorities	Oral

^aMinimum age (or older) and revaccinated 1 year later. ^bOne month = 28 days. ^cIntramuscularly. ^dSubcutaneously.

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