

Board of Veterinary Medicine

Rabies Vaccination Committee Report

Submitted February 8, 2012



Minnesota Board of Veterinary Medicine

2829 University Avenue Southeast, Suite 540

Minneapolis, Minnesota 55414

<http://www.vetmed.state.mn.us>

Email: vet.med@state.mn.us

Phone: (651)201-2844

Fax: (651)201-2842

Committee Members

Barbara Fischley, DVM, Committee Chair

Sharon Todoroff

Committee Support

John King, Executive Director

Donna Carolus, Office Manager

Karen Andrews, Assistant Attorney General

Table of Contents

Introduction

I.	Background, History and Purpose of Committee	3
II.	Data Collection	4
III.	Conclusions By Committee Based on Data Collected	4
IV.	Committee Recommendations to the Board of Veterinary Medicine	5
V.	Appendix – Information, Data and Documents	6

Introduction

Rabies vaccination of domesticated animals by Minnesota licensed veterinarians is an important and effective practice to assist in providing public health and safety. Domesticated animals, especially companion animals, are the most likely conduit or vector for the transmission of the rabies virus from the wildlife rabies reservoir to humans. Rabies vaccination by licensed Minnesota veterinarians is the critical lynchpin in public health and safety.

Background, History and Purpose of Committee

At the September 27, 2011 meeting of the Minnesota Board of Veterinary Medicine (“Board”), Minnesota citizens expressed their concern regarding the alleged inappropriate rabies vaccination practices of some licensed veterinarians. The concerned citizens indicated that some veterinarians were using a USDA-licensed rabies vaccine with three-year duration of immunity, but were informing dog owners that the duration of immunity was for less than three years. The concerned citizens also alleged that some veterinarians were issuing rabies vaccination certificates showing a revaccination date of two years from the administered rabies vaccination, even where the vaccine actually had a longer duration of immunity. The concerned citizens asserted that veterinarians were practicing in a fraudulent and deceptive manner motivated by personal financial gain, and that excessive rabies vaccinations placed dogs at a risk of harm.

At that September 27, 2011 meeting, the Board passed a motion to create an ad hoc committee to gather information and report back at a future board meeting. Following the meeting, Board members Barbara Fischley, DVM, and Sharon Todoroff volunteered to serve on the Rabies Vaccination Committee (“RVC”) with the purpose of determining the extent to which these rabies vaccination practices were occurring, veterinarian rationale for their practices, and what action, if any, the Board should take to address the identified problem.

The RVC held an organizational meeting open to the public on November 9, 2011. A second public RVC meeting was held on December 14, 2011, in order to review information that had been gathered, make preliminary conclusions, and determine what additional information was needed, if any. A third and final public RVC meeting was held on January 25, 2012 to determine what recommendations would be made to the full Board.

Data Collection

Information was obtained from the U.S. Department of Agriculture (“USDA”), rabies vaccine manufacturers and technical representatives, the National Association of State Public Health Veterinarians (“NASPHV”), the U.S. Department of Health and Human Services Centers for Disease Control and Prevention (“CDC”), the American Veterinary Medical Association (“AVMA”), the Minnesota Board of Animal Health, the Minnesota Department of Health (“MDH”), prominent veterinarians and scientists recognized for animal vaccine research, citizens of Minnesota, and an electronic survey distributed to Minnesota licensed veterinarians with a Minnesota address. Documents obtained, survey questions and results, and correspondence are included in the appendices of this report.

Conclusions

Based on the thorough review of the information and data obtained, the RVC reached the following conclusions:

1. Of the Minnesota licensed veterinarians who responded to the survey, 89% use a USDA licensed rabies vaccine with a three-year duration of immunity for dogs and cats.
2. Of these veterinarians, 39% are administering rabies vaccine more often than every three years.
3. The majority of veterinarians inform the client of the labeled duration of immunity for the rabies vaccine administered.
4. Most veterinarians base their decision to vaccinate more often than the labeled duration of immunity upon: (a) the veterinarian’s belief that more frequent rabies vaccination was required by the local/regional ordinances addressing companion animal licensing and rabies vaccination; (b) the likelihood of rabies exposure; and/or (c) the desire to prevent the rabies vaccination from becoming overdue.
5. Veterinarians who utilize a vaccine with a three-year labeled duration of immunity but nevertheless choose to vaccinate more often do not always indicate on the rabies vaccination certificate that the labeled duration of immunity is three years.
6. There is little evidence that the practice of administration of rabies vaccine more often than every three years is motivated by financial gain or a desire to deceive the owner.
7. The documents reviewed do not show that administration of rabies vaccine more often than the labeled duration of immunity creates a significant risk of harm.
8. The most appropriate way to address these rabies vaccination practices is through education of all Minnesota licensed veterinarians.

Committee Recommendations

1. The Board should pursue opportunities to educate Minnesota licensed veterinarians on the recommendations and protocols for rabies vaccination of companion animals. Rabies vaccination recommendations and protocols should be scientifically-based from unbiased sources. The Committee has identified the NASPHV *Compendium of Animal Rabies Prevention and Control* as an appropriate reference document.
2. If a veterinarian chooses to exercise his/her professional medical judgment to adopt other rabies vaccination protocols or schedules, the decision should be based on credible, scientifically-based information. This information and documentation should be in the possession of the veterinarian and available for review if requested.
3. If a veterinarian adopts other rabies vaccination protocols or schedules, the veterinarian should disclose to the animal owner that this is his/her medical recommendation and it is not based on the rabies vaccine labeled duration of immunity. The veterinarian should document the informed consent in the animal's medical record.
4. The rabies vaccination certificate should always comply with Minnesota Rule 1705.1146, including displaying the date of vaccination and the rabies vaccine labeled duration of immunity, even if the veterinarian recommends more frequent rabies vaccination.
5. Veterinarians should not adopt rabies vaccination recommendations and protocols based on actual or perceived client compliance with the rabies vaccination schedule. It is the animal owner's responsibility to ensure that the animal's rabies vaccination status is current.
6. Veterinarians should not adopt rabies vaccination recommendations and protocols based solely upon local/regional ordinances which prescribe rabies vaccination frequency. It is the animal owner's responsibility to meet the requirements of local/regional animal licensing ordinances.

Appendix - Information, Data and Documents

- A1) National Association of State Public Health Veterinarians, Inc. (NASPHV): Compendium of Animal Rabies Prevention and Control, 2011
- A2) NASPHV: 5/31/11 Memorandum regarding notable changes and updates
- A3) John King, DVM: 12/1/11 Memorandum to Rabies Vaccination Committee re Rabies Vaccination Efficacy
- A4) Pfizer Animal Health: August, 1998 Technical Bulletin – “Evaluation of Defensor®3 Rabies Vaccine Against Street Rabies Strains”
- A5) Boehringer Ingelheim Rabvac® Technical Document
- A6) R. D. Schultz, Professor and Chair, Department of Pathobiological Sciences, School of Veterinary Medicine, University of Wisconsin: 12/8/11 Letter to Dr. King
- A7) W. Jean Dodds, DVM – “Adverse Vaccine Reactions in Pet Animals” (submitted by R. D. Schultz)
- A8) “Proinflammatory Vaccines and Vaccine Adjuvants” (submitted by R. D. Schultz)
- A9) Email to Dr. John King titled “Municipality ordinances” forwarded by Stacey Schwabenlander, DVM, MPH, Minnesota Board of Animal Health
- A10) Minnesota Board of Veterinary Medicine: Rabies Vaccination Committee survey questions sent to Minnesota licensed veterinarians
- A11) Minnesota Board of Veterinary Medicine: Rabies Vaccination Committee survey results
- A12) Minnesota Board of Veterinary Medicine: Rabies Vaccination Committee Survey Report 12/14/11
- A13) Chris Addington and Jane E. Anderson: 5/15/11 letter to Minnesota Board of Veterinary Medicine
- A14) Chris Addington and Jane E. Anderson: 9/1/11 letter to Minnesota Board of Veterinary Medicine
- A15) Chris Addington and Jane E. Anderson: 9/30/11 letter to Minnesota Board of Veterinary Medicine
- A16) Chris Addington and Jane E. Anderson: 12/1/11 letter to Minnesota Board of Veterinary Medicine
- A17) Chris Addington and Jane E. Anderson: 1/2/11 letter to Minnesota Board of Veterinary Medicine
- A18) Robert Washabau, DVM: Email to Dr. John King and *Journal of Veterinary Internal Medicine* article “Idiopathic Immune-Mediated Thrombocytopenia and Recent Vaccination in Dogs”

Compendium of Animal Rabies Prevention and Control, 2011

National Association of State Public Health Veterinarians, Inc.



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CONTENTS

Introduction.....	1
Methods.....	1
Part I. Rabies Prevention and Control.....	2
Part II. Recommendations for Parenteral Rabies Vaccination	
Procedures.....	9
Part III: Rabies Vaccines Licensed and Marketed in the United States and Rabies Vaccine Manufacturer Contact Information.....	10
References.....	12

Front cover photo: Raccoons are a primary reservoir of rabies virus in the United States.

The *MMWR* series of publications is published by the Office of Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

Suggested Citation: Centers for Disease Control and Prevention. [Title]. *MMWR* 2011;60(No. RR-#):[inclusive page numbers].

Centers for Disease Control and Prevention

Thomas R. Frieden, MD, MPH, *Director*
 Harold W. Jaffe, MD, MA, *Associate Director for Science*
 James W. Stephens, PhD, *Director, Office of Science Quality*
 Stephen B. Thacker, MD, MSc, *Deputy Director for Surveillance, Epidemiology, and Laboratory Services*
 Stephanie Zaza, MD, MPH, *Director, Epidemiology and Analysis Program Office*

MMWR Editorial and Production Staff

Ronald L. Moolenaar, MD, MPH, <i>Editor, MMWR Series</i>	Martha F. Boyd, <i>Lead Visual Information Specialist</i>
Christine G. Casey, MD, <i>Deputy Editor, MMWR Series</i>	Maureen A. Leahy, Julia C. Martinroe, Stephen R. Spriggs, Terraye M. Starr <i>Visual Information Specialists</i>
Teresa F. Rutledge, <i>Managing Editor, MMWR Series</i>	Quang M. Doan, MBA, Phyllis H. King <i>Information Technology Specialists</i>
David C. Johnson, <i>Lead Technical Writer-Editor</i>	
Catherine B. Lansdowne, MS, <i>Project Editor</i>	

MMWR Editorial Board

William L. Roper, MD, MPH, Chapel Hill, NC, <i>Chairman</i>	Patricia Quinlisk, MD, MPH, Des Moines, IA
Virginia A. Caine, MD, Indianapolis, IN	Patrick L. Remington, MD, MPH, Madison, WI
Jonathan E. Fielding, MD, MPH, MBA, Los Angeles, CA	Barbara K. Rimer, DrPH, Chapel Hill, NC
David W. Fleming, MD, Seattle, WA	John V. Rullan, MD, MPH, San Juan, PR
William E. Halperin, MD, DrPH, MPH, Newark, NJ	William Schaffner, MD, Nashville, TN
King K. Holmes, MD, PhD, Seattle, WA	Anne Schuchat, MD, Atlanta, GA
Deborah Holtzman, PhD, Atlanta, GA	Dixie E. Snider, MD, MPH, Atlanta, GA
John K. Iglehart, Bethesda, MD	John W. Ward, MD, Atlanta, GA
Dennis G. Maki, MD, Madison, WI	

Compendium of Animal Rabies Prevention and Control, 2011

National Association of State Public Health Veterinarians, Inc. (NASPHV)

Summary

Rabies has one of the highest case-fatality ratios of any infectious disease. This report provides recommendations for public health officials, veterinarians, animal control officials, and other parties engaged in rabies prevention and control activities and should serve as the basis for standardizing procedures among jurisdictions. The recommendations regarding domestic animal vaccination, management of animals exposed to rabies, and management of animals that bite humans are the core elements of animal rabies control and human rabies prevention. These updated 2011 guidelines include the national case definition for animal rabies and clarify the role of the CDC rabies laboratory in providing confirmatory testing of suspect animals. The table of rabies vaccines licensed and marketed in the United States has been updated, and additional references have been included to provide scientific support for information in this report.

Introduction

Rabies is a fatal viral zoonosis and a serious public health problem (1). All mammals (referred to as animals in this report) are believed to be susceptible to the disease. Rabies is an acute, progressive encephalitis caused by a lyssavirus. Worldwide, rabies virus is the most important lyssavirus. In the United States, multiple rabies virus variants are maintained in wild mammalian reservoir populations such as raccoons, skunks, foxes, and bats. Although the United States has been declared free of canine rabies virus variant transmission, reintroduction of this variant is always a risk (2–6).

Rabies virus usually is transmitted from animal to animal through bites. The incubation period is highly variable. In domestic animals, the incubation period is generally 3–12 weeks but can range from several days to months, rarely exceeding 6 months (7). Rabies is communicable during the period of salivary shedding of rabies virus. Experimental and historic evidence indicates that dogs, cats, and ferrets shed virus a few days before clinical onset and during illness. Clinical signs of rabies and include inappetence, dysphagia, cranial nerve deficits, abnormal behavior, ataxia, paralysis, altered vocalization, and seizures. Progression to death is rapid. There are currently no known effective rabies antiviral drugs.

The recommendations in this compendium serve as a 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.* The most current version replaces all previous versions. These recommendations do not supersede state and local laws or requirements. Principles of rabies prevention and control are detailed in Part I; recommendations for parenteral vaccination procedures are presented in Part II; and all animal rabies vaccines licensed by the U.S. Department of Agriculture and marketed in the United States are listed and described in Part III.

Methods

NASPHV periodically updates the recommendations to prevent and control animal rabies. The revision includes reviewing recent literature, updating licensed vaccine product information as provided by the manufacturers, and soliciting input from NASPHV members and stakeholder groups. During July 15–16, 2010, NASPHV members and external expert consultants met in Atlanta, Georgia. A committee consensus was required to add or modify existing language or recommendations. After the meeting, the updated draft was circulated via e-mail for final review by all voting committee members.

The 2011 guidelines include several updates. First, the national case definition for animal rabies was added to clarify how rabies cases are defined for public health surveillance purposes. Second, the diagnostics section was expanded to 1) clarify that the CDC rabies laboratory is available for confirmatory testing and on an emergency basis to expedite exposure management decisions, 2) include information on

Corresponding preparer: Catherine M. Brown, DVM, Massachusetts Department of Public Health, Hinton State Laboratory Institute, 305 South St., Jamaica Plain, MA 02130. Telephone: 617-983-6800; Fax: 617-983-6840; E-mail: Catherine.Brown@state.ma.us.

*This compendium has been endorsed by the American Public Health Association, the American Veterinary Medical Association, the Association of Public Health Laboratories, CDC, the Council of State and Territorial Epidemiologists, and the National Animal Control Association.

testing methodology appropriate for field testing of surveillance specimens, and 3) clarify that no reliable antemortem rabies tests are available for use in animals. Third, the research section was expanded to include additional topics that warrant further study. Finally, the table of rabies vaccines licensed and marketed in the United States was updated, and additional references were included to provide scientific support for information provided in the recommendations.

Part I. Rabies Prevention and Control

A. Principles of Rabies Prevention and Control

1. **Case Definition.** An animal is determined to be rabid after diagnosis by a qualified laboratory as specified in Part I.A.9. The national case definition for animal rabies requires laboratory confirmation by either
 - a positive direct fluorescent antibody (DFA) test (preferably performed on central nervous system tissue); or
 - isolation of rabies virus (in cell culture or in a laboratory animal) (8).
2. **Rabies Virus Exposure.** Rabies virus is transmitted when the virus is introduced into bite wounds, into open cuts in skin, or onto mucous membranes from saliva or other potentially infectious material such as neural tissue (9). Questions regarding possible exposures should be directed promptly to state or local public health authorities.
3. **Public Health Education.** Essential components of rabies prevention and control include ongoing public education, responsible pet ownership, routine veterinary care and vaccination, and professional continuing education. The majority of animal and human exposures to rabies virus can be prevented by raising awareness concerning rabies virus transmission routes, avoiding contact with wildlife, and following appropriate veterinary care. Prompt recognition of possible exposure and prompt reporting to medical professionals and local public health authorities is critical.
4. **Human Rabies Prevention.** Rabies in humans can be prevented either by eliminating exposures to rabid animals or by providing persons who have been exposed with prompt local treatment

of wounds combined with the appropriate administration of human rabies immune globulin and vaccine. Exposure assessment should occur before rabies postexposure prophylaxis (PEP) is initiated and should include discussions between medical providers and public health officials. The rationale for recommending preexposure prophylaxis and details of both preexposure and postexposure prophylaxis administration are available in the current recommendations of the Advisory Committee on Immunization Practices (ACIP) (9,10). These recommendations, in addition to information concerning the current local and regional epidemiology of animal rabies and the availability of human rabies biologics, are available from state health departments.

5. **Domestic Animal Vaccination.** Multiple vaccines are licensed for use in domestic animal species. Vaccines available include inactivated or modified live-virus vectored products, products for intramuscular and subcutaneous administration, products with durations of immunity from 1 to 4 years, and products with varying minimum age of vaccination. The recommended vaccination procedures and the licensed animal vaccines are specified in Parts II and III of this compendium, respectively. Local governments should initiate and maintain effective programs to ensure vaccination of all dogs, cats, and ferrets and to remove stray and unwanted animals. Such procedures in the United States have reduced laboratory-confirmed cases of rabies in dogs from 6,949 in 1947 to 93 in 2009 and are responsible for the elimination of the canine rabies virus variant (2). Because more rabies cases involving cats are reported annually (274 in 2009) than dogs, vaccination of cats should be required (2). Animal shelters and animal control authorities should establish policies to ensure that adopted animals are vaccinated against rabies.
6. **Rabies in Vaccinated Animals.** Rabies is rare in vaccinated animals (11–13). If suspected, the case should be reported to public health officials, the vaccine manufacturer, and the USDA Animal and Plant Health Inspection Service, Center for Veterinary Biologics (website: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). The laboratory diagnosis should be confirmed and the virus variant characterized by the CDC rabies reference laboratory.

A thorough epidemiologic investigation should be conducted, including documentation of the animal's vaccination history and a description of potential rabies exposures.

7. **Rabies in Wildlife.** Controlling rabies in wildlife reservoirs is difficult (14). Vaccination of free-ranging wildlife or selective population reduction is useful in some situations (15); however, the success of these procedures depends on the circumstances surrounding each rabies outbreak (see Part I, C.). Because of the risk for rabies in wild animals (especially raccoons, skunks, coyotes, foxes, and bats), the American Veterinary Medical Association, the American Public Health Association, the Council of State and Territorial Epidemiologists, the National Animal Control Association, and the National Association of State Public Health Veterinarians (NASPHV) strongly recommend the enactment and enforcement of state laws prohibiting the importation, distribution, translocation, and private ownership of these animals.
8. **Rabies Surveillance.** Enhanced laboratory-based rabies surveillance and variant typing are essential components of rabies prevention and control programs. Accurate and timely information and reporting is necessary to guide human PEP decisions, determine the management of potentially exposed animals, aid in discovery of emerging pathogens, describe the epidemiology of the disease, and assess the need for and effectiveness of vaccination programs for domestic animals and wildlife. Every animal submitted for rabies testing should be reported to CDC to evaluate surveillance trends. Electronic laboratory reporting and notification of animal rabies surveillance data should be implemented (16). Optimal information on animals submitted for rabies testing should include species, point location, vaccination history, rabies virus variant (if rabid), and human or domestic animal exposures. A case of rabies in an animal with a history of importation into the United States within 60 days is immediately notifiable by state health departments to CDC; reporting of indigenous cases should follow standard notification protocols (17). Integration with standard public health reporting and notification systems should facilitate the transmission of the data discussed in this paragraph.

9. Rabies Diagnosis

- a) **DFA.** The DFA test is the gold standard for rabies diagnosis. The test should be performed in accordance with the established national standardized protocol (available at <http://www.cdc.gov/rabies/pdf/RabiesDFASPv2.pdf>) by a qualified laboratory that has been designated by the local or state health department (18,19). Animals submitted for rabies testing should be euthanized (20,21) in a way that maintains the integrity of the brain and allows the laboratory to recognize the anatomical parts. Except for very small animals, such as bats, only the head or brain (including the brain stem) should be submitted to the laboratory. To facilitate prompt laboratory testing, submitted specimens should be stored and shipped under refrigeration (rather than frozen) without delay. Thawing frozen specimens will delay testing. Chemical fixation of tissues should be avoided because it can cause substantial testing delays and might preclude reliable testing. Questions about testing fixed tissues should be directed to the local rabies laboratory or public health department.
- b) **Emergency Rabies Testing.** Emergency rabies testing should be available to expedite exposure management decisions (18). When state health departments need confirmatory testing (e.g., for inconclusive results, unusual species, or mass exposures), the CDC rabies laboratory can provide results within 24 hours of submission (22).
- c) **Direct Rapid Immunohistochemical Test (DRIT).** DRITs are being used by trained field personnel in surveillance programs for specimens not involved in human or domestic animal exposures (23–26). All positive DRIT results need to be confirmed by DFA testing at a qualified laboratory.
- d) **Unlicensed Test Kits.** No USDA-licensed rapid test kits are commercially available for rabies diagnosis. Unlicensed tests should not be used for several reasons: the sensitivity and specificity are not known; the tests have not been validated against current standard methods; the excretion of virus in the saliva is intermittent and the amount varies over time; any test result would need to be

confirmed by more reliable methods such as DFA testing on brain tissue; and the interpretation of results might place exposed animals and persons at risk.

10. Rabies Serology. Certain jurisdictions require evidence of vaccination and rabies virus antibodies for animal importation. Rabies virus antibody titers are indicative of a response to vaccine or infection. Titers do not directly correlate with protection because other immunologic factors also play a role in preventing rabies, and the ability to measure and interpret those other factors is not well-developed. Therefore, evidence of circulating rabies virus antibodies in animals should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations (27–30).

11. Rabies Research. Information derived from well-designed studies is essential for the development of science-based recommendations. Data are needed in several areas, including viral shedding periods for domestic livestock and lagomorphs, potential shedding of virus in milk, earliest age at which rabies vaccination is effective and the protective effects of maternal antibodies, duration of immunity, PEP protocols for domestic animals, models for treatment of clinical rabies, extra label vaccine use in domestic animals and wildlife rabies reservoirs, host-pathogen adaptations and dynamics, and the ecology of wildlife rabies reservoir species, especially in relation to the use of oral rabies vaccines.

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 licensed veterinarian on the premises. Rabies vaccinations may also be administered under the supervision of a licensed veterinarian to animals being held in animal control shelters before release. The veterinarian who signs the rabies vaccination certificate must ensure that the person administering vaccine is identified on the certificate and is appropriately trained in vaccine storage, handling, administration, and in the management of adverse events. This practice ensures that a qualified and responsible person is held accountable for properly

vaccinating the animal. Within 28 days after initial vaccination, a peak rabies virus antibody titer is reached, and the animal can be considered immunized (29,31–33). 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 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). No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines after the initial series. Because a rapid anamnestic response is expected, an animal is considered currently vaccinated immediately after a booster vaccination (34).

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, the animal should be revaccinated. Immediately after the booster, the animal is considered currently vaccinated and should be placed on a booster schedule, depending on the labeled duration of the vaccine used.

b) Livestock. All horses should be vaccinated against rabies (35). Livestock, including species for which licensed vaccines are not available, that have frequent contact with humans (e.g., in petting zoos, fairs, and other public exhibitions) should be vaccinated against rabies (36,37). Consideration also should be given to vaccinating particularly valuable livestock.

c) Captive Wild Animals and Hybrids

(1) Wild animals or hybrids (the offspring of wild animals crossbred to domestic animals) should not be kept as pets (38–40). No parenteral rabies vaccines are licensed for use in wild animals or hybrids (41).

(2) Animals that live in exhibits and in zoological parks and 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. Employees who work with animals at such facilities should receive preexposure rabies vaccine. The use of preexposure or postexposure rabies vaccinations for handlers who work with animals at such facilities might reduce the need for euthanasia of captive animals that expose handlers. Carnivores and bats should be housed in a manner that precludes direct contact with the public (36,37).

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 are required to have identification and are confined or kept on leash. Stray animals should be impounded for at least 3 business days to determine whether human exposure has occurred and to give owners sufficient time to reclaim animals.

3. Importation and Interstate Movement of Animals

- a) **International.** CDC regulates the importation of dogs and cats into the United States (5). Importers of dogs must comply with rabies vaccination requirements (42 CFR, Part 71.51[c] (<http://www.cdc.gov/animalimportation/dogs.html>)) and complete CDC form 75.37 (<http://www.cdc.gov/animalimportation/pdf/dog-import.pdf>). These regulations require dogs imported from rabies-endemic countries to be vaccinated for rabies and confined for varying periods depending on age and prior vaccination status. The appropriate health official of the state of destination should be notified within 72 hours of the arrival of any imported dog required to be placed in confinement under these regulations. Failure of the owner to comply with these confinement requirements should be reported promptly to the CDC Division of Global Migration and Quarantine (telephone: 404-639-4528 or 404-639-4537). For emergencies or after-hours calls, contact the CDC Emergency Operations Center (telephone: 770-488-7100).

Federal regulations alone will not prevent the introduction of rabid animals into the United States (3,4,42,43). 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 of an owner to comply with state or local requirements should be referred to the appropriate state or local official.

- b) **Areas with Dog-to-Dog Rabies Transmission.** Canine rabies virus variants have been eliminated in the United States (2,6). Rabid dogs have been introduced into the continental United States from areas with dog-to-dog rabies transmission (3,4,42,43). The movement of dogs for the purposes of adoption or sale from areas with dog-to-dog rabies transmission increases the risk for introducing canine-transmitted rabies to areas where the disease does not exist and should be prohibited.

- c) **Interstate.** Before interstate (including commonwealths and territories) movement, dogs, cats, ferrets, and horses should be currently vaccinated against rabies in accordance with the recommendations in this compendium (see Part I.B.1.). Animals in transit should be accompanied by a currently valid NASPHV Form 51 (Rabies Vaccination Certificate) (<http://www.nasphv.org/Documents/RabiesVacCert.pdf>). When an interstate health certificate or certificate of veterinary inspection is required, the inspection should contain the same rabies vaccination information as Form 51.

4. **Adjunct Procedures.** Methods or procedures that enhance rabies control include the following (<http://www.rabiesblueprint.com/spip.php?article119>):

- a) **Identification.** Dogs, cats, and ferrets should be identified (e.g., metal or plastic tags or microchips) to allow for verification of rabies vaccination status.
- b) **Licensure.** Registration or licensure of all dogs, cats, and ferrets is an integral component of an effective rabies control program. A fee frequently is charged for such licensure, and revenues collected are used to maintain rabies or animal

control activities. Evidence of current vaccination should be 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 local jurisdictions should incorporate stray animal control, leash laws, animal-bite prevention, and training of personnel in their programs.
- f) **Public Education.** All local jurisdictions should incorporate education covering responsible pet ownership, bite prevention, and appropriate veterinary care in their programs.

5. Postexposure Management. This section refers to any animal exposed (see Part I.A.2.) to a confirmed or suspected rabid animal. Wild mammalian carnivores or bats that are not available or suitable for testing should be considered rabid.

- a) **Dogs, Cats, and Ferrets.** Any illness in an animal that has been exposed to rabies should be reported immediately to the local health department. If signs suggestive of rabies develop (e.g., paralysis or seizures), the animal should be euthanized and the head shipped for testing as described in Part I.A.9.

- (1) Dogs, cats, and ferrets that have never been vaccinated and are exposed to a rabid animal should be euthanized immediately. If the owner is unwilling to euthanize, the animal should be placed in strict isolation for 6 months. Isolation in this context refers to confinement in an enclosure that precludes direct contact with people and other animals. Rabies vaccine should be administered after entry into isolation or up to 28 days before release to comply with preexposure vaccination recommendations (see Part I.B.1.a.). No USDA-licensed biologics for postexposure prophylaxis of previously unvaccinated domestic animals exist, and evidence indicates

that the use of vaccine alone does not reliably prevent the disease in these animals (44).

- (2) Animals overdue for a booster vaccination should be evaluated on a case-by-case basis based on severity of exposure, time elapsed since last vaccination, number of previous vaccinations, current health status, and local rabies epidemiologic factors to determine need for euthanasia or immediate revaccination and observation with isolation.
 - (3) Dogs, cats, and ferrets that are currently vaccinated should be revaccinated immediately, kept under the owner's control, and observed for 45 days. The rationale for an observation period is based in part on the potential for overwhelming viral challenge, incomplete vaccine efficacy, improper vaccine administration, variable host immunocompetence, and immune-mediated fatality (i.e., early death phenomenon) (12,45–47).
- b) **Livestock.** All species of livestock are susceptible to rabies; cattle and horses are the most frequently reported infected species (2). Any illness in an animal exposed to rabies should be reported immediately to the local health and agriculture officials. If signs suggestive of rabies develop, the animal should be euthanized and the head shipped for testing as described in Part I.A.9.
 - (1) Unvaccinated livestock should be euthanized immediately. For animals that are not euthanized, on a case-by-case basis, they should be observed and confined for 6 months.
 - (2) Livestock exposed to a rabid animal and currently vaccinated with a vaccine approved by USDA for that species should be revaccinated immediately and observed for 45 days.
 - (3) Multiple rabid animals in a herd or herbivore-to-herbivore transmission are uncommon (48); therefore, restricting the rest of the herd if a single animal has been exposed to or infected by rabies is usually not necessary.

(4) Handling and consumption of tissues from animals exposed to rabies might carry a risk for rabies virus transmission. Risk factors depend in part on the sites of exposure, the amount of virus present, the severity of the wounds, and whether sufficient contaminated tissue has been excised. If an exposed animal is to be custom- or home-slaughtered for consumption, the slaughter should occur immediately after the exposure, and all tissues should be cooked thoroughly. Persons handling animals, carcasses, and tissues that have been exposed should use barrier precautions (49,50). Historically, federal guidelines for meat inspectors required that any animal known to have been exposed to rabies within 8 months be rejected for slaughter (51). The USDA Food and Inspection Service (FSIS) and state meat inspectors should be notified when such exposures occur in food animals before slaughter.

Rabies virus is widely distributed in tissues of rabid animals (52–54). Tissues and products from a rabid animal should not be used for human or animal consumption (55,56) or transplantation (57). Pasteurization and cooking inactivate rabies virus (58); therefore, inadvertently drinking pasteurized milk or eating thoroughly cooked animal products does not constitute a rabies exposure.

- c) **Other Animals.** Other mammals exposed to a rabid animal should be euthanized immediately. Animals maintained in USDA-licensed research facilities or accredited zoological parks should be evaluated on a case-by-case basis in consultation with public health authorities. Options might include isolation, observation, or administration of rabies biologics (i.e., immune globulin or vaccine or both).

6. Management of Animals that Bite Humans

- a) **Dogs, Cats, and Ferrets.** Rabies virus is excreted in the saliva of infected dogs, cats, and ferrets during illness and/or for only a few days before illness or death (59–61). Regardless of rabies

vaccination status, a healthy dog, cat, or ferret that potentially exposes a person through a bite should be confined and observed daily for 10 days from the time of the exposure (62); administration of rabies vaccine to the animal is not recommended during the observation period to prevent confusion between signs of rabies and rare adverse reactions (13). Any illness in the animal should be reported immediately to the local health department. Animals should be evaluated by a veterinarian at the first sign of illness during confinement. If signs suggestive of rabies develop, the animal should be euthanized and the head submitted for testing as described in Part I.A.9. Any stray or unwanted dog, cat, or ferret that potentially exposes a person to rabies may be euthanized immediately and the head submitted for rabies examination.

- b) **Other Animals.** Other 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 exposure, the epidemiology of rabies in the area, and the animals' history, current health status, and the potential for exposure to rabies. The shedding period for rabies virus is undetermined for most species. Previous vaccination of these animals might not preclude the necessity for euthanasia and testing.

- 7. **Outbreak Prevention and Control.** The emergence of new rabies virus variants or the introduction of nonindigenous viruses poses a significant risk to humans, domestic animals, and wildlife (63–70). A rapid and comprehensive response includes the following measures (71):

- a) **Characterize Virus.** Characterize the virus at the national reference laboratory.
- b) **Identify and Control Source.** Identify and control the source of the virus introduction.
- c) **Enhance Surveillance.** Enhance laboratory-based surveillance in wild and domestic animals.
- d) **Increase Vaccination.** Increase animal rabies vaccination rates.

- e) **Restrict Animals.** Restrict the movement of animals. (e.g., returned to owner, died or euthanized, adopted, relocated to another shelter, and address of new location).
 - f) **Evaluate Need to Reduce Vector Population.** Evaluate the need for vector population reduction.
 - g) **Coordinate Response.** Coordinate a multiagency response.
 - h) **Provide Outreach.** Provide public and professional outreach and education.
8. **Disaster Response.** Animals might be displaced during and after man-made or natural disasters and need emergency sheltering (<http://www.bt.cdc.gov/disasters/petshelters.asp> and <http://www.avma.org/disaster/default.asp>) (72). Animal rabies vaccination and exposure histories often are not available for displaced animals. Disaster response creates situations in which animal caretakers might lack appropriate training and preexposure vaccination. In such situations, implementing and coordinating rabies prevention and control measures is critical to reduce the risk for rabies transmission and the need for human PEP. Such measures include the following:
- a) **Coordinate Relief.** Coordinate relief efforts of individuals and organizations with the local emergency operations center before deployment.
 - b) **Examine Animals.** Examine each animal at a triage site for possible bite injuries or signs of rabies.
 - c) **Isolate Animals.** Isolate animals exhibiting signs of rabies, pending evaluation by a veterinarian.
 - d) **Check Animal Identifiers.** Ensure that all animals have a unique identifier.
 - e) **Vaccinate.** Administer a rabies vaccination to all dogs, cats, and ferrets unless reliable proof of vaccination exists.
 - f) **Adopt Caretaker Standards.** Adopt minimum standards for animal caretakers as feasible, including personal protective equipment, preexposure rabies vaccination, and appropriate training in animal handling (73).
 - g) **Maintain Documentation.** Maintain documentation of animal disposition and location
- h) **Provide Facilities for Animals that Have Been Exposed.** Provide facilities to confine and observe animals involved in exposures (see Part I.B.6.).
 - i) **Report Human Exposures.** Report human exposures to rabies to appropriate public health authorities (see Part I.A.3.).
- C. **Prevention and Control Methods Related to Wildlife.** The public should be warned not to handle or feed wild animals. Wild animals and hybrids that expose persons, pets, or livestock to rabies should be considered for euthanasia and rabies diagnosis. A person exposed by any wild animal should immediately report the incident to a health-care provider who, in consultation with public health authorities, can evaluate the need for PEP (9,10).
- Translocation of infected wildlife has contributed to the spread of rabies (63–68,74); therefore, the translocation of known terrestrial rabies reservoir species should be prohibited. Whereas state-regulated wildlife rehabilitators and nuisance wildlife control operators might play a role in a comprehensive rabies control program, minimum standards for persons who handle wild animals should include rabies vaccination, appropriate training, and continuing education.
1. **Carnivores.** The use of oral rabies vaccines (ORV) for the mass vaccination of free-ranging wildlife should be considered in selected situations with the approval of the appropriate state agencies (14,75). Success has been documented using ORV to control rabies in wildlife in North America (75–78). The currently licensed vaccinia-vectored ORV is labeled for use in raccoons and coyotes. The distribution of ORV 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 ORV programs to enhance their effectiveness. Continuous and persistent programs for trapping or poisoning wildlife do not reduce wildlife rabies reservoirs statewide. However, limited population control in high-contact areas (e.g., picnic grounds, camps, and suburban areas) might be indicated for the

removal of selected species of wildlife at high risk for having rabies. State agriculture, public health, and wildlife agencies should be consulted for planning, coordination, and evaluation of vaccination or population reduction programs (14).

2. **Bats.** From the 1950s through 2011, indigenous rabid bats have been reported from every state except Hawaii and have caused rabies in at least 43 humans in the United States (79–92). Bats should be excluded appropriately from houses, public buildings, and adjacent structures to prevent direct association with humans (93,94). 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 (95), except as recommended in Part I.B.1.
- B. **Vaccine Selection.** Part III lists all vaccines licensed by USDA and marketed in the United States at the time of publication. New vaccine approvals or changes in label specifications made after publication of this report should be considered a part of this list. Any of the listed vaccines can be used for revaccination, even if the product is not the same as previously administered. Vaccines used in state and local rabies control programs should have at least a 3-year duration of immunity. This constitutes the most effective method of increasing the proportion of immunized dogs and cats in any population (96). No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines following the initial series.
- C. **Adverse Events.** No epidemiologic association exists between a particular licensed vaccine product and specific adverse events (13,97–99); although rare, adverse events including vomiting, swelling at the injection site, lethargy, hypersensitivity, and rabies in a previously vaccinated animal have been reported. Adverse events should be reported to the vaccine manufacturer and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). No contraindication to rabies vaccination exists. Animals with a previous history of anaphylaxis can be medically managed and observed after vaccination (46).
- D. **Wildlife and Hybrid Animal Vaccination.** The safety and efficacy of parenteral rabies vaccination of wildlife and hybrids have not been established, and no rabies vaccines are licensed for these animals. Zoos or research institutions may establish vaccination programs to attempt to protect valuable animals; however, these programs should not replace appropriate public health activities that protect humans (see Part I.B.1.c.2).
- E. **Accidental Human Exposure to Vaccine.** Human exposure to parenteral animal rabies vaccines listed in Part III does not constitute a risk for rabies virus infection. Human exposure to vaccinia-vectored ORVs should be reported to state health officials (100,101).
- F. **Rabies Certificate.** All agencies and veterinarians should use NASPHV Form 51 (revised 2007), Rabies Vaccination Certificate, or an equivalent. This form can be obtained from vaccine manufacturers, NASPHV (available at <http://www.nasphv.org/Documents/RabiesVacCert.pdf>), or CDC (available at http://www.cdc.gov/rabies/pdf/nasphv_form51.pdf). The form must be completed in full and signed by the administering or supervising veterinarian. Computer-generated forms containing the same information also are acceptable.

Part III: Rabies Vaccines Licensed and Marketed in the United States and Rabies Vaccine Manufacturer Contact Information

Adverse events after receipt of vaccine should be reported to the vaccine manufacturer (Tables 1 and 2) and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255).

TABLE 1. Rabies vaccines licensed and marketed in the United States, 2011

Product name	Produced by	Marketed by	For use in	Dose	Age at primary vaccination*	Booster recommended	Route of vaccination
Monovalent (inactivated)							
Rabvac 1	Boehringer Ingelheim Vetmedica, Inc. ^f License no. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs	1 mL	3 mos ^g	Annually	IM or SC
			Cats	1 mL	3 mos	Annually	IM or SC
Rabvac 3	Boehringer Ingelheim Vetmedica, Inc. License no. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs	1 mL	3 mos	1 yr later and triennially	IM or SC
			Cats	1 mL	3 mos	1 yr later and triennially	IM or SC
			Horses	2 mL	3 mos	Annually	IM
Rabvac 3TF	Boehringer Ingelheim Vetmedica, Inc. License no. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs	1 mL	3 mos	1 yr later and triennially	IM or SC
			Cats	1 mL	3 mos	1 yr later and triennially	IM or SC
			Horses	2 mL	3 mos	Annually	IM
Continuum Rabies	Intervet, Inc. License no. 165A	Intervet, Inc.	Dogs	1 mL	3 mos	1 yr later and triennially	SC
			Cats	1 mL	3 mos	1 yr later and quadrennially	SC
EquiRab	Intervet, Inc. License no. 165A	Intervet, Inc.	Horses	1 mL	4 mos	Annually	IM
Prorab 1	Intervet, Inc. License no. 165A	Intervet, Inc.	Dogs	1 mL	3 mos	Annually	IM or SC
			Cats	1 mL	3 mos	Annually	IM or SC
			Sheep	2 mL	3 mos	Annually	IM
Defensor 1	Pfizer, Inc. License no. 189	Pfizer, Inc.	Dogs	1 mL	3 mos	Annually	IM or SC
			Cats	1 mL	3 mos	Annually	SC
Defensor 3	Pfizer, Inc. License no. 189	Pfizer, Inc.	Dogs	1 mL	3 mos	1 yr later and triennially	IM or SC
			Cats	1 mL	3 mos	1 yr later and triennially	SC
			Sheep	2 mL	3 mos	Annually	IM
			Cattle	2 mL	3 mos	Annually	IM
Rabdomun	Pfizer, Inc. License no. 189	Schering-Plough Animal Health	Dogs	1 mL	3 mos	1 yr later and triennially	IM or SC
			Cats	1 mL	3 mos	1 yr later and triennially	SC
			Sheep	2 mL	3 mos	Annually	IM
			Cattle	2 mL	3 mos	Annually	IM
Rabdomun 1	Pfizer, Inc. License no. 189	Schering-Plough Animal Health	Dogs	1 mL	3 mos	Annually	IM or SC
			Cats	1 mL	3 mos	Annually	SC
Imrab 1	Merial, Inc. License no. 298	Merial, Inc.	Dogs	1 mL	3 mos	Annually	SC
			Cats	1 mL	3 mos	Annually	SC
Imrab 1TF	Merial, Inc. License no. 298	Merial, Inc.	Dogs	1 mL	3 mos	Annually	SC
			Cats	1 mL	3 mos	Annually	SC
Imrab 3	Merial, Inc. License no. 298	Merial, Inc.	Dogs	1 mL	3 mos	1 yr later and triennially	IM or SC
			Cats	1 mL	3 mos	1 yr later and triennially	IM or SC
			Sheep	2 mL	3 mos	1 yr later and triennially	IM or SC
			Cattle	2 mL	3 mos	Annually	IM or SC
			Horses	2 mL	3 mos	Annually	IM or SC
			Ferrets	1 mL	3 mos	Annually	SC

See table footnotes on page 11.

TABLE 1. (Continued) Rabies vaccines licensed and marketed in the United States, 2011

Product name	Produced by	Marketed by	For use in	Dose	Age at primary vaccination*	Booster recommended	Route of vaccination
Imrab 3 TF	Merial, Inc. License no. 298	Merial, Inc.	Dogs	1 mL	3 mos	1 yr later and triennially	IM or SC
			Cats	1 mL	3 mos	1 yr later and triennially	IM or SC
			Ferrets	1 mL	3 mos	Annually	SC
			Cattle	2 mL	3 mos	Annually	IM or SC
Imrab Large Animal	Merial, Inc. License no. 298	Merial, Inc.	Horses	2 mL	3 mos	Annually	IM or SC
			Sheep	2 mL	3 mos	1 yr later and triennially	IM or SC
Monovalent (rabies glycoprotein, live canary pox vector)							
PureVax Feline Rabies	Merial, Inc. License no. 298	Merial, Inc.	Cats	1 mL	3 mos	Annually	SC
Combination (inactivated rabies)							
Continuum DAP-R	Intervet, Inc. License no. 165A	Intervet, Inc.	Dogs	1 mL	3 mos	1 yr later and triennially	SC
Continuum Feline HCP-R	Intervet, Inc. License no. 165A	Intervet, Inc.	Cats	1 mL	3 mos	1 yr later and triennially	SC
Equine Potomavac + Imrab	Merial, Inc. License no. 298	Merial, Inc.	Horses	1 mL	3 mos	Annually	IM
Combination (rabies glycoprotein, live canary pox vector)							
PureVax Feline 3/ Rabies	Merial, Inc. License no. 298	Merial, Inc.	Cats	1 mL	8 wks	Every 3 wks until 3 mos and annually	SC
					3 mos		
PUREVAX Feline 4/ Rabies	Merial, Inc. License no. 298	Merial, Inc.	Cats	1 mL	8 wks	Every 3 wks until 3 mos and annually	SC
					3 mos		
Oral (rabies glycoprotein, live vaccinia vector): restricted to use in state and federal rabies control programs							
Raboral V-RG	Merial, Inc. License no. 298	Merial, Inc.	Coyotes Raccoons	N/A	N/A	As determined by local authorities	Oral

Abbreviations: IM = intramuscular; N/A = not applicable; SC = subcutaneous; TF = thimerosal free.

* Minimum age (or older) and revaccinated 1 year later.

† Fort Dodge Animal Health was recently acquired by Boehringer Ingelheim Vetmedica, Inc.

§ One month = 28 days.

TABLE 2. Rabies vaccine manufacturer contact information

Manufacturer	Phone number	Internet address
Boehringer Ingelheim Vetmedica, Inc.	800-638-2226	Not available
Intervet, Inc.	800-441-8272	http://www.intervetusa.com
Merial, Inc.	888-637-4251	http://us.merial.com
Pfizer, Inc.	800-366-5288	http://www.pfizerah.com

References

- American Public Health Association. Rabies. In: Heymann D, ed. Control of communicable diseases manual. 19th ed. Washington, DC: American Public Health Association; 2008:498–508.
- Blanton JD, Palmer D, Christian KA, Rupprecht CE. Rabies surveillance in the United States during 2009. *J Am Vet Med Assoc* 2010;237:646–57.
- Castrodale L, Walker V, Baldwin J, Hofmann J, Hanlon C. Rabies in a puppy imported from India to the USA, March 2007. *Zoonoses Public Health* 2008;55:427–30.
- CDC. Rabies in a dog imported from Iraq—New Jersey, June 2008. *MMWR* 2008;57:1076–8.
- McQuiston JH, Wilson T, Harris S, et al. Importation of dogs into the United States: risks from rabies and other zoonotic diseases. *Zoonoses Public Health* 2008;55:421–6.
- Velasco-Villa A, Reeder SA, Orciari LA, et al. Enzootic rabies elimination from dogs and reemergence in wild terrestrial carnivores, United States. *Emerg Infect Dis* 2008;14:1849–54.
- Beran GW. Rabies and infections by rabies-related viruses. In: Beran GW, ed. Handbook of zoonoses section B: Viral, 2nd ed. Boca Raton, FL: CRC Press; 1994:307–57.
- Council of State and Territorial Epidemiologists. Public health reporting and national notification for animal rabies. Infectious disease positions statements, June 2009. Atlanta, GA: Council of State and Territorial Epidemiologists. Available at <http://www.cste.org/ps2009/09-ID-12.pdf>. Accessed September 1, 2011.
- CDC. Human rabies prevention—United States, 2008. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2008;57(No. RR-3).
- CDC. Use of reduced (4-dose) vaccine schedule for postexposure prophylaxis to prevent human rabies. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2010;59(No. RR-2).
- McQuiston J, Yager PA, Smith JS, Rupprecht CE. Epidemiologic characteristics of rabies virus variants in dogs and cats in the United States, 1999. *J Am Vet Med Assoc* 2001;218:1939–42.
- Murray KO, Holmes KC, Hanlon CA. Rabies in vaccinated dogs and cats in the United States, 1997–2001. *J Am Vet Med Assoc* 2009;235:691–5.
- Frana TS, Clough NE, Gatewood DM, Rupprecht CE. Postmarketing surveillance of rabies vaccines for dogs to evaluate safety and efficacy. *J Am Vet Med Assoc* 2008;232:1000–2.
- Hanlon CA, Childs JE, Nettles VE, et al. Recommendations of the Working Group on Rabies. Article III: rabies in wildlife. *J Am Vet Med Assoc* 1999;215:1612–8.
- Slate D, Algeo TD, Nelson KM, et al. Oral rabies vaccination in North America: opportunities, complexities, and challenges. *PLoS Negl Trop Dis* 2009;3:1–9.
- Council of State and Territorial Epidemiologists. Electronic laboratory reporting in the US: underfunded and under potential, or, recommendations for the implementation of ELR in the US. Policy Positions Statements. Atlanta, GA: Council of State and Territorial Epidemiologists; 2009. Available at <http://www.cste.org/ps2009/09-SI-03.pdf>. Accessed September 1, 2011.
- Council of State and Territorial Epidemiologists. Process statement for immediately nationally notifiable conditions. Policy Positions Statements, Atlanta, GA: Council of State and Territorial Epidemiologists; 2009. Available at <http://www.cste.org/ps2009/09-SI-04.pdf>. Accessed September 1, 2011.
- Hanlon CA, Smith JS, Anderson GR, et al. Recommendations of the Working Group on Rabies. Article II: laboratory diagnosis of rabies. *J Am Vet Med Assoc* 1999;215:1444–6.
- Rudd RJ, Smith JS, Yager PA, et al. A need for standardized rabies-virus diagnostic procedures: effect of cover-glass mountant on the reliability of antigen detection by the fluorescent antibody test. *Virus Res* 2005;111:83–8.
- American Veterinary Medical Association. AVMA guidelines on euthanasia. Schaumburg, IL: American Veterinary Medical Association; 2007. Available at http://www.avma.org/issues/animal_welfare/euthanasia.pdf. Accessed September 1, 2011.
- Michigan Rabies Working Group. Humane euthanasia of bats for public health rabies testing. Lansing, MI: Michigan Rabies Working Group; 2008. Available at http://www.michigan.gov/documents/emergingdiseases/Humane_Euthanasia_of_Bats-Final_244979_7.pdf. Accessed September 1, 2011.
- CDC. Public health response to a potentially rabid bear cub—Iowa, 1999. *MMWR* 1999;48:971–3.
- Niezgoda M, Rupprecht CE. Standard operating procedure for the direct rapid immunohistochemistry test for the detection of rabies virus antigen. National Laboratory Training Network Course. Atlanta, GA: US Department of Health and Human Services, CDC; 2006:1–16. Available at http://www.rabiesblueprint.com/IMG/pdf/DRIT_SOP.pdf. Accessed September 1, 2011.
- Lembo T, Niezgoda M, Velasco-Villa A, Cleaveland S, Ernest F, Rupprecht CE. Evaluation of a direct, rapid immunohistochemical test for rabies diagnosis. *Emerg Infect Dis* 2006;12:310–3.
- Dürr S, Naissengar S, Mindekem R, et al. Rabies diagnosis for developing countries. *PLoS Negl Trop Dis* 2008;26:e206.
- Saturday GA, King R, Fuhrmann L. Validation and operational application of a rapid method for rabies antigen detection. *US Army Med Dep J* 2009;Jan–Mar:42–5.
- Tizard I, Ni Y. Use of serologic testing to assess immune status of companion animals. *J Am Vet Med Assoc* 1998;213:54–60.
- Greene CE, ed. Rabies and other lyssavirus infections. In: Infectious diseases of the dog and cat. 3rd ed. London, England: Saunders Elsevier; 2006:167–83.
- Rupprecht CE, Gilbert J, Pitts R, Marshall K, Koprowski H. Evaluation of an inactivated rabies virus vaccine in domestic ferrets. *J Am Vet Med Assoc* 1990;196:1614–6.
- Moore SM, Hanlon CA. Rabies-specific antibodies: measuring surrogates of protection against a fatal disease. *PLoS Negl Trop Dis* 2010;4:e595.
- Aubert MF. Practical significance of rabies antibodies in cats and dogs. *Rev Sci Tech* 1992;11:735–60.
- Muirhead TL, McClure JT, Wichtel JJ, et al. The effect of age on serum antibody titers after rabies and influenza vaccination in healthy horses. *J Vet Intern Med* 2008;22:654–61.
- Shimazaki Y, Inoue S, Takahashi C, et al. Immune response to Japanese rabies vaccine in domestic dogs. *J Vet Med B* 2003;50:95–8.
- Cliquet F, Verdier Y, Sagné L, et al. Neutralising antibody titration in 25,000 sera of dogs and cats vaccinated against rabies in France, in the framework of the new regulations that offer an alternative to quarantine. *Rev Sci Tech* 2003;22:857–66.

35. Rabies. In: Guidelines for the vaccination of horses. Lexington, KY: American Association of Equine Practitioners; 2009. Available at <http://www.aaep.org/rabies.htm>. Accessed September 1, 2011.
36. CDC. Compendium of measures to prevent disease and injury associated with animals in public settings, 2007. MMWR 2007;56(No. RR-5).
37. Bender J, Schulman S. Reports of zoonotic disease outbreaks associated with animal exhibits and availability of recommendations for preventing zoonotic disease transmission from animals to people in such settings. J Am Vet Med Assoc 2004;224:1105-9.
38. American Veterinary Medical Association. Private ownership of wild animals. Schaumburg, IL: American Veterinary Medical Association; 2006. Available at http://www.avma.org/issues/policy/wild_animal_ownership.asp. Accessed September 1, 2011.
39. American Veterinary Medical Association. Position on canine hybrids. Schaumburg, IL: American Veterinary Medical Association; 2008.
40. Siino BS. Crossing the line: the case against hybrids. New York City, NY: American Society for the Prevention of Cruelty to Animals, Animal Watch; 2000:22-9. Available at <http://www.petfinder.com/before-pet-adoption/case-against-hybrids.html?page-index=1&query=hybrids>. Accessed September 1, 2011.
41. Jay MT, Reilly KF, DeBess EE, Haynes EH, Bader DR, Barrett LR. Rabies in a vaccinated wolf-dog hybrid. J Am Vet Med Assoc 1994;205:1729-32.
42. CDC. An imported case of rabies in an immunized dog. MMWR 1987;36:94-6.
43. CDC. Imported dog and cat rabies—New Hampshire, California. MMWR 1988;37:559-60.
44. Hanlon CA, Niezgodka MN, Rupprecht CE. Postexposure prophylaxis for prevention of rabies in dogs. Am J Vet Res 2002;63:1096-100.
45. Rabies vaccine, killed virus. 9 C.F.R. Sect. 113.209 (2003).
46. Greene CE, ed. Immunoprophylaxis. In: Infectious diseases of the dog and cat. 3rd ed. London, England: Saunders, Elsevier; 2006:1069-119.
47. Willoughby, RE. "Early death" and the contraindication of vaccine during rabies treatment. Vaccine 2009;27:7173-7.
48. Mansfield K, McElhinney L, Hübschle O, et al. A molecular epidemiological study of rabies epizootics in kudu (*Tragelaphus strepsiceros*) in Namibia. BMC Vet Res 2006;2:2.
49. Viral agents. In: US Department of Health and Human Services. Biosafety in microbiological and biomedical laboratories. 5th ed. Washington, DC: U.S. Government Printing Office; 2007:234-5. Available at http://www.cdc.gov/biosafety/publications/bmb15/BMBLS_sect_VIII_e.pdf. Accessed September 1, 2011.
50. Wertheim HFL, Nguyen TQ, Nguyen KAT, et al. Furious rabies after an atypical exposure. PLoS Med 2009;6(3):0264-8.
51. Ante-mortem inspection. In: US Meat and Poultry Inspection Program. Meat and poultry inspection manual. Washington, DC: US Government Printing Office; 1973:314.
52. Debbie JG, Timarchi CV. Pantropism of rabies virus in free-ranging rabid red fox (*Vulpes fulva*). J Wildl Dis 1970;6:500-6.
53. Fekadu M, Shaddock JH. Peripheral distribution of virus in dogs inoculated with two strains of rabies virus. Am J Vet Res 1984;45:724-729.
54. Charlton, KM. The pathogenesis of rabies and other lyssaviral infections: recent studies. Curr Top Microbiol Immunol 1994;187:95-119.
55. Afshar A. A review of non-bite transmission of rabies virus infection. Br Vet J 1979;135:142-8.
56. CDC. Mass treatment of humans who drank unpasteurized milk from rabid cows—Massachusetts, 1996-1998. MMWR 1999;48:228-9.
57. CDC. U.S. public health service guideline on infectious disease issues in xenotransplantation. MMWR 2001;50(No. RR-15).
58. Turner GS, Kaplan C. Some properties of fixed rabies virus. J Gen Virol 1967;1:537-51.
59. Vaughn JB, Gerhardt P, Paterson J. Excretion of street rabies virus in saliva of cats. J Am Med Assoc 1963;184:705.
60. Vaughn JB, Gerhardt P, Newell KW. Excretion of street rabies virus in saliva of dogs. J Am Med Assoc 1965;193:363-8.
61. Niezgodka M, Briggs DJ, Shaddock J, Rupprecht CE. Viral excretion in domestic ferrets (*Mustela putorius furo*) inoculated with a raccoon rabies isolate. Am J Vet Res 1998;59:1629-32.
62. Tepsumethanon V, Lumlerdacha B, Mitmoonpitak C, Sitprija V, Meslin FX, Wilde H. Survival of naturally infected rabid dogs and cats. Clin Infect Dis 2004;39:278-80.
63. Jenkins SR, Perry BD, Winkler WG. Ecology and epidemiology of raccoon rabies. Rev Infect Dis 1988;10(Suppl 4):S620-5.
64. CDC. Translocation of coyote rabies—Florida, 1994. MMWR 1995;44:580-7.
65. Rupprecht CE, Smith JS, Fekadu M, Childs JE. The ascension of wildlife rabies: a cause for public health concern or intervention? Emerg Infect Dis 1995;1:107-14.
66. Constantine DG. Geographic translocation of bats: known and potential problems. Emerg Infect Dis 2003;9:17-21.
67. Krebs JW, Strine TW, Smith JS, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 1993. J Am Vet Med Assoc 1994;1695-709.
68. VF Nettles, JH Shaddock, RK Sikes, CR Reyes. Rabies in translocated raccoons. Am J Public Health 1979;69:601-2.
69. RM Engeman, KI Christensen, MJ Pipas, DL Bergman. Population monitoring in support of a rabies vaccination program for skunks in Arizona. J Wildl Dis 2003;39:746-50.
70. Leslie MJ, Messenger S, Rohde RE, et al. Bat-associated rabies virus in skunks. Emerg Infect Dis 2006;12:1274-7.
71. Rupprecht CE, Hanlon CA, Slate D. Control and prevention of rabies in animals: paradigm shifts. Dev Biol (Basel). 2006;125:103-11.
72. Pers Evacuation and Transportations Standards Act of 2006. P.L. 109-308, 109th Cong., 120 Stat. 1725 (2006).
73. National Animal Control Association. National Animal Control Association guidelines. Kansas City, MO: National Animal Control Association. Available at <http://www.nacenet.org/guidelines.html>. Accessed September 1, 2011.
74. Chipman R, Slate D, Rupprecht C, Mendoza M. Downside risk of translocation. In: Dodet B, Fooks AR, Muller T, Tordo N; Scientific & Technical Department of the OIE, eds: Towards the elimination of rabies in Eurasia. Dev Biol 2008;131:223-32.
75. Slate D, Rupprecht CE, Rooney JA, Donovan D, Lein DH, Chipman RB. Status of oral rabies vaccination in wild carnivores in the United States. Virus Res 2005;111:68-76.
76. Sidwa TJ, Wilson PJ, Moore GM, et al. Evaluation of oral rabies vaccination programs for control of rabies epizootics in coyotes and gray foxes: 1995-2003. J Am Vet Med Assoc 2005;227:785-92.
77. MacInnes CD, Smith SM, Tinline RR, et al. Elimination of rabies from red foxes in eastern Ontario. J Wildl Dis 2001;37:119-32.
78. Rosatte RC, Power MJ, Donovan D, et al. Elimination of arctic variant of rabies in red foxes, metropolitan Toronto. Emerg Infect Dis 2007;1325-27.

Recommendations and Reports

79. Messenger SL, Smith JS, Rupprecht CE. Emerging epidemiology of bat-associated cryptic cases of rabies in humans in the United States. *Clin Infect Dis* 2002;35:738–47.
80. CDC. Human rabies—California, 2002. *MMWR* 2002;51:686–8.
81. CDC. Human rabies—Tennessee, 2002. *MMWR* 2002;51:828–9.
82. CDC. Human rabies—Iowa, 2002. *MMWR* 2003;52:47–8.
83. CDC. Human death associated with bat rabies—California, 2003. *MMWR* 2004;53:33–5.
84. CDC. Recovery of a patient from clinical rabies, Wisconsin, 2004. *MMWR* 2004;53:1171–3.
85. CDC. Human rabies—Mississippi, 2005. *MMWR* 2006;55:207–8.
86. CDC. Human rabies—Indiana and California, 2006. *MMWR* 2007;56:361–5.
87. CDC. Human rabies—Minnesota, 2007. *MMWR* 2008;57:460–2.
88. CDC. Human rabies—Missouri, 2008. *MMWR* 2009;58:1207–9.
89. CDC. Human rabies—Kentucky/Indiana, 2009. *MMWR* 2010;59:393–6.
90. CDC. Human rabies—Virginia, 2009. *MMWR* 2010;59:1236–8.
91. CDC. Presumptive abortive human rabies—Texas, 2009. *MMWR* 2010;59:185–90.
92. CDC. Human rabies—Michigan, 2009. *MMWR* 2011;60:437–40.
93. Greenhall AM. House bat management. US Fish and Wildlife Service, Resource Publication 143;1982. Jamestown, ND: Northern Prairie Wildlife Research Center Online; 1982. Available at <http://www.npwr.usgs.gov/resource/mammals/housebat/index.htm>. Accessed September 1, 2011.
94. Greenhall AM, Frantz SC. Bats. In: Hygnstrom SE, Timm RM, Larson GE, eds. Prevention and control of wildlife damage. Cooperative Extension Division Institute of Agriculture and Natural Resources University of Nebraska—Lincoln; United States Department of Agriculture Animal and Plant Health Inspection Service Animal Damage Control; Great Plains Agricultural Council Wildlife Committee; 1994. Available at <http://icwdm.org/handbook/mammals/bats.asp>. Accessed September 1, 2011.
95. American Veterinary Medical Association. Model rabies control ordinance. Schaumburg, IL: American Veterinary Medical Association; 2008. Available at <http://www.avma.org/issues/policy/AVMA-Model-Rabies-Ordinance.pdf>. Accessed September 1, 2011.
96. Bunn TO. Canine and feline vaccines, past and present. In Baer GM, ed. The natural history of rabies. 2nd ed. Boca Raton, FL: CRC Press; 1991:415–25.
97. Macy DW, Hendrick MJ. The potential role of inflammation in the development of postvaccinal sarcomas in cats. *Vet Clin North Am Small Anim Pract* 1996;26:103–9.
98. Gobar GM, Kass PH. World wide web-based survey of vaccination practices, postvaccinal reactions, and vaccine site-associated sarcomas in cats. *J Am Vet Med Assoc* 2002;220:1477–82.
99. Kass PH, Spangler WL, Hendrick MJ, et al. Multicenter case-control study of risk factors associated with development of vaccine-associated sarcomas in cats. *J Am Vet Med Assoc* 2003;223:1283–92.
100. Rupprecht CE, Blass L, Smith K, et al. Human infection due to recombinant vaccinia-rabies glycoprotein virus. *N Engl J Med* 2001;345:582–6.
101. CDC. Human vaccinia infection after contact with a raccoon rabies vaccine bait—Pennsylvania, 2009. *MMWR* 2009;58:1204–7.

National Association of State Public Health Veterinarians

Committee Members

Catherine M. Brown, DVM, Chair, Massachusetts Department of Public Health, Jamaica Plain, Massachusetts; Lisa Conti, DVM, Florida Department of Health, Tallahassee, Florida; Paul Ertestad, DVM, New Mexico Department of Health, Sante Fe, New Mexico; Mira J. Leslie, DVM, Ministry of Agriculture and Lands, Abbotsford, British Columbia; Faye E. Sorhage, VMD, New Jersey Department of Health and Senior Services, Trenton, New Jersey; Ben Sun, DVM, Nevada Department of Health and Human Services, Carson City, Nevada.

Committee Consultants

Donald Hoenig, VMD, American Veterinary Medical Association, Augusta, Maine; Donna M. Gatewood, DVM, U.S. Department of Agriculture, Center for Veterinary Biologics, Ames, Iowa; Lorraine Moule, National Animal Control Association, Windsor, Connecticut; Barbara Nay, Animal Health Institute, Millsboro, Delaware; Raoult Ratard, MD, Council of State and Territorial Epidemiologists, Metairie, Louisiana; Charles E. Rupprecht, VMD, PhD, CDC, Atlanta, Georgia; Dennis Slate, PhD, U.S. Department of Agriculture Wildlife Services, Concord, New Hampshire; James Powell, MS, Association of Public Health Laboratories, Madison, Wisconsin; Burton Wilcke, Jr., PhD, American Public Health Association, Burlington, Vermont.



NATIONAL ASSOCIATION
of STATE PUBLIC HEALTH VETERINARIANS, INC.

May 31, 2011

MEMORANDUM

TO: State Public Health Veterinarians
State Epidemiologists
State Veterinarians
Other Parties Interested in Rabies Prevention and Control

FROM: Catherine M. Brown, DVM, MSc, MPH, Chair
Compendium of Animal Rabies Prevention and Control Committee

SUBJECT: *Compendium of Animal Rabies Prevention and Control, 2011*

The National Association of State Public Health Veterinarians (NASPHV) is pleased to provide the 2011 revision of the Compendium of Animal Rabies Prevention and Control for your use and for distribution to practicing veterinarians, wildlife rehabilitators, animal welfare organizations, and officials in animal control, public health, wildlife management, and agriculture in your state. This document is reviewed and revised as necessary, and the most current version replaces all previous versions. This cover memo summarizes the most notable changes that were made to the document and provides updates on other rabies issues.

COMPENDIUM CHANGES

Part I A.1. The national case definition for animal rabies was added for clarification of how rabies cases are defined for public health surveillance purposes.

Part I A.9. was expanded to: clarify that the Centers for Disease Control and Prevention's (CDC) rabies laboratory is available for confirmatory testing and on an emergency basis to expedite exposure management decisions; include information on testing methodology appropriate for field testing of surveillance specimens; and to clarify that there are no reliable ante mortem rabies tests available for use in animals.

Part I A.11. was expanded to include additional research topics that warrant further study.

Part III: The table of rabies vaccines licensed and marketed in the U.S. was updated for 2011.

Additional references have been added to provide scientific support for information provided in the document.

RABIES UPDATES

The fifth World Rabies Day will be on September 28, 2011. More information is available at: <http://www.worldrabiesday.org>.

The 22nd annual international conference on Rabies in the Americas (RITA) is scheduled for October 16-21, 2011 in San Juan, Puerto Rico. More information is available at: <http://www.rabiesintheamericas.org/>.

CDC's Rabies Laboratory is attempting to collect specimens to evaluate the potential for rabies transmission via milk from lactating animals. Over the past 15 years, CDC has received mammary tissue and unpasteurized milk from approximately 1 rabid cow per year. To date, no rabies virus antigen or nucleic acids have been detected. However, continued collection of appropriate samples is critical to obtain a sufficient sample size to make evidence based recommendations. When rabies is suspected in a lactating animal, milk and mammary tissue should be collected and stored. If rabies is diagnosed, the milk and mammary tissue should be shipped on dry ice to:

Dr. Charles E. Rupprecht
DASH, Building 18, Room SSB218
Centers for Disease Control and Prevention
1600 Clifton Road, NE
Atlanta, GA 30333
(404) 639-1050

Enhanced surveillance of the rabies virus variants currently circulating in the U.S. is critical for detecting new or introduced rabies virus variants. CDC requests an aliquot of CNS tissue from: rabid domestic animals (especially dogs); less common non-reservoir species (e.g. ruminants); and, from rabid carnivores in areas where bats are the only enzootic rabies reservoir, for antigenic and phylogenetic characterization. In addition, to better evaluate the potential of certain species groups to transmit rabies, the entire head of any rodent or lagomorph testing positive for rabies should be submitted to evaluate the presence of rabies virus in salivary glands. Where feasible, rabies diagnostic laboratories should store the heads of highly suspect rodents and lagomorphs until testing is completed. Positive specimens should be sent to CDC at the above address for further analysis.

Compendium of Animal Rabies Prevention and Control, 2011*

National Association of State Public Health Veterinarians, Inc. (NASPHV)

Rabies is a fatal viral zoonosis and a serious public health problem (1). All mammals are believed to be susceptible to the disease, and for purposes of this document, use of the term "animal" refers to mammals. The disease is an acute, progressive encephalitis caused by a lyssavirus. Rabies virus is the most important lyssavirus globally. In the United States, multiple rabies virus variants are maintained in wild mammalian reservoir populations such as raccoons, skunks, foxes, and bats. Although the U.S. has been declared free of canine rabies virus variant transmission, there is always a risk of reintroduction of these variants (2-6).

The virus is usually transmitted from animal to animal through bites. The incubation period is highly variable. In domestic animals it is generally 3-12 weeks, but can range from several days to months, rarely exceeding 6 months (7). Rabies is communicable during the period of salivary shedding of rabies virus. Experimental and historic evidence document that dogs, cats, and ferrets shed virus a few days prior to clinical onset and during illness. Clinical signs of rabies are variable and include inappetance, dysphagia, cranial nerve deficits, abnormal behavior, ataxia, paralysis, altered vocalization, and seizures. Progression to death is rapid. There are currently no known effective rabies antiviral drugs.

The recommendations in this compendium serve as a 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 and revised as necessary. The most current version replaces all previous versions. These recommendations do not supersede state and local laws or requirements. Principles of rabies prevention and control are detailed in Part I; recommendations for parenteral vaccination procedures are presented in Part II; and all animal rabies vaccines licensed by the United States Department of Agriculture (USDA) and marketed in the United States are listed and described in Part III.

The NASPHV Committee

Catherine M. Brown, DVM, MSc, MPH, Chair
Lisa Conti, DVM, MPH
Paul Ettestad, DVM, MS
Mira J. Leslie, DVM, MPH
Faye E. Sorhage, VMD, MPH
Ben Sun, DVM, MPVM

Consultants to the Committee

Donald Hoenig, VMD; AVMA
Donna M. Gatewood, DVM, MS; USDA Center for
Veterinary Biologics
Lorraine Moule; NACA
Barbara Nay; Animal Health Institute
Raoult Ratard, MD, MS, MPH; CSTE
Charles E. Rupprecht, VMD, MS, PhD; CDC
Dennis Slate, MS, PhD; USDA Wildlife Services
James Powell, MS; APHL
Burton Wilcke, Jr., PhD; APHA

*Address all correspondence to:

Catherine M. Brown, DVM, MSc, MPH
State Public Health Veterinarian
Massachusetts Department of Public Health
Hinton State Laboratory Institute,
305 South St.
Jamaica Plain, MA 02130

Endorsed by:

American Public Health Association (APHA)
American Veterinary Medical Association (AVMA)
Association of Public Health Laboratories (APHL)
Council of State and Territorial Epidemiologists (CSTE)
National Animal Control Association (NACA)

Part I. Rabies Prevention and Control

A. PRINCIPLES OF RABIES PREVENTION AND CONTROL

1. CASE DEFINITION: An animal is determined to be rabid after diagnosis by a qualified laboratory as specified in Part I.A.9. The national case definition for animal rabies requires laboratory confirmation by either:

- A positive direct fluorescent antibody test (preferably performed on central nervous system tissue); or
- Isolation of rabies virus (in cell culture or in a laboratory animal (8)).

2. RABIES EXPOSURE: Rabies is transmitted 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 (9). Questions regarding possible exposures should be directed promptly to state or local public health authorities.

3. PUBLIC HEALTH EDUCATION: Essential components of rabies prevention and control include ongoing public education, responsible pet ownership, routine veterinary care and vaccination, and professional continuing education. The majority of animal and human exposures to rabies can be prevented by raising awareness concerning: rabies transmission routes, avoiding contact with wildlife, and following appropriate veterinary care. Prompt recognition and reporting of possible exposures to medical professionals and local public health authorities is critical.

4. 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 appropriate administration of human rabies immune globulin and vaccine. Exposure assessment should occur before postexposure rabies prophylaxis (PEP) is initiated and should include discussion between medical providers and public health officials. The rationale for recommending preexposure prophylaxis and details of both pre- and post-exposure prophylaxis administration can be found in the current recommendations of the Advisory Committee on Immunization Practices (ACIP) (9,10). 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.

5. DOMESTIC ANIMAL VACCINATION: Multiple vaccines are licensed for use in domestic animal species. Vaccines available include: inactivated or modified live virus vectored products; products for intramuscular and subcutaneous administration; products with durations of immunity from one to 4 years; and products with varying minimum age of vaccination. The recommended vaccination procedures and the licensed animal vaccines are specified in Parts II and III of this compendium, respectively. 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 93 in 2009 (2). Because more rabies cases are reported annually involving cats (274 in 2009) than dogs, vaccination of cats should be required (2). Animal shelters and animal control authorities should establish policies to ensure that adopted animals are vaccinated against rabies.

6. RABIES IN VACCINATED ANIMALS: Rabies is rare in vaccinated animals (11-13). If such an event is suspected, it should be reported to public health officials; the vaccine manufacturer; and USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). The laboratory diagnosis should be confirmed and the virus variant characterized by the Centers for Disease Control and Prevention (CDC) rabies reference laboratory. A thorough epidemiologic investigation

including documentation of the animal's vaccination history and a description of potential rabies exposures should be conducted.

7. RABIES IN WILDLIFE: The control of rabies among wildlife reservoirs is difficult (14). Vaccination of free-ranging wildlife or selective population reduction is useful in some situations (15), but the success of such procedures depends on the circumstances surrounding each rabies outbreak (see Part I. C.). Because of the risk of rabies in wild animals (especially raccoons, skunks, coyotes, foxes, and bats), the American Veterinary Medical Association, American Public Health Association, Council of State and Territorial Epidemiologists, National Animal Control Association and the National Association of State Public Health Veterinarians strongly recommend the enactment and enforcement of state laws prohibiting their importation, distribution, translocation, and private ownership.

8. RABIES SURVEILLANCE: Enhanced laboratory-based rabies surveillance and variant typing are essential components of rabies prevention and control programs. Accurate and timely information and reporting is necessary to: guide human PEP 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 vaccination programs for domestic animals and wildlife. Every animal submitted for rabies testing should be reported to CDC to evaluate surveillance trends. Electronic laboratory reporting and notification of animal rabies surveillance data should be implemented (16). Optimal information on animals submitted for rabies testing should include species, point location, vaccination history, rabies virus variant (if rabid), and human or domestic animal exposures. Rabid animals with a history of importation within 60 days into the United States are immediately notifiable by state health departments to CDC; all indigenous cases should follow standard notification protocols (17). Integration with standard public health reporting and notification systems should facilitate the transmission of the above data elements.

9. RABIES DIAGNOSIS:

a) The direct fluorescent antibody (DFA) test is the gold standard for rabies diagnosis. The DFA test should be performed in accordance with the established national standardized protocol (http://www.cdc.gov/rabies/docs/standard_dfa_protocol_rabies.pdf) by a qualified laboratory that has been designated by the local or state health department (18,19). Animals submitted for rabies testing should be euthanized (20,21) 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. To facilitate prompt laboratory testing, submitted specimens should be stored and shipped under refrigeration without delay. The need to thaw frozen specimens will delay testing. Chemical fixation of tissues should be avoided to prevent significant testing delays and because it might preclude reliable testing. Questions about testing of fixed tissues should be directed to the local rabies laboratory or public health department.

b) Rabies testing should be available on an emergency basis to expedite exposure management decisions (18). When confirmatory testing is needed by state health departments (e.g., inconclusive results, unusual species, mass exposures), the CDC rabies laboratory can provide results within 24 hours of submission (22).

c) A direct rapid immunohistochemical test (DRIT) is being used by trained field personnel in surveillance programs for specimens not involved in human or domestic animal exposures (23-26). All positive DRIT results need to be confirmed by DFA testing at a qualified laboratory.

d) Currently, there are no USDA licensed rapid test kits commercially available for rabies diagnosis. Unlicensed tests should not be used due to several concerns: the sensitivity/specificity are not known; the tests have not been validated against current standard methods; the excretion of virus in the saliva is intermittent and the amount varies over time; any test result would need to be confirmed by more

reliable methods such as DFA testing on brain tissue; and the interpretation of results may place exposed animals and persons at risk.

10. RABIES SEROLOGY: Some jurisdictions require evidence of vaccination and rabies virus antibodies for animal importation purposes. Rabies virus antibody titers are indicative of a 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 in animals should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations (27-30).

11. RABIES RESEARCH: Information derived from well-designed studies is essential for the development of science-based recommendations. Data are needed in several areas including: viral shedding periods for domestic livestock and lagomorphs; potential shedding of virus in milk; earliest age at which rabies vaccination is effective and protective effect of maternal antibody; duration of immunity; postexposure prophylaxis protocols for domestic animals; models for treatment of clinical rabies; extra label vaccine use in domestic animals and wildlife rabies reservoirs; host-pathogen adaptations and dynamics; and the ecology of wildlife rabies reservoir species, especially in relation to the use of oral rabies vaccines.

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 licensed veterinarian on premises. Rabies vaccinations may also be administered under the supervision of a licensed veterinarian to animals held in animal control shelters before release. The veterinarian signing a rabies vaccination certificate must ensure that the person administering vaccine is identified on the certificate and is appropriately trained in vaccine storage, handling, administration, and in the management of adverse events. This practice assures that a qualified and responsible person can be held accountable for properly vaccinating the animal. Within 28 days after initial vaccination, a peak rabies virus antibody titer is reached, and the animal can be considered immunized (29,31-33). 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 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). No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines after the initial series. Because a rapid anamnestic response is expected, an animal is considered currently vaccinated immediately after a booster vaccination (34).

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 after the booster, the animal is considered currently vaccinated and should be placed on a booster schedule, depending on the labeled duration of the vaccine used.

b) LIVESTOCK

All horses should be vaccinated against rabies (35). Livestock, including species for which licensed vaccines are not available, that have frequent contact with humans (e.g., in petting zoos, fairs, and other public exhibitions) should be vaccinated against rabies (36,37). Consideration should also be given to vaccinating livestock that are particularly valuable.

c) **CAPTIVE WILD ANIMALS AND HYBRIDS** (the offspring of wild animals crossbred to domestic animals).

(1) Wild animals or hybrids should not be kept as pets (38-40). No parenteral rabies vaccines are licensed for use in wild animals or hybrids (41).

(2) Animals that are maintained in exhibits and in zoological parks and 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. Employees who work with animals at such facilities should receive preexposure rabies vaccination. The use of pre- or postexposure rabies vaccinations for handlers who work with animals at such facilities might reduce the need for euthanasia of captive animals that expose handlers. Carnivores and bats should be housed in a manner that precludes direct contact with the public (36,37).

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 are required to 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 to give owners sufficient time to reclaim animals.

3. IMPORTATION AND INTERSTATE MOVEMENT OF ANIMALS:

a) **INTERNATIONAL.** CDC regulates the importation of dogs and cats into the United States (5). Importers of dogs must comply with rabies vaccination requirements (42 CFR, Part 71.51[c] [<http://www.cdc.gov/animalimportation/dogs.html>]) and complete CDC form 75.37 (<http://www.cdc.gov/animalimportation/pdf/dog-import.pdf>). These regulations require dogs imported from rabies endemic countries to be vaccinated for rabies and confined for varying timeframes depending on age, prior vaccination status, and country of origin. The appropriate health official of the state of destination should be notified within 72 hours of the arrival of any imported dog required to be placed in confinement under these regulations. Failure of the owner to comply with these confinement requirements should be promptly reported to the Division of Global Migration and Quarantine, CDC (telephone: 404-639-4528 or 404-639-4537).

Federal regulations alone are insufficient to prevent the introduction of rabid animals into the United States (3,4,42,43). 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 of the owner to comply with state or local requirements should be referred to the appropriate state or local official.

b) **AREAS WITH DOG-TO-DOG RABIES TRANSMISSION.** Canine rabies virus variants have been eliminated in the United States (2,6). Rabid dogs have been introduced into the continental United States from areas with dog-to-dog rabies transmission (3,4,42,43). The movement of dogs for the purposes of adoption or sale from areas with dog-dog rabies transmission increases the risk of introducing canine-transmitted rabies to areas where it does not currently exist and should be prohibited.

c) **INTERSTATE.** Before interstate (including commonwealths and territories) movement, dogs, cats, ferrets, and horses should be currently vaccinated against rabies in accordance with this compendium's recommendations (see Part I. B.1.). Animals in transit should be accompanied by a currently valid NASPHV Form 51, Rabies Vaccination Certificate (<http://www.nasphv.org/Documents/RabiesVacCert.pdf>). When an interstate health certificate or certificate of veterinary inspection is required, it should contain the same rabies vaccination information as Form 51.

4. ADJUNCT PROCEDURES: Methods or procedures that enhance rabies control include the following (<http://www.rabiesblueprint.com/spip.php?article119>):

- a) **IDENTIFICATION.** Dogs, cats, and ferrets should be identified (e.g., metal or plastic tags or microchips) to allow for verification of rabies vaccination status.
- b) **LICENSURE.** Registration or licensure of all dogs, cats, and ferrets is an integral component of an effective rabies control program. A fee is frequently charged for such licensure, and revenues collected are used to maintain rabies or animal control activities. Evidence of current vaccination should be 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 local jurisdictions should incorporate stray animal control, leash laws, animal bite prevention, and training of personnel in their programs.
- f) **PUBLIC EDUCATION.** All local jurisdictions should incorporate education covering responsible pet ownership, bite prevention, and appropriate veterinary care in their programs.

5. POSTEXPOSURE MANAGEMENT: This section refers to any animal exposed (see Part I.A.2.) to a confirmed or suspected rabid animal. Wild mammalian carnivores or bats that are not available or suitable for testing should be regarded as rabid animals.

a) **DOGS, CATS AND FERRETS.** Any illness in an exposed animal should be reported immediately to the local health department. If signs suggestive of rabies develop (e.g., paralysis, seizures, etc.), the animal should be euthanized and the head shipped for testing as described in Part I.A.9.

(1) Dogs, cats, and ferrets that have never been vaccinated and are 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. Isolation in this context refers to confinement in an enclosure that precludes direct contact with people and other animals. Rabies vaccine should be administered upon entry into isolation or up to 28 days before release to comply with preexposure vaccination recommendations (see Part I.B.1.a.). There are currently no USDA licensed biologics for postexposure prophylaxis of previously unvaccinated domestic animals, and there is evidence that the use of vaccine alone will not reliably prevent the disease in these animals (44).

(2) Animals overdue for a booster vaccination should be evaluated on a case-by-case basis based upon severity of exposure, time elapsed since last vaccination, number of previous vaccinations, current health status, and local rabies epidemiology to determine need for euthanasia or immediate revaccination and observation/isolation.

(3) Dogs, cats, and ferrets that are currently vaccinated should be revaccinated immediately, kept under the owner's control, and observed for 45 days. The rationale for an observation period is based in part on the potential for: overwhelming viral challenge, incomplete vaccine efficacy, improper vaccine administration, variable host immunocompetence, and immune-mediated fatality (i.e., early death phenomenon) (12,45-47).

b) **LIVESTOCK.** All species of livestock are susceptible to rabies; cattle and horses are the most frequently reported infected species (2). Any illness in an exposed animal should be reported immediately to the local health and agriculture officials. If signs suggestive of rabies develop, the animal should be euthanized and the head shipped for testing as described in Part I.A.9.

(1) Unvaccinated livestock should be euthanized immediately. If the animal is not euthanized, it should be observed and confined on a case-by-case basis for 6 months.

(2) Livestock exposed to a rabid animal and currently vaccinated with a vaccine approved by USDA for that species should be revaccinated immediately and observed for 45 days.

(3) Multiple rabid animals in a herd or herbivore-to-herbivore transmission are uncommon (48); therefore, restricting the rest of the herd if a single animal has been exposed to or infected by rabies is usually not necessary.

(4) Handling and consumption of tissues from exposed animals might carry a risk for rabies transmission. Risk factors depend in part on the site(s) of exposure, amount of virus present, severity of wounds, and whether sufficient contaminated tissue has been excised. If an exposed animal is to be custom or home-slaughtered for consumption, it should be done immediately after exposure, and all tissues should be cooked thoroughly. Persons handling exposed animals, carcasses, and tissues should use barrier precautions (49,50). Historically, federal guidelines for meat inspectors required that any animal known to have been exposed to rabies within 8 months be rejected for slaughter (51). USDA Food and Inspection Service (FSIS) and state meat inspectors should be notified if such exposures occur in food animals before slaughter.

Rabies virus is widely distributed in tissues of rabid animals (52-54). Tissues and products from a rabid animal should not be used for human or animal consumption (55,56) or transplantation (57). Pasteurization and cooking will inactivate rabies virus (58); therefore, inadvertently drinking pasteurized milk or eating thoroughly cooked animal products does not constitute a rabies exposure.

c) OTHER ANIMALS. Other mammals exposed to a rabid animal should be euthanized immediately. Animals maintained in USDA-licensed research facilities or accredited zoological parks should be evaluated on a case-by-case basis in consultation with public health authorities. Management options may include isolation, observation, or administration of rabies biologics.

6. MANAGEMENT OF ANIMALS THAT BITE HUMANS:

a) Dogs, Cats, and Ferrets. Rabies virus is excreted in the saliva of infected dogs, cats, and ferrets during illness and/or for only a few days before illness or death (59-61). Regardless of rabies vaccination status, a healthy dog, cat, or ferret that exposes a person should be confined and observed daily for 10 days from the time of the exposure (62); administration of rabies vaccine to the animal is not recommended during the observation period to avoid confusing signs of rabies with rare adverse reactions (13). Any illness in the animal should be reported immediately to the local health department. Such animals should be evaluated by a veterinarian at the first sign of illness during confinement. If signs suggestive of rabies develop, the animal should be euthanized and the head submitted for testing as described in Part I.A.9. Any stray or unwanted dog, cat, or ferret that exposes a person may be euthanized immediately and the head submitted for rabies examination.

b) Other Animals. Other 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 exposure, the epidemiology of rabies in the area, the exposing animal's history, current health status, and the animal's potential for exposure to rabies. The shedding period for rabies virus is undetermined for most species. Previous vaccination of these animals might not preclude the necessity for euthanasia and testing.

7. **OUTBREAK PREVENTION AND CONTROL.** The emergence of new rabies virus variants or the introduction of non-indigenous viruses poses a significant risk to humans, domestic animals, and wildlife (63-70). A rapid and comprehensive response includes the following measures (71):

- a) Characterize the virus at the national reference laboratory.
- b) Identify and control the source of the introduction.
- c) Enhance laboratory-based surveillance in wild and domestic animals.
- d) Increase animal rabies vaccination rates.
- e) Restrict the movement of animals.
- f) Evaluate the need for vector population reduction.
- g) Coordinate a multiagency response.
- h) Provide public and professional outreach and education.

8. DISASTER RESPONSE: Animals might be displaced during and after man-made or natural disasters and require emergency sheltering (<http://www.bt.cdc.gov/disasters/petshelters.asp> and <http://www.avma.org/disaster/default.asp>) (72). Animal rabies vaccination and exposure histories often are not available for displaced animals. Disaster response creates situations where animal caretakers might lack appropriate training and preexposure vaccination. In such situations, it is critical to implement and coordinate rabies prevention and control measures to reduce the risk of rabies transmission and the need for human PEP. Such measures include actions to:

- a) Coordinate relief efforts of individuals and organizations with the local emergency operations center before deployment.
- b) Examine each animal at a triage site for possible bite injuries or signs of rabies.
- c) Isolate animals exhibiting signs of rabies, pending evaluation by a veterinarian.
- d) Ensure that all animals have a unique identifier.
- e) Administer a rabies vaccination to all dogs, cats and ferrets unless reliable proof of vaccination exists.
- f) Adopt minimum standards for animal caretakers as feasible, including personal protective equipment, preexposure rabies vaccination, and appropriate training in animal handling (73).
- g) Maintain documentation of animal disposition and location (e.g., returned to owner, died or euthanized, adopted, relocated to another shelter, and address of new location).
- h) Provide facilities to confine and observe animals involved in exposures (see Part I.B.6.).
- i) Report human exposures to appropriate public health authorities (see Part I.A.3.).

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 expose persons, pets, or livestock should be considered for euthanasia and rabies diagnosis. A person exposed by any wild mammal should immediately report the incident to a healthcare provider who, in consultation with public health authorities, can evaluate the need for PEP (9,10).

Translocation of infected wildlife has contributed to the spread of rabies (63-68,74); therefore, the translocation of known terrestrial rabies reservoir species should be prohibited. Whereas state regulated wildlife rehabilitators and nuisance wildlife control operators may play a role in a comprehensive rabies control program, minimum standards for persons who handle wild mammals should include rabies vaccination, appropriate training, and continuing education.

1. CARNIVORES: The use of oral rabies vaccines (ORV) for the mass vaccination of free-ranging wildlife should be considered in selected situations, with the approval of the appropriate state agencies (14,75). There have been documented successes using ORV to control rabies in wildlife in North America (75-78). The currently licensed vaccinia-vectored ORV is labeled for use in raccoons and coyotes. The distribution of ORV 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 ORV 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 (e.g., picnic grounds, camps, and suburban areas) might be indicated for the removal of selected high-risk species of wildlife. State agriculture, public health, and wildlife agencies should be consulted for planning, coordination, and evaluation of vaccination or population reduction programs (14).

2. BATS: From the 1950's to date, indigenous rabid bats have been reported from every state except Hawaii and have caused rabies in at least 43 humans in the United States (79-92). Bats should be excluded appropriately from houses, public buildings, and adjacent structures to prevent direct association with humans (93,94). 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 (95), except as recommended in Part I.B.1.

B. VACCINE SELECTION: Part III lists all vaccines licensed by 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 as previously administered. Vaccines used in state and local rabies control programs should have at least a 3-year duration of immunity. This constitutes the most effective method of increasing the proportion of immunized dogs and cats in any population (96). No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines following the initial series.

C. ADVERSE EVENTS: Currently, no epidemiologic association exists between a particular licensed vaccine product and adverse events (13,97-98). Although rare, adverse events including vomiting, injection site swelling, lethargy, hypersensitivity, and rabies in a previously vaccinated animal have been reported. Adverse events should be reported to the vaccine manufacturer and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). No contraindication to rabies vaccination exists. Animals with a previous history of anaphylaxis can be medically managed and observed after vaccination (46).

D. WILDLIFE AND HYBRID ANIMAL VACCINATION: The safety and efficacy of parenteral rabies vaccination of wildlife and hybrids have not been established, and no rabies vaccines are licensed for these animals. Zoos or research institutions may establish vaccination programs to attempt to protect valuable animals, but these should not replace appropriate public health activities that protect humans (see Part I.B.1.c.2).

E. ACCIDENTAL HUMAN EXPOSURE TO VACCINE: Human exposure to parenteral animal rabies vaccines listed in Part III does not constitute a risk for rabies virus infection. Human exposure to vaccinia-vectored oral rabies vaccines should be reported to state health officials (100,101).

F. RABIES CERTIFICATE: All agencies and veterinarians should use NASPHV Form 51 (revised 2007), Rabies Vaccination Certificate, or an equivalent. This form can be obtained from vaccine manufacturers, NASPHV (<http://www.nasphv.org/Documents/RabiesVacCert.pdf>), or CDC (http://www.cdc.gov/rabies/pdf/nasphv_form51.pdf). The form must be completed in full and signed by the administering or supervising veterinarian. Computer generated forms containing the same information are also acceptable.

III. Rabies Vaccines Licensed and Marketed in the U.S., 2011

Product Name	Produced by	Marketed by	For Use In	Dosage	Age at Primary Vaccination ^a	Booster Recommended	Route of Inoculation
A) MONOVALENT (Inactivated)							
RABVAC 1	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs Cats	1 ml 1 ml	3 months ^b 3 months	Annually Annually	IM ^c or SC ^d IM or SC
RABVAC 3	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	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	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	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
CONTINUUM RABIES	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	1 year later & triennially 1 year later & quadrennially	SC SC
EQUI-RAB	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Horses	1 ml	4 months	Annually	IM
PRORAB-1	Intervet, Incorporated License No. 165A	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
DEFENSOR 1	Pfizer, Incorporated License No. 189	Pfizer, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	IM or SC 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 Animal Health	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 Animal Health	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	IM or SC SC
IMRAB 1	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	SC SC
IMRAB 1 TF	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	SC 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
B) MONOVALENT (Rabies glycoprotein, live canary pox vector)							
PUREVAX Feline Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	3 months	Annually	SC
C) COMBINATION (Inactivated rabies)							
CONTINUUM DAP-R	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs	1 ml	3 months	1 year later & triennially	SC
CONTINUUM Feline HCP-R	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Cats	1 ml	3 months	1 year later & triennially	SC
Equine POTOMAVAC + IMRAB	Merial, Incorporated License No. 298	Merial, 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	1ml	8 weeks 3 months	Every 3 weeks until 3 months & annually 3 weeks later & annually	SC
PUREVAX Feline 4/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	8 weeks 3 months	Every 3 weeks until 3 months & annually 3 weeks later & 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	Coyotes Raccoons	N/A	N/A	As determined by local authorities	Oral

a. Minimum age (or older) and revaccinated one year later
 b. One month = 28 days
 c. Intramuscularly

d. Subcutaneously
 e. Fort Dodge Animal Health was recently acquired by Boehringer Ingelheim Vetmedica, Inc.

Rabies Vaccine Manufacturer Contact Information

Manufacturer	Phone Number	Internet Address
Boehringer Ingelheim Vetmedica, Inc.	800-638-2226	Not available
Intervet, Inc.	800-441-8272	http://www.intervetusa.com
Merial, Inc.	888-637-4251	http://us.merial.com
Pfizer, Inc.	800-366-5288	http://www.pfizerah.com

ADVERSE EVENTS: Adverse events should be reported to the vaccine manufacturer and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255;).

REFERENCES:

1. Rabies. In: Heymann D, ed. Control of communicable diseases manual. 19th ed. Washington, DC: American Public Health Association; 2008:498-508.
2. Blanton JD, Palmer D, Christian KA, Rupprecht CE. Rabies surveillance in the United States during 2009. *J Am Vet Med Assn* 2010;237(6):646-657. Available at: <http://www.cdc.gov/rabies/resources/publications/index.html>.
3. Castrodale L, Walker V, Baldwin J, Hofmann J, Hanlon C. Rabies in a puppy imported from India to the USA, March 2007. *Zoonoses Public Health* 2008;55(8-10):427-430.
4. CDC. Rabies in a Dog Imported from Iraq -- New Jersey, June 2008. *MMWR* 2008; 57:1076-1078. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5739a3.htm>.
5. McQuiston JH, Wilson T, Harris S, et al. Importation of dogs into the United States: risks from rabies and other zoonotic diseases. *Zoonoses Public Health* 2008;55(8-10):421-426.
6. Velasco-Villa A, Recoder SA, Orziari LA, et al. Enzootic rabies elimination from dogs and reemergence in wild terrestrial carnivores, United States. *Emerg Infect Dis* 2008;14(12):1849-1854. Available at: <http://www.cdc.gov/EID/content/14/12/1849.htm>.
7. Beran GW. Rabies and infections by rabies-related viruses. In: Beran GW (ed.) Handbook of zoonoses section B: Viral, second ed. Boca Raton, FL: CRC Press; 1994:307-57.
8. Council of State and Territorial Epidemiologists. Public Health Reporting and National Notification for Animal Rabies. Infectious Disease Positions Statements, June 2009. CSTE, Atlanta, GA. Available at: <http://www.cste.org/ps2009/09-ID-12.pdf>.
9. CDC. Human rabies prevention—United States, 2008. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2008;57(No. RR-3):1-28. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr57e507a1.htm>.
10. CDC. Use of reduced (4-dose) vaccine schedule for postexposure prophylaxis to prevent human rabies. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2010;59(No. RR-2):1-12. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5902a1.htm>.
11. McQuiston J, Yager PA, Smith JS, Rupprecht CE. Epidemiologic characteristics of rabies virus variants in dogs and cats in the United States, 1999. *J Am Vet Med Assoc* 2001;218:1939-42.
12. Murray KO, Holmes KC, Hanlon CA. Rabies in vaccinated dogs and cats in the United States, 1997-2001. *J Am Vet Med Assoc* 2009;235:691-695.
13. Frana TS, Clough NE, Gatewood DM, Rupprecht CE. Postmarketing surveillance of rabies vaccines for dogs to evaluate safety and efficacy. *J Am Vet Med Assoc* 2008;232:1000-1002.
14. Hanlon CA, Childs JE, Nettles VF, et al. Recommendations of the Working Group on Rabies. Article III: rabies in wildlife. *J Am Vet Med Assoc* 1999;215:1612-8.
15. Slate D, Algeo TD, Nelson KM, et al. Oral rabies vaccination in North America: opportunities, complexities, and challenges. *PLoS Negl Trop Dis* 2009;3(12):1-9
16. Council of State and Territorial Epidemiologists. Electronic laboratory reporting in the US: underfunded and under potential, or, recommendations for the implementation of ELR in the US. Policy Positions Statements, June 2009. CSTE, Atlanta, GA. Available at: <http://www.cste.org/ps2009/09-SI-03.pdf>.
17. Council of State and Territorial Epidemiologists. Process statement for immediately nationally notifiable conditions. Policy Positions Statements, June 2009. CSTE, Atlanta, GA. Available at: <http://www.cste.org/ps2009/09-SI-04.pdf>.
18. Hanlon CA, Smith JS, Anderson GR, et al. Recommendations of the Working Group on Rabies. Article II: laboratory diagnosis of rabies. *J Am Vet Med Assoc* 1999;215:1444-6.
19. Rudd RJ, Smith JS, Yager PA, et al. A need for standardized rabies-virus diagnostic procedures: effect of cover-glass mountant on the reliability of antigen detection by the fluorescent antibody test. *Virus Res* 2005;111:83-8.
20. American Veterinary Medical Association. AVMA guidelines on euthanasia, June 2007. Schaumburg, IL: American Veterinary Medical Association; 2007. Available at: http://www.avma.org/issues/animal_welfare/euthanasia.pdf.
21. Michigan Rabies Working Group. Humane euthanasia of bats for public health rabies testing. 2008. Available at: http://www.michigan.gov/documents/emergingdiseases/Humane_Euthanasia_of_Bats-Final_244979_7.pdf.
22. CDC. Public health response to a potentially rabid bear cub -- Iowa, 1999. *MMWR* 1999;48:971-3. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4842a5.htm>.

23. Niezgoda M, Rupprecht CE. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention 1-16; 2006. Standard operating procedure for the direct rapid immunohistochemistry test for the detection of rabies virus antigen. National Laboratory Training Network Course. Available at: http://www.rabiesblueprint.com/IMG/pdf/DRIT_SOP.pdf.
24. Lembo T, Niezgoda M, Velasco-Villa A, Cleaveland S, Ernest E, Rupprecht CE. Evaluation of a direct, rapid immunohistochemical test for rabies diagnosis. *Emerg Infect Dis*. 2006. Feb;12(2):310-3.
25. Dürr S, Naïssengar S, Mindekem R, et al. Rabies diagnosis for developing countries. *PLoS Negl Trop Dis*. 2008. Mar 26;2(3):e206.
26. Saturday GA, King R, Fuhrmann L. Validation and operational application of a rapid method for rabies antigen detection. *US Army Med Dep J*. 2009. Jan-Mar:42-5.
27. Tizard I, Ni Y. Use of serologic testing to assess immune status of companion animals. *J Am Vet Med Assoc* 1998;213:54–60.
28. Greene CE, ed. Rabies and other lyssavirus infections. In: *Infectious diseases of the dog and cat*. 3rd ed. London, England: Saunders Elsevier; 2006;167–83.
29. Rupprecht CE, Gilbert J, Pitts R, Marshall K, Koprowski H. Evaluation of an inactivated rabies virus vaccine in domestic ferrets. *J Am Vet Med Assoc* 1990;196:1614–6.
30. Moore SM, Hanlon CA. Rabies-specific antibodies: measuring surrogates of protection against a fatal disease. *PLoS Negl Trop Dis*. 2010. Mar 9;4(3):e595.
31. Aubert MF. Practical significance of rabies antibodies in cats and dogs. *Rev Sci Tech* 1992;11:735–60.
32. Muirhead TL, McClure JT, Wichtel JJ, et al. The effect of age on serum antibody titers after rabies and influenza vaccination in healthy horses. *J Vet Intern Med* 2008;22:654-661.
33. Shimazaki Y, Inoue S, Takahashi C, et al. Immune response to Japanese rabies vaccine in domestic dogs. *J Vet Med B* 2003;50:95-8.
34. Cliquet F, Verdier Y, Sagné L, et al. Neutralising antibody titration in 25,000 sera of dogs and cats vaccinated against rabies in France, in the framework of the new regulations that offer an alternative to quarantine. *Rev Sci Tech* 2003;22:857–66.
35. Rabies. In: *Guidelines for the vaccination of horses*. American Association of Equine Practitioners; 2009. Available at: <http://www.aiep.org/rabies.htm>.
36. National Association of State Public Health Veterinarians. Compendium of measures to prevent disease and injury associated with animals in public settings, 2007. *MMWR* 2007;56(RR05);1-13. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5805a1.htm>.
37. Bender J, Schulman S. Reports of zoonotic disease outbreaks associated with animal exhibits and availability of recommendations for preventing zoonotic disease transmission from animals to people in such settings. *J Am Vet Med Assoc* 2004;224:1105–9.
38. American Veterinary Medical Association. Private ownership of wild animals. Schaumburg, IL: American Veterinary Medical Association; 2006. Available at: http://www.avma.org/issues/policy/wild_animal_ownership.asp.
39. American Veterinary Medical Association. Position on canine hybrids. Schaumburg, IL: American Veterinary Medical Association; 2008. Available at: http://www.avma.org/issues/policy/canine_hybrids.asp.
40. Siino BS. Crossing the line: the case against hybrids. *American Society for the Prevention of Cruelty to Animals, Animal Watch*; 2000:22–9. Available at: <http://www.petfinder.com/before-pet-adoption/case-against-hybrids.html?page-index=1&query=hybrids>.
41. Jay MT, Reilly KF, DeBess EE, Haynes EH, Bader DR, Barrett LR. Rabies in a vaccinated wolf-dog hybrid. *J Am Vet Med Assoc* 1994;205:1729–32.
42. CDC. An imported case of rabies in an immunized dog. *MMWR* 1987;36:94–6. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00000874.htm>.
43. CDC. Imported dog and cat rabies—New Hampshire, California. *MMWR* 1988;37:559–60. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00001275.htm>.
44. Hanlon CA, Niezgoda MN, Rupprecht CE. Postexposure prophylaxis for prevention of rabies in dogs. *Am J Vet Res* 2002;63:1096–100.
45. US Government Printing Office. 9CFR113.209. Available at: http://edocket.access.gpo.gov/cfr_2003/9cfr113.209.htm.
46. Greene CE, ed. Immunoprophylaxis. In: *Infectious diseases of the dog and cat*. 3rd ed. London, England: Saunders Elsevier; 2006;1069-1119.
47. Willoughby, RE. “early death” and the contraindication of vaccine during rabies treatment. *Vaccine* 2009;27:7173-7177.
48. Mansfield K, McElhinney L, Hübschle O, et al. A molecular epidemiological study of rabies epizootics in kudu (*Tragelaphus strepsiceros*) in Namibia. *BMC Vet Res* 2006;2:2.
49. Viral agents. In: U.S. Department of Health and Human Services. *Biosafety in Microbiological and Biomedical Laboratories*. 5th edition. Washington, D.C.: U.S. Government Printing Office; 2007:234-235. Available at: http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5_sect_VIII_e.pdf.
50. Wertheim HIFL, Nguyen TQ, Nguyen KAT, et al. Furious rabies after an atypical exposure. *PLoS Med* 2009;6(3):0264-8.
51. Ante-mortem inspection. In: U.S. Meat and Poultry Inspection Program. *Meat and poultry inspection manual*. Washington, D.C.: U.S. Government Printing Office; 1973:314 p.
52. Debbie JG, Trimarchi CV. Pantropism of rabies virus in free-ranging rabid red fox (*Vulpes fulva*). *J Wildl Dis* 1970;6(4):500-6.
53. Fekadu M, Shaddock JH. Peripheral distribution of virus in dogs inoculated with two strains of rabies virus. *Am J Vet Res* 1984;45(4):724-729.

54. Charlton, KM. The pathogenesis of rabies and other lyssaviral infections: recent studies. *Curr Top Microbiol Immunol* 1994;187:95–119.
55. Afshar, A. A review of non-bite transmission of rabies virus infection. *Br Vet J* 1979;135:142-8.
56. CDC. Mass treatment of humans who drank unpasteurized milk from rabid cows—Massachusetts, 1996–1998. *MMWR* 1999;48:228–9. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00056759.htm>.
57. CDC. Public health service guideline on infectious disease issues in xenotransplantation. *MMWR* 2001;50(No. RR-15):1-56.
58. Turner GS, Kaplan C. Some properties of fixed rabies virus. *J Gen Virol* 1967;1:537-551.
59. Vaughn JB, Gerhardt P, Paterson J. Excretion of street rabies virus in saliva of cats. *J Am Med Assoc* 1963;184:705.
60. Vaughn JB, Gerhardt P, Newell KW. Excretion of street rabies virus in saliva of dogs. *J Am Med Assoc* 1965;193:363–8.
61. Niezgodna M, Briggs DJ, Shaddock J, Rupprecht CE. Viral excretion in domestic ferrets (*Mustela putorius furo*) inoculated with a raccoon rabies isolate. *Am J Vet Res* 1998;59:1629–32.
62. Tepsumethanon V, Lumlerdacha B, Mitmoonpitak C, Sitprija V, Meslin FX, Wilde H. Survival of naturally infected rabid dogs and cats. *Clin Infect Dis* 2004;39:278–80.
63. Jenkins SR, Perry BD, Winkler WG. Ecology and epidemiology of raccoon rabies. *Rev Infect Dis* 1988;10(Suppl 4):S620–5.
64. CDC. Translocation of coyote rabies—Florida, 1994. *MMWR* 1995;44:580–7. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00038451.htm>.
65. Rupprecht CE, Smith JS, Fekadu M, Childs JE. The ascension of wildlife rabies: a cause for public health concern or intervention? *Emerg Infect Dis* 1995;1:107–14. Available at: <http://www.cdc.gov/ncidod/eid/vol1no4/rupprech.htm>.
66. Constantine DG. Geographic translocation of bats: known and potential problems. *Emerg Infect Dis* 2003;9:17–21. Available at: <http://www.cdc.gov/ncidod/EID/vol9no1/02-0104.htm>.
67. Krebs JW, Strine TW, Smith JS, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 1993. *J Am Vet Med Assoc* 1994;205:1695–709.
68. VF Nettles, JH Shaddock, RK Sikes, CR Reyes. Rabies in translocated raccoons. *Am J Public Health* 1979;69:601–2.
69. RM Engeman, KL Christensen, MJ Pipas, DL Bergman. Population monitoring in support of a rabies vaccination program for skunks in Arizona. *J Wildl Dis* 2003;39:746–50.
70. Leslie MJ, Messenger S, Rohde RE, et al. Bat-associated rabies virus in skunks. *Emerg Infect Dis* 2006;12:1274–7. Available at: <http://www.cdc.gov/ncidod/EID/vol12no08/05-1526.htm>.
71. Rupprecht CE, Hanlon CA, Slate D. Control and prevention of rabies in animals: paradigm shifts. *Dev Biol (Basel)* 2006;125:103-11.
72. Pets Evacuation and Transportations Standards Act of 2006. Available at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_public_laws&docid=f:publ308.109.pdf.
73. National Animal Control Association guidelines. Available at: <http://www.nacenet.org/guidelines.html>.
74. Chipman R, Slate D, Rupprecht C, Mendoza M. Downside Risk of Translocation. Dodet B, Fooks AR, Muller T, Tordo N, and the Scientific & Technical Department of the OIE (eds): Towards the Elimination of Rabies in Eurasia. *Dev Biol. Basel, Karger* 2008;131:223-232.
75. Slate D, Rupprecht CE, Rooney JA, Donovan D, Lein DH, Chipman RB. Status of oral rabies vaccination in wild carnivores in the United States. *Virus Res* 2005;111:68–76.
76. Sidwa TJ, Wilson PJ, Moore GM, et al. Evaluation of oral rabies vaccination programs for control of rabies epizootics in coyotes and gray foxes: 1995-2003. *J Am Vet Med Assoc* 2005;227:785-792.
77. MacInnes CD, Smith SM, Tinline RR, et al. Elimination of rabies from red foxes in eastern Ontario. *J Wildl Dis* 2001;37:119-132.
78. Rosatte RC, Power MJ, Donovan D, et al. Elimination of arctic variant of rabies in red foxes, metropolitan Toronto. *Emerg Infect Dis* 2007;13(1)25-27. Available at: <http://www.cdc.gov/ncidod/EID/13/1/25.htm>.
79. Messenger SL, Smith JS, Rupprecht CE. Emerging epidemiology of bat-associated cryptic cases of rabies in humans in the United States. *Clin Infect Dis* 2002;35:738–47.
80. CDC. Human rabies—California, 2002. *MMWR* 2002;51:686–8. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5131a4.htm>.
81. CDC. Human rabies—Tennessee, 2002. *MMWR* 2002;51:828–9. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5137a2.htm>.
82. CDC. Human rabies—Iowa, 2002. *MMWR* 2003;52:47–8. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5203a3.htm>.
83. CDC. Human death associated with bat rabies—California, 2003. *MMWR* 2004;53:33–5. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5302a4.htm>.
84. CDC. Recovery of a patient from clinical rabies, Wisconsin, 2004. *MMWR* 2004;53:1171–3. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5350a1.htm>.
85. CDC. Human rabies—Mississippi, 2005. *MMWR* 2006;55:207–8. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5508a4.htm>.
86. CDC. Human rabies—Indiana and California, 2006. *MMWR* 2007;56:361–5. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5615a1.htm>.
87. CDC. Human rabies—Minnesota, 2007. *MMWR* 2008;57:460-462. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5717a3.htm>.

88. CDC. Human rabies—Missouri, 2008. MMWR 2009;58:1207-9. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5843a3.htm>.
89. CDC. Human rabies—Kentucky/Indiana, 2009. MMWR 2010;59:393-6. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5913a3.htm>.
90. CDC. Human rabies—Virginia, 2009. MMWR 2010;59:1236-8. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5938a3.htm>.
91. CDC. Presumptive abortive human rabies—Texas, 2009. MMWR 2010;59:185-90. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5907a1.htm>.
92. CDC. Human rabies-Michigan 2009. MMWR 2011;60:437-40. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6014a1.htm?s_cid=mm6014a1_w
93. Greenhall AM. House bat management. US Fish and Wildlife Service, Resource Publication 143;1982. Jamestown, ND: Northern Prairie Wildlife Research Center Online. Available at: <http://www.npwrc.usgs.gov/resource/mammals/housebat/index.htm>.
94. Greenhall, AM. Frantz, SC. Bats. In: Hygnstrom SE, Timm RM, Larson GE, eds. Prevention and Control of Wildlife Damage 1994. Available at: <http://icwdm.org/handbook/mammals/bats.asp>.
95. American Veterinary Medical Association. Model rabies control ordinance. Schaumburg, IL: American Veterinary Medical Association 2008. Available at: <http://www.avma.org/issues/policy/AVMA-Model-Rabies-Ordinance.pdf>.
96. Bunn TO. Canine and feline vaccines, past and present. In Baer GM, ed. The natural history of rabies. 2nd ed. Boca Raton, FL: CRC Press; 1991:415–25.
97. Macy DW, Hendrick MJ. The potential role of inflammation in the development of postvaccinal sarcomas in cats. Vet Clin North Am Small Anim Pract 1996;26:103–9.
98. Gobar GM, Kass PH. World wide web-based survey of vaccination practices, postvaccinal reactions, and vaccine site-associated sarcomas in cats. J Am Vet Med Assoc 2002;220:1477–82.
99. Kass PH, Spangler WL, Hendrick MJ, et al. Multicenter case-control study of risk factors associated with development of vaccine-associated sarcomas in cats. J Am Vet Med Assoc 2003;223:1283–92.
100. Rupprecht CE, Blass L, Smith K, et al. Human infection due to recombinant vaccinia-rabies glycoprotein virus. N Engl J Med 2001;345:582–6.
101. CDC. Human vaccinia infection after contact with a raccoon rabies vaccine bait— Pennsylvania, 2009. MMWR 2009; 58:1204-7. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5843a2.htm>.

Memorandum

To: Rabies Vaccination Committee
From: John King, DVM
Date: December 1, 2011
Re Rabies Vaccination Efficacy

Today I spoke to Donna M. Gatewood, DVM, MS, Section Leader, Virology, USDA/APHIS/VS/CVB PEL, Center for Veterinary Biologics to gather information on vaccine licensure process and demonstration of vaccine efficacy.

The criteria for USDA approval and licensure of a vaccine:

1. There must be a population of animals that would be the recipient of the proposed vaccine.
One group of 25 animals or more of vaccinates
One group of 10 animals or more that are control or non-vaccinate subjects
2. At the specific time that the manufacturer is proposing the duration of immunity that will be listed on the label, both groups of animals are challenged (injected) with a live virus / bacteria.
3. At least 80% of the control or non-vaccinates **must develop** signs of the disease and either die or are humanely euthanized.
4. Not less than 87% of the vaccinated animals **must not develop** signs of the disease.

Other criteria are evaluated in addition to the vaccine efficacy challenge study (adverse reactions, Etc.). If the proposed vaccine meets the minimum threshold of criteria established by the USDA, the vaccine is approved and licensed and can be made available to the public for use.

Technical Bulletin

August 1998



Evaluation of Defensor® 3 Rabies Vaccine Against Street Rabies Strains

For three consecutive years—1994, 1995, 1996—reported cases of rabies in animals decreased.¹ Despite the favorable trend, the total number of rabies cases reported in 1996 remains high at 7,124 cases.¹ Of the total, domestic animals accounted for 8% of the cases, continuing to demonstrate that mass vaccination of dogs has led to significant reductions in the number of canine rabies cases. In 1996, only 111 cases in dogs were reported, whereas in the late 1940s, 5,000 cases were reported annually. Of continuing concern to public health were the 6,550 cases of rabies reported in wild animals (Figure 1). In descending order, the most frequently reported rabid wildlife species were raccoons (3,595 cases in 1996), skunks (1,656 cases), bats (741 cases), and foxes (412 cases). Four cases of rabies in human beings were reported in 1996, bringing the total number of cases diagnosed in the U.S. between 1980 and 1996 to 32. Of the 20 people thought to have acquired their infections in the U.S., 17 were infected with rabies virus variants associated with bats.^{2,3,4} Although rabies in humans is relatively rare in the U.S., annually more than 22,000 people receive treatment to prevent disease following an exposure.⁵

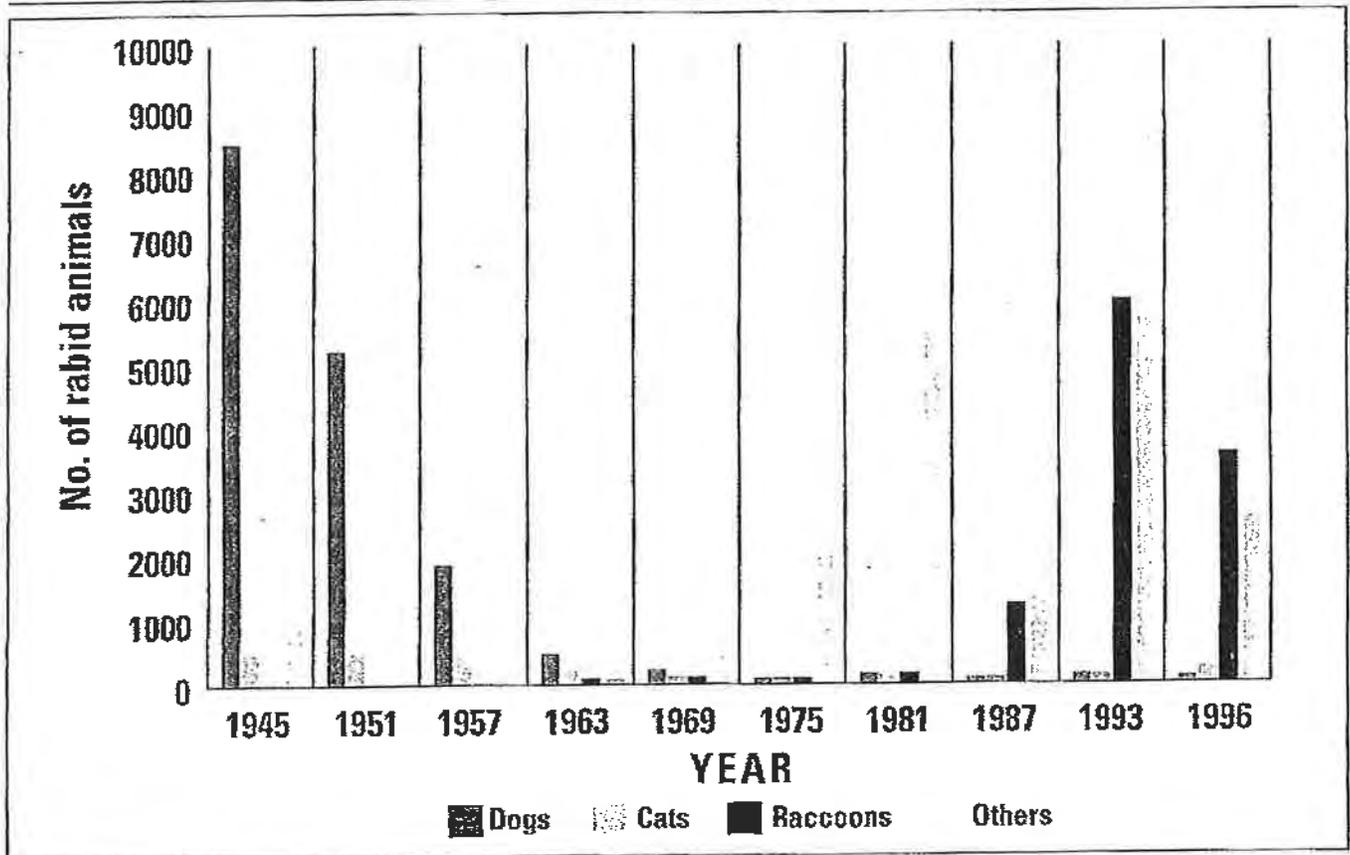
Inactivated feline and canine vaccines probably are effective in protecting against the

Key Points

- Despite the success of rabies control measures in dogs and cats, both rabies postexposure prophylaxis in human beings and the number of rabies cases in animals remain relatively high in the U.S.
- Most human deaths from rabies are caused by rabid wildlife, especially bats, whereas most rabies cases in animals are attributable to raccoons.
- Results of a study conducted on mice to evaluate the potency of Defensor 3 against 5 wild rabies viruses (isolated from coyote, skunk, fox, raccoon, and bat) demonstrated that Defensor 3 protected against all wild viruses, but provided exceptional protection against rabies from raccoons and bats.

*By monoclonal antibody analysis and genetic sequencing.

Fig. 1 Reported rabid animals in the United States from 1945 to 1996.



rabies viruses found in wild animals, but insufficient testing has been done to document this. Further, the potency tests used to evaluate vaccines assess only laboratory standard viruses, which differ from street viruses. The study reported in this bulletin examined the potency of Defensor 3 rabies vaccine against 5 street viruses and a laboratory standard virus by using the National Institutes of Health (NIH) and Center for Disease Control (CDC) rabies potency tests.⁶

Materials and Methods

Four-week-old mice were tested for immunity to 6 rabies strains after being vaccinated with Defensor 3 rabies vaccine or a reference vaccine. Two different antigen-extinction test procedures were used to evaluate vaccine potency: the NIH test and the CDC test. Challenge strains tested in the study were "street" viruses (those likely to be encountered by an animal), which had been obtained from various state health departments. They included rabies viruses associated with: a raccoon from the central area of New York; a red fox from northern

New York; a striped skunk from the northern states in the midwestern U.S.; a silver-haired bat from New York; and a coyote from Texas. Additionally, a challenge virus standard (CVS) from a mouse passage strain was included as a reference.

Virus Passage

Each virus was passed serially in mice via the intracerebral route until sufficient quantities of rabies virus were available. The strains were then diluted for challenge exposure (intracerebral or intramuscular) to provide the appropriate number of LD₅₀ (Table 1).

NIH Test

In the NIH test, 128 mice were vaccinated twice intraperitoneally with 4 graded dilutions (1:10, 1:50, 1:250, and 1:1250) of Defensor 3 or the reference vaccine. The remaining 256 mice were nonvaccinated controls. Two weeks later, all mice were challenged intracerebrally with 0.03 mL of virus. Sixty-four mice (16 for each dilution) were used for each of the 6 challenge strains (5 street and 1 CVS).

Table 1. Rabies virus titer and challenge exposure dosage

Species	NIH Test	IC Titer	CDC Test	IM Titer
	Virus Titer	LD ₅₀ Injected	Virus Titer	LD ₅₀ Injected
Raccoon	10 ^{6.36}	36	10 ^{2.9}	10
Fox	10 ^{5.91}	29	10 ^{3.2}	8
Skunk	10 ^{6.55}	44	10 ^{3.9}	6
Bat	10 ^{6.89}	33	10 ^{4.1}	8
Coyote	10 ^{5.92}	45	10 ^{3.6}	10
CVS	10 ^{6.89}	33	10 ^{5.1}	10

CVS=challenge virus standard

CDC Test

In the CDC test, 128 mice were vaccinated once intramuscularly in the hind limb with 4 graded dilutions (1:2, 1:10, 1:50, and 1:250) of Defensor 3 or the reference vaccine. The remaining 256 mice were nonvaccinated controls. Four weeks later, they were challenged with 0.1 mL in the masseter muscle. Sixty-four mice were used for each of the 6 challenge strains (5 street and 1 CVS). All viruses had been titered to ensure that the proper challenge dose was selected (Table 1).

Results and Discussion

Results were measured by comparing the Defensor 3 effective protective dose (ED₅₀) with that of the reference vaccine to give relative potencies. Relative potency describes the ratio between the potency (ED₅₀) of a vaccine, compared to that of the reference vaccine. Table 2 contains the relative potencies of Defensor 3 against the 5 street strains and ratios for each value, compared to that against CVS. Ratios were computed by dividing the relative potencies of the street strains by that of the CVS.

As the data in Table 2 illustrate, Defensor 3 provided protection (relative potency of >1) against each of the street viruses and the

CVS. The highest relative potencies were obtained against the raccoon and bat viruses. Differences in relative potencies between the NIH test and the CDC test are attributed to methodologies. The CDC method more closely simulates challenge exposure due to a bite than does the NIH method.⁶

Conclusions

Regardless of test methodology, Defensor 3 demonstrated potency against all of the street viruses and the challenge virus standard. More importantly, Defensor 3 yielded the highest level of protection, relative to the reference vaccine, against the raccoon and bat viruses. During the past two decades, the greatest number of rabies cases in human beings have been the result of infection by rabies virus variants associated with bats.¹ In the 1996 rabies surveillance, raccoons were identified as a primary reservoir of rabies virus, accounting for 50.4% (3,595/7,124) of all rabies cases reported in non-human animals.¹

Defensor 3

Defensor 3 rabies vaccine offers the valued combination of animal comfort and excel-

Table 2. Relative potencies of Defensor 3 against various rabies strains

Species	CDC Test		NIH Test	
	Relative Potency	Ratio vs CVS	Relative Potency	Ratio vs CVS
Raccoon	3.49	0.76	6.40	3.4
Fox	2.10	0.46	2.14	1.1
Skunk	1.96	0.43	1.78	0.9
Bat	3.05	0.67	4.32	2.3
Coyote	1.84	0.40	1.81	1.0
CVS	4.56	NA	1.88	NA

CVS=challenge virus standard NA=not applicable

lent protection. Because Defensor 3 uses a novel dual-buffering system that restricts the pH to a narrow, safe range, the product is extremely well tolerated after injection. In field safety studies, thousands of in-clinic doses yielded minimal response from animals in terms of barking, scratching/biting the injection site, or stiffness/lameness after the injection.⁷ More than 96% of the vaccinated animals had no signs of injection site discomfort, which may be attributable to Defensor 3's purified adjuvant.⁷ In these studies, 99.9% of the dogs and cats remained free of lumps or swelling associated with the injection site for 21 days after vaccination.⁷

Further, the strain used in Defensor 3 (Paris, PV-4) closely resembles the original rabies isolate discovered by Louis Pasteur in the late 1800s. Duration of immunity challenge studies showed that 96.7% of cats and 86.7% of dogs were free from rabies after being severely challenged 3 years after vaccination. Additional laboratory studies revealed that Defensor 3's effectiveness is not limited to rabies strains commonly found in dogs, but extends to other strains of the virus as well.

Defensor 3 can be used in dogs, cats, cattle, and sheep. The primary vaccination should be administered to animals at 3 months of age and followed with a repeat dose 1 year later. Revaccination should occur every 3 years in dogs and cats and annually in cattle and sheep.

References

1. Krebs JW, Smith JS, Rupprecht, et al. Rabies surveillance in the United States during 1996. *JAVMA* 211:1525-1539,1996.
2. Centers for Disease Control and Prevention. Human rabies—Florida, 1996. *MMWR Morb Mortal Wkly Rep* 1996; 45:719-727.
3. Centers for Disease Control and Prevention. Human rabies—Kentucky and Montana, 1996. *MMWR Morb Mortal Wkly Rep* 1997; 46:267-270.
4. Centers for Disease Control and Prevention. Human rabies—Florida, 1996. *MMWR Morb Mortal Wkly Rep* 1997; 46:397-400.
5. Centers for Disease Control and Prevention. Facts about rabies from the CDC office of communications. *CDC Media Relations* May 9, 1997; 1-2.
6. Baer GM. Evaluation of an animal rabies vaccine by use of two types of potency tests. *Am J Vet Res* 58:837-840,1997.
7. Data on file at Pfizer Animal Health.



Animal Health



Defensor® is a registered trademark of Pfizer Inc

© Pfizer Inc 8/98 RAB9801

Efficacy you can count on

Rabvac[®] offers proven protection with **100 percent efficacy¹** for both canine and feline patients.

- **Proven safe** in the largest-ever vaccine safety study for dogs and cats^{2,3}
- **Available with one- and three-year duration of immunity** and in single-dose vials or ten-dose tanks to better fit your vaccine protocols and clients' needs
- **Aluminum-free**

	SKU#	Qty.	rabies	
Rabvac [®] 1	156021-000	10ds tank	K	
Rabvac [®] 1	156041-000	50 x 1 ds	K	
Rabvac [®] 3	156121-000	10ds tank	K	
Rabvac [®] 3	156141-000	50 x 1 ds	K	

K = inactivated (killed).



¹USDA Licensure Data. Data on file at Bostinger Ingelheim Vetmedica, Inc.

²Moore GE, Gupta LF, Ward MP, et al. Adverse events diagnosed within three days of vaccine administration in dogs. *JAVMA*. 2005;38(7):1102-1108.

³Moore GE, DeSantis-Kerr AC, Gupta LF, et al. Adverse events after vaccine administration in cats: 2,560 cases (2002-2005). *JAVMA*. 2007;231(1):94-100.



December 8, 2011

Dear Dr. King,

I was asked to send you some information on rabies vaccines. The question the Minnesota Veterinary Association should be asking is why would you want to recommend a canine rabies vaccine with a minimum duration of immunity (DOI) of 3 years more often than every 3 years? This is the one and only vaccine for which the USDA has required a minimum DOI study from all companies. All rabies vaccines on the market for the dog have been shown to have a minimum DOI of either 1 or 3 years. Ironically, many of those products are identical because of the way the studies were performed. Many of the studies included two groups of dogs. One year after vaccination, half the vaccinates and half the control dogs were challenged with virulent rabies virus. A prescribed percentage of the control dogs must die and a prescribed percentage of the vaccinated dogs must live without evidence of rabies. The second half of the vaccinates and controls were held for 2 more years, then the same challenge studies with virulent rabies are performed and the same criteria used to prove the vaccine has a 3 year DOI. Based on these studies, if they meet the requirements, a minimum 1 year DOI label is placed on the vaccine tested at one year and a minimum 3 year label is placed on the vaccine tested at 3 years post vaccination. The vaccine can fail to get the label for 2 reasons: either the vaccinates do not have the number of protected dogs required at challenge, or the necessary number of controls do not die from rabies after challenge. Failure in one or both these criteria results in the vaccine not receiving a DOI label of 1 or 3 years. The same studies are performed for feline rabies vaccines. There is nothing precluding a company from looking at a longer DOI than 3 years. In the past few years, one company has a feline rabies vaccine that was tested at 4 years instead of 3 years, so that product has a minimum DOI of 4 years. I currently have studies in progress with groups of vaccinated dogs and groups of control dogs that I will challenge at the 5th year after vaccination (2012). I will challenge them according to the USDA Guidelines to determine if the rabies vaccines I used give 5 years minimum DOI and if they do, I have a second group of vaccinates and controls that have been housed with the 5 year group that will be challenged at 7 years post vaccination. If that challenge is successful, we will then have demonstrated using USDA's requirements that a rabies vaccine or vaccines can provide a minimum DOI of 7 years!

I can think of no scientific reason any rabies vaccine should be given more often than the minimum DOI demonstrated in the USDA studies. All vaccines have the potential to cause adverse reactions and canine rabies vaccines, because they are noninfectious adjuvanted products administered to more dogs than any other adjuvanted vaccine have a history of causing more adverse reactions than other killed

School of Veterinary Medicine • Department of Pathobiological Sciences
2015 Linden Drive, Madison WI 53706-1102
608/263-9888 FAX: 608/263-0438
www.vetmed.wisc.edu

Advancing animal and human health with science and compassion

viral vaccines. The only vaccines with higher rates of adverse reactions are some killed bacterial products. Because adjuvanted products, especially rabies and leukemia vaccines, cause injection site sarcomas in cats and injection site tumors in dogs, efforts have been made to eliminate the adjuvants wherever and whenever possible, especially when used in cats. That is why the canarypox recombinant vectored feline rabies vaccine is the most widely used rabies product in the cat. As stated in the AAHA Canine Vaccination Guidelines and the AAFP Feline Vaccination Guidelines, "only those vaccines that are needed for the specific animal should be given and then *only readministered when and if necessary.*" That is the reason the core vaccines (CDV/CPV-2/CAV-2 in the dog and FPV/FCV/FHV-1 in the cat) are recommended not more often than every 3 years. Because all the companies currently have a canine rabies vaccine with a minimum DOI of 3 years and all states require 3 year revaccination intervals, this core product should be given every 3 years after the dose at 1 year of age. There is no scientific information suggesting that the interval needs to be less than 3 years and future vaccines may have a longer DOI!

Please find attached information that may be of interest and of concern. After reading this information, you should ask "Why would I want my dog (or my family member's pet) to be revaccinated more often than necessary with any vaccine, especially those with adjuvants like alum, or indeed any other adjuvant (some that are currently used are worse than alum). Much of the information in the references about alum is work related to human vaccines but applies to any species.

I hope this information helps. Please contact me if you have questions.



R.D. Schultz

Professor and Chair

Department of Pathobiological Sciences, School of Veterinary Medicine

University of Wisconsin-Madison

ADVERSE VACCINE REACTIONS IN PET ANIMALS

W. Jean Dodds, DVM
Hemopet/Hemolife
938 Stanford Street
Santa Monica, CA 90403
310-828-4804; Fax 310-453-5240

Viral disease and recent vaccination with single or combination modified live-virus (MLV) vaccines, especially those containing distemper virus, adenovirus 1 or 2, and parvovirus are increasingly recognized contributors to immune-mediated blood disease, bone marrow failure, and organ dysfunction.¹⁻¹¹ Potent adjuvanted killed vaccines like those for rabies virus also can trigger immediate and delayed (vaccinosis) adverse vaccine reactions.⁷⁻¹⁰ Genetic predisposition to these disorders in humans has been linked to the leucocyte antigen D-related gene locus of the major histocompatibility complex, and is likely to have parallel associations in domestic animals.^{5,7}

Beyond immediate hypersensitivity reactions, other acute events tend to occur 24-72 hours afterwards, or 7-45 days later in a delayed type immunological response.^{1-4, 6-10} Even more delayed adverse effects include mortality from high-titered measles vaccine in infants, canine distemper antibodies in joint diseases of dogs, and feline and canine injection-site fibrosarcomas.^{5,7} The increasing antigenic load presented to the host individual by modified-live virus (MLV) vaccines during the period of viremia is presumed to be responsible for the immunological challenge that can result in a delayed hypersensitivity reaction.^{2,3,6,7}

The clinical signs associated with vaccine reactions typically include fever, stiffness, sore joints and abdominal tenderness, susceptibility to infections, neurological disorders and encephalitis, collapse with autoagglutinated red blood cells and icterus (autoimmune hemolytic anemia) (AIHA), or generalized petechiae and ecchymotic hemorrhages (immune-mediated thrombocytopenia)(ITP).^{1, 2, 4, 7, 8, 12, 13} Hepatic enzymes may be markedly elevated, and liver or kidney failure may occur by itself or accompany bone marrow suppression. Furthermore, MLV vaccination has been associated with the development of transient seizures in puppies and adult dogs of breeds or cross-breeds susceptible to immune-mediated diseases especially those involving hematologic or endocrine tissues (e.g. AIHA, ITP, autoimmune thyroiditis).^{1,7,10} Post-vaccinal polyneuropathy is a recognized entity associated occasionally with the use of distemper, parvovirus, rabies and presumably other vaccines.^{2,3,7} This can result in various clinical signs including muscular atrophy, inhibition or interruption of neuronal control of tissue and organ function, muscular excitation, incoordination and weakness, as well as seizures.⁷ Certain breeds or families of dogs appear to be more susceptible to adverse vaccine reactions, particularly post-vaccinal seizures, high fevers, and painful episodes of hypertrophic osteodystrophy (HOD).^{7,9} Therefore, we have the responsibility to advise companion animal breeders and caregivers of the potential for genetically susceptible littermates and relatives to be at increased risk for similar adverse vaccine reactions.^{1, 4, 6-9, 14-17} In popular (or rare) inbred and linebred animals, the breed in general can be at increased risk as illustrated in the examples below.

Commercial vaccines can on rare occasion be contaminated with other adventitious viral agents,^{3, 15} which can produce significant untoward effects such as occurred when a

commercial canine parvovirus vaccine was contaminated by blue tongue virus. It produced abortion and death when given to pregnant dogs,¹⁵ and was linked causally to the ill-advised but all too common practice of vaccinating pregnant animals. The potential for side-effects such as promotion of chronic disease states in male and non-pregnant female dogs receiving this lot of vaccine remains in question, although there have been anecdotal reports of reduced stamina and renal dysfunction in performance sled dogs.¹⁷ Recently, a vaccine manufacturer had to recall all biologic products containing a distemper component, because they were associated with a higher than expected rate of central nervous system postvaccinal reactions 1-2 weeks following administration.¹⁷ Vaccination of pet and research dogs with polyvalent vaccines containing rabies virus or rabies vaccine alone was recently shown to induce production of antithyroglobulin autoantibodies, a provocative and important finding with implications for the subsequent development of hypothyroidism.¹⁰ Furthermore, injection site fibrosarcomas have recently been documented in dogs as well as cats.¹⁸

Other issues arise from overvaccination, as the increased cost in time and dollars spent needs to be considered, despite the well-intentioned solicitation of clients to encourage annual booster vaccinations so that pets also can receive a wellness examination.⁶ Giving annual boosters when they are not necessary has the client paying for a service which is likely to be of little benefit to the pet's existing level of protection against these infectious diseases. It also increases the risk of adverse reactions from the repeated exposure to foreign substances.

Polyvalent MLV vaccines which multiply in the host elicit a stronger antigenic challenge to the animal and should mount a more effective and sustained immune response.^{2,3,6} However, this can overwhelm the immunocompromised or even a healthy host that has ongoing exposure to other environmental stimuli as well as a genetic predisposition that promotes adverse response to viral challenge.^{1,2,7,14,16,17} The recently weaned young puppy or kitten being placed in a new environment may be at particular risk. Furthermore, while the frequency of vaccinations is usually spaced 2-3 weeks apart, some veterinarians have advocated vaccination once a week in stressful situations, a practice makes little sense scientifically or medically.⁶

An augmented immune response to vaccination is seen in dogs with pre-existing inhalant allergies (atopy) to pollens.⁷ Furthermore, the increasing current problems with allergic and immunological diseases has been linked to the introduction of MLV vaccines more than 20 years ago.³ While other environmental factors no doubt have a contributing role, the introduction of these vaccine antigens and their environmental shedding may provide the final insult that exceeds the immunological tolerance threshold of some individuals in the pet population. The accumulated evidence indicates that vaccination protocols should no longer be considered as a "one size fits all" program.⁹

For these special cases, appropriate alternatives to current vaccine practices include: measuring serum antibody titers; avoidance of unnecessary vaccines or overvaccinating; caution in vaccinating sick or febrile individuals; and tailoring a specific minimal vaccination protocol for dogs of breeds or families known to be at increased risk for adverse reactions.^{6,7,19-22} Considerations include starting the vaccination series later, such as at nine or ten weeks of age when the immune system is more able to handle antigenic challenge; alerting the caregiver to pay particular attention to the puppy's behavior and overall health after the second or subsequent boosters; and avoiding revaccination of individuals already experiencing a significant adverse event. Littermates of affected puppies should be closely monitored after receiving additional vaccines in a puppy series, as they too are at higher risk.

References

1. Dodds WJ. Immune-mediated diseases of the blood. *Adv Vet Sci Comp Med* 1983; 27:163-196.
2. Phillips TR, Jensen JL, Rubino MJ, Yang WC, Schultz RD. Effects on vaccines on the canine immune system. *Can J Vet Res* 1989; 53: 154-160.
3. Tizard I. Risks associated with use of live vaccines. *J Am Vet Med Assoc* 1990; 196:1851-1858.
4. Duval D, Giger U. Vaccine-associated immune-mediated hemolytic anemia in the dog. *J Vet Int Med* 1996;10: 290-295.
5. Cohen AD, Shoenfeld Y. Vaccine-induced autoimmunity. *J Autoimmunity* 1996; 9: 699-703.
6. Schultz R. Current and future canine and feline vaccination programs. *Vet Med* 1998; 93:233-254.
7. Dodds WJ. More bumps on the vaccine road. *Adv Vet Med* 1999; 41: 715-732.
8. HogenEsch H, Azcona-Olivera J, Scott-Moncrieff C, Snyder PW, Glickman LT. Vaccine-induced autoimmunity in the dog. *Adv Vet Med* 1999; 41:733-744.
9. Dodds WJ. Vaccination protocols for dogs predisposed to vaccine reactions. *J Am An Hosp Assoc* 2001; 38: 1-4.
10. Scott-Moncrieff JC, Azcona-Olivera J, Glickman NW, Glickman LT, HogenEsch H. Evaluation of antithyroglobulin antibodies after routine vaccination in pet and research dogs. *J Am Vet Med Assoc* 2002; 221: 515-521.
11. Paul MA (chair) et al. Report of the AAHA Canine Vaccine Task Force: 2003 canine vaccine guidelines, recommendations, and supporting literature. AAHA, April 2003, 28 pp.
12. May C, Hammill J, Bennett, D. Chinese shar pei fever syndrome: A preliminary report. *Vet Rec* 1992;131: 586-587.
13. Scott-Moncrieff JC, Snyder PW, Glickman LT, Davis EL, Felsburg PJ. Systemic necrotizing vasculitis in nine young beagles. *J Am Vet Med Assoc* 1992; 201: 1553-1558.
14. Dodds WJ. Estimating disease prevalence with health surveys and genetic screening. *Adv Vet Sci Comp Med* 1995; 39: 29-96.
15. Wilbur LA, Evermann JF, Levings RL, Stoll LR, Starling DE, Spillers CA, Gustafson GA, McKeirnan AJ. Abortion and death in pregnant bitches associated with a canine vaccine contaminated with blue tongue virus. *J Am Vet Med Assoc* 1994; 204:1762-1765.
16. Day MJ, Penhale WJ. Immune-mediated disease in the old English sheepdog. *Res Vet Sci* 1992; 53: 87-92.
17. Dougherty SA, Center SA. Juvenile onset polyarthritis in Akitas. *J Am Vet Med Assoc* 1991; 198: 849-855.
18. Vascellari M, Melchiotti E, Bozza MA et al. Fibrosarcomas at presumed sites of injection in dogs: characteristics and comparison with non-vaccination site fibrosarcomas and feline post-vaccinal fibrosarcomas. *J Vet Med* 50 (6): 286-291, 2003.
19. Twark L, Dodds WJ. Clinical use of serum parvovirus and distemper virus antibody titers for determining revaccination strategies in healthy dogs. *J Am Vet Med Assoc* 2000; 217:1021-1024.
20. Flemming DD, Scott JF. The informed consent doctrine: what veterinarians should tell their clients. *J Am Vet Med Assoc* 224: 1436-1439, 2004.
21. Klingborg DJ, Hustead DR, Curry-Galvin E, et al. AVMA Council on Biologic and Therapeutic Agents' report on cat and dog vaccines. *J Am Vet Med Assoc* 221: 1401-1407, 2002.
22. Schultz RD, Ford RB, Olsen J, Scott F. Titer testing and vaccination: a new look at traditional practices. *Vet Med*, 97: 1-13, 2002 (insert).
23. Moore et al. Adverse events diagnosed within three days of vaccine administration in dogs. *J Am Vet Med Assoc* 227:1102-1108, 2005.

All About Vaccine Issues & Vaccinations

By W. Jean Dodds, DVM and
Ronald D. Schultz, PhD



There is little doubt that application of modern vaccine technology has permitted us to protect companion animals effectively against serious infectious diseases. Today, we can question conventional vaccine regimens and adopt effective and safe alternatives primarily because the risk of disease has been significantly reduced by the widespread use of vaccination programs, which convey underlying population or herd immunity.

For many veterinary practitioners canine vaccination programs have been “practice management tools” rather than medical procedures. Thus, it is not surprising that attempts to change the vaccines and vaccination programs based on scientific information have created significant controversy. A “more is better” philosophy still prevails with regard to pet vaccines.

Annual vaccination has been and remains the single most important reason why most pet owners bring their pets for an annual or more often “wellness visit.” Another reason for the reluctance to change current vaccination programs is that many practitioners really don’t understand the principles of vaccinal immunity. Clearly, the accumulated evidence indicates that vaccination protocols should no longer be considered as a one-size-fits-all program.

Giving annual boosters when they are not necessary has the client paying for a service that is likely to be of little benefit to the pet’s existing level of protection against these infectious diseases. It also increases the risk of adverse reactions from the repeated exposure to foreign substances.

So, have veterinarians really embraced the national policies on vaccination guidelines from the American Animal Hospital Association, American Veterinary Medical Association, and Academy of Feline Practitioners? Does the public trust veterinarians to be up to date on these issues or are they unsure? Do they believe veterinarians have

a conflict of interest if they seek the income from annual booster vaccinations? Given current media attention to vaccination issues, the public is more aware and worried about vaccine safety.

Some veterinarians today still tell their clients there is no scientific evidence linking vaccinations with adverse effects and serious illness. This is ignorance, and confuses an impressionable client. On the other hand, vaccine zealots abound with hysteria and misinformation. None of these polarized views is helpful.

Further, veterinarians are still routinely vaccinating ill dogs and those with chronic diseases or prior adverse vaccine reactions. This is especially problematic for rabies boosters, since many colleagues believe they have no legal alternative, even though the product label states it’s intended for *healthy animals*. For more information, visit www.rabieschallengefund.org.

For many veterinary practitioners canine vaccination programs have been “practice management tools” rather than medical procedures.

Some alternatives to current vaccine practices include

- Measuring serum antibody titers
- Avoiding unnecessary vaccines or overvaccinating
- Exercising caution in vaccinating sick or febrile individuals
- Tailoring a specific minimal vaccination protocol for dogs of breeds or families known to be at increased risk for adverse reactions
- Starting the vaccination series later, such as at nine or ten weeks of age when the immune system is better able to handle antigenic challenge
- Alerting the caregiver to pay particular attention to the puppy's behavior and overall health after the second or subsequent boosters
- Avoiding revaccination of individuals already experiencing a significant adverse event. Littermates of affected puppies should be closely monitored after receiving additional vaccines in a puppy series, as they too are at higher risk.

Frequently Asked Questions

Some of these questions are part of the Guidelines for Vaccination of Dogs and Cats compiled by the Vaccine Guidelines Group (VGG) of the World Small Animal Veterinary Association (WSAVA).

Q: Do dogs competing in agility or other events need more vaccines for protection than other pet dogs?

A: No, although if the event location has an exposure risk for leptospirosis or Lyme disease, annual vaccination for these diseases should be considered.

Q: Is there risk of overvaccinating with vaccines not needed for a specific animal?

A: Yes. Vaccines contain material designed to challenge the immune system of the pet, and so can cause adverse reactions. They should not be given needlessly, and should be tailored to the pet's individual needs.

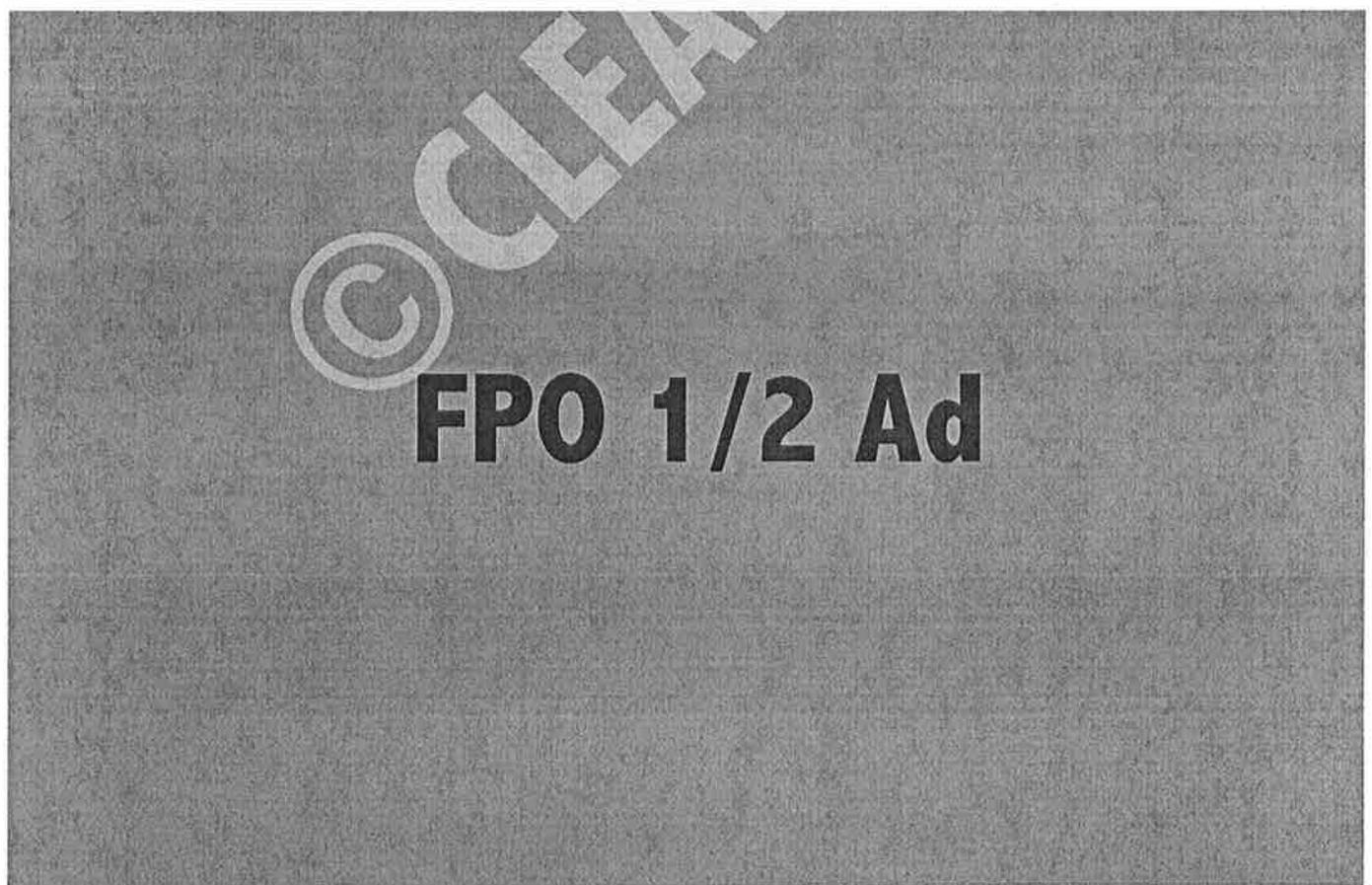
Q: Are the initial series of puppy core vaccines immunosuppressive?

A: Yes. This period of immunosuppression from MLV canine distemper and hepatitis vaccines coincides with the time of vaccine-induced viremia, from days 3 to 10 after vaccination.

Q: Can anesthetized patients be vaccinated?

A: This is not preferred, because a hypersensitivity reaction with vomiting and aspiration could occur and anesthetic agents can be immunomodulating.

A "more is better" philosophy still prevails with regard to pet vaccines.



Q: Is it safe to vaccinate pregnant pets?

A: Absolutely not.

Q: Should pets with immunosuppressive diseases such as cancer or autoimmune diseases, or adverse vaccine reactions/ hypersensitivity receive booster vaccinations?

A: No. Vaccination with MLV products should be avoided as the vaccine virus may cause disease; vaccination with killed products may aggravate the immune-mediated disease or be ineffective. For rabies boosters that are due, local authorities may accept titers instead or accept a letter from your veterinarian.

Q: If an animal receives immunosuppressive therapy, how long afterward can the pet safely be vaccinated?

A: Wait at least 2 weeks.

Q: Should vaccines be given more often than 2 weeks apart even if a different vaccine is being given?

A: No. The safest and most effective interval is 3-4 weeks apart.

Q: At what age should the last vaccine dose be given in the puppy series?

A: The last dose of vaccine should be given between 14-16 weeks regardless of the number of doses given prior to this age. Rabies vaccine should preferably be given separately as late as possible under the law (e.g. 16-24 weeks).

Q: Should the new canine influenza vaccine be given routinely?

A: No. It is intended primarily for pounds and shelters and high-density boarding facilities, as nose-to-nose contact and crowding promote viral transmission.

Q: Can intranasal Bordetella vaccine be given parenterally (injected)?

A: No. The vaccine can cause a severe local reaction and may even kill the pet.

Q: Will a killed parenteral Bordetella vaccine given intranasally produce immunity?

A: No.

Q: Are homeopathic nosodes capable of immunizing pets?

A: No. There is no scientific documentation that nosodes protect against infectious diseases of pets. The one parvovirus nosode trial conducted years ago did not protect against challenge.

Q: Should disinfectant be used at the vaccine injection site?

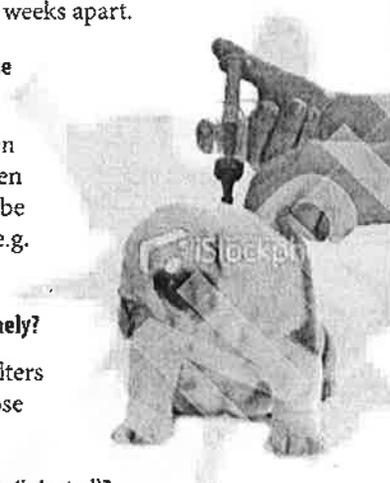
A: No. Disinfectants could inactivate a MLV product.

Q: Can vaccines cause autoimmune diseases?

A: Vaccines themselves do not cause these diseases, but they can trigger autoimmune responses followed by disease in genetically predisposed animals, as can any infection, drug, or chemical/toxic exposure.

Q: Can a single vaccine dose provide any benefit to the dog? Will it benefit the canine population?

A: Yes. One dose of a MLV canine core vaccine should provide long-term immunity when given to animals at or after 16 weeks of age. Every puppy 16 weeks of age or older should receive at least one dose of the MLV core vaccines. We need to vaccinate more animals in the population with core vaccines to achieve herd immunity and thereby prevent epidemic outbreaks.



Vaccines Every Dog and Cat Should Have

The "core" vaccines are

- Distemper
- Adenovirus (Hepatitis)*
- Parvovirus
- Rabies

*Immunity provided by a CAV-2 vaccine

Vaccine Conclusions for Canines

Factors that increase risk of adverse events 3 days after vaccination:

- Young adult age
- Small-breed size
- Neutering
- Multiple vaccines given per visit
- These risks should be communicated to clients

*from Moore et al, JAVMA 227:1102-1108, 2005

Q: If an animal receives only the first dose of a vaccine that needs two doses to immunize, will it have immunity?

A: No. A single dose of a two-dose vaccine like leptospirosis vaccine will not provide immunity. The first dose is for priming the immune system. The second for boosting the immunity has to be given within 6 weeks; otherwise the series has to start over again. After those two doses, revaccination with a single dose can be done at any time.

Q: Can maternally derived antibodies (MDA) also block immunity to killed vaccines and prevent active immunization with MLV vaccines?

A: Yes. MDA can block certain killed vaccines, especially those that require two doses to immunize. With MLV vaccines, two doses are often recommended, particularly in young animals, to be sure one is given beyond the neutralizing period of MDA.

Q: How long after vaccination does an animal develop immunity that will prevent severe disease when the core vaccines are used?

A: This is dependent on the animal, the vaccine, and the disease.

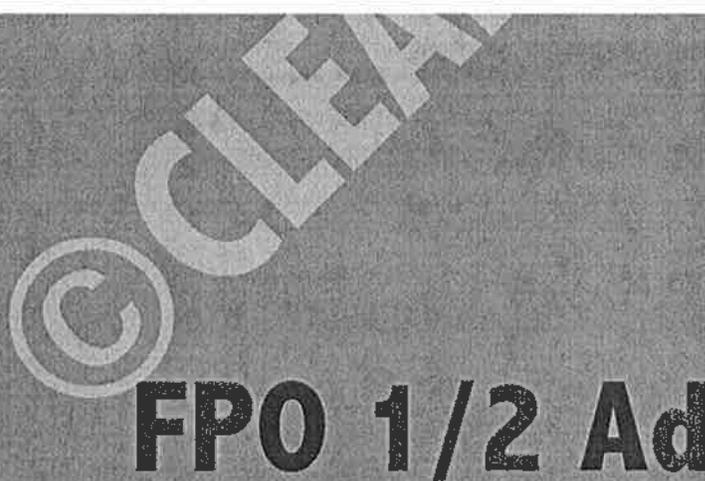
The fastest immunity is provided by canine distemper virus (CDV) vaccines—MLV and recombinant canarypox virus vectored. The immune response starts within minutes to hours and provides protection within a day without interference from MDA.

Immunity to canine parvovirus (CPV-2) develops after 3-5 days when an effective MLV vaccine is used.

Canine adenovirus-2/hepatitis (CAV-2) MLV given parenterally provides immunity against CAV-1 in 5 to 7 days.

Q: Can dogs be "non-responders" and fail to develop an immune response to vaccines?

A: Yes. This is a genetic characteristic seen particularly in some breeds or dog families. Boosting them regularly will not produce measurable antibody. Some of these animals may be protected against disease by their cell-mediated and secretory immunity.



Q: Are there parvovirus and distemper virus field mutants that are not adequately protected by current MLV vaccines?

A: No. All the current CPV-2 and CDV vaccines provide protection from all known viral isolates, when tested experimentally as well as in the field. The current CPV-2 and CPV-2b vaccines provide both short and long term protection from challenge by the CPV-2c variant.

Q: Are serum antibody titres useful in determining vaccine immunity?

A: Yes. They are especially useful for CDV, CPV-2 and CAV-1 in the dog, FPV in the cat, and rabies virus in the cat and dog. Rabies titers, however, are often not acceptable to exempt individual animals from mandated rabies boosters in spite of medical justification. Serum antibody titers are of limited or no value for (many of) the other vaccines. 🐾

W. Jean Dodds, DVM, President, Hemopet, 938 Stanford Street, Santa Monica, California 90403; Ronald D. Schultz, PhD, Chairman, Department of Pathobiological Sciences, School of Veterinary Medicine, University of Wisconsin-Madison, Madison, Wisconsin 53706

*Excerpted from: AKC Health Foundation, St. Louis, MO, 2007; J Sm An Pract 48, 528-541, 2007; 5th IVVDC Conference, Madison, WI, 2009

Additional Literature

Day MJ, Horzinek MC, Schultz RD. Guidelines for the vaccination of dogs and cats. J Sm An Pract, 48, 528-541 2007.

Dodds WJ. Vaccination protocols for dogs predisposed to vaccine reactions. J Am An Hosp Assoc 38: 1-4, 2001.

Dodds WJ. Vaccine issues revisited: what's really happening? Proc Am Hol Vet Med Assoc, Tulsa, OK, 2007, pp 132-140.

Paul MA (chair) et al. Report of the AAHA Canine Vaccine Task Force: 2006 AAHA Canine Vaccine Guidelines. J Am An Hosp Assoc 42:80-109, Mar-April 2006, 28 pp. www.aahanet.org.

Schultz R D Considerations in designing effective and safe vaccination programs for dogs. In: Carmichael LE (editor), Recent Advances in Canine Infectious Diseases. Intern Vet Inform Serv, 2000. www.ivis.org.

Schultz RD. Duration of immunity for canine and feline vaccines: a review. Vet Microbiol 117:75-79, 2006.

Canine Vaccine Adverse Events*

- Retrospective cohort study; 1.25 million dogs vaccinated at 360 veterinary hospitals
- 38 adverse events per 10,000 dogs vaccinated
- Inversely related to dog weight
- Vaccines prescribed on a 1-dose-fits-all basis, rather than by body weight.
- Increased for dogs up to 2 years of age, then declined
- Greater for neutered versus sexually intact dogs
- Increased as number of vaccines given together increased

Increased after the third or fourth vaccination

- Genetic predisposition to adverse events documented

*from Moore et al, JAVMA 227:1102-1108, 2005

© CLEAN
FPO 1/2 Ad

Istituto Zooprofilattico Sperimentale delle Venezie, Histopathology Department, Viale dell'Università, Legnaro (PD), Italy

Fibrosarcomas at Presumed Sites of Injection in Dogs: Characteristics and Comparison with Non-vaccination Site Fibrosarcomas and Feline Post-vaccinal Fibrosarcomas

M. VASCELLARI, E. MELCHIOTTI, M. A. BOZZA and F. MUTINELLI¹

Address of authors: Istituto Zooprofilattico Sperimentale delle Venezie, Histopathology Department, Viale dell'Università 10, 35020 Legnaro (PD), Italy; ¹Corresponding author; Tel.: +39 049 8084261; fax: +39 049 8084258; E-mail: fmutinelli@izsvenezie.it

With 3 figures and 3 tables

Received for publication: September 13, 2002

Summary

Fifteen fibrosarcomas, surgically excised from presumed sites of injection in dogs, and 10 canine fibrosarcomas excised from sites not used for injection were histologically and immunohistochemically compared with 20 feline post-vaccinal fibrosarcomas. Canine fibrosarcomas from presumed injection sites were of grade I (3), of grade II (4) and grade III (8). Two fibrosarcomas from non-injection sites were of grade I, four of grade II and four of grade III. Feline samples were classified as grade I (2), grade II (4) and grade III (14). All fibrosarcomas from presumed injection sites of both species showed lymphocytic inflammatory infiltration located at the tumour periphery, while two canine fibrosarcomas from non-injection sites showed perivascular inflammatory infiltration within the neoplasm. All samples were immunohistochemically examined for vimentin, smooth muscle actin, muscle specific actin and desmin expression. All tumours were positive for vimentin. Ten canine fibrosarcomas from presumed injection sites and all feline samples contained cells consistent with a myofibroblastic immunophenotype. Aluminium deposits were detected in eight canine fibrosarcomas from presumed injection sites and 11 feline post-vaccinal fibrosarcomas by the aurintricarboxylic acid method. The present study identifies distinct similarities between canine fibrosarcomas from presumed injection sites and feline post-vaccinal fibrosarcomas, suggesting the possibility of the development of post-injection sarcomas not only in cats, but also in dogs.

Introduction

Dogs and cats can sometimes develop subcutaneous inflammatory reactions at sites of injection, and there is some evidence to further suggest that, although other drugs may be involved, those reactions are mainly associated with the use of inactivated virus vaccines containing aluminium-based adjuvants (Hendrick, 1998). In both dogs and cats, the development of necrotizing panniculitis at sites of rabies vaccine administration was first observed by Hendrick and Dunagan (1991). These lesions were characterized by a central area of

necrosis rimmed by an inflammatory reaction, often with lymphatic follicles formation. Moreover, in cats a distinctive tumour which developed at sites of rabies and feline leukaemia vaccine administration, was noted by Hendrick and Goldschmidt (1991). Feline post-vaccinal fibrosarcomas (Hendrick et al., 1998) have received a great deal of attention in veterinary literature over the past 10 years. These neoplastic lesions seem to arise in younger cats and seem to be more aggressive, with a higher recurrent rate, than fibrosarcomas arising at other sites (Hendrick, 1998). Histologically, feline post-vaccinal fibrosarcomas are characterized by inflammatory peritumoural infiltration, multinucleated giant cells and myofibroblastic cells (Dubielzig et al., 1993). Grey-brown granular to crystalline foreign material was found within macrophages in the inflammatory foci in 42 of 198 post-vaccinal sarcomas, and in three cases the electron probe X-ray analysis demonstrated that it was composed of aluminium and oxygen (Hendrick et al., 1992). Post-vaccinal fibrosarcomas are believed to arise as a result of proliferation of fibroblasts and myofibroblasts at sites of chronic inflammation induced by the vaccine's adjuvants, its antigens, or both (Macy and Hendrick, 1996).

Fibrosarcoma is the second most prevalent skin tumour in cats, while in dogs it represents a rare tumour (Yager and Wilcock, 1994).

In the present study, 15 cases of canine fibrosarcomas arising at presumed sites of injections and 10 canine fibrosarcomas developing at sites not used for injections (oral cavity, legs) were examined and histologically and immunohistochemically compared with 20 feline post-vaccinal fibrosarcomas.

Materials and Methods

Animals and tissue processing

Paraffin blocks containing fibrosarcomas surgically excised from dogs and cats between 1998 and 2001 were retrieved from the archives of the Histopathology Department of the Istituto Zooprofilattico Sperimentale delle Venezie (northern Italy). Fifteen canine fibrosarcomas, arising at sites commonly used

by veterinarians for subcutaneous injections (back of the neck, inter-scapular region, thorax) comprised the group of 'fibrosarcomas from presumed injection sites'. All dogs had been vaccinated regularly against the most common canine infectious diseases (infectious gastroenteritis, distemper, infectious hepatitis and leptospirosis), and six dogs received also rabies vaccines. Ten canine fibrosarcomas from sites not used for injections and 20 feline post-vaccinal fibrosarcomas, showing typical histopathological characteristics (Hendrick et al., 1998), were examined for comparison. The cats included in the present study had been vaccinated regularly against feline leukaemia virus (FeLV) and other common feline infectious diseases.

For each specimen, 4- μ m-thick sections were stained with haematoxylin and eosin and examined microscopically in order to grade the neoplasia and to investigate the presence of an inflammatory reaction. The grading scheme, previously adapted to the dog (Powers et al., 1995) and recently applied to feline post-vaccinal fibrosarcomas (Couto et al., 2002), was based on cellular differentiation, presence and extension of necrosis within the neoplasm and mitotic rate. All fibrosarcomas were scored 1–3 for overall differentiation (1 = tumours closely resembling the mature differentiation; 2 = tumours that had a defined histological phenotype; 3 = poorly differentiated tumours), mitotic rates (1 = 1–9 mitotic figures per ten 400 \times fields; 2 = 10–19 mitotic figures per ten 400 \times fields; 3 = 20 or more mitotic figures per ten 400 \times fields) and necrosis (1 = no necrosis; 2 = < 50% of the total area; 3 = > 50% of the total area). Final scores of three or four were designated grade I; scores of five or six were designated grade II; scores of seven, eight or nine were designated grade III.

A computer program was used for the statistical analysis (STATA). Comparison between canine tumour categories with respect to the grade was performed using the Kruskal–Wallis non-parametric analysis of variance (ANOVA). A level of significance of 0.05 ($P < 0.05$) was used.

Immunohistochemistry

For each sample, 3 μ m sections were cut and immunohistochemically stained for vimentin (V9, DAKO, Carpinteria, CA,

USA, M0725, 1 : 25), desmin (DE-R-11, DAKO, Carpinteria, CA, USA, M724, 1 : 50), smooth muscle actin (1A4, DAKO, Carpinteria, CA, USA, M851, 1 : 50), and muscle specific actin (MSA) (HHF35, DAKO, Carpinteria, CA, USA, M0635, 1 : 50) (Inter-Species Cross-Reactivity of DAKO antibodies, Code N° 10 145). Each primary antibody was incubated for 30 min at room temperature. Antigen retrieval for desmin and smooth muscle actin was obtained by trypsinization for 30 min at 37°C. The EnVision™ Detection Kit Peroxidase/DAB Rabbit Mouse (DAKO, Carpinteria, CA, USA, K5007) was applied. The sections were counterstained with Mayer's haematoxylin.

Histochemistry

For the detection of aluminium deposits in tissues, the aurintricarboxylic acid method was applied to the sections. Aluminium deposits appeared red under light microscopy (Bonucci, 1981).

Results

Canine fibrosarcomas from presumed injection sites

The average age of dogs with fibrosarcomas at presumed injection sites was 6.2 years (7 months–11 years) (Table 1).

Samples were characterized by a subcutaneous proliferation of neoplastic cells, of a mesenchymal phenotype and a variable degree of pleomorphism and mitotic rate. Neoplasms were sometimes pseudo-encapsulated and showed infiltrative growth. According to the grading scheme introduced, on the basis of cellular differentiation, mitotic rate and extension of necrosis, samples were classified as grade I (3), grade II (4) and grade III (8). All samples exhibited an inflammatory infiltration, mainly composed of lymphocytes, macrophages and plasma cells, localized at the tumour periphery, often in a follicle-like arrangement (Fig. 1).

Immunohistochemically, all fibrosarcomas were strongly positive for vimentin, and negative for desmin. Eight samples showed bundles of cells, mainly located at the tumour periphery, which stained positive for smooth muscle actin and 10 samples contained bundles of cells, which stained

Table 1. Case summaries for 15 dogs with fibrosarcomas from presumed injection sites

Case	Breed	Age (years)	Sex	Location	Vaccine history	Aluminium
1	Collie	5	M	Shoulder	Regularly vaccinated	+
2	Mixed	11	M	Shoulder	Rabies	+
3	Mixed	10	F	Thorax	Regularly vaccinated	–
4	Mixed	10	M	Thorax	Regularly vaccinated	+
5	German Shepherd dog	8	F	Thorax	Rabies	–
6	Mixed	2	M	Back	Regularly vaccinated	–
7	Schnauzer	3	M	Shoulder	Rabies	–
8	Chow-Chow	8	M	Shoulder	Regularly vaccinated	–
9	Golden Retriever	2	M	Shoulder	Regularly vaccinated	+
10	American pit bull	1	F	Shoulder	Regularly vaccinated	–
11	Mixed	6	M	Back	Rabies	+
12	Mixed	10	M	Thorax	Regularly vaccinated	–
13	Siberian Husky	11	M	Shoulder	Rabies	+
14	Drahthaar	7 months	F	Back	Regularly vaccinated	+
15	Irish setter	5	M	Shoulder	Rabies	+

M, male; F, female; regularly vaccinated = vaccinated against the common canine infectious diseases; rabies, vaccinated against the common canine infectious diseases and rabies.

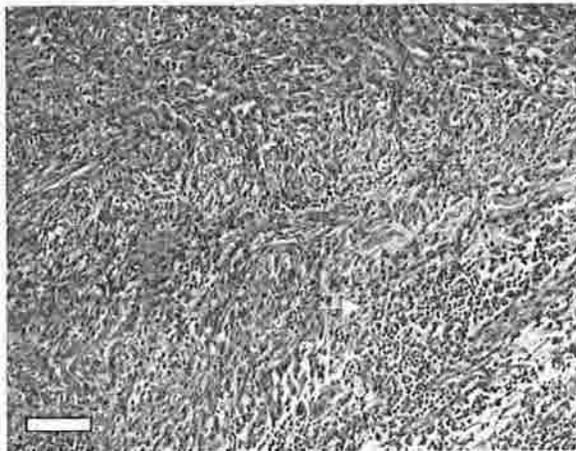


Fig. 1. Canine fibrosarcoma from presumed injection site. The inflammatory reaction (arrow) composed of lymphocytes and rare plasma cells was located at the tumour periphery. HE. Bar = 50 μ m.

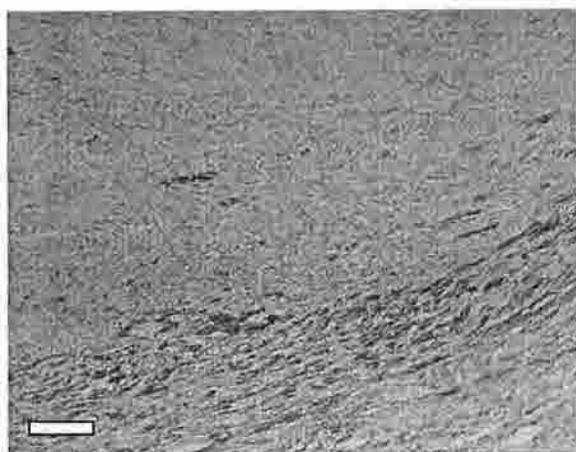


Fig. 2. Canine fibrosarcoma from presumed injection site. Muscle specific actin antigen is expressed by cells located in the tumour periphery. EnVision™ Detection Kit Peroxidase with HHF35 antibody and haematoxylin counterstain. Bar = 50 μ m.

positive for MSA (Fig. 2). These cells showed a fibroblastic phenotype, with abundant cytoplasm and elongated nuclei.

Aluminium deposits were detected in eight fibrosarcomas, both within macrophages and in the fibrous stroma (Table 1; Fig. 3).

Canine fibrosarcomas from sites not used for injection

The average age of dogs with fibrosarcomas from sites not used for injection was 8.4 years (5–11 years) (Table 2).

Two samples were of grade I, four of grade II and four of grade III. Neoplasms were not encapsulated and locally infiltrative. Two fibrosarcomas, from gum and foreleg, showed ulceration of the mucous membrane and cutis, respectively, and perivascular inflammatory infiltration within the neoplastic mass.

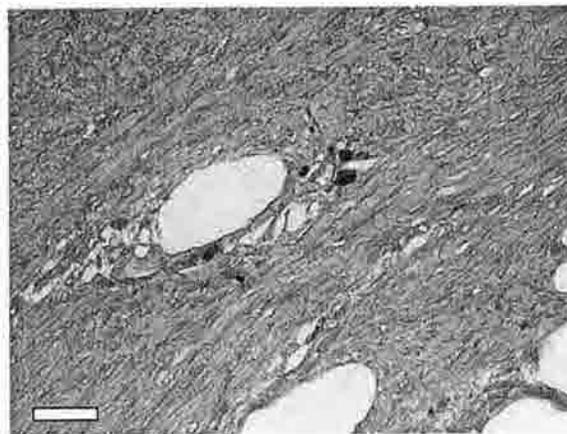


Fig. 3. Canine fibrosarcoma from presumed injection site. Aluminium deposits revealed by the aurintricarboxylic acid method in the fibrous stroma of the excised tumours. Bar = 25 μ m.

Table 2. Case summaries for dogs with fibrosarcomas from sites not used for injection

Case	Breed	Age (years)	Sex	Location
1	Mixed	7	F	Gum
2	German shepherd dog	11	F	Foreleg
3	Dobberman	10	F	Gum
4	Mixed	11	M	Gum
5	Rottweiler	6	M	Gum
6	Dalmatian	5	F	Hind leg
7	Mixed	7	F	Lip
8	German shepherd dog	6	F	Gum
9	German shepherd dog	11	M	Gum
10	Bloodhound	10	M	Foreleg

M, male; F, female.

When tested by immunohistochemistry, all samples were strongly positive for vimentin and negative for desmin. Single cells positively stained for MSA antigen were detected within two fibrosarcomas. Aluminium deposits were not detected in any sample.

Feline post-vaccinal fibrosarcomas

The average age of cats included in the present survey was 8.4 years (5–13 years) (Table 3). Samples included two fibrosarcomas of grade I, four of grade II and 14 of grade III. All samples showed lymphocytic aggregates at the periphery of the neoplastic proliferation. Multinucleated giant cells were detected in 10 fibrosarcomas.

Immunohistochemically, all samples were strongly positive for vimentin. Bundles of neoplastic cells positive stained for the smooth muscle actin were detected at the periphery of 16 feline fibrosarcomas. Eighteen samples showed cells positive stained for MSA. Only one feline post-vaccinal fibrosarcoma showed few single cells positive for desmin. Aluminium deposits were detected in 11 fibrosarcomas by the aurintricarboxylic acid method.

Table 3. Case summaries for cats with post-vaccinal fibrosarcomas

Case	Breed	Age (years)	Sex	Location
1	DSH	10	M	Shoulder
2	DSH	7	F	Shoulder
3	DSH	ns	M	Shoulder
4	Persian	9	F	Neck
5	DSH	7	F	Shoulder
6	DSH	13	M	Shoulder
7	DSH	9	F	Shoulder
8	Persian	10	F	Shoulder
9	DSH	8	F	Shoulder
10	DSH	6	M	Shoulder
11	DSH	7	F	Shoulder
12	Persian	7	M	Back
13	DSH	9	F	Back
14	DSH	8	M	Shoulder
15	DSH	5	F	Lateral thorax
16	DSH	8	M	Back
17	DSH	7	M	Neck
18	DSH	13	M	Shoulder
19	DSH	10	F	Back
20	DSH	6	M	Lateral thorax

DSH, domestic short haired; ns, non-specified; M, male; F, female.

Discussion

Fibrosarcoma is a rare tumour in dogs, and its most common sites of development are the skin of the trunk and of the proximal limbs as well as the oral cavity (Yager and Wilcock, 1994).

Canine fibrosarcomas arising at presumed sites of subcutaneous injection (shoulder, inter-scapular region, thorax) were examined and morphologically and immunohistochemically compared with canine fibrosarcomas arising at sites not used for injection and feline post-vaccinal fibrosarcomas.

The average age of dogs with fibrosarcomas from presumed injection sites was 6.2 years. The average age of dogs with fibrosarcomas at sites not used for injection was 8.5 years while that of cats was 8.4 years. According to the literature, the average age of cats with fibrosarcomas at sites not used for injection is 12 years (Gross et al., 1992), while post-vaccinal fibrosarcomas are reported to arise in cats with an average age of 8.1 years (Hendrick et al., 1994) and 8.6 years (Doddy et al., 1996), respectively. The average age of dogs with fibrosarcomas, irrespective of the site of development, was reported as 10 years (Gross et al., 1992). The comparison between the average age of the three classes of animals was statistically analysed and no significant difference was detected. Although epidemiological evaluations are not possible due to the limited number of cases included in the present study, the young age of some dogs with presumed post-injection fibrosarcomas supports the hypothesis of an iatrogenic origin.

The three groups of neoplasms were histologically examined for morphological distinctions. The grading scheme applied, was the one used in categorizing canine soft-tissue sarcomas (Powers et al., 1995) and feline post-vaccinal fibrosarcomas (Couto et al., 2002) and allowed the separation of the neoplasms into three classes with increasing malignancy. Histological grading is the most important prognostic factor for human adult soft-tissue sarcomas with regard to the probability of metastasis development and survival rate (Kandel et al., 1999; Mandard et al., 1989). It has been shown that feline post-vaccinal fibrosarcomas exhibit histopatholog-

ical features consistent with a more aggressive biologic behaviour than fibrosarcomas at sites not used for injection (Doddy et al., 1996). The statistical analysis applied to the tumour grades in this study did not reveal significant differences between the two different groups of canine fibrosarcomas. In both species the fibrosarcomas surgically excised from presumed sites of injection showed an inflammatory response, mainly as lymphatic follicle-like aggregates located at the tumour periphery. In contrast, only two canine fibrosarcomas, excised from the gum and the foreleg, were accompanied by perivascular infiltration of lymphocytes within the neoplasm. In these cases, the inflammatory reaction was probably the consequence of ulceration of the mucous membrane and cutis lining the fibrosarcomas, respectively. The inflammatory response is one of the distinctive features of the feline post-vaccinal fibrosarcomas (Doddy et al., 1996). Data suggest that local inflammation caused by aluminium or other potentially irritant inoculated substances, may predispose tissues to tumour development. Furthermore, feline fibrosarcomas found in vaccine sites are histologically identical to those observed in previously traumatized areas (Smith, 1995). However, the role of lymphocytes in tumorigenesis or host response to neoplasia is still unknown (Couto et al., 2002).

Multinucleated giant cells were detected in 10 feline post-vaccinal fibrosarcomas, whereas they were not detected in any canine sample. The presence of multinucleated giant cells is a common finding in feline fibrosarcomas and is regarded as an indicator of a less differentiated phenotype (Doddy et al., 1996). In human oncology, the presence of multinucleated giant cells is correlated with an aggressive, invasive tumour phenotype and is used as part of a paradigm to estimate prognosis (Couto et al., 2002).

Tumours were tested immunohistochemically for vimentin, actin and desmin expression. All samples were strongly positive for vimentin, thus confirming the mesenchymal origin of the neoplastic cells.

Myofibroblasts are interesting cells identified for the first time in contractile granulation tissue and wounds in the early 1970s (Mentzel and Fletcher, 1997). Ultrastructurally, myofibroblasts are recognized by their features of both fibroblasts and smooth muscle actin. Immunohistochemistry identified four mainly myofibroblastic phenotypes which show, in addition to cytoplasmic β - and γ -actins, immunopositivity for vimentin, vimentin and desmin, vimentin and alpha-smooth muscle actin, or vimentin, alpha-smooth muscle actin, and desmin (Mentzel and Fletcher, 1997). In the present study, immunolabelling of tumours with muscular antigens allowed the identification of bundles of cells with a myofibroblast-like immunophenotype in all the feline and in 10 canine fibrosarcomas from presumed injection sites. These cells were localized at the tumour periphery, often adjacent to lymphatic follicle-like aggregates. It is generally accepted that myofibroblasts represent an important component of numerous benign and malignant mesenchymal neoplasms. In addition to tissue repair process and stromal response to neoplasia, proliferating myofibroblasts are the main cellular component in four pathological settings: reactive lesions, benign tumours, locally aggressive fibromatoses and sarcomas with myofibroblastic differentiation (Mentzel and Fletcher, 1997). Myofibroblasts were previously detected in feline post-vaccinal fibrosarcomas, identified by both immunohistochemistry and electron microscopy (Dubielzig et al., 1993; Madewell et al., 2001).

The function and biological implications of myofibroblasts in tumour growth are far from being clarified. One recent study performed on a rat colorectal tumour model (Lieubeau et al., 1999), suggests that myofibroblasts, due to their contractile properties, are able to form a capsule that enveloped neoplastic nodules, mechanically preventing penetration of T lymphocytes and macrophages into the tumour, while promoting tumour growth and progression. In fact, locomotion and tumour access of immune cells is crucial for the function of the immune system. If this mechanical action should be the same in injection-associated fibrosarcomas, it may account for the presence of abundant lymphocytes along the periphery of the tumours and for their more aggressive biological behaviour than fibrosarcomas at sites not used for injections. In canine fibrosarcomas from non-injection sites, there was no evidence of myofibroblastic differentiation. The single cells positive for MSA, which were observed in two cases, are considered consistent with normal muscular cells entrapped in the neoplastic proliferation.

Aluminium deposits were detected in eight canine fibrosarcomas from presumed injection sites and 11 feline fibrosarcomas by histochemistry. The aurintricarboxylic acid method is a specific method for the identification of aluminium hydroxide deposits in tissues (Bonucci, 1981). Aluminium hydroxide adjuvants are used in many veterinary and human inactivated vaccines. In animals it has been detected at sites of subcutaneous injection for up to 1 year after application (Madewell et al., 2001). Aluminium deposits were previously highlighted in three of 198 feline post-vaccinal fibrosarcomas by electron probe X-ray analysis and ultrastructurally (Hendrick et al., 1992; Madewell et al., 2001), suggesting the role of aluminium-containing adjuvant as irritant in the pathogenesis of these fibrosarcomas. The development of foreign body granulomas caused by aluminium has also been reported in humans (Hendrick et al., 1992; Fawcett and Smith, 1984). All the animals included in the present study received annual vaccinations and underwent surgery soon after the first observation of the neoplastic growth by the owners or veterinarians. Such a special care paid to these pets, assuring a prompt recognition and removal of the nodules, may have guaranteed short intervals between onset of neoplastic growth and histochemical examination, thus resulting in a high percentage of samples containing aluminium deposits. Furthermore, four of eight samples containing aluminium deposits were excised from dogs that had received vaccination against rabies, other than against the most common infectious diseases. The development of necrotizing panniculitis after rabies vaccine administration has already been reported in dogs (Hendrick and Dunagan, 1991). Rabies vaccines have also been associated with the development of fibrosarcomas in cats (Hendrick and Goldschmidt, 1991). Furthermore, it is accepted that substances other than aluminium can be involved in the pathogenesis of these fibrosarcomas. For close to 100 years, investigators have observed that irritation, inflammation and/or wounds are promoters of tumour development (Macy and Hendrick, 1996). Virtually anything that causes a local inflammatory reaction may potentially be responsible for neoplastic initiation (Withrow and MacEwen, 2001). Sarcomas developing at sites of subcutaneous administration of long acting drugs and at sites with deep non-absorbable sutures, as well as ocular post-traumatic sarcomas, are clinical examples that

support these findings (Dubielzig, 1984; Dubielzig et al., 1990; Esplin et al., 1999; Buracco et al., 2002).

Although the post-vaccinal fibrosarcoma has been considered as a specific entity in the cat, many similar features were noted in feline and canine samples. In both species, fibrosarcomas arose at the same sites, probably used by practitioners for subcutaneous injections. The lesions were characterized by the proliferation of mesenchymal neoplastic cells, consistent with fibroblasts, with areas of necrosis and peritumoural inflammatory infiltration. Cells with a myofibroblastic phenotype were detected immunohistochemically in fibrosarcomas from presumed injection sites of both species, but not in the canine fibrosarcomas arising at sites not used for injection. Aluminium deposits were noted not only in feline samples, but also in eight canine fibrosarcomas, from presumed injection sites.

In conclusion, the findings of this study support the hypothesis that post-injection fibrosarcomas do not only occur in cats but also in dogs. However, further investigations are needed to elucidate the possible relationship between vaccine administration and fibrosarcoma development at sites of injection in dogs.

Acknowledgements

We wish to thank the veterinary practitioners who submitted the canine and feline samples included in the present study.

References

- Bonucci, E., 1981: *Manuale di istochimica*. Lombardo Editore, Roma.
- Buracco, E., M. Martano, E. Morello, and A. Ratto, 2002: Vaccine associated-like fibrosarcoma in the site of a deep nonabsorbable suture in a cat. *Vet. J.* 163, 105–107.
- Couto, S. S., S. M. Griffey, P. C. Duarte, and B. R. Madewell, 2002: Feline vaccine-associated fibrosarcoma: morphologic distinctions. *Vet. Pathol.* 39, 33–41.
- Doddy, F. D., L. T. Glickman, N. W. Glickman, and E. B. Janovits, 1996: Feline fibrosarcomas at vaccination sites and non-vaccination sites. *J. Comp. Pathol.* 114, 165–174.
- Dubielzig, R. R., K. L. Hawkins, and P. E. Miller, 1993: Myofibroblastic sarcoma originating at the site of rabies vaccination in a cat. *J. Vet. Diagn. Invest.* 5, 637–638.
- Dubielzig, R. R., 1984: Ocular sarcoma following trauma in three cats. *J. Am. Vet. Med. Assoc.* 184, 578–581.
- Dubielzig, R. R., J. A. Everitt, J. A. Shaddock, and D. M. Albert, 1990: Clinical and morphologic features of post-traumatic ocular sarcomas in cats. *Vet. Pathol.* 27, 62–65.
- Esplin, D. G., M. Bigelow, L. D. McGill, and S. R. Wilson, 1999: Fibrosarcoma at the site of a Lufenuron injection in a cat. *Vet. Cancer Soc. Newsletter* 23, 8–9.
- Fawcett, H. A., and N. P. Smith, 1984: Injection-site granuloma due to aluminium. *Arch. Dermatol.* 120, 1318–1322.
- Gross, T. L., P. J. Ibrke, and E. J. Walder, 1992: *Veterinary Dermatopathology*. Mosby Year Book, St. Louis.
- Hendrick, M. J., and M. H. Goldschmidt, 1991: Do injection site reactions induce fibrosarcoma in cats? *J. Am. Vet. Med. Assoc.* 99, 968.
- Hendrick, M. J., and C. A. Dunagan, 1991: Focal necrotizing granulomatous panniculitis associated with subcutaneous injection of rabies vaccine in cats and dogs: 10 cases (1988–1989). *J. Am. Vet. Med. Assoc.* 198, 304–305.
- Hendrick, M. J., M. H. Goldschmidt, F. S. Shofer, Y. Y. Wang, and A. P. Somlyo, 1992: Postvaccinal sarcomas in the cat: epidemiology and electron probe microanalytical identification of aluminium. *Cancer Res.* 52, 5391–5394.

- Hendrick, M. J., 1998: Historical review and current knowledge of risk factors involved in feline vaccine-associated sarcomas. *J. Am. Vet. Med. Assoc.* 213, 1422-1423.
- Hendrick, M. J., F. S. Shofer, M. H. Goldschmidt, J. C. Haviland, S. H. Schelling, S. J. Engler, and J. M. Gliatto, 1994: Comparison of fibrosarcomas that developed at vaccination sites and at nonvaccination sites in cats: 239 cases (1991-1992). *J. Am. Vet. Med. Assoc.* 205, 1425-1429.
- Hendrick, M. J., E. A. Mahaffey, F. M. Moore, J. H. Vos, and E. J. Walder, 1998: Histological classification of mesenchymal tumors of skin and soft tissues of domestic animals. WHO, Second series, Vol. II, AFIP, Washington, D.C.
- Kandel, R. A., R. S. Bell, J. S. Wunder, B. O'Sullivan, C. N. Catton, L. M. White, and A. M. Davis, 1999: Comparison between a 2- and 3-grade system in predicting metastatic-free survival in extremity soft tissue sarcoma. *J. Surg. Onc.* 79, 77-82.
- Lieubeau, B., M. F. Heymann, F. Henry, I. Barbicux, K. Mcflah, and M. Gregoire, 1999: Immunomodulatory effects of tumor-associated fibroblasts in colorectal tumor development. *Int. J. Cancer* 81, 629-636.
- Macy, D. W., and M. J. Hendrick, 1996: The potential role of inflammation in the development of postvaccinal sarcomas in cats. *Vet. Clin. North Am. Small Anim. Pract.* 26, 103-109.
- Madewell, B. R., S. M. Griffey, M. C. McEntee, V. J. Leppert, and R. J. Munn, 2001: Feline vaccine associated fibrosarcoma: an ultrastructural study of 20 tumors (1996-1999). *Vet. Pathol.* 38, 196-202.
- Mandard, A. M., J. F. Petiot, J. Marnay, J. C. Mandard, J. Chaste, E. de Ranieri, P. Dupin, P. Herlin, J. de Ranieri, A. Tanguy, N. Boulier, and J. S. Abbattucci, 1989: Prognostic factors in soft tissue sarcomas. A multivariate analysis of 109 cases. *Cancer* 63, 1437-1451.
- Mentzel, T., and C. D. M. Fletcher, 1997: The emerging role of myofibroblasts in soft tissue neoplasia. *Am. J. Clin. Pathol.* 107, 2-4.
- Powers, B. E., P. J. Hoppes, and E. J. Ehrhart, 1995: Tumor diagnosis, grading and staging. *Semin. Vet. Med. Surg. (Small Anim.)* 10, 158-157.
- Smith, C. A., 1995: Are we vaccinating too much. *J. Am. Vet. Med. Assoc.* 207, 421-425.
- Withrow, S. J., and E. G. MacEwen, 2001: Small animal clinical oncology. W.B. Saunders Company, Philadelphia.
- Yager, J. A., and B. P. Wilcock, 1994: Color atlas and text of surgical pathology of the dog and cat. Mosby Year Book Europe Limited, London.

Early animal studies have shown that brain inflammation frequently ensues following vaccines and is also commonly associated with brain hemorrhages. These studies are with *Bordetella* vaccines. *B. pertussis* and *B. bronchiseptica* have similar properties with regard to causing hypersensitivity reactions.

Iwasa S, Ishida S, Akama K. Swelling of the brain caused by pertussis vaccine: its quantitative determination and the responsible factors in the vaccine, *Japan J Med Sci Biol*, 1985; 38(2):53-65.

Levine S. Hyperacute encephalomyelitis, *Amer J Pathol*, 1973. 37:247-250.

Munoz JJ, Bernard CE, Mackay IR. Elicitation of experimental encephalomyelitis in mice with aid of pertussigen, *Cellular Immunol*.1984; 83:92-100.

Proinflammatory Vaccines and Vaccine Adjuvants

Adjuvants Defined

Vaccine adjuvants are substances added to vaccine formulations during the manufacturing process that are designed to boost and prolong the overall immunological responses to vaccines. This results in a priming of the brain's immune cells, the microglia and astrocytes, followed by intense microglial and astrocyte reactions with each successive series of vaccination. As reviewed by Viera Scheibner, PhD, there are three general classes of adjuvants:

1. *Aluminum*: Aluminum phosphate, Aluminum hydroxide, Aluminum hydroxyphosphate sulfate, and Aluminum potassium sulfate
2. *Various oils*, including Freund's emulsified oil, mineral oil, emulsified peanut oil (adjuvant 65), and squalene (shark oil),
3. *Bacterial products*, including *Bordetella pertussis* (whooping cough), *bronchiseptica* (kennel cough), *Mycobacterium* (sp.), cholera toxin, and others. Adjuvants in various vaccines are listed on vaccine package inserts.

In what may be the most comprehensive review to date on the pathophysiology of adverse vaccine reactions, neurosurgeon Russell Blaylock has compiled a mass of evidence that repeated stimulation of the brain's immune system results in intense reactions of microglial and astrocyte cells, which serve as the brain's immune system, with each successive series of vaccinations. This is primarily the result of **vaccine adjuvants** that are added expressly for immune stimulation purposes.

In explanation, microglia and astrocytes are first-line immunological responder cells located in the brain that defend against foreign infectious invaders. Normally this response, such as to a viral infection, is of limited duration and harmless to the brain. However, when microglia and astrocytes are over-stimulated for prolonged periods, which vaccine adjuvants are designed to bring about, this extended activation can be very destructive to the brain causing inflammation and/or bleeding.

Because of the critical dependence of the developing brain on a timed sequence of cytokine, and excitatory amino acid fluctuations, according to Blaylock, sequential vaccinations can result in alterations of this critical process that will not only result in synaptic and dendritic loss, but abnormal (nerve) pathway development.

When microglia are excessively activated by vaccines, especially chronically, they secrete a number of proinflammatory cytokines, free radicals, lipid peroxidation products, and the two excitotoxins, glutamate and quinolenic acid, which may become proinflammatory and highly destructive when activated for prolonged periods.

As a potential connecting link between vaccines and brain inflammation, Diana Vargas and colleagues (2005) examined the brains from autopsies of 11 autistic patients ranging in ages from 5 to 44 years, in which they found the presence of extensively activated microglia and astrocytes (the brain's immune cells) along with proinflammatory cytokines.

Normally dormant, the microglia and astrocytes can become very destructive when overstimulated for prolonged periods of time, which vaccine adjuvants are designed to bring about.

For many years two forms of aluminum, *aluminum hydroxide* and *aluminum phosphate*, were the only compounds specifically authorized by the FDA to be used as human vaccine adjuvants. These virtually insoluble aluminum compounds serve to dramatically boost and prolong the immune reaction to the vaccination by prolonged activation of the macrophagic immune subsystem in some people. Currently four forms are used in vaccines according to the Centers for Disease Control and Prevention (CDC). These same adjuvants are used in animal vaccines and have been associated with injection site sarcomas and other tumors in cats and dogs.

Because vaccine adjuvants are designed to produce prolonged immune stimulation, they pose a particular hazard for the nervous system. Studies have shown that immune activation following vaccination can last several years, which means that destructive over-stimulation of microglia may also be primed for this length of time or even longer. In addition, it is known that aluminum accumulates in the brain and that this accumulation is associated with Alzheimer's and Parkinson's diseases and with Gulf War Syndrome.

“Aluminum is an experimentally demonstrated neurotoxin and the most commonly used vaccine adjuvant. Despite almost 90 years of widespread use of aluminum adjuvants, medical science's understanding of their mechanisms of action is still remarkably poor. There is also a concerning scarcity of data on toxicology and pharmacokinetics of these compounds. In spite of this, the notion that aluminum in vaccines is safe appears to be widely accepted.”

Experimental research, in contrast, clearly shows that aluminum in adjuvant form...carries a risk for autoimmunity, long-term brain inflammation and subsequent neurological complications and may thus have profound and widespread adverse health complications.

Scheibner V. Adverse effects of adjuvants in vaccines, Nexus, Dec. 2000; 8(1).

<http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/B/excipient-table-1.pdf>.

Blaylock RI, The danger of excessive vaccination during brain development, *Medical Veritas*, 2008; 5(1): 1727-1741.

Blaylock, RI. Chronic microglial activation and excitotoxicity secondary to excessive immune stimulation: possible factors in Gulf War Syndrome and autism. *Journal American Physicians and Surgeons*, 2004; 9(2):46-52.

Blaylock RI. Vaccines, depression and neurodegeneration after age 50: Another reason to avoid the recommended vaccines. *VRAN Newsletter, Vaccine Risk Awareness Network Inc. Spring*, 2008; lead article. 1991; 230(1): 22-37.

Vargas, DL, Nascimbene C, Zimmerman, AW, Pardo CA. Brain inflammation Found in autism. *Annals of Neurology*, 2005; 57:67-81.

Lach B, Cupier EJ. Macrophage myofasciitis in children is a localized reaction to vaccination. *Journal of Child Neurology*, 2008; 23(6): 614-619.

Kalil FK, Monteiro A Jr., Lima MI, Sislviere EB et al, Macrophage myofasciitis in childhood: The role of scanning electron microscopy/energy dispersive spectroscopy for diagnosis. *Ultrastruct Pathology*, 2007; 31(1): 45-50.

Ryan AM, Bermingham N, Harrington IJ, Keohane C. Atypical presentation of macrophage myofasciitis 10 years post-vaccination. *Neuromuscular Disorders*, 2006; 16(12):867-869.

Authier F, Sauvat S, Christov C, Chariot P, Rasbac G, et al. ALOH3-adjuvant vaccine-induced macrophagic disorders in rats influenced by genetic background. *Neuromuscular Disorders*, 2006; 16(5): 347-353.

Shingde M, Hughes J, Goadle R, Wills RJ, et al, Macrophagic myofasciitis associated with vaccine-derived aluminum. *Medical Journal of Australia*, 2005; 183(3): 145-6.

Verdier F, Burnett R, Michelet-Habcht C et al, Aluminum assay and evaluation of the local reaction at several time points after intramuscular administration of aluminum-containing vaccines in the *Cynomolgus* monkey, *Vaccine*, 2005; 23(11): 1349-1367.

Good PF, Peri DP, Biercr LM, Schmeidler J. Selective accumulation of aluminum and iron in the neurofibrillary tangles of Alzheimer's disease: a laser microprobe (LAMMA) study. *Annals of Neurology*, 1992; 31:286-292.

Campbell A, Becaria A, Lahiti DK, Sharmān K, Bondy SC. Chronic exposure to aluminum in drinking water increases inflammatory parameters selectively in the brain. *Journal of Neuroscience Research*. 2004; 75: 565-572.

Petrit MS, Wong MC, Tabata RC, Garry RF, Shaw CA. Aluminum adjuvant linked to Gulf War Syndrome. *Neuromolecular Medicine*. 2007; 9(1): 83-100.

Tomljenovic L and Shaw CA. Aluminum vaccine adjuvants: Are they Safe? *Current Medicinal Chemistry*. 2011; 18: 2630-2637.

John King

Subject: FW: Municipality ordinances

Freeport - <http://www.freeportmn.org/files/city-of-freeport/forms/freeport-mn-pet-registration.pdf> - see page 4 – requires bi-annual rabies vaccination with a modified live vaccine

Albany - <http://www.ci.albany.mn.us/ORDINANCE%20-CHAPTER%207/ORDINANCE%2071%20-ANIMALS.pdf> - see page 5 - Subd. 1: Evidence of Vaccination. Before any license or permit may be issued for an animal, the owner or keeper of the animal must provide satisfactory evidence to show that the animal for whom the license is sought, has been properly vaccinated for rabies within two (2) years immediately preceding issuance of the license. Any animals not so vaccinated and tagged may be impounded and destroyed.

Eagan - <http://library.municode.com/index.aspx?clientId=13070> - City of Eagan requires proof of rabies vaccination to get a license - vaccine must last duration of license - license renewal is required every 2 years.

Albertville - http://www.sterlingcodifiers.com/codebook/index.php?book_id=460 - City of Albertville - Fees And Application Requirements: It shall be required of each person owning, keeping, or harboring a dog to pay a license fee to the city administrator or finance director as imposed by this section. The license fee for any dog shall be computed at the rate duly set by resolution of the council. Each application for such license shall include a statement, signed by the person applying for the license, which certifies that the dog has been inoculated for rabies not more than twenty four (24) months preceding the date of application. Upon receipt of the license fee and the signed application, the city administrator or finance director shall execute the receipt in duplicate, the original of which shall be given to the person who pays the fee. The duplicate shall be retained in the records of the city administrator. This receipt shall describe the dog as to color, breed, age, sex, and weight. Any owner shall produce for inspection the license receipt upon the request of the animal control authority.

Cokato - <http://www.cokato.mn.us/wp-content/uploads/2009/12/chap05.pdf> - see page 10 - Cokato - *Subdivision D. RABIES VACCINATION*

Every application for a license shall be accompanied by a certificate from a qualified veterinarian showing that the dog had been vaccinated for rabies within two years prior to the expiration of the license applied for.

Elk River - <http://library.municode.com/index.aspx?clientId=13427> - Elk River - *Application; fee; receipt*. It shall be required of each person owning, keeping, or harboring a dog or cat to pay a license fee to the city administrator as imposed by this section, except as provided in section 10-83. The license fee for any dog or cat shall be as established by resolution. Each application for such license shall include a statement, signed by the person applying for the license, which certifies that the dog or cat has been inoculated for rabies not more than 24 months preceding the date of application.

Loretto - <http://lorettomn.govoffice2.com/vertical/Sites/{42E0CBDC-5516-467A-B9BA-17F3247B9F52}/uploads/{52F5945C-4601-4AB7-BB8B-4C2C393EFA49}.PDF> - Loretto - *Subd. 3. Vaccination*. Every dog over the age of six months is required to have a vaccination against rabies, which vaccination shall be renewed not less frequently than every two years. All rabies vaccinations shall be of the modified live vaccine type.

Montrose - <http://montrose-mn.com/assets/files/docs/CityOrds/CO9.pdf> - Montrose - (2) No person shall own, harbor or keep any dog or cat over five months of age unless the dog or cat has been vaccinated within the last 12 months with a killed rabies vaccine or within the past 24 months with a live rabies vaccine and a certificate of vaccination has been obtained.

Hector - (D) The City Administrator shall not issue any license for a dog or cat until the applicant furnishes a certificate from a veterinarian indicating that the animal has been vaccinated for rabies within the preceding two years.

St Francis - <http://stfrancis.govoffice.com/vertical/Sites/{ECBFA704-102D-4B78-9CB5-82A178C237A7}/uploads/{29A5DCB5-54F4-43ED-B94F-C0236C09BA5A}.PDF> - D. License Issuance, Term and Renewal. Every owner or keeper of a dog shall cause the same to be vaccinated by a licensed veterinarian with anti-rabies vaccine at least once in every twenty-four (24) month period prior to the time such dog shall reach the age of six (6) months and at least once every twenty-four (24) months thereafter. (Ord 17, SS, 5-3-1993)

Waverly -

[http://www.amlegal.com/nxt/gateway.dll/Minnesota/waverly/titleixgeneralregulations/chapter92animals?f=templates\\$fn=document-frameset.htm\\$q=rabies%20\\$x=server\\$3.0#LPHit1](http://www.amlegal.com/nxt/gateway.dll/Minnesota/waverly/titleixgeneralregulations/chapter92animals?f=templates$fn=document-frameset.htm$q=rabies%20$x=server$3.0#LPHit1) -

(3) No person shall own, harbor or keep any dog over five months of age unless the dog has been vaccinated within the past 12 months with a killed rabies vaccine or within the past 24 months with a live rabies vaccine and a certificate of vaccination has been obtained.

Stacey Schwabenlander, DVM, MPH

Minnesota Board of Animal Health
625 Robert St North, St. Paul, MN 55155
Office Telephone: 651-201-6813
Mobile Telephone: 612-616-1465
Fax: 651-296-7414
Stacey.Schwabenlander@state.mn.us

The Minnesota Board of Veterinary Medicine is gathering information about the rabies vaccination practices of Minnesota licensed veterinarians. Individuals who complete the survey will not be identified and the data collected will only be used in aggregate and summary form.

Thank you for taking the time to complete this brief survey.

*** 1. Do you provide rabies vaccinations for dogs and cats in your practice?**

- Yes
- No

In the following questions you should assume that the dog or cat has received the initial 1 year rabies vaccination and you are administering a rabies booster.

2. What rabies vaccine do you use the majority of the time in your practice?

- Merial - IMRAB®
- Pfizer - DEFENSOR®
- Merck / Intervet - Nobivac® Rabies
- Boehringer Ingelheim - Rabvac™
- Other (Please identify manufacturer or brand)

3. With the rabies vaccine you use, what is the USDA licensed duration of immunity?

- 1 year
- 3 year
- Other (Please explain)

4. What is the duration of immunity or expiration date you record on the rabies certificate?

- 1 year
- 2 year
- 3 year
- Other (please explain)

5. If the duration of immunity or expiration date that you record on the rabies certificate is something different than what the rabies vaccine is licensed for, why is that?

- Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where my practice is located.
- Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where the animal owner lives.
- I want to examine the dog or cat at least every one to two years to evaluate the health of the animal and this is a good way to get the animal owner to comply.
- I recommend more frequent rabies vaccination than what the vaccine is licensed for because dogs and cats are often presented to me for rabies vaccination and their rabies vaccination has already expired.
- I recommend more frequent rabies vaccination than what the vaccine is licensed for because of where the animal lives or the occupation that the animal has and the increased potential of exposure to rabid animals.
- I record on the rabies certificate the duration of immunity and expiration date that the rabies vaccine is licensed for.
- Other (please explain)

6. If the duration of immunity or expiration date that you record on the rabies certificate is something different than what the rabies vaccine is licensed for, do you inform the animal owner of this?

- Yes
- No

***7. In what County of Minnesota is the physical address of your practice located?**

Thank you for participating in this Survey.

1. Do you provide rabies vaccinations for dogs and cats in your practice?

		Response Percent	Response Count
Yes		89.9%	490
No		10.1%	55
answered question			545
skipped question			0

2. What rabies vaccine do you use the majority of the time in your practice?

		Response Percent	Response Count
Merial - IMRAB®		51.0%	213
Pfizer - DEFENSOR®		21.5%	90
Merck / Intervet – Nobivac® Rabies		5.3%	22
Boehringer Ingelheim - Rabvac™		11.5%	48
Other (Please identify manufacturer or brand)		10.8%	45
answered question			418
skipped question			127

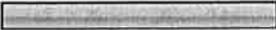
3. With the rabies vaccine you use, what is the USDA licensed duration of immunity?

		Response Percent	Response Count
1 year		2.1%	9
3 year		88.8%	373
Other (Please explain)		9.0%	38
answered question			420
skipped question			125

4. What is the duration of immunity or expiration date you record on the rabies certificate?

		Response Percent	Response Count
1 year		2.9%	12
2 year		36.2%	152
3 year		43.8%	184
Other (please explain)		17.1%	72
answered question			420
skipped question			125

5. If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that?

		Response Percent	Response Count
Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where my practice is located.		12.6%	44
Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where the animal owner lives.		5.2%	18
I want to examine the dog or cat at least every one to two years to evaluate the health of the animal and this is a good way to get the animal owner to comply.		4.3%	15
I recommend more frequent rabies vaccination than what the vaccine is licensed for because dogs and cats are often presented to me for rabies vaccination and their rabies vaccination has already expired.		17.8%	62
I recommend more frequent rabies vaccination than what the vaccine is licensed for because of where the animal lives or the occupation that the animal has and the increased potential of exposure to rabid animals.		5.5%	19
I record on the rabies certificate the duration of immunity and expiration date that the rabies vaccine is licensed for.		42.8%	149
Other (please explain)		11.8%	41
answered question			348

skipped question 197

6. If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, do you inform the animal owner of this?

		Response Percent	Response Count
Yes	<input type="checkbox"/>	59.1%	165
No	<input type="checkbox"/>	40.9%	114
		answered question	279
		skipped question	266

7. In what County of Minnesota is the physical address of your practice located?

	Response Count
	412
	answered question 412
	skipped question 133

Page 3, Q2. What rabies vaccine do you use the majority of the time in your practice?

1	merial imrab for dogs, purevax for cats	Dec 6, 2011 12:51 PM
2	ft. dodge	Dec 5, 2011 9:59 PM
3	Dogs: 3 year IMRAB, Cats: PureVax 1 year	Dec 1, 2011 6:33 PM
4	Merial - IMRAB for dogs; Merial - PUREVAX for cats	Nov 30, 2011 3:11 PM
5	Merial Imrab for dogs, Canary Pox for cats	Nov 29, 2011 6:30 PM
6	schering-Plough	Nov 28, 2011 2:51 PM
7	Rabdomun-dogs, Merial Pure Vac-Cats	Nov 28, 2011 1:46 PM
8	continuum by intervet.	Nov 28, 2011 9:45 AM
9	We use Merial PureVax for cats and Pfizer Defensor for dogs.	Nov 27, 2011 2:58 PM
10	Defensor in k-9 and Pure-vac in feline	Nov 25, 2011 5:51 PM
11	Rabdomun	Nov 25, 2011 1:17 PM
12	Rabdomun- Schering Plough Animal Health	Nov 25, 2011 8:26 AM
13	Defensor for dogs, Purevax for cats	Nov 25, 2011 12:08 AM
14	fort dodge	Nov 24, 2011 12:12 PM
15	Fort Dodge	Nov 23, 2011 4:55 PM
16	dogs- pfizer defensor3 Cats-merial purevax	Nov 23, 2011 10:42 AM
17	FORT DODGE RABVAC 3TF	Nov 23, 2011 8:25 AM
18	FORT DODGE	Nov 23, 2011 7:53 AM
19	Merial purevax	Nov 23, 2011 5:52 AM
20	Rabvac for dogs and PureVax for cats	Nov 23, 2011 5:44 AM
21	Rabdomen	Nov 22, 2011 9:50 PM
22	Scering-Plough - Rabdomun	Nov 22, 2011 8:42 PM
23	Purevax (feline)	Nov 22, 2011 8:02 PM
24	Dogs merial Imrab, Cats merial purevax	Nov 22, 2011 8:01 PM
25	Rabdimune	Nov 22, 2011 7:19 PM
26	Merial's Imrab in dogs and Purevax in cats	Nov 22, 2011 7:19 PM
27	dogs-merial imrab /cats-merial purevax	Nov 22, 2011 7:06 PM

Page 3, Q2. What rabies vaccine do you use the majority of the time in your practice?

28	Intervet	Nov 22, 2011 6:58 PM
29	RABVAC 3	Nov 22, 2011 5:32 PM
30	Pfizer Defensor for dogs. Merial Purevax for cats.	Nov 22, 2011 4:52 PM
31	Merial IMRAB for dogs, Merial PurVax for cats	Nov 22, 2011 4:19 PM
32	Intervet Continuum rabies for dogs, for cats we use a 1 year vaccine	Nov 22, 2011 4:08 PM
33	Fort Dodge	Nov 22, 2011 3:21 PM
34	KILLED CANINE/FELINE Continuum Rabies	Nov 22, 2011 3:18 PM
35	Fort Dodge "Rabvac 3"	Nov 22, 2011 3:12 PM
36	imrab for dogs/ purvax rabies merial for cats	Nov 22, 2011 3:10 PM
37	Merial-IMRAB3 for all Dogs/Merial PureVax for all cats	Nov 22, 2011 3:03 PM
38	imrab 3 for dogs. merial purevax for cats	Nov 22, 2011 3:00 PM
39	Merck rhabdimune	Nov 22, 2011 2:57 PM
40	Merial 1 year for cats and Pfizer 3 year for dogs	Nov 22, 2011 2:56 PM
41	Fort Dodge Rabvac-3	Nov 22, 2011 2:54 PM
42	Ft. Dodge Rabvac 3	Nov 22, 2011 2:53 PM
43	Nobivac 3	Nov 22, 2011 2:49 PM
44	merial purevax	Nov 22, 2011 2:43 PM
45	Rabvac for dogs, Merial Rabies for cats	Nov 22, 2011 2:41 PM

Page 3, Q3. With the rabies vaccine you use, what is the USDA licensed duration of immunity?

1	imrab 3 years, purevax 1 year	Dec 6, 2011 12:51 PM
2	Imrab 3 year PureVax, 1 year	Dec 1, 2011 6:33 PM
3	1 year if it is there first vaccination or if they go beyond the expiration of when they need a booster. Otherwise it is a 3 year vaccine after their first initial shot as long as they come in to be revaccinated before the expiration date.	Nov 30, 2011 10:24 PM
4	3 year for dogs 1 year for cats	Nov 30, 2011 3:11 PM
5	3 yr dogs, 1 yr cats	Nov 29, 2011 6:30 PM
6	3 years dogs, 1 year cats	Nov 28, 2011 1:46 PM
7	PureVax = 1 yr, Pfizer Defensor = 2 yrs	Nov 27, 2011 2:58 PM
8	Initial vaccination then 1 year later, then every 3 years after that	Nov 26, 2011 11:16 AM
9	3 year in Defensor 1 year in Pure-vac	Nov 25, 2011 5:51 PM
10	3 for dogs, 1 for cats	Nov 25, 2011 12:08 AM
11	Meriel's cat vaccine is licensed for 1 yr only	Nov 24, 2011 9:37 PM
12	horse-1yr; dog 3 yr., cat 1 yr	Nov 23, 2011 10:57 PM
13	For cats - in the 1st year, I use the 1yr lic vacc all else I use the 3 year and mark it as 1yr on the 1st vacc or when reinstating vacc after more than 4 years	Nov 23, 2011 6:33 PM
14	3 yr for dogs, canarypox 1 yr for cats	Nov 23, 2011 12:26 PM
15	! or 3 years depending if a puppy/kitten or adult	Nov 23, 2011 12:11 PM
16	First Vac3 ms or older, repeat at 1 year, 3 years after that	Nov 23, 2011 12:10 PM
17	age determines 1st vac., 2nd one 12 mo. later is 3 years.	Nov 23, 2011 12:00 PM
18	annually for horses; annually 1st time dogs/cats; then 3 yr	Nov 23, 2011 11:31 AM
19	Annual after 1st vaccination, every 3 years after that	Nov 23, 2011 10:48 AM
20	dogs-3 cats-1	Nov 23, 2011 10:42 AM
21	3 yr unless it is the first rabies vx or they missed due date by more than 6 mos	Nov 23, 2011 6:48 AM
22	1 year purevax for cats and 3 year imrab for dogs	Nov 22, 2011 11:36 PM
23	2 years	Nov 22, 2011 11:20 PM
24	1 yr cats, 2 yr dogs	Nov 22, 2011 10:25 PM
25	feline 1yr canine 3yr	Nov 22, 2011 9:26 PM
26	3 yr - dogs, 1 yr - cats	Nov 22, 2011 9:05 PM

Page 3, Q3. With the rabies vaccine you use, what is the USDA licensed duration of immunity?

27	Dogs 3yr., Cats 1 yr.	Nov 22, 2011 8:01 PM
28	cats 1 year and dogs 3 year	Nov 22, 2011 7:19 PM
29	dogs-3yrs /cats-one yr	Nov 22, 2011 7:06 PM
30	Pfizer 3yr. Merial Purevax 1yr.	Nov 22, 2011 4:52 PM
31	IMRAB 1 yr for 1st k-9, then 3yr. Purvax is only 1yr for cats	Nov 22, 2011 4:19 PM
32	annual, then tri-annual	Nov 22, 2011 3:21 PM
33	1 yr for cats and 3yrs for dogs	Nov 22, 2011 3:10 PM
34	3yrs for dogs/1yr for cats	Nov 22, 2011 3:03 PM
35	3 year for dogs. 1 year for cats	Nov 22, 2011 3:00 PM
36	2 year	Nov 22, 2011 2:56 PM
37	1 year for first known dose, three years thereafter	Nov 22, 2011 2:46 PM
38	3 years for dogs, 1 year for cats	Nov 22, 2011 2:41 PM

Page 3, Q4. What is the duration of immunity or expiration date you record on the rabies certificate?

1	1 year for cats, 2 years for dogs	Dec 6, 2011 12:51 PM
2	1 year then if boosted on time every 3 years	Dec 5, 2011 9:59 PM
3	1 year for cats, 2 year for dogs	Dec 5, 2011 4:35 PM
4	3 year on small dogs, 2 year on large dogs, 1 year on cats	Dec 1, 2011 6:33 PM
5	1 year if it is their first vaccination or if they go beyond the expiration of when they need a booster. Otherwise it is a 3 year vaccine after their first initial shot as long as they come in to be revaccinated before the expiration date.	Nov 30, 2011 10:24 PM
6	3 year for dogs 1 year for cats	Nov 30, 2011 3:11 PM
7	Usually 3 years. In some hunting dogs, more often as required by State where they will be hunting. In puppies Rabies vaccine will only be good for a year.	Nov 30, 2011 1:34 PM
8	3 yr dogs, 1 yr cats	Nov 29, 2011 6:30 PM
9	Will say 1 year for booster, then 3 years if current	Nov 29, 2011 3:31 PM
10	Usually 3 years but in some hunting dogs will do it more frequent based on the requirements of the county or state where they will be hunting.	Nov 28, 2011 8:25 PM
11	2 years dogs, 1 year cats	Nov 28, 2011 1:46 PM
12	depends on the circumstances the animal. Including exposure to wild animals.	Nov 27, 2011 9:43 PM
13	1 or 3 year depending on previous vaccine status; first time given, 1 year expiration date; upon booster at 1 year of age, a 3 year expiration date is recorded.	Nov 27, 2011 7:54 PM
14	Cats = 1 yr, Dogs = 2 yr	Nov 27, 2011 2:58 PM
15	Rochester city license requires 2 year renewal	Nov 27, 2011 11:29 AM
16	3 years unless a city's local ordinance requires 2 years. Our reminder system is set up to accommodate both.	Nov 26, 2011 11:16 AM
17	above	Nov 25, 2011 5:51 PM
18	3 year duration unless first rabies vaccination.	Nov 25, 2011 1:17 PM
19	1 year after the first vaccine and after that yearly booster 3 years	Nov 25, 2011 8:26 AM
20	3 for dogs, 1 for cats	Nov 25, 2011 12:08 AM
21	certs for dogs=3 yr; cats=1 year	Nov 23, 2011 10:57 PM
22	1 year booster, then every 2 years	Nov 23, 2011 4:34 PM
23	initial one year, then 3 years	Nov 23, 2011 4:12 PM
24	1 year or 3 year depending on previous history	Nov 23, 2011 2:35 PM

Page 3, Q4. What is the duration of immunity or expiration date you record on the rabies certificate?

25	as above	Nov 23, 2011 12:26 PM
26	First year 1 year, boosters 2 years	Nov 23, 2011 12:10 PM
27	one year for 1st, 3 years for 2nd a year later.	Nov 23, 2011 12:00 PM
28	as above; exp. based on lot #	Nov 23, 2011 11:31 AM
29	Post vaccination: 1 year for first vaccine and 3 years for boosters thereafter	Nov 23, 2011 10:48 AM
30	dogs- 3yr cats-1yr	Nov 23, 2011 10:42 AM
31	currently 2 years but starting Jan 1 we are changing to 3 year.	Nov 23, 2011 10:28 AM
32	DEPENDS ON IF IT IS THEIR FIRST RABIES VACCINATION THEN IT IS A 1 YR. IF IT IS THEIR 2ND AND IT IS GIVEN IN A TIMELY FASHION THEN IT IS A 2 YR VACCINE.	Nov 23, 2011 8:25 AM
33	2 year unless after discussion with the client we decide to make it 3 year	Nov 23, 2011 7:37 AM
34	3 year unless it is their first rabies vx	Nov 23, 2011 6:48 AM
35	puppy and first time adult vaccine - 1 year, there after every 3 years	Nov 23, 2011 12:36 AM
36	1 year for cats and 3 year for dogs	Nov 22, 2011 11:36 PM
37	1 yr cats, 2 yr dogs	Nov 22, 2011 10:25 PM
38	1yr first k9, 3yr add k9 1yr feline	Nov 22, 2011 9:26 PM
39	1 year on 1st rabies 3yr on each additional meds	Nov 22, 2011 8:18 PM
40	Dogs 3 yr, Cats 1 yr	Nov 22, 2011 8:01 PM
41	1 yr initial vaccination, 3 yrs booster	Nov 22, 2011 7:58 PM
42	cats one year and dogs 3 years	Nov 22, 2011 7:19 PM
43	dogs-2yrs /cats-one yr	Nov 22, 2011 7:06 PM
44	1yr if intial dose, 3yr if booster on time	Nov 22, 2011 6:57 PM
45	1 year first vacce, 3 year after if given before vaccine expires.	Nov 22, 2011 6:55 PM
46	2.5 yr	Nov 22, 2011 6:54 PM
47	never been vaccinated-1 year. High exposure or history or suspect poor compliance-2 year	Nov 22, 2011 6:31 PM
48	hunting dogs 2yr/indoor dogs 3yr/1st time vaccinates1yr	Nov 22, 2011 4:55 PM
49	Pfizer 3yr. Merial Purevax 1yr.	Nov 22, 2011 4:52 PM
50	it	Nov 22, 2011 4:43 PM

Page 3, Q4. What is the duration of immunity or expiration date you record on the rabies certificate?

51	The first Rabies vaccine is good for one year if animal is under 1 years old or has never received a rabies vaccine, the next is good for 3 years.	Nov 22, 2011 4:40 PM
52	1 year for 1st, 3 year for boosters	Nov 22, 2011 4:38 PM
53	depends upon if initial or booster vaccination	Nov 22, 2011 4:27 PM
54	Imrab 2 yr for k-9, 1 yr for cats	Nov 22, 2011 4:19 PM
55	2 or 3 years depending upon the animal's lifestyle	Nov 22, 2011 4:00 PM
56	Three years unless it is the first vaccination	Nov 22, 2011 3:43 PM
57	For puppies/kittens and any adult with no known prior rabies, we put a 1 year duration. The 2nd rabies vaccine and any subsequent are good for 3 years.	Nov 22, 2011 3:35 PM
58	We have recently switched so that we give a 3 yr duration whereas we previously called it a 2 year vaccine.	Nov 22, 2011 3:33 PM
59	Depends on age of animal and vax history	Nov 22, 2011 3:32 PM
60	If first vacc--1 year, if boosted 1 year later then 3 year	Nov 22, 2011 3:21 PM
61	We just recently changed to 3 year--had always done every 2 years	Nov 22, 2011 3:18 PM
62	one yr for cats and 3 yrs for dogs	Nov 22, 2011 3:10 PM
63	If "Adults" dog=3yrs, cat=1 yr	Nov 22, 2011 3:03 PM
64	1 year first dose Consequent doses- 2 year if in city of Albert Lea city limits(required by city), 3 year for all others.	Nov 22, 2011 3:02 PM
65	2 year for dogs. 1 year for cats	Nov 22, 2011 3:00 PM
66	2 year EXCEPT when vaccinating puppy or kitten then boost in one year	Nov 22, 2011 2:56 PM
67	1 year for cats with Merial and 3 year for dogs with Pfizer	Nov 22, 2011 2:56 PM
68	1 yr if 1st Rabies Vaccine, 3 yr if 2nd Rabies Vaccine	Nov 22, 2011 2:55 PM
69	1 year for first vaccine, 3 years for boosters	Nov 22, 2011 2:54 PM
70	1 year if it's their first rabies vaccination, 2 years if it's not	Nov 22, 2011 2:50 PM
71	1 year for first dose, three years thereafter	Nov 22, 2011 2:46 PM
72	1 year for puppies, 3 year for adult dogs	Nov 22, 2011 2:41 PM

Page 3, Q5. If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that?

1	Based on what I believe are Minnesota state requirements for revaccination of rabies for dogs	Dec 6, 2011 12:51 PM
2	I was under the opinion that the State recognizes the vaccine as current for only a 2 yr period. Vaccinating every 2 years helps to keep compliance within the licensed period.	Dec 4, 2011 11:07 AM
3	I want to play it safe with dogs more likely to be exposed to rabies	Dec 1, 2011 6:33 PM
4	For owner compliance so that there is still a time frame for them to get the vaccination boosted that fits with the licensed duration as there is low compliance with coming into booster vaccination exactly when vaccination is due.	Nov 28, 2011 9:34 PM
5	Actually, I would answer numbers 1, 2 and 4	Nov 28, 2011 6:16 PM
6	This is the protocol that the clinic had when i was employed here, we are planning to change it in 2012, but the owner of the practice argues that we much vaccinate farm dogs yearly because of increased risk of exposure to a rabid animal and the other dogs in the community have an expiration date of 2 years because people will then come in before the vaccine has expired at the three year mark.	Nov 28, 2011 1:53 PM
7	Many clients delay their visit for vaccination and the dog remains current.	Nov 28, 2011 1:46 PM
8	To ensure animals stay up-to-date on vaccination, even when they come in late for their revaccination.	Nov 28, 2011 8:40 AM
9	practice owner requires more frequent vaccination, I personally am not in agreement with this practice.	Nov 27, 2011 7:19 PM
10	it only allow me to check 1 box. For dogs, we usually do a '2 year' vaccine because a) they are then protected if the owner is late for their booster; and b) some of the city ordinances require more frequent vaccines. Since we have clients from all over, it is most consistent for us to use a '2 year' protocol.	Nov 27, 2011 2:58 PM
11	Minnesota requires 2 years	Nov 25, 2011 7:01 AM
12	I tell owners that the vaccine is licensed for three years and that they will receive a reminder for booster in 2 years to prevent a lapse in protection.	Nov 24, 2011 2:31 PM
13	we do 1 yr because we are vaccinating rescue animals and are unsure of the animal's vaccination status	Nov 23, 2011 4:55 PM
14	We used to give a 2 year expiration date for the 3 year vaccine to try to prevent animals from being 'overdue' on the vaccine if it was boosted late. We found this created some confusion with our clients, and some clients thought it was somewhat deceptive, so we opted to change to a 3 year vaccination date for our 3 year licensed vaccine.	Nov 23, 2011 3:52 PM
15	We remind at 2 years because many times they delay in coming in...and will lapse. Clients that are consistent with visits, we will often do a 3 year reminder and discuss it with them	Nov 23, 2011 11:42 AM

Page 3, Q5. If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that?

16	Our small animal clinic may send 2-yr reminder to clients that may not respond in time for the 3-yr booster	Nov 23, 2011 11:31 AM
17	One adjoining town requires rabies vaccination every two years for licensing. We also want to examine the dog and get the Rabies vaccine in before 3 years. When we make a note of expiration at two years, it usually gets done by 3 years. If we would note 3 years, most would not schedule an appointment until after three years.	Nov 23, 2011 9:23 AM
18	Rabies vacc is due every 2 years, it is not past due for 3 years. The overlap reduces the risk of out of date rabies immunization and the public health concern.	Nov 23, 2011 9:03 AM
19	Our practice is surrounded by municipalities that have a variety of requirements for rabies vaccines. It is easier to use the shortest duration of immunity to practice. Additionally, many of our dogs travel out of state and other states have a variety of requirements.	Nov 22, 2011 10:26 PM
20	I do the last except that is I record on the rabies certificate the duration of immunity and expiration day that the rabies vaccine is licensed for, except 1st Rabies vaccine expires in a year, using the labeled 3year vaccine	Nov 22, 2011 8:18 PM
21	Do not do any other vaccines than the one year for cats (work at a feline-only).	Nov 22, 2011 8:02 PM
22	We maximize the duration of the rabies except if the dog or cat is high risk. ie high land hunting dog or outdoor cat	Nov 22, 2011 7:19 PM
23	The certificate is written for 3 years. Some clients with outdoor dogs that run loose and have interactions with wildlife are boosted in 2 years. The client participates in teh decision.	Nov 22, 2011 6:59 PM
24	Options 4 and 5. Most are written as 3 year, but when I digress from that protocol, it is for reasons 4 and 5. Survey would only allow 1 answer.	Nov 22, 2011 6:31 PM
25	There communities that require 2 year vaccination for liscensure even though we use a 3 year rabies. I so not believe the communities should do that and are causing the owners increased expense for their pets.	Nov 22, 2011 6:13 PM
26	THREE LOCAL CITIES REQUIRE TWO YEAR SO ALL ARE 2 YEAR. THIS DOES COVER ABOUT 85 TO 90% OF MY PATIENTS. MOST OF THE REST ARE RURAL DOGS AND EXPOSURE RISK HIGHER. #6 SHOULD BE EXPLAINED. MOST CLIENTS HAVE THIS EXPLAINED WHEN GIVING THE FIRST RABIES DOSE BUT NOT AFTER THIS.	Nov 22, 2011 5:58 PM
27	Owners are told the label is for 3 years but liability problems can arise if they are late and the animal bites someone, so we send reminders at 2 years.	Nov 22, 2011 5:57 PM
28	If under 1 year, I repeat the vaccine 1 year later because I want to make sure that the animals immune system was mature enough to mount a good immune response. AAHA guidelines.	Nov 22, 2011 4:40 PM
29	Expiration date of vaccine is when the pet needs to return to get re-vaccinated; duration of immunity is always three years based on licensure of the vaccine	Nov 22, 2011 4:27 PM

Page 3, Q5. If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that?

30	we were previously required by municipality to do every 2 yrs for k-9, also we are presented with pets who are overdue for rabies vaccine. We will adjust to 3 yr is asked by client	Nov 22, 2011 4:19 PM
31	As I said above, we switched because we had mistakenly understood that the county required it every 2 years, but it is also understandable that some people ignore their reminders and may not get the pet until way after the expiration date. We are now calling it a 3 year vaccine.	Nov 22, 2011 3:33 PM
32	Working with a population of animals with unknown vaccination history; assume not vaccinated and give expiration date of 1 year.	Nov 22, 2011 3:32 PM
33	Several reasons. Many owners are delinquent with vaccinations. Risk vs Benefit outweighs itself by far for a disease that is not cureable and zoonotic.	Nov 22, 2011 3:18 PM
34	Combination of several factors. The Municipality requires more frequent vaccination. Also due to the fact that when owners are late on a 3 year duration the pets have potentially been exposed to rabies or may have exposed a person. With a 2 year duration we have a 12 month cushion.	Nov 22, 2011 3:17 PM
35	The company states trust it for 2 years but not 3 total and many of the animals are farm or hunting origin and frequently could be exposed to rabies.	Nov 22, 2011 3:12 PM
36	after the 2nd vaccine i record duration of immunity that the vaccine is liscenced for	Nov 22, 2011 3:10 PM
37	More than one of the above and It fits with our program of alternating the rabies and distemper vaccines.	Nov 22, 2011 2:58 PM
38	The animals I see have no known vaccine history, so I treat each vaccine as if it were the first; thus, requiring a "booster" in 1 year.	Nov 22, 2011 2:54 PM
39	The practice owner decided many years ago to institute a 2-year Rabies policy because of the number of positive cases in this area, the general lack of compliance of owners, and the general safety of the vaccine - I comply with the company policy.	Nov 22, 2011 2:53 PM
40	We have 3 practices. One of our practices is located in a community that the city requires 2 year rabies. To be consistent we use that at all 3 clinics. I also believe that a 2 year expiration provides a window of safety since most pets are often late for routine vaccines.	Nov 22, 2011 2:49 PM
41	2 & 5 above plus gives us a buffer zone for clients late on their vaccinations.	Nov 22, 2011 2:49 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

1	ottertail	Dec 7, 2011 9:12 PM
2	Hennepin	Dec 6, 2011 3:39 PM
3	Renville	Dec 6, 2011 12:51 PM
4	Carver	Dec 6, 2011 10:58 AM
5	dakota	Dec 6, 2011 10:20 AM
6	Morrison	Dec 5, 2011 9:59 PM
7	Hennepin	Dec 5, 2011 9:41 PM
8	clearwater	Dec 5, 2011 4:35 PM
9	Hennepin	Dec 5, 2011 10:36 AM
10	Scott	Dec 5, 2011 7:31 AM
11	Hennepin	Dec 4, 2011 11:03 PM
12	Otter Tail	Dec 4, 2011 4:43 PM
13	mcleod	Dec 4, 2011 4:07 PM
14	Otter Tail	Dec 4, 2011 11:07 AM
15	Scott	Dec 3, 2011 4:23 PM
16	washington	Dec 2, 2011 7:18 PM
17	Hennepin	Dec 1, 2011 11:46 PM
18	Washington	Dec 1, 2011 11:39 PM
19	POLK	Dec 1, 2011 6:46 PM
20	Cass	Dec 1, 2011 6:33 PM
21	Ramsey	Dec 1, 2011 6:24 PM
22	Crow Wing	Dec 1, 2011 4:54 PM
23	Olmsted	Dec 1, 2011 3:55 PM
24	Ottertail	Dec 1, 2011 3:25 PM
25	grant	Dec 1, 2011 9:06 AM
26	Morrison	Nov 30, 2011 10:24 PM
27	Douglas	Nov 30, 2011 10:06 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

28	Hennepin	Nov 30, 2011 3:11 PM
29	Wright	Nov 30, 2011 1:34 PM
30	Winona	Nov 30, 2011 1:01 PM
31	Clearwater	Nov 30, 2011 9:27 AM
32	hennepin	Nov 30, 2011 1:48 AM
33	Ramsey	Nov 29, 2011 9:00 PM
34	Hennepin	Nov 29, 2011 8:16 PM
35	Hennepin	Nov 29, 2011 6:30 PM
36	Stevens	Nov 29, 2011 5:47 PM
37	Hennepin	Nov 29, 2011 5:31 PM
38	Anoka	Nov 29, 2011 3:31 PM
39	Scott	Nov 29, 2011 1:30 PM
40	St. Louis	Nov 29, 2011 12:03 PM
41	Carver	Nov 29, 2011 9:42 AM
42	WINONA	Nov 29, 2011 8:00 AM
43	Hennepin	Nov 28, 2011 11:04 PM
44	douglas	Nov 28, 2011 9:34 PM
45	olmsted	Nov 28, 2011 9:15 PM
46	Wright	Nov 28, 2011 8:25 PM
47	Washington	Nov 28, 2011 7:38 PM
48	Washington	Nov 28, 2011 7:03 PM
49	Ramsey	Nov 28, 2011 6:39 PM
50	Hennipen	Nov 28, 2011 6:26 PM
51	Ramsey	Nov 28, 2011 6:16 PM
52	Stearns	Nov 28, 2011 4:48 PM
53	Waseca	Nov 28, 2011 4:28 PM
54	Itasca	Nov 28, 2011 3:52 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

55	Wright	Nov 28, 2011 2:51 PM
56	mcloud	Nov 28, 2011 2:30 PM
57	We are in Dickey County, ND but I am still licensed in MN.	Nov 28, 2011 1:53 PM
58	washington	Nov 28, 2011 1:48 PM
59	Meeker	Nov 28, 2011 1:46 PM
60	stearns	Nov 28, 2011 1:42 PM
61	Washington	Nov 28, 2011 11:53 AM
62	Dakota	Nov 28, 2011 11:46 AM
63	Anoka	Nov 28, 2011 11:34 AM
64	Grant County	Nov 28, 2011 10:59 AM
65	ramcey	Nov 28, 2011 9:45 AM
66	Nobles	Nov 28, 2011 8:40 AM
67	Hennipen	Nov 27, 2011 10:32 PM
68	Washington	Nov 27, 2011 10:31 PM
69	Crow wing	Nov 27, 2011 10:05 PM
70	Washington	Nov 27, 2011 9:59 PM
71	koochiching	Nov 27, 2011 9:43 PM
72	Ottertail	Nov 27, 2011 8:41 PM
73	Crow Wing	Nov 27, 2011 7:54 PM
74	Goodhue	Nov 27, 2011 7:23 PM
75	dakota	Nov 27, 2011 7:19 PM
76	Dickey County North Dakota	Nov 27, 2011 7:16 PM
77	Ramsey	Nov 27, 2011 2:58 PM
78	Rochester	Nov 27, 2011 11:29 AM
79	Kandiyohi	Nov 27, 2011 11:19 AM
80	Lyon	Nov 26, 2011 10:32 PM
81	Dakota	Nov 26, 2011 7:27 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

82	Scott	Nov 26, 2011 5:25 PM
83	WASHINGTON	Nov 26, 2011 5:10 PM
84	Blue Earth	Nov 26, 2011 11:16 AM
85	Ramsey	Nov 26, 2011 11:07 AM
86	St. Louis	Nov 25, 2011 11:07 PM
87	Wabashs	Nov 25, 2011 9:37 PM
88	Winona	Nov 25, 2011 8:32 PM
89	hennepin	Nov 25, 2011 7:24 PM
90	Dakota	Nov 25, 2011 5:51 PM
91	Lake	Nov 25, 2011 4:52 PM
92	ramsey	Nov 25, 2011 4:18 PM
93	swift	Nov 25, 2011 3:09 PM
94	Hennepin	Nov 25, 2011 2:36 PM
95	Hennepin	Nov 25, 2011 1:17 PM
96	Washington	Nov 25, 2011 12:06 PM
97	Anoka	Nov 25, 2011 11:37 AM
98	Grant	Nov 25, 2011 11:20 AM
99	Olmsted	Nov 25, 2011 9:12 AM
100	Goodhue	Nov 25, 2011 8:26 AM
101	dakota	Nov 25, 2011 8:25 AM
102	Fillmore	Nov 25, 2011 8:22 AM
103	carver	Nov 25, 2011 8:09 AM
104	Washington	Nov 25, 2011 7:38 AM
105	Lyon	Nov 25, 2011 7:01 AM
106	Faribault	Nov 25, 2011 6:21 AM
107	henn	Nov 25, 2011 5:03 AM
108	Wright	Nov 25, 2011 12:08 AM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

109	Becker	Nov 24, 2011 9:37 PM
110	Morrison	Nov 24, 2011 7:36 PM
111	Hennepin	Nov 24, 2011 6:52 PM
112	Anoka	Nov 24, 2011 6:33 PM
113	Carver	Nov 24, 2011 4:31 PM
114	scott	Nov 24, 2011 2:31 PM
115	Le Sueur	Nov 24, 2011 12:12 PM
116	Olmsted	Nov 24, 2011 11:03 AM
117	ramsey	Nov 24, 2011 10:40 AM
118	winona	Nov 24, 2011 10:04 AM
119	Wright	Nov 24, 2011 9:35 AM
120	houston	Nov 24, 2011 8:20 AM
121	St Louis	Nov 24, 2011 7:29 AM
122	Carver	Nov 23, 2011 10:57 PM
123	Ramsey	Nov 23, 2011 9:52 PM
124	Pope	Nov 23, 2011 6:33 PM
125	Ramsey county	Nov 23, 2011 5:35 PM
126	Carver and Scott	Nov 23, 2011 4:55 PM
127	Anoka	Nov 23, 2011 4:54 PM
128	Stearns	Nov 23, 2011 4:52 PM
129	Blue Earth	Nov 23, 2011 4:44 PM
130	Fillmore	Nov 23, 2011 4:43 PM
131	Stearns	Nov 23, 2011 4:34 PM
132	Hennepin	Nov 23, 2011 4:12 PM
133	Hennepin	Nov 23, 2011 3:59 PM
134	Ramsey	Nov 23, 2011 3:52 PM
135	Stearns	Nov 23, 2011 3:48 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

136	Hennepin	Nov 23, 2011 3:40 PM
137	Dakota	Nov 23, 2011 3:39 PM
138	Sherburne	Nov 23, 2011 2:35 PM
139	carlton	Nov 23, 2011 2:26 PM
140	Hennepin	Nov 23, 2011 1:34 PM
141	Clay	Nov 23, 2011 1:20 PM
142	prior lake	Nov 23, 2011 1:14 PM
143	Hennepin	Nov 23, 2011 12:45 PM
144	Carlton	Nov 23, 2011 12:27 PM
145	goodhue	Nov 23, 2011 12:26 PM
146	Hennepin	Nov 23, 2011 12:25 PM
147	Hennepin	Nov 23, 2011 12:22 PM
148	Hennepin	Nov 23, 2011 12:11 PM
149	McLeod	Nov 23, 2011 12:10 PM
150	Ramsey	Nov 23, 2011 12:04 PM
151	Dakota	Nov 23, 2011 12:01 PM
152	Sibley	Nov 23, 2011 12:00 PM
153	Chisago	Nov 23, 2011 11:44 AM
154	Anoka	Nov 23, 2011 11:42 AM
155	Ramsey	Nov 23, 2011 11:36 AM
156	Wright	Nov 23, 2011 11:31 AM
157	Wright	Nov 23, 2011 11:23 AM
158	Isanti	Nov 23, 2011 11:15 AM
159	Hennepin	Nov 23, 2011 10:54 AM
160	Jackson	Nov 23, 2011 10:48 AM
161	McLeod	Nov 23, 2011 10:42 AM
162	Ottertail	Nov 23, 2011 10:28 AM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

163	Scott	Nov 23, 2011 10:07 AM
164	st louis	Nov 23, 2011 10:02 AM
165	Douglas	Nov 23, 2011 9:55 AM
166	anoka	Nov 23, 2011 9:45 AM
167	Meeker. the adjoining city is in Stearns that has the two year requirement.	Nov 23, 2011 9:23 AM
168	Olmsted	Nov 23, 2011 9:07 AM
169	Stearns	Nov 23, 2011 9:03 AM
170	Hennepin	Nov 23, 2011 9:03 AM
171	Hennipen	Nov 23, 2011 8:32 AM
172	Hennepin	Nov 23, 2011 8:28 AM
173	BECKER	Nov 23, 2011 8:25 AM
174	goodhue	Nov 23, 2011 8:07 AM
175	sherburne	Nov 23, 2011 7:59 AM
176	Dakota	Nov 23, 2011 7:54 AM
177	ST LOUIS	Nov 23, 2011 7:53 AM
178	Olmsted	Nov 23, 2011 7:53 AM
179	Pine	Nov 23, 2011 7:47 AM
180	Dakota	Nov 23, 2011 7:47 AM
181	Hennepin	Nov 23, 2011 7:37 AM
182	Freeborn	Nov 23, 2011 7:36 AM
183	chisago	Nov 23, 2011 7:24 AM
184	Le Sueur	Nov 23, 2011 6:56 AM
185	ramsay	Nov 23, 2011 6:48 AM
186	Hennepin	Nov 23, 2011 5:52 AM
187	Hennepin	Nov 23, 2011 5:44 AM
188	Nicollet	Nov 23, 2011 5:41 AM
189	Ramsey	Nov 23, 2011 12:58 AM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

190	washington	Nov 23, 2011 12:36 AM
191	Hennepin	Nov 22, 2011 11:36 PM
192	Hennepin	Nov 22, 2011 11:33 PM
193	Crow wing	Nov 22, 2011 11:32 PM
194	Washington	Nov 22, 2011 11:20 PM
195	Washington	Nov 22, 2011 11:10 PM
196	wright	Nov 22, 2011 11:01 PM
197	Hennepin	Nov 22, 2011 10:40 PM
198	Dakota	Nov 22, 2011 10:35 PM
199	Washingotn	Nov 22, 2011 10:26 PM
200	Hennepin	Nov 22, 2011 10:25 PM
201	Lyon	Nov 22, 2011 10:20 PM
202	Scott	Nov 22, 2011 10:20 PM
203	Mille Lacs	Nov 22, 2011 10:15 PM
204	hennipen	Nov 22, 2011 10:06 PM
205	Lyon	Nov 22, 2011 10:00 PM
206	st. louis	Nov 22, 2011 9:50 PM
207	Carver	Nov 22, 2011 9:41 PM
208	winona	Nov 22, 2011 9:41 PM
209	ramsey	Nov 22, 2011 9:39 PM
210	Ramsey	Nov 22, 2011 9:34 PM
211	Hennepin	Nov 22, 2011 9:31 PM
212	Scott	Nov 22, 2011 9:31 PM
213	WRIGHT COUNTY AND SHERBURN COUNTY	Nov 22, 2011 9:27 PM
214	ramsey	Nov 22, 2011 9:26 PM
215	Chippewa	Nov 22, 2011 9:24 PM
216	anoka	Nov 22, 2011 9:17 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

217	Hennepin	Nov 22, 2011 9:16 PM
218	goodhue	Nov 22, 2011 9:15 PM
219	Hennepin	Nov 22, 2011 9:09 PM
220	waseca	Nov 22, 2011 9:09 PM
221	anoka	Nov 22, 2011 9:09 PM
222	Olmsted	Nov 22, 2011 9:05 PM
223	Hennepin	Nov 22, 2011 9:04 PM
224	Winona Mn	Nov 22, 2011 9:03 PM
225	Redwood	Nov 22, 2011 9:02 PM
226	Hennepin	Nov 22, 2011 9:00 PM
227	Isanti	Nov 22, 2011 8:58 PM
228	WRIGHT	Nov 22, 2011 8:52 PM
229	ramsey	Nov 22, 2011 8:42 PM
230	Hennepin	Nov 22, 2011 8:42 PM
231	Hennepin	Nov 22, 2011 8:40 PM
232	Washington	Nov 22, 2011 8:24 PM
233	Itasca	Nov 22, 2011 8:18 PM
234	mower	Nov 22, 2011 8:15 PM
235	Scott	Nov 22, 2011 8:10 PM
236	DODGE	Nov 22, 2011 8:09 PM
237	Anoka	Nov 22, 2011 8:08 PM
238	Ramsey	Nov 22, 2011 8:02 PM
239	Relief vet, several practices. Ramsey and Dakota	Nov 22, 2011 8:01 PM
240	Scott	Nov 22, 2011 8:00 PM
241	Hennipen	Nov 22, 2011 7:59 PM
242	benton	Nov 22, 2011 7:58 PM
243	Le Sueur	Nov 22, 2011 7:57 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

244	Hennepin	Nov 22, 2011 7:56 PM
245	Meeker	Nov 22, 2011 7:53 PM
246	scott	Nov 22, 2011 7:35 PM
247	Washington	Nov 22, 2011 7:31 PM
248	St. Louis	Nov 22, 2011 7:31 PM
249	ramsey	Nov 22, 2011 7:30 PM
250	Washington	Nov 22, 2011 7:29 PM
251	Stearns	Nov 22, 2011 7:28 PM
252	Goodhue	Nov 22, 2011 7:20 PM
253	sherburne	Nov 22, 2011 7:19 PM
254	Scott	Nov 22, 2011 7:19 PM
255	Wabasha	Nov 22, 2011 7:15 PM
256	Winona	Nov 22, 2011 7:12 PM
257	carver	Nov 22, 2011 7:08 PM
258	Le Sueur	Nov 22, 2011 7:06 PM
259	hennepin	Nov 22, 2011 7:06 PM
260	Washington	Nov 22, 2011 7:01 PM
261	Hennepin	Nov 22, 2011 7:01 PM
262	Carver	Nov 22, 2011 6:59 PM
263	hennepin	Nov 22, 2011 6:58 PM
264	Ramsey	Nov 22, 2011 6:58 PM
265	Todd	Nov 22, 2011 6:57 PM
266	meeker	Nov 22, 2011 6:57 PM
267	Rice	Nov 22, 2011 6:55 PM
268	Sherburne	Nov 22, 2011 6:55 PM
269	Renville	Nov 22, 2011 6:54 PM
270	Crow wing	Nov 22, 2011 6:54 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

271	Anoka	Nov 22, 2011 6:52 PM
272	Dakota	Nov 22, 2011 6:51 PM
273	Carlton	Nov 22, 2011 6:44 PM
274	hennipen	Nov 22, 2011 6:39 PM
275	Blue Earth	Nov 22, 2011 6:38 PM
276	clay	Nov 22, 2011 6:37 PM
277	Washington	Nov 22, 2011 6:36 PM
278	Scott	Nov 22, 2011 6:31 PM
279	Itasca	Nov 22, 2011 6:15 PM
280	WASECA	Nov 22, 2011 6:13 PM
281	fillmore	Nov 22, 2011 6:07 PM
282	Mcleod	Nov 22, 2011 5:58 PM
283	STEELE	Nov 22, 2011 5:58 PM
284	Sherburne	Nov 22, 2011 5:57 PM
285	Hennepin	Nov 22, 2011 5:56 PM
286	Goodhue	Nov 22, 2011 5:50 PM
287	Washington	Nov 22, 2011 5:50 PM
288	Sherburne	Nov 22, 2011 5:40 PM
289	Stearns	Nov 22, 2011 5:37 PM
290	BELTRAMI	Nov 22, 2011 5:32 PM
291	Anoka	Nov 22, 2011 5:29 PM
292	Hennepin	Nov 22, 2011 5:26 PM
293	Carver	Nov 22, 2011 5:11 PM
294	Todd	Nov 22, 2011 5:03 PM
295	Dakota	Nov 22, 2011 5:01 PM
296	JACKSON	Nov 22, 2011 4:59 PM
297	Washington	Nov 22, 2011 4:57 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

298	todd	Nov 22, 2011 4:55 PM
299	dakota	Nov 22, 2011 4:53 PM
300	Hennepin	Nov 22, 2011 4:52 PM
301	Ramsey	Nov 22, 2011 4:48 PM
302	Anoka	Nov 22, 2011 4:48 PM
303	depends. discuss 3 yr duration but often recommend 2 yrs to allow for procrastination.	Nov 22, 2011 4:43 PM
304	Hennepin	Nov 22, 2011 4:42 PM
305	Washington	Nov 22, 2011 4:40 PM
306	nicollet	Nov 22, 2011 4:39 PM
307	Ramsey	Nov 22, 2011 4:39 PM
308	Stevens	Nov 22, 2011 4:38 PM
309	Hennepin	Nov 22, 2011 4:37 PM
310	Meeker	Nov 22, 2011 4:35 PM
311	Scott	Nov 22, 2011 4:32 PM
312	Hennepin	Nov 22, 2011 4:30 PM
313	Anoka	Nov 22, 2011 4:27 PM
314	NA	Nov 22, 2011 4:27 PM
315	Dakota	Nov 22, 2011 4:26 PM
316	Polk	Nov 22, 2011 4:19 PM
317	Carver	Nov 22, 2011 4:17 PM
318	ramsey	Nov 22, 2011 4:16 PM
319	Hennepin	Nov 22, 2011 4:14 PM
320	Dane	Nov 22, 2011 4:08 PM
321	goodhue	Nov 22, 2011 4:06 PM
322	Fillmore	Nov 22, 2011 4:03 PM
323	rice	Nov 22, 2011 4:01 PM
324	McLeod	Nov 22, 2011 4:01 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

325	Hubbard	Nov 22, 2011 4:00 PM
326	hennepin	Nov 22, 2011 3:57 PM
327	Lyon	Nov 22, 2011 3:55 PM
328	McLeod	Nov 22, 2011 3:55 PM
329	Polk	Nov 22, 2011 3:45 PM
330	Becker	Nov 22, 2011 3:44 PM
331	scott	Nov 22, 2011 3:43 PM
332	Stearns	Nov 22, 2011 3:40 PM
333	hennepin	Nov 22, 2011 3:40 PM
334	Faribault	Nov 22, 2011 3:39 PM
335	Waseca	Nov 22, 2011 3:38 PM
336	Hennepin	Nov 22, 2011 3:37 PM
337	Goodhue	Nov 22, 2011 3:35 PM
338	Ramsey	Nov 22, 2011 3:33 PM
339	Rice	Nov 22, 2011 3:32 PM
340	St. Louis	Nov 22, 2011 3:32 PM
341	Hennepin	Nov 22, 2011 3:27 PM
342	anoka	Nov 22, 2011 3:27 PM
343	Hennipen	Nov 22, 2011 3:27 PM
344	Hennipin	Nov 22, 2011 3:26 PM
345	WRIGHT	Nov 22, 2011 3:23 PM
346	olmsted	Nov 22, 2011 3:22 PM
347	Otter Tail	Nov 22, 2011 3:21 PM
348	Olmsted	Nov 22, 2011 3:21 PM
349	Blue Earth	Nov 22, 2011 3:18 PM
350	Ramsey	Nov 22, 2011 3:18 PM
351	Ramsey	Nov 22, 2011 3:18 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

352	Hennepin	Nov 22, 2011 3:18 PM
353	anoka	Nov 22, 2011 3:17 PM
354	Hennepin	Nov 22, 2011 3:14 PM
355	Dakota	Nov 22, 2011 3:14 PM
356	Ramsey	Nov 22, 2011 3:12 PM
357	Sibley	Nov 22, 2011 3:12 PM
358	Olmsted	Nov 22, 2011 3:11 PM
359	anoka	Nov 22, 2011 3:11 PM
360	Clay	Nov 22, 2011 3:11 PM
361	ramsey	Nov 22, 2011 3:10 PM
362	Steele	Nov 22, 2011 3:08 PM
363	Hennepin	Nov 22, 2011 3:07 PM
364	Hennepin	Nov 22, 2011 3:07 PM
365	Carlton	Nov 22, 2011 3:05 PM
366	Hennepin	Nov 22, 2011 3:05 PM
367	hennepen	Nov 22, 2011 3:03 PM
368	hennepin	Nov 22, 2011 3:03 PM
369	Freeborn	Nov 22, 2011 3:02 PM
370	Dakota	Nov 22, 2011 3:01 PM
371	Anoka	Nov 22, 2011 3:01 PM
372	Hennepin	Nov 22, 2011 3:00 PM
373	ramsey	Nov 22, 2011 3:00 PM
374	ramsey	Nov 22, 2011 2:59 PM
375	Pipestone	Nov 22, 2011 2:58 PM
376	washington	Nov 22, 2011 2:58 PM
377	Hennepin	Nov 22, 2011 2:57 PM
378	Itasca	Nov 22, 2011 2:57 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

379	Washington	Nov 22, 2011 2:57 PM
380	Otter Tail	Nov 22, 2011 2:56 PM
381	todd	Nov 22, 2011 2:56 PM
382	Ramsey	Nov 22, 2011 2:56 PM
383	Kandyohi	Nov 22, 2011 2:56 PM
384	Not in MN, in WI 54017	Nov 22, 2011 2:55 PM
385	anoka	Nov 22, 2011 2:54 PM
386	dakota	Nov 22, 2011 2:54 PM
387	Washington	Nov 22, 2011 2:54 PM
388	Blue Earth	Nov 22, 2011 2:53 PM
389	Otter Tail Count	Nov 22, 2011 2:53 PM
390	Washington	Nov 22, 2011 2:53 PM
391	kandiohi	Nov 22, 2011 2:51 PM
392	Hennepin	Nov 22, 2011 2:50 PM
393	Prior Lake	Nov 22, 2011 2:50 PM
394	Anoka	Nov 22, 2011 2:50 PM
395	Kandiyohi	Nov 22, 2011 2:50 PM
396	dakota	Nov 22, 2011 2:49 PM
397	Dakota	Nov 22, 2011 2:49 PM
398	anoka	Nov 22, 2011 2:49 PM
399	Stearns	Nov 22, 2011 2:49 PM
400	Anoka	Nov 22, 2011 2:49 PM
401	Hennepijn	Nov 22, 2011 2:48 PM
402	ramsey	Nov 22, 2011 2:48 PM
403	Dakota	Nov 22, 2011 2:47 PM
404	Washington	Nov 22, 2011 2:47 PM
405	Anoka	Nov 22, 2011 2:46 PM

Page 3, Q7. In what County of Minnesota is the physical address of your practice located?

406	Itasca	Nov 22, 2011 2:46 PM
407	stillwater	Nov 22, 2011 2:45 PM
408	Dakota	Nov 22, 2011 2:45 PM
409	dakota	Nov 22, 2011 2:43 PM
410	Washington	Nov 22, 2011 2:41 PM
411	Le Sueur	Nov 20, 2011 5:33 PM
412	kjhlkj	Nov 18, 2011 2:02 PM

Board of Veterinary Medicine



Rabies Vaccination Committee Survey Report

December 14, 2011

Committee Members
Barbara Fischley, DVM Chair
Sharon Todoroff

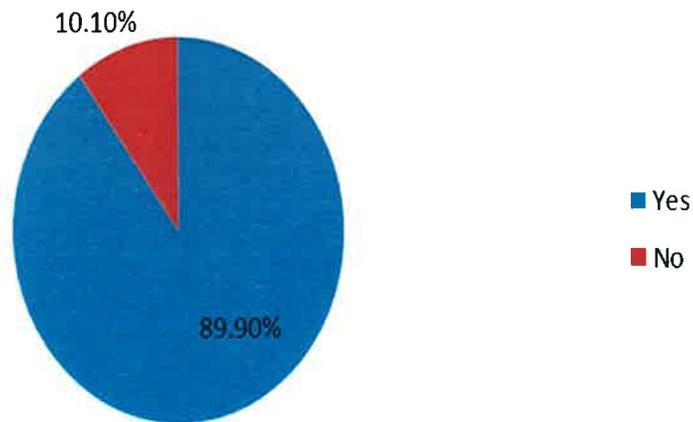
Scope of Survey

- 2,001 active licensees with MN address.
- 109 licensees of group have not provided email address.
- 1,892 licensees were emailed Rabies Vaccination Survey.
- 148 emails bounced back.
- 1,744 licensees received Rabies Vaccination Survey.
- Survey open from 11/22/2011 thru 12/08/2011
(17 days)
- 545 licensees responded to survey.

1) Do you provide rabies vaccinations for dogs and cats in your practice?

% Number

1) Do you provide rabies vaccinations for dogs and cats in your practice?



Yes 89.90% 490

No 10.10% 55

Answered Question

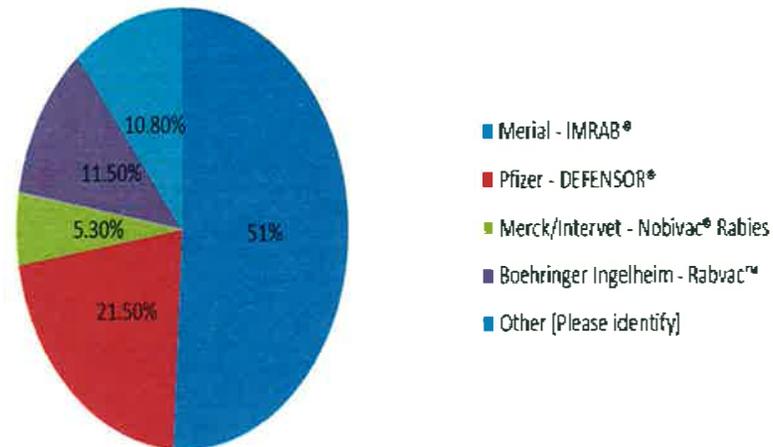
545

Skipped Question

0

2) What rabies vaccine do you use the majority of the time in your practice?

2) What rabies vaccine do you use the majority of the time in your practice?



Merial - IMRAB®
51% 213

Pfizer - DEFENSOR®
21.50% 90

Merck/Intervet-Nobivac®
5.30% 22

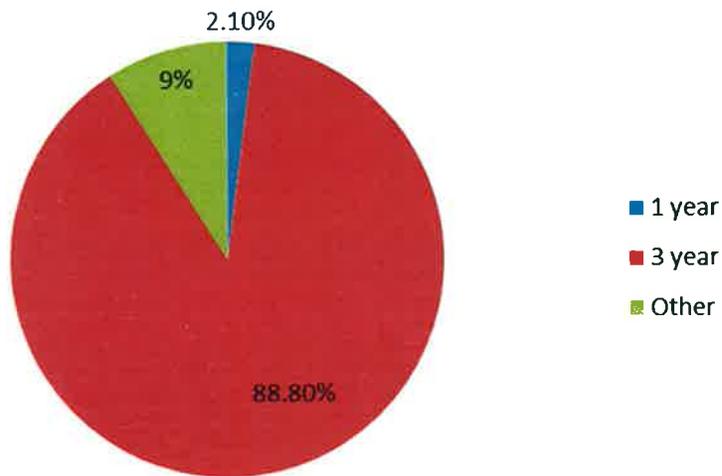
Boehringer Ingelheim-
Rabvac™

11.50% 48

• Other (Please identify)
10.80% 45

3)With the rabies vaccine you use, what is the USDA licensed duration of immunity?

3)With the rabies vaccine you use, what is the USDA licensed duration of immunity?



1 year	2.10%	9
3 year	88.80%	373
Other	9%	38

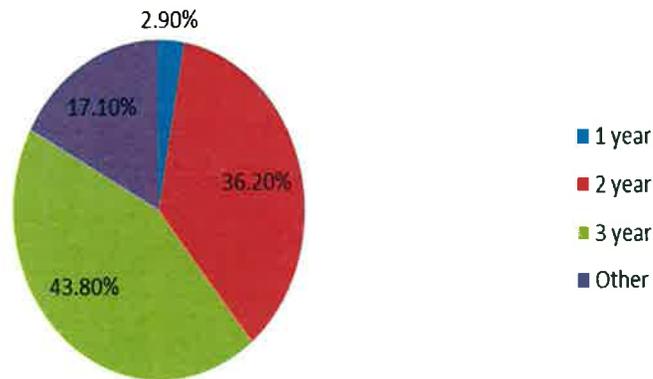
Page 3, Q3. With the rabies vaccine you use, what is the USDA licensed duration of immunity?

- 1 imrab 3 years, purevax 1 year
- 2 Imrab 3 year PureVax, 1 year
- 3 1 year if it is there first vaccination or if they go beyond the expiration of when they need a booster. Otherwise it is a 3 year vaccine after their first initial shot as long as they come in to be revaccinated before the expiration date.
- 4 3 year for dogs 1 year for cats
- 5 3 yr dogs, 1 yr cats
- 6 3 years dogs, 1 year cats
- 7 PureVax = 1 yr, Pfizer Defensor = 2 yrs
- 8 Initial vaccination then 1 year later, then every 3 years after that
- 9 3 year in Defensor 1 year in Pure-vac
- 10 3 for dogs, 1 for cats
- 11 Merial's cat vaccine is licensed for 1 yr only
- 12 horse-1yr, dog 3 yr., cat 1 yr
- 13 For cats - in the 1st year, I use the 1yr lic vacc all else I use the 3 year and mark it as 1yr on the 1st vacc or when reinstating vacc after more than 4 years
- 14 3 yr for dogs, canarypox 1 yr for cats
- 15 1 or 3 years depending if a puppy/kitten or adult
- 16 First Vac3 ms or older, repeat at 1 year, 3 years after that
- 17 age determines 1st vac., 2nd one 12 mo. later is 3 years.
- 18 annually for horses; annually 1st time dogs/cats; then 3 yr
- 19 Annual after 1st vaccination, every 3 years after that
- 20 dogs-3 cats-1
- 21 3 yr unless it is the first rabies vx or they missed due date by more than 6 mos
- 22 1 year purevax for cats and 3 year imrab for dogs
- 23 2 years
- 24 1 yr cats, 2 yr dogs
- 25 feline 1yr canine 3yr
- 26 3 yr - dogs, 1 yr - cats

- 27 Dogs 3yr., Cats 1 yr.
- 28 cats 1 year and dogs 3 year
- 29 dogs-3yrs /cats-one yr
- 30 Pfizer 3yr. Merial Purevax 1yr.
- 31 IMRAB 1 yr for 1st k-9, then 3yr. Purvax is only 1yr for cats
- 32 annual, then tri-annual
- 33 1 yr for cats and 3yrs for dogs
- 34 3yrs for dogs/1yr for cats
- 35 3 year for dogs, 1 year for cats
- 36 2 year
- 37 1 year for first known dose, three years thereafter
- 38 3 years for dogs, 1 year for cats

4) What is the duration of immunity or expiration date you record on the rabies certificate?

4) What is the duration of immunity or expiration date you record on the rabies certificate?



1 year	2.90%	12
2 year	36.20%	152
3 year	43.80%	184
Other	17.10%	72

Page 3, Q4. What is the duration of immunity or expiration date you record on the rabies certificate?

1	1 year for cats, 2 years for dogs	25	as above
2	1 year then if boosted on time every 3 years	26	First year 1 year, boosters 2 years
3	1 year for cats, 2 year for dogs	27	one year for 1st, 3 years for 2nd a year later.
4	3 year on small dogs, 2 year on large dogs, 1 year on cats	28	as above; exp. based on lot #
5	1 year if it is their first vaccination or if they go beyond the expiration of when they need a booster. Otherwise it is a 3 year vaccine after their first initial shot as long as they come in to be revaccinated before the expiration date.	29	Post vaccination: 1 year for first vaccine and 3 years for boosters thereafter
6	3 year for dogs 1 year for cats	30	dogs- 3yr cats-1yr
7	Usually 3 years. In some hunting dogs, more often as required by State where they will be hunting. In puppies Rabies vaccine will only be good for a year.	31	currently 2 years but starting Jan 1 we are changing to 3 year.
8	3 yr dogs, 1 yr cats	32	DEPENDS ON IF IT IS THEIR FIRST RABIES VACCINATION THEN IT IS A 1 YR. IF IT IS THEIR 2ND AND IT IS GIVEN IN A TIMELY FASHION THEN IT IS A 2 YR VACCINE.
9	Will say 1 year for booster, then 3 years if current	33	2 year unless after discussion with the client we decide to make it 3 year
10	Usually 3 years but in some hunting dogs will do it more frequent based on the requirements of the county or state where they will be hunting.	34	3 year unless it is their first rabies vx
11	2 years dogs, 1 year cats	35	puppy and first time adult vaccine - 1 year, there after every 3 years
12	depends on the circumstances the animal. including exposure to wild animals.	36	1 year for cats and 3 year for dogs
13	1 or 3 year depending on previous vaccine status; first time given, 1 year expiration date; upon booster at 1 year of age, a 3 year expiration date is recorded.	37	1 yr cats, 2 yr dogs
14	Cats = 1 yr. Dogs = 2 yr	38	1yr first k9, 3yr add k9 1yr feline
15	Rochester city license requires 2 year renewal	39	1 year on 1st rabies 3yr on each additional meds
16	3 years unless a city's local ordinance requires 2 years. Our reminder system is set up to accommodate both.	40	Dogs 3 yr, Cats 1 yr
17	above	41	1 yr initial vaccination, 3 yrs booster
18	3 year duration unless first rabies vaccination.	42	cats one year and dogs 3 years
19	1 year after the first vaccine and after that yearly booster 3 years	43	dogs-2yrs /cats-one yr
20	3 for dogs, 1 for cats	44	1yr if initial dose, 3yr if booster on time
21	certs for dogs=3 yr, cats=1 year	45	1 year first vaccine, 3 year after if given before vaccine expires.
22	1 year booster, then every 2 years	46	2.5 yr
23	initial one year, then 3 years	47	never been vaccinated-1 year. High exposure or history or suspect poor compliance-2 year
24	1 year or 3 year depending on previous history	48	hunting dogs 2yr/indoor dogs 3yr/1st time vaccinates 1yr
		49	Pfizer 3yr. Merial Purevax 1yr.
		50	it

Page 3, Q4. What is the duration of immunity or expiration date you record on the rabies certificate?

- | | |
|----|---|
| 51 | The first Rabies vaccine is good for one year if animal is under 1 years old or has never received a rabies vaccine, the next is good for 3 years. |
| 52 | 1 year for 1st, 3 year for boosters |
| 53 | depends upon if initial or booster vaccination |
| 54 | Imrab 2 yr for k-9, 1 yr for cats |
| 55 | 2 or 3 years depending upon the animal's lifestyle |
| 56 | Three years unless it is the first vaccination |
| 57 | For puppies/kittens and any adult with no known prior rabies, we put a 1 year duration. The 2nd rabies vaccine and any subsequent are good for 3 years. |
| 58 | We have recently switched so that we give a 3 yr duration whereas we previously called it a 2 year vaccine. |
| 59 | Depends on age of animal and vax history |
| 60 | If first vacc--1 year, if boosted 1 year later then 3 year |
| 61 | We just recently changed to 3 year--had always done every 2 years |
| 62 | one yr for cats and 3 yrs for dogs |
| 63 | If "Adults" dog=3yrs, cat=1 yr |
| 64 | 1 year first dose Consequent doses- 2 year if in city of Albert Lea city limits(required by city), 3 year for all others. |
| 65 | 2 year for dogs. 1 year for cats |
| 66 | 2 year EXCEPT when vaccinating puppy or kitten then boost in one year |
| 67 | 1 year for cats with Merial and 3 year for dogs with Pfizer |
| 68 | 1 yr if 1st Rabies Vaccine, 3 yr if 2nd Rabies Vaccine |
| 69 | 1 year for first vaccine, 3 years for boosters |
| 70 | 1 year if it's their first rabies vaccination, 2 years if it's not |
| 71 | 1 year for first dose, three years thereafter |
| 72 | 1 year for puppies, 3 year for adult dogs |

5) If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that?

1. Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where my practice is located.
2. Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where the animal owner lives.
3. I want to examine the dog or cat at least every one to two years to evaluate the health of the animal and this is a good way to get the animal owner to comply.
4. I recommend more frequent rabies vaccination than what the vaccine is licensed for because dogs and cats are often presented to me for rabies vaccination and their rabies vaccination has already expired.
5. I recommend more frequent rabies vaccination than what the vaccine is licensed for because of where the animal lives or the occupation that the animal has and the increased potential of exposure to rabid animals.
6. I record on the rabies certificate the duration of immunity and expiration date that the rabies vaccine is licensed for.
7. Other (please explain)

Response Percent

Response Count

12.60%

44

5.20%

18

4.30%

15

17.80%

62

5.50%

19

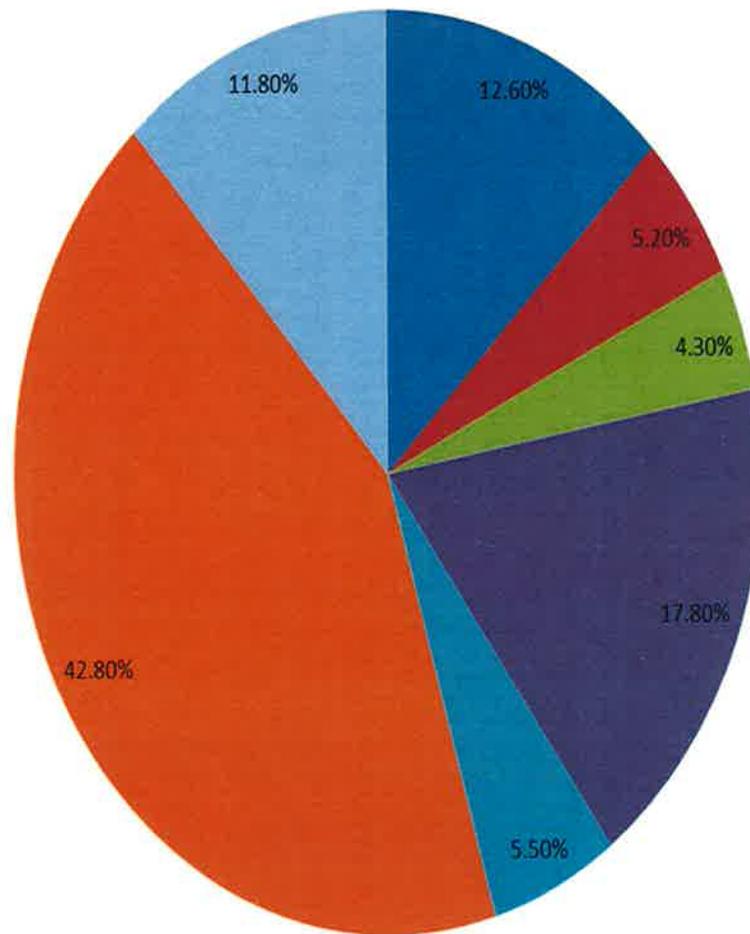
42.80%

149

11.80%

41

5) If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that? If the duration of immunity or expiration date that you record on the rabies cert



- Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where my practice is located.
- Municipal or County ordinance requires rabies vaccination more frequently than what the vaccine is licensed for to license dogs and cats in the community where the animal owner lives.
- I want to examine the dog or cat at least every one to two years to evaluate the health of the animal and this is a good way to get the animal owner to comply.
- I recommend more frequent rabies vaccination than what the vaccine is licensed for because dogs and cats are often presented to me for rabies vaccination and their rabies vaccination has already expired.
- I recommend more frequent rabies vaccination than what the vaccine is licensed for because of where the animal lives or the occupation that the animal has and the increased potential of exposure to rabid animals.
- I record on the rabies certificate the duration of immunity and expiration date that the rabies vaccine is licensed for.
- Other (please explain)

Page 3, Q5. If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that?

- | | | | |
|----|--|----|--|
| 1 | Based on what I believe are Minnesota state requirements for revaccination of rabies for dogs | 10 | Our small animal clinic may send 2-yr reminder to clients that may not respond in time for the 3-yr booster |
| 2 | I was under the opinion that the State recognizes the vaccine as current for only a 2 yr period. Vaccinating every 2 years helps to keep compliance within the licensed period. | 17 | One adjoining town requires rabies vaccination every two years for licensing. We also want to examine the dog and get the Rabies vaccine in before 3 years. When we make a note of expiration at two years, it usually gets done by 3 years. If we would note 3 years, most would not schedule an appointment until after three years. |
| 3 | I want to play it safe with dogs more likely to be exposed to rabies | 18 | Rabies vacco is due every 2 years, it is not past due for 3 years. The overlap reduces the risk of out of date rabies immunization and the public health concern. |
| 4 | For owner compliance so that there is still a time frame for them to get the vaccination boosted that fits with the licensed duration as there is low compliance with coming into booster vaccination exactly when vaccination is due. | 19 | Our practice is surrounded by municipalities that have a variety of requirements for rabies vaccines. It is easier to use the shortest duration of immunity to practice. Additionally, many of our dogs travel out of state and other states have a variety of requirements. |
| 5 | Actually, I would answer numbers 1, 2 and 4 | 20 | I do the last except that is I record on the rabies certificate the duration of immunity and expiration day that the rabies vaccine is licensed for, except 1st Rabies vaccine expires in a year, using the labeled 3year vaccine |
| 6 | This is the protocol that the clinic had when i was employed here, we are planning to change it in 2012, but the owner of the practice argues that we much vaccinate farm dogs yearly because of increased risk of exposure to a rabid animal and the other dogs in the community have an expiration date of 2 years because people will then come in before the vaccine has expired at the three year mark. | 21 | Do not do any other vaccines than the one year for cats (work at a feline-only). |
| 7 | Many clients delay their visit for vaccination and the dog remains current. | 22 | We maximize the duration of the rabies except if the dog or cat is high risk, ie high land hunting dog or outdoor cat |
| 8 | To ensure animals stay up-to-date on vaccination, even when they come in late for their revaccination. | 23 | The certificate is written for 3 years. Some clients with outdoor dogs that run loose and have interactions with wildlife are boosted in 2 years. THE client participates in teh decision. |
| 9 | practice owner requires more frequent vaccination, I personally am not in agreement with this practice. | 24 | Options 4 and 5. Most are written as 3 year, but when I digress from that protocol, it is for reasons 4 and 5. Survey would only allow 1 answer. |
| 10 | It only allow me to check 1 box. For dogs, we usually do a '2 year' vaccine because a) they are then protected if the owner is late for their booster; and b) some of the city ordinances require more frequent vaccines. Since we have clients from all over, it is most consistent for us to use a '2 year' protocol. | 25 | There communities that require 2 year vaccination for licensure even though we use a 3 year rabies. I do not believe the communities should do that and are causing the owners increased expense for their pets. |
| 11 | Minnesota requires 2 years | 26 | THREE LOCAL CITIES REQUIRE TWO YEAR SO ALL ARE 2 YEAR. THIS DOES COVER ABOUT 85 TO 90% OF MY PATIENTS. MOST OF THE REST ARE RURAL DOGS AND EXPOSURE RISK HIGHER. #6 SHOULD BE EXPLAINED. MOST CLIENTS HAVE THIS EXPLAINED WHEN GIVING THE FIRST RABIES DOSE BUT NOT AFTER THIS. |
| 12 | I tell owners that the vaccine is licensed for three years and that they will receive a reminder for booster in 2 years to prevent a lapse in protection. | 27 | Owners are told the label is for 3 years but liability problems can arise if they are late and the animal bites someone, so we send reminders at 2 years. |
| 13 | we do 1 yr because we are vaccinating rescue animals and are unsure of the animal's vaccination status | 28 | If under 1 year, I repeat the vaccine 1 year later because I want to make sure that the animals immune system was mature enough to mount a good immune response. AAHA guidelines. |
| 14 | We used to give a 2 year expiration date for the 3 year vaccine to try to prevent animals from being 'overdue' on the vaccine if it was boosted late. We found this created some confusion with our clients, and some clients thought it was somewhat deceptive, so we opted to change to a 3 year vaccination date for our 3 year licensed vaccine. | 29 | Expiration date of vaccine is when the pet needs to return to get re-vaccinated; duration of immunity is always three years based on licensure of the vaccine |
| 15 | We remind at 2 years because many times they delay in coming in...and will lapse. Clients that are consistent with visits, we will often do a 3 year reminder and discuss it with them | | |

Page 3, Q5. If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, why is that?

- 30 we were previously required by municipality to do every 2 yrs for k-9, also we are presented with pets who are overdue for rabies vaccine. We will adjust to 3 yr is asked by client
- 31 As I said above, we switched because we had mistakenly understood that the county required it every 2 years, but it is also understandable that some people ignore their reminders and may not get the pet until way after the expiration date. We are now calling it a 3 year vaccine.
- 32 Working with a population of animals with unknown vaccination history; assume not vaccinated and give expiration date of 1 year.
- 33 Several reasons. Many owners are delinquent with vaccinations. Risk vs Benefit outweighs itself by far for a disease that is not cureable and zoonotic.
- 34 Combination of several factors. The Municipality requires more frequent vaccination. Also due to the fact that when owners are late on a 3 year duration the pets have potentially been exposed to rabies or may have exposed a person. With a 2 year duration we have a 12 month cushion.
- 35 The company states trust it for 2 years but not 3 total and many of the animals are farm or hunting origin and frequently could be exposed to rabies.
- 36 after the 2nd vaccine i record duration of immunity that the vaccine is liscenced for
- 37 More than one of the above and It fits with our program of alternating the rabies and distemper vaccines.
- 38 The animals I see have no known vaccine history, so I treat each vaccine as if it were the first; thus, requiring a "booster" in 1 year.
- 39 The practice owner decided many years ago to institute a 2-year Rabies policy because of the number of positive cases in this area, the general lack of compliance of owners, and the general safety of the vaccine - I comply with the company policy.
- 40 We have 3 practices. One of our practices is located in a community that the city requires 2 year rabies. To be consistent we use that at all 3 clinics. I also believe that a 2 year expiration provides a window of safety since most pets are often late for routine vaccines.
- 41 2 & 5 above plus gives us a buffer zone for clients late on their vaccinations.

6) If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, do you inform the animal owner of this?

Response Percent

Response Count

Yes

59.10%

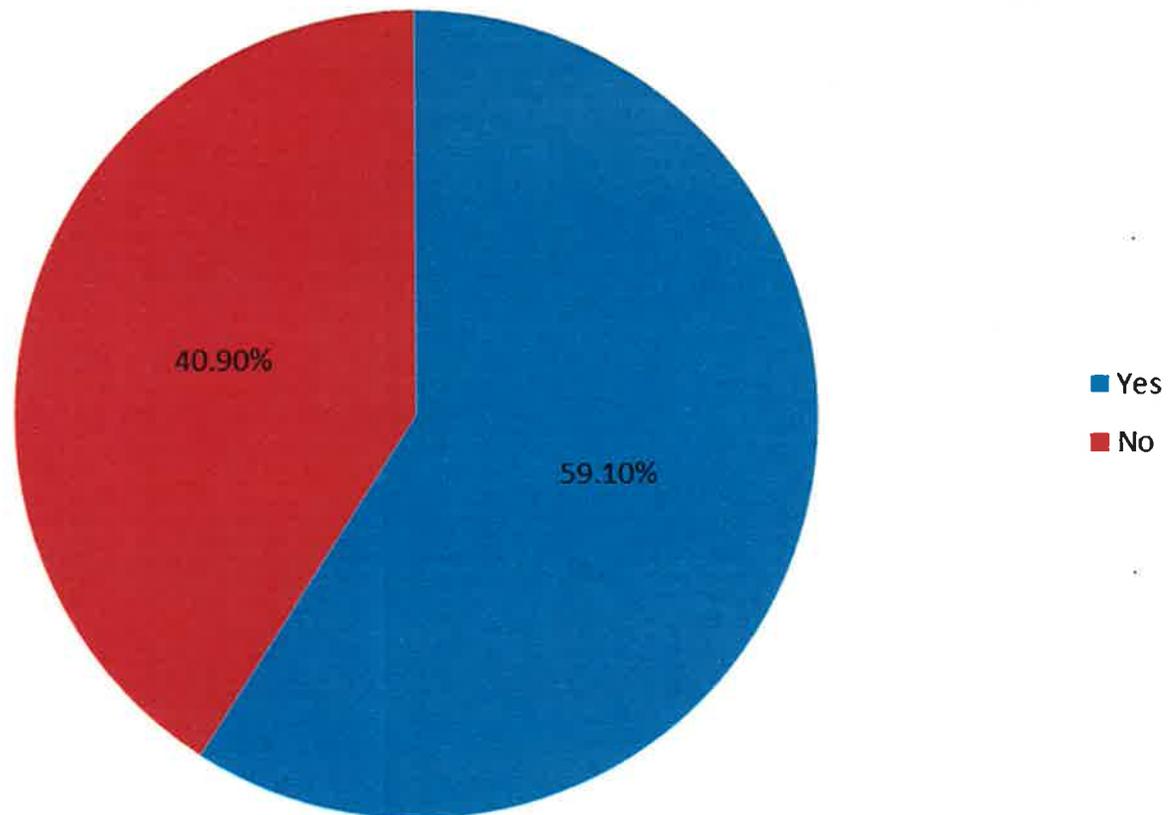
165

No

40.90%

114

6) If the duration of immunity or expiration date that you record on the rabies certificate is something different from what the rabies vaccine is licensed for, do you inform the animal owner of this?



Proposed Conclusions

- It appears that a number of veterinarians are vaccinating dogs more often than every three years.
- The rationale for this practice appears to be what the veterinarian believes is the local ordinance, the likelihood of rabies exposure, and the desire that the dog's rabies vaccination does not become overdue.
- There is little evidence that the practice of vaccinating dogs more often than every three years is motivated by financial gain or a desire to deceive the owner.
- It appears that a number of veterinarians that vaccinate dogs more often than every three years do not inform the client of the vaccine's duration of immunity.
- Other conclusions?

May 15, 2011



Minnesota Board of Veterinary Medicine

Dear Dr. King,

We are writing to you with our concern since the mission of the MBVM is "to promote, preserve and protect the health, safety and welfare of the public and animals through the effective control and regulation of the practice of veterinary medicine". For many years we have been concerned about the practice of some Minnesota veterinarians administering Rabies vaccines every two years without disclosing to the client that the vaccine has a duration of three years as stated by the manufacturer. This practice may be violating Minnesota consumer protection laws by allowing veterinarians to knowingly sell clients a redundant vaccine from which their animal derives no benefit and which incurs unnecessary costs to the pet owner. In addition this practice goes against the recommendation of ALL the national veterinary medical associations, CDC's National Association of State Public Health Veterinary Compendium, American Animal Hospital Association and the American Veterinary Medical Association, as well as the national three year standard set in all 50 states including Minnesota state law.

Although Minnesota does recognize a three year Rabies vaccine, some cities and municipalities have codes and ordinances requiring a two year vaccine to obtain their required licenses. There is no two year vaccine manufactured. Why are the cities and municipalities not being educated by the MBVM? There is proof that when presented with the facts and educated regarding this issue, communities have changed their code and ordinances. Example: St. Anthony Village MN city code section 91.02 changed from two year to "no license will be issued until the owner has furnished a current Rabies vaccination certificate". Please do not use the excuse that if cities say three years, residents will procrastinate and come in late, thus having an unprotected pet. And the excuse that Rabies exposure is high in some areas won't work either because there is proof more vaccine does not translate to more protection. This only punishes those who follow the rules. Pets suffer physically and owners suffer emotionally and financially.

Veterinarians are supposed to issue certificates stating if a one year or three year vaccine was administered in accordance with the manufacturer's recommendation. There are veterinarians not doing this. Because clients place their trust and respect in their veterinarians and often do not have medical knowledge or expertise, they assume their

doctor is being honest and acting in their pet's best interest. That is what they took an Oath to do. These clients have the right to know if their pet received a three year duration vaccine and the veterinarians have a moral, ethical and legal obligation to disclose this information. They have a right to know that a three year vaccine is being administered if the veterinarian represents it as a two year vaccine. The clients must be provided with an informed consent. We are certainly not telling veterinarians how to practice medicine, but if they choose to vaccinate on a two year schedule they have an obligation to disclose that there is no two year vaccine . Withholding this information appears to us to be fraudulent and the veterinarian could be legally negligent.

Veterinarians up to date on current literature and practices should also be aware of the issue of not vaccinating rabies in conjunction with other vaccines to prevent reactions. This also needs to be disclosed to the clients and the veterinarian must present the options available and let the client choose to either return or proceed with the vaccine administration.

We have both experienced the death of beloved pets because of the effects of over vaccination. We, and many other pet owners, know in our hearts that if our veterinarians had disclosed our pets were receiving more vaccines than necessary and given us the alternative options available, we may not have had to witness our pets pain and suffering and/or their tragic and unnecessary deaths.

Please explain to us why the MBVM, as a consumer protection agency, is not doing anything to change this dangerous practice of the veterinarians it licenses.

Thank you for your attention and we look forward to hearing from you.

Sincerely,

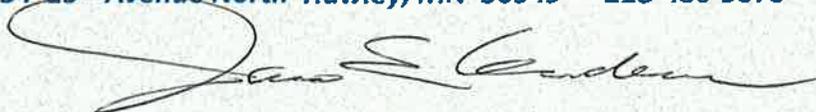
Chris Addington R.N. BS, CNOR Sugar Plum Siberians

4820 Normandale Avenue North Baytown Township, MN 55082 651-430-4929



Jane E. Anderson BA owner Groom Room Grooming and Boarding. Breeder, owner, handler of Champion Samoyeds and Curly Coat Retrievers.

25334 15th Avenue North Hawley, MN 56549 218-486-5678



September 1, 2011



Dear Dr. King,

As you requested, this is our agenda for the September 27, 2011 MN Board of Veterinary Medicine meeting, under the discussion Rabies vaccination protocol. Please have your Board members familiarized with:

- 1. The CDC Public Health Veterinary Rabies Compendium, which names the following organizations as recognizing and endorsing the three year Rabies vaccine protocol:**
 - A. American Veterinary Medical Association**
 - B. National Animal Control Association**
 - C. American Animal Hospital Association**
 - D. American Public Health Association**
 - E. Association of Public Health Laboratories**
 - F. Council of State and Territorial Epidemiologists**
- 2. Minnesota Board of Animal Health Administrative Rule 1705.10 Subp7 "vaccinated".**
- 3. AVMA Policy of Owner/Informed Consent**
- 4. Rabies vaccine pharmaceutical labeling**
- 5. Minnesota Veterinary Practice Act**
- 6. Minnesota Administrative Rule 9100.0800 "Minimum Standards of Practice".**

Discussion shall include, but not be limited to:

- 1. Definition of owner/informed consent, disclosure and consumer protection as it relates to veterinary practice and the administration of Rabies vaccinations.**
- 2. Medical Waivers and titer acceptance**
- 3. Current inconsistencies in administration of Rabies vaccinations. Conflicting information provided by veterinarians and their support staff and incorrect information given to owners by veterinarians and support staff. How this relates to:**
 - A. The consumer**
 - B. The animal**
 - C. The pet care industry**

We will be prepared to present our extensive research on:

- 1. City/municipality ordinances/codes**
- 2. Statements from veterinary support staff when asked about duration of immunity, manufactured vaccines and city ordinances/codes**
- 3. Statements from veterinarians practicing a three year Rabies protocol and how their practices have done with this**

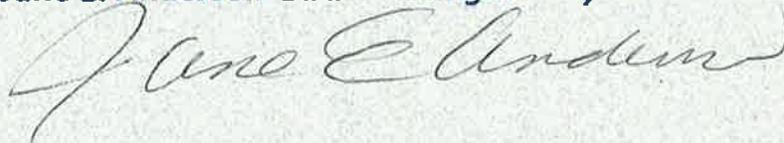
Questions posed to the Board shall include, but not be limited to:

- 1. How will the Board proceed to address the issue of disclosure, owner/informed consent and consumer protection in relation to the administration of Rabies vaccinations?**
- 2. What legislation is in place or pending regarding vaccine disclosure and owner/informed consent and consumer protection as related to the administration of Rabies (and other) vaccines. Position on including medical waivers and titer testing?**
- 3. What educational opportunities are currently, or will become ,available for veterinarians and their support staff in relation to the administration of Rabies (and other) vaccines?**
- 4. How many formal complaints have the Board received against veterinarians/and or clinics for not disclosing to owners the duration of immunity of Rabies vaccines and issuing two year certificates without confirming city ordinances/codes? To include incorrect information furnished to the owners by support staff**
- 5. What is the Board's responsibility in addressing these complaints and how are they being investigated?**

Thank you very much for the opportunity to present these important concerns of consumer protection at this Board meeting. We look forward to working with the Board of Veterinary Medicine, the MN Board of Animal Health and the Minnesota Veterinary Medical Association to insure consumer advocacy in the practice of veterinary medicine.

Chris Addington R.N. BS, CNOR Sugar Plum Siberians 651-430-4929

Jane E. Anderson B.A. Jangio Curly Coated Retrievers 218-486-5678



September 30, 2011



Minnesota Board of Veterinary Medicine

Dear Board members,

Thank you again for the opportunity to present our concerns at Tuesday's meeting. We greatly appreciate your time and attention. We believe we have provided you with in depth research on the topic of Rabies vaccination protocols and stressed the need for compliance with the documentation we presented. Unfortunately, this issue is charged with emotion and anger. There is no way to get around this, and we believe you have now recognized the tremendous impact of this situation because of this emotion. The Board acts as a licensing agency but along with that responsibility, the Board must act as a consumer protection agency.

In summary, we are respectfully requesting the Board :

1. Acknowledge this issue with an assigned degree of high priority
2. Address the concerns brought to the Board's attention promptly
3. Establish a task force to include lay members of the community and pet care industry to further explore the topic
4. Coordination of information with all Board members to include all e-mails and phone messages from community members regarding this topic
5. Communication with the MVMA and BAH
6. Issue a position statement and inform the media when this is finalized
7. Address formal complaints and consider disciplinary action against those found not to be in compliance with any of the established mandates

We look forward to communication from the Board and sub-committee and if we can be of any assistance, please don't hesitate to contact us.

Sincerely,


Jane E. Anderson


Chris Addington

December 1, 2011



Dear Minnesota Board of Veterinary Medicine Rabies Vaccination Committee,

We would like to present clarifying information to the Committee on several aspects of Rabies vaccination practices previously discussed at the November 9, 2011 committee meeting.

- 1. Florida Statute 828.30 "Rabies vaccination of dogs, cats and ferrets. The owner of any dog, cat and ferret shall have the animal revaccinated 12 months after the initial vaccination. Thereafter, the interval between vaccinations shall conform to the manufacturer's direction." A handler does not need a 2 year Rabies certificate to show a dog in Florida as stated at the November 9th committee meeting. All 50 States recognize the 3 year duration of immunity for the Rabies vaccine.**
- 2. The USDA established a standard for Rabies vaccines to be licensed under Title 9 of the Code of Federal Regulations Section 113.209 and the 3 year Rabies vaccine meets their 3 year label requirement with the efficacy they have determined. It also meets the criteria for the Center for Disease Control's National Association of State Public Health Veterinarians, the American Veterinary Medical Association, the American Animal Hospital Association, every veterinary College in the USA including the University of Minnesota, all manufacturers of Rabies vaccines, as well as the World Small Animal Veterinary Association. The CDC's NASPHV 2008 Compendium of Animal Rabies Prevention and Control specifically cautions against doing precisely what the Minnesota Board is allowing veterinarians to do: "All vaccines used in State and local Rabies control programs should have at least a 3 year duration of immunity. No laboratory or epidemiological data exists to support the annual or biennial administration of a 3 year vaccine following the initial series. All vaccines MUST be administered in accordance with the specifications of the product label or package insert". There is no option for veterinary discretion in vaccine administration given by the CDC's NASPHV when they declare that Rabies vaccines MUST be administered according to the product label or package insert. They do NOT state they "may be" administered in accordance with the product label. If the committee is**

aware of any scientific data/research documenting vaccinating for Rabies more often than every 3 years is recommended by a nationally recognized veterinary medical authority, please provide that information and cite the source and date of the recommendation.

- 3. Informed Consent. Veterinarians who fail to disclose to clients that they are administering a 3 year duration of immunity Rabies vaccine every 2 years may be violating consumer protection laws and this practice appears to constitute "Unprofessional Conduct" as defined by Minnesota Administrative Rule 9100.0700 SubPart 1B "Engaging in conduct likely to deceive the public ". One of the causes for which a Minnesota veterinarian may have their license revoked under Minnesota Statute 156.081 is "fraud, deception or incompetence in the practice of veterinary medicine including any departure from or failure to conform to the minimum standards of prevailing practice, without actual injury having to be established". By allowing Minnesota veterinarians to go un-reprimanded for routinely giving animals a 3 year vaccine every 2 years, the Minnesota Board of Veterinary Medicine is knowingly allowing veterinarians to engage in unprofessional acts by their own Administrative Rule. Under the SubPart 9 of the Minimum Standards of Care is Informed Consent, "a client shall be informed by the veterinarian prior to treatment, of the treatment choices for consideration by the client". The Board must enforce this important component of medical practice.**
- 4. Standards of Care/Practice. Veterinarians, like physicians, are licensed professionals obligated to follow the established standard of medical care set forth by their nationally recognized medical associations. For veterinary care, that standard of care is set by the recommendations promulgated by the Compendium, NAPHV, AVMA, AAHA, World Small Animal Veterinary Association and vaccine manufacturer. The failure to meet the minimum standards of care /practice appears to constitute "unprofessional conduct" as cited in Minnesota Administrative Rule 9100.0700 SubPart 1A "prohibited acts" and Q "performing or prescribing unnecessary treatment". It also appears the Board has allowed Minnesota veterinarians to violate the established minimum standards of care as set in SubPart 2 Pharmaceutical Services Section B "a veterinarian is responsible for assuring that a prescribed drug or biologic prescribed for**

use is properly administered". The above organizations and the vaccine manufacturer set the protocol for Rabies vaccine administration. They are not "clubs", as they were referred to in the November 9th committee meeting. The Board requires Minnesota veterinarians to complete 40 hours of continuing education credits per 2 year license renewal and they endorse these organizations programs to provide these educational opportunities.

- 5. We believe the unscientific survey sent to veterinarians is comparable to the IRS sending a survey to taxpayers asking "do you cheat on your taxes?" then requiring a personal and identifying electronic response. We feel it would be more appropriate to have client records audited to verify Rabies certificates issued with Rabies vaccines administered, as documented in the animals record.**

- 6. City Codes. Explore how city codes originated and who was/is responsible for uneducated ordinances. It would appear veterinarians failure to educate, which would result in safe care of animals and fair treatment of consumers, is not only unprofessional but acting against the Oath veterinarians take to "accept as a lifelong obligation the continual improvement of professional knowledge and competence". There should be a UNIFORM RABIES PROTOCOL established for all of Minnesota.**

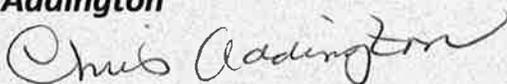
We respectfully request that the Minnesota Board of Veterinary Medicine issue a policy statement declaring that Minnesota veterinarians shall adhere to the Rabies vaccination protocol recommended by the CDC's National Association of State Public Health Veterinarian's Rabies Compendium and that all Rabies vaccines be administered in accordance with the manufacturer's labeled instructions.

Sincerely,

Jane Anderson



Chris Addington



January 2, 2012



Dear Board members and Rabies vaccination committee members,

We would like to take this opportunity to reiterate our opposition to the Board's/committee's scientifically unfounded endorsement of veterinarians administering a 3 year Rabies vaccine every 2 years.

We would also like to clarify a point discussed at the last committee meeting regarding "importation and interstate movement of animals".

A story was shared at the meeting about an owner traveling with her canine companion from England to France recently. This owner could have been spared a costly and inconvenient trip back to get yet another Rabies vaccination for her dog, and the dog risked an adverse event and the possible risks of over-vaccination because her American veterinarian issued a 2 year certificate instead of the 3 year that should have been issued. The committee took issue with this. We would like to point out that veterinarians issuing a 2 year Rabies certificate do so in defiance of the Center for Disease Control's National Association of State Public Health Veterinarian's (NASPHV) recommendations in the Rabies Compendium, as well as the vaccine manufacturers and all national veterinary medical associations and veterinary medical colleges.

Given that no 2 year Rabies vaccine is licensed in the USA, 2 year certificates are not consistent here or internationally within the context of Section B3 of the CDC's Compendium which states that "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". Under 42CFR Part 71.51[c] of the Minnesota Board of Animal Health rules, Administrative Rule 1705.1090 recognizes a 3 year Rabies vaccination protocol and specifies that the Rabies vaccine should be "used in accordance with the manufacturers labeling". [c] "before interstate movement dogs, cats, ferrets and horse should be currently vaccinated against Rabies in accordance with this Compendium's recommendations (see Part 1B1)" animals in transit should be accompanied by a currently valid NASPHV Form 51, Rabies vaccination certificate...When an interstate health certificate or certificate of veterinary inspection is required, it should contain the same Rabies vaccination information as Form 51".

Minnesota dog show Premium Lists have used the BAH rule for years setting the Rabies immunization requirement for interstate travel as "the vaccination is

recognized for the duration of immunity as stated on the vaccine vial and that should be entered on the certificate”.

Immunologically, the Rabies vaccine is the most potent of veterinary vaccines and administering it is a potent medical treatment with both benefits and risks to the patient. Adverse events, including some potentially severe and life threatening, can be unintended consequences of vaccinations. It is medically unsound for this vaccine to be given more often than necessary to maintain immunity. None of the national veterinary medical associations, veterinary colleges or vaccine manufacturers who set the standard of practice for Rabies vaccine administration recommend giving a 3 year vaccine more often than every 3 years. There is NO scientific data/research demonstrating that giving a 3 year duration of immunity Rabies vaccine more often than every 3 years enhances immunity or benefits the animals health in any way. Consumers should not have to pay for an unnecessary medical treatment which does not benefit, and may even harm, their animal.

The Boards declared mission is to “promote, preserve and protect the health , safety and welfare of the public and animals through the effective control and regulation of the practice of veterinary medicine”. Despite being a public agency funded by taxpayers, we have reason to believe closed meetings of the committee have been held on this issue affecting Minnesotas pet owners. It was obvious the agenda was set and the survey compiled without public input which would have arisen from a public meeting.

The Board/committee does not appear to support the practice of informed consent as mandated by Minnesota Administrative Rule 9100.0700 SubPart9 “Minimum Standards of Care, Informed Consent”- “a client shall be informed by the veterinarian prior to the treatment of the treatment choices for consideration by the client”. The survey the committee sent to Minnesota veterinarians did not account for the fact that some veterinarians may not even understand what informed consent is and the implications of not following the practice. Failing to disclose that a vaccine being administered has a duration of immunity of 3 years appears to constitute “unprofessional conduct” under Minnesota Administrative Rule 9100.0700 SubPart1B “engaging in conduct likely to deceive the public”. Informed Consent MUST also be documented in the patient record as stated by the 2007 American Veterinary Medical

Association's position statement "Informed Consent". We would also like to remind the Board/committee that telling clients "the city requires it", "I like giving this vaccine every 2 years" and "we do this because clients might be over due" does NOT qualify as informed consent. Failure to obtain informed consent not only carries potential legal liabilities, it may also violate Minnesota consumer protection laws. This Board is a consumer protection agency and has the moral and regulatory authority to protect pet owners and their animals from deceptive veterinarians who administer a 3 year Rabies vaccine every 2 years without full/complete disclosure and informed consent. Veterinarians wishing to vaccinate more often than the vaccine manufacturers labeled instructions and the interval recommended by the CDC and national veterinary medical associations MUST give full disclosure to the client divulging the duration of immunity of the vaccine being given and the potential adverse reactions that may occur. As consumers and responsible pet owners, we need to know and have the right to know this information so we may make educated choices for our companion animals.

It is improper and unprofessional for this Board to ignore or oppose the national standard of care for Rabies immunizations set by the United States Department of Agriculture, the CDC's NASPHV's Rabies Compendium, the American Animal Hospital Association, The American Veterinary Medical Association, the American Association of Feline Practitioners, all veterinary medical colleges, including the University of Minnesota, and all Rabies vaccine manufacturers. The Board and its committee have failed to provide any scientific data/research recommending that a 3 year duration of immunity Rabies vaccine be administered every 2 years. We also find the Board unprofessional and disrespectful to all the Minnesota veterinarians who practice the 3 year protocol by their continued defense of veterinarians practicing a 2 year protocol in light of all the compelling literature.

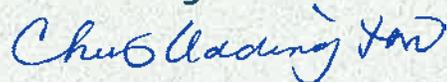
We strongly urge the Board to issue an immediate directive to all Minnesota veterinarians stating they are to administer all Rabies vaccines in accordance with the recommendation of the CDC's NASPHV's Rabies Compendium.

Sincerely,

Jane E. Anderson



Chris Addington



John King

Subject: FW: Vaccination and Immune-Mediated Disease
Attachments: JVIM-Vaccination-and-ITP-2012.pdf

Dr. King:

As a follow-up to the dialogue we shared a few weeks ago, I've attached a recent study published in the Journal of Veterinary Internal Medicine that probed the association between vaccination and the subsequent development of immune-mediated thrombocytopenia (ITP) in dogs. They found no such association. The authors did correctly point out that their study is not the final word, as anyone could argue that the study population wasn't sufficiently large enough to rule out an association. Still, it's a study worth knowing about, and it's an example of evidence-based medicine vs. the political theories of Dr. Dodds. Hoping you are well, and enjoy the MVMA meeting. - Robert

Robert J. Washabau, VMD, PhD, Dipl. ACVIM
Professor of Medicine and Department Chair
Director of the Comparative Medicine Program

Department of Veterinary Clinical Sciences
College of Veterinary Medicine
1352 Boyd Avenue
University of Minnesota
St. Paul, Minnesota 55108

(612) 625-5273 Office
(612) 624-0751 FAX
(612) 624-0781 Lab
washabau@umn.edu

Idiopathic Immune-Mediated Thrombocytopenia and Recent Vaccination in Dogs

A.A. Huang, G.E. Moore, and J.C. Scott-Moncrieff

Background: Vaccination is often cited as a potential cause of immune-mediated thrombocytopenia (ITP) in dogs. Although an association has been documented in humans, particularly in children, this relationship has not been definitively established in dogs.

Objectives: To identify the presence of an association between recent vaccination and ITP in dogs.

Animals: Forty-eight client-owned dogs with presumptive idiopathic ITP and 96 age-matched, client-owned dogs with non-immune-mediated disease.

Methods: Retrospective, case-control study. Dogs were identified through the Veterinary Medical Database (VMDB) and Hospital Information System at Purdue University.

Results: The median age at presentation for dogs with ITP was 7 years (range: 2–15 years). The majority of the ITP group was comprised of mixed breed dogs (38%); no pure breed was represented by more than 3 cases. The number of dogs that were vaccinated within 42 days of diagnosis of ITP did not differ significantly ($P = .361$) between cases of presumptive ITP (4/48, 8%) and the control group (13/96, 14%).

Conclusions and Clinical Importance: This study failed to confirm the presence of an association between presumptive idiopathic ITP in dogs and recent vaccination; however, the possibility of an association cannot be completely ruled out based on the small sample populations and requires further investigation.

Key words: Adverse reaction; Platelet recovery time; Platelets; Vaccine.

Immune-mediated thrombocytopenia (ITP) is a condition in which antibodies are directed against platelets leading to their phagocytosis and destruction by macrophages.¹ These antibodies are typically gamma G immunoglobulin^{2,3} and are most often directed against platelet surface antigens such as glycoprotein IIb and IIIa.⁴

Immune-mediated thrombocytopenia in dogs is a relatively uncommon hemostatic disorder, occurring in approximately 5% of thrombocytopenic dogs that present to veterinary institutions.^{5,6} The disease is considered idiopathic or primary when no underlying cause is identified and is considered secondary when an etiology is established.⁷ A variety of causes of ITP have been documented in dogs such as rickettsial infections,^{8,9} drug administration,^{10,11} systemic lupus erythematosus,¹² and neoplasia.¹³ To definitively establish the cause of thrombocytopenia as immune-mediated, antiplatelet antibody testing is required. However, antiplatelet antibody assays are not widely available and have variable sensitivity and specificity, therefore a clinical diagnosis of ITP is typically made on the basis

Abbreviations:

DIC	disseminated intravascular coagulation
IMHA	immune-mediated hemolytic anemia
ITP	immune-mediated thrombocytopenia
MMR	measles-mumps-rubella
pRBCs	packed red blood cells
PT	prothrombin time
PTT	partial thromboplastin time
PUVTH	Purdue University Veterinary Teaching Hospital
RBC	red blood cell
VMDB	Veterinary Medical Database

of exclusion of other identifiable causes of thrombocytopenia and response to treatment.¹⁴

In addition to the above-mentioned causes of ITP, recent vaccination in humans is associated with ITP, particularly after immunization with the measles-mumps-rubella (MMR) vaccine in children.^{15–17} This association in humans has raised concern in the veterinary community of a similar association in dogs, although a definitive relationship has not been established in dogs. Thrombocytopenia occurs in dogs after vaccination with distemper and hepatitis vaccines^{18,19}; however, the platelet count does not often decrease below 100,000 cells/ μ L, nor does this decrease typically result in clinical signs of hemorrhage.¹⁹ In 1 case, a dog developed severe thrombocytopenia that resulted in clinical bleeding after recent vaccination.¹⁹ Despite limited evidence, the concern that there is a relationship between clinically relevant ITP and recent vaccination drives some clinicians to withhold vaccination in dogs with previously diagnosed ITP.

The purpose of this study was to investigate whether an association between recent vaccination and ITP exists in dogs. We hypothesize that the proportion of recently vaccinated dogs with presumptive idiopathic

From the Department of Veterinary Clinical Sciences, School of Veterinary Medicine, Purdue University, West Lafayette, IN (Huang, Moore, Scott-Moncrieff); and Department of Comparative Pathobiology, School of Veterinary Medicine, Purdue University, West Lafayette, IN (Moore). This work was presented as an oral abstract at the 2010 ACVIM Forum, Anaheim, California.

Corresponding author: J.C. Scott-Moncrieff, Department of Veterinary Clinical Sciences, School of Veterinary Medicine, Purdue University, West Lafayette, IN 47907; e-mail: scottmon@purdue.edu.

Submitted September 29, 2010; Revised September 3, 2011; Accepted November 4, 2011.

Copyright © 2011 by the American College of Veterinary Internal Medicine

10.1111/j.1939-1676.2011.00850.x

ITP would be significantly higher than the proportion of recently vaccinated dogs within the control group.

Materials and Methods

Patient Selection—Dogs with ITP

A search of the computerized Veterinary Medical Database (VMDB)^a and Hospital Information System at Purdue University was performed to identify all dogs that were presented to the Purdue University Veterinary Teaching Hospital (PUVTH) from January 1994 to December 2010 that had a final diagnosis that included the term "thrombocytopenia." Three-hundred and ninety medical records were identified and reviewed.

Criteria for inclusion into the study included a diagnosis of presumptive idiopathic ITP and a complete vaccination history. Dogs were classified as having idiopathic ITP if they had a platelet count of less than 40,000 cells/ μ L at the time of presentation, clinical signs of bleeding, a prothrombin time (PT), and partial thromboplastin time (PTT) that were not prolonged beyond 25% of the upper end of the reference range, a negative antibody titer for *Ehrlichia canis*, and no other evidence for an underlying cause of thrombocytopenia. A cut-off of 40,000 cells/ μ L was chosen to minimize the likelihood of including cases of secondary ITP and to ensure that ITP cases had clinically relevant thrombocytopenia.^{14,20-22} Diagnostic tests required for case inclusion were a CBC and serum biochemistry analysis at the time of presentation, a PT and PTT within 1 day of presentation to the PUVTH, *E. canis* antibody titer, and diagnostic imaging (thoracic radiographs, abdominal radiographs, or complete abdominal ultrasound). All dogs that were included in the ITP group were considered to have a presumptive diagnosis of ITP, as antiplatelet antibody assays were not routinely performed at the PUVTH. A vaccination history was considered complete if the type of vaccine that was given before presentation to the PUVTH was reported, as well as, the exact date or month of vaccination administration. If the vaccine was given in the 2 months prior to presentation, the exact date was recorded.

Cases were excluded from the study if they had a concurrent illness known to be associated with thrombocytopenia such as malignant neoplasia, severe systemic infection, bone marrow disease, rickettsial infection, or immune-mediated disease. Dogs that had a history of exposure to drugs known to be associated with ITP, including cephalosporins or trimethoprim-sulfadimethoxazole, in the 42 days prior to diagnosis of ITP were also excluded.

Patient Selection—Control Dogs

The control population consisted of dogs that were presented to the PUVTH for any non-immune-mediated illness during the study period. For each ITP case included in the study, 2 age-matched controls were randomly selected. Control cases were age-matched to within 1 year of their respective ITP case and were required to have a normal platelet count on their CBC at the time of presentation, as well as a complete vaccination history that included the type of vaccine given and date or month of last vaccination. If the time of vaccination was within 2 months of the date of presentation, the exact date was recorded.

Data Collection

Variables that were recorded for both ITP and control cases included sex, age, breed, and CBC results. Additional data that were collected in dogs with presumptive idiopathic ITP included results of coagulation profiles, bone marrow aspirates, diagnostic imaging, and infectious disease titers.

In dogs with presumptive idiopathic ITP, platelet recovery times and survival times were determined. Two separate platelet recovery times were calculated. The first was defined as the time from diagnosis of ITP to a platelet count of greater than 40,000 cells/ μ L and the second was defined as the time from diagnosis of ITP to a platelet count within reference range. Short-term survival was defined as the time in days from presentation to the PUVTH to discharge or death. Death that occurred spontaneously or because of euthanasia before discharge was considered ITP related. Long-term survival time was recorded as the duration of time in days from discharge to either death or the last known contact date. The follow-up information was gathered by phone conversation with the referring veterinarian.

Laboratory Methods

Values for the white blood cell count, red blood cell (RBC) count, RBC indices, and platelet counts were determined by standard automated and manual methods.^b Platelets were manually counted if the platelet number as determined by the automated analyzer was "clumped" or if the automated count was 50,000 cells/ μ L or less. This approach is standard practice for all CBC samples submitted to the Purdue University School of Veterinary Medicine Clinical Pathology Laboratory. Serum biochemistry analytes were determined by standard automated methods.^c The PT and PTT were analyzed by standard automated methods.^d Infectious disease titers were submitted to various reference laboratories. Most were submitted to the Louisiana Veterinary Medical Diagnostic Laboratory.

Data Analysis

Recent vaccination was defined as vaccination performed in the 42 days before presentation based on similar criteria used in a study that identified a relationship between ITP and recent immunization with the MMR vaccine in children.¹⁷ To determine whether ITP was related to recent vaccination in dogs, the number of ITP cases vaccinated in the 42 days before presentation to the PUVTH was compared with the number of control cases that were vaccinated in the same time period.

Statistical analysis was performed using a commercial software program.^e Chi-square analysis was used to determine significant associations between ITP and recent vaccination. The Fisher's exact test was used to determine significant associations between proportionate survival of the group that was vaccinated 42 days before presentation and the group that was not vaccinated within that time period. A value of $P < .05$ was considered significant.

Results

Study Populations

One-hundred and forty-four dogs were included into the study—48 dogs with presumptive ITP and 96 control dogs.

Within the ITP group, 24 breeds were represented. Mixed breed dogs constituted the majority of cases (38%) and no single breed was represented by more than 3 cases. Of the 48 dogs, 25 (52%) were spayed females, 18 (38%) were castrated males, 3 (6%) were males of unknown neuter status, 1 (2%) was an intact female, and 1 (2%) was a female of unknown neuter status. The median age at the time of diagnosis was 7 years (range: 2–15 years). The median weight of dogs with presumptive idiopathic ITP was 25.8 kg

(range: 4.2–58.0 kg). The most common clinical signs of dogs with ITP at the time of presentation were petechiae (35/48, 73%) and ecchymotic hemorrhages (27/48, 56%). Other reported signs included melena (20/48, 42%), oral bleeding (18/48, 38%), hematoma formation or excessive bleeding from wounds and venipuncture sites (17/48, 35%), pale mucous membranes (13/48, 27%), ocular bleeding (11/48, 23%), hematochezia (9/48, 19%), heart murmur (9/48, 19%), hematemesis (9/48, 19%), hematuria (8/48, 17%), vestibular signs (5/48, 10%), and hemoptysis (4/48, 8%). Of the 48 dogs with presumptive idiopathic ITP, 46 (96%) had negative *Rickettsia rickettsii* antibody titers. The 2 cases without testing for antibodies against *R. rickettsii* did not have clinical signs consistent with infection such as lymphadenopathy or fever.²³ Most cases were tested for *Borrelia burgdorferi* (44/48, 92%) and 3 were positive. Two of the 3 tests were positive because of a Lyme vaccine based on Western blot testing. Forty-one (85%) of 48 presumptive idiopathic ITP cases were tested for antibodies against *Babesia canis* and all were negative. Many cases were also tested for antibodies to *Ehrlichia platys* (33/48, 69%) and all were negative. Fourteen (29%) were tested for *Anaplasma phagocytophilum* antibodies, all of which were negative. Of the 48 presumptive ITP cases, 10 (21%) were tested for *Ehrlichia risticii* antibodies, all of which were negative. All 48 dogs with presumptive ITP had thoracic and abdominal radiographs performed, and those of 37 (77%) and 34 (71%) dogs, respectively, were considered within normal limits. None of the minor radiographic abnormalities in the other dogs were considered to be related to the cause of thrombocytopenia. Forty-four (92%) of 48 dogs with presumptive ITP had an abdominal ultrasound performed and no evidence of an underlying cause of thrombocytopenia was identified. Thirty-six (75%) of 48 presumptive idiopathic ITP dogs had a bone marrow aspirate, a bone marrow core biopsy, or both that revealed either a normal number of megakaryocytes or megakaryocytic hyperplasia. Three dogs had bone marrow aspirate samples that demonstrated megakaryocytic hypoplasia, 2 of which were confirmed with a bone marrow core biopsy or upon necropsy. The other 9 dogs either had nondiagnostic bone marrow aspirate samples or did not undergo bone marrow sampling.

In the 96 control dogs, 42 breeds were represented. Seventeen dogs (18%) were of mixed breeding. There were 6 (6%) Labrador Retrievers, 6 (6%) Golden Retrievers, 5 (5%) Miniature Schnauzers, 5 (5%) Rottweilers, 5 (5%) Yorkshire Terriers, 4 (4%) Beagles, and 3 (3%) Jack Russell Terriers, with other breeds represented by no more than 2 cases. Of the 96 dogs, 44 (46%) were spayed females, 37 (39%) were castrated males, 6 (6%) were males of unknown neuter status, 5 (5%) were females of unknown neuter status, and 4 (4%) were intact male dogs. The control dogs were presented to the PUVTH for a variety of reasons including neoplasia ($n = 27$), neurologic disease ($n = 13$), urinary disease ($n = 12$), gastrointestinal disease ($n = 10$), orthopedic disease, including trauma

($n = 9$), respiratory disease ($n = 8$), endocrine disease ($n = 5$), ophthalmologic disease ($n = 5$), dermatologic disease ($n = 3$), behavioral aggression ($n = 3$), and pacemaker implantation ($n = 1$).

Comparison of Recent Vaccination between Groups

Four (8%) of the 48 dogs with presumptive ITP were vaccinated in the 42 days before presentation to the PUVTH compared with 13 (14%) of the control dogs. There was no statistical difference between the 2 groups ($P = .361$). The mean and median time from vaccination to presentation to the PUVTH for the presumptive ITP group were 281 and 198 days (range: 19–1,386 days), respectively, and 231 and 204 days (range: 6–1,397 days) for the control group.

ITP Population—Clinicopathologic Findings and Platelet Recovery Time

The median platelet count of all dogs with presumptive idiopathic ITP at the time of presentation was 1,000 cells/ μ L (range: 0–39,500 cells/ μ L). Twenty-five (52%) of the 48 dogs were anemic at presentation. The anemia was most commonly characterized as a normocytic (21/25, 84%), normochromic (23/25, 92%), highly regenerative anemia (13/18, 72%). The median hematocrit at the time of presentation was 27.1% (range: 7–59.9%). Sixteen (33%) of the 48 dogs with idiopathic ITP had a left shift present on the CBC.

Information regarding platelet recovery time to 40,000 cells/ μ L was available for 38 (79%) of 48 presumptive idiopathic ITP dogs—9 did not survive to discharge and 1 did not have a complete medical record. The median time to a platelet count of greater than 40,000 cells/ μ L for these dogs with information regarding platelet recovery time was 4 days (range: 1–15 days). Information regarding platelet recovery time to a platelet count within reference range was available for 36 (75%) of the ITP dogs. The median time to a platelet count within reference range for these dogs was 11 days (range: 2–42 days). Platelet counts for 2 of the 48 ITP dogs never completely normalized based on the last CBC recorded in the medical record.

ITP Population—Treatment

Forty-five (94%) of 48 dogs in the ITP group were treated with corticosteroids in the form of prednisone (dose range: 1–4 mg/kg/day PO)—most (35/45, 78%) received between 2 and 4 mg/kg/day. Twenty-one (44%) of the 48 ITP dogs received dexamethasone (dose range: 0.04–0.5 mg/kg/day IV). Eighteen of these dogs received the dexamethasone before initiating oral prednisone treatment, whereas the other 3 were never transitioned to oral prednisone because they did not survive to discharge.

Ten (21%) of the 48 presumptive ITP dogs were treated with azathioprine (2 mg/kg/day PO) before discharge, in addition to the above detailed doses of corticosteroids. The platelet recovery time to

40,000 cells/ μ L was available for 7 of these 10 cases and ranged from 4 to 12 days with a median of 6 days. The platelet recovery time to a platelet count within reference range for these 7 dogs ranged from 12 to 21 days with a median of 15 days. Seven (70%) of 10 dogs that received azathioprine survived to discharge.

Ten (21%) of the 48 presumptive ITP dogs received a single injection of vincristine (0.02 mg/kg IV) during hospitalization, in addition to the above-detailed doses of corticosteroids. Information regarding platelet recovery time was available for 8 of the 10 dogs that received vincristine. These 8 cases had a platelet recovery time to 40,000 cells/ μ L between 2 and 10 days with a median of 4 days. The time for the platelet count to reach reference range for these 8 cases was between 3 and 42 days with a median of 10 days. Nine (90%) of 10 dogs that received vincristine survived to discharge.

Six (13%) of the 48 presumptive ITP dogs received a single dose of human immunoglobulin (dose range: 0.35–0.81 g/kg IV), in addition to the above-detailed doses of corticosteroids. Platelet recovery times were available for 5 of the 6 dogs that received human immunoglobulin. The median platelet recovery time to 40,000 cells/ μ L was 5 days (range: 2–10 days). The median time for the platelet count to normalize was 12 days (range: 2–13 days). Five (83%) of 6 dogs that received human immunoglobulin survived to discharge.

Forty-six (96%) of the 48 presumptive ITP cases were treated with doxycycline (dose range: 5.8–17 mg/kg/day PO) and most were treated with a full 4-week course. Most dogs also received famotidine either IV or PO (35/48, 73%) and many received a sucralfate slurry PO (20/48, 42%). Other adjunctive treatments, after diagnosis of ITP, included ampicillin (8/48, 17%), ampicillin/sublactam (2/48, 4%), amoxicillin/clavulanic acid (1/48, 2%), cefazolin (1/48, 2%), enrofloxacin (4/48, 8%), prednisolone acetate 1% (7/48, 15%), timolol (2/48, 4%), artificial tears (2/48, 4%), neomycin-polymixin B-bacitracin ophthalmic ointment (2/48, 4%), diphenhydramine (4/48, 8%), butorphanol (3/48, 6%), hydromorphone (3/48, 6%), buprenorphine (2/48, 4%), tramadol (2/48, 4%), acepromazine (2/48, 4%), potassium gluconate (2/48, 4%), cimetidine (2/48, 4%), pentoxifylline (1/48, 2%), vitamin K (2/48, 4%), meclizine (1/48, 2%), misoprostol (1/48, 2%), filgrastim (1/48, 2%), and fenbendazole (1/48, 2%).

Nineteen (40%) of the 48 presumptive ITP dogs required between 1 and 7 blood transfusions per dog in the form of whole blood or packed red blood cells (pRBCs). Most of the dogs received whole blood IV (15/19, 79%) at a dose between 7.4 and 44 mL/kg/transfusion with a median of 20 mL/kg/transfusion. Nine (47%) of the 19 ITP dogs that received a RBC transfusion received pRBCs, in addition to whole blood or alone at a dose of 4.5–27.5 mL/kg/transfusion with a median of 10.4 mL/kg/transfusion. Five (10%) of 48 presumptive ITP dogs received between 1 and 3 platelet transfusions per dog at a dose of 1.8–13.5 mL/kg/transfusion with a median of 8.7 mL/kg/transfusion.

ITP Population—Survival Data

Thirty-nine (81%) of the 48 presumptive idiopathic ITP dogs survived to discharge with a median hospitalization time of 6 days (range: 0–19 days). Follow-up information beyond discharge was not available for 1 of the 48 ITP dogs. Most (36/47, 77%) dogs with ITP survived to at least 1 month after discharge. Twenty (43%) of the 47 presumptive idiopathic ITP dogs that survived to discharge, survived beyond 1 year of discharge. Fourteen (70%) of those 20 dogs survived to beyond 2 years of discharge.

The median survival time beyond discharge was 439 days (range: 4–12,775 days). Only 1 of the 4 (25%) presumptive ITP dogs that was vaccinated within 42 days did not survive to discharge—this dog was euthanized because of a poor prognosis. The other 3 dogs survived beyond discharge—1 was euthanized 12 days later after discharge because of development of disseminated intravascular coagulation (DIC), which was diagnosed at necropsy, 1 had a last known contact time of 1,719 days after discharge, and 1 had a last known contact time of 3,154 days after discharge. Eight of the 44 (15%) presumptive ITP dogs that were not vaccinated within 42 days did not survive to discharge from the hospital. Those surviving ITP dogs that were not vaccinated within the 42 day time period had last known contact dates ranging from 4 days to 1,923 days and had a median survival time beyond discharge of 303 days. There was no statistically significant difference between the proportion of nonsurviving ITP dogs that were vaccinated in the 42 days before presentation and nonsurviving ITP dogs that were not vaccinated within this time period ($P = .514$).

Discussion

In our study, a diagnosis of presumptive idiopathic ITP was not found to be associated with recent vaccination. This result is consistent with findings by Putsche and Kohn where none of their 30 dogs with primary ITP had been vaccinated within 4 weeks before the onset of clinical signs.²⁴ However, the types of vaccines that were given to their population were not reported. We did attempt to evaluate whether the type of vaccine administered was related to the incidence of ITP diagnosed within 42 days after immunization; however, there were too few cases of ITP diagnosed within this time period to allow meaningful conclusions.

Although this study failed to find an association between recent vaccination and idiopathic ITP in dogs, the possibility of a causal relationship remains. In children, ITP has been associated with administration of vaccines for hepatitis B, tick-borne encephalitis, influenza, diphtheria-pertussis-tetanus, chicken-pox, human papillomavirus, and MMR vaccines.^{15,25–29} Of these, recent vaccination with the MMR vaccine in children has been most commonly associated with the development of ITP.^{15,25,30,31} Thrombocytopenia in these patients can result in clinical bleeding and purpura,

but the thrombocytopenia typically resolves spontaneously within 1 month.²⁵ The platelet count nadir generally occurs 21 days after the vaccination and can be as low as 1,000 cells/ μ L; however, within 1 month the platelet counts are usually greater than 100,000 cells/ μ L.³¹ The incidence of ITP after MMR vaccination is quite rare, occurring in only 1 in 21,000 to 40,000 inoculations.³² It is possible that vaccine-associated ITP in dogs is similarly rare and would not have been detected by this study.

The relationship between vaccination and another immune-mediated hematologic disease, immune-mediated hemolytic anemia (IMHA), has been evaluated in dogs in 2 studies and results are conflicting. In 1 study, an association was noted between recent vaccination, defined as vaccination within 4 weeks of presentation, and the development of IMHA.³³ In that study, an increased number of IMHA cases (26%) were vaccinated within the 4 weeks before the onset of illness compared with a control population. A 2nd study, however, failed to identify a similar relationship.³⁴ Neither study documented the nature or number of all previous vaccinations, factors that may have predisposed dogs to an adverse immune-mediated event. The association between vaccination and other autoimmune disease in dogs, such as polyarthropathy or masticatory myositis, has not been investigated.

Given the retrospective nature of this study, we were limited by the information that was available for analysis. Information regarding the number of vaccinations during a dog's lifetime was not consistently available and could be an important factor in risk of development of ITP. It is possible that chronic immune stimulation by sequential vaccine administration is required to trigger an event in a susceptible dog. Another limitation of this study is the difficulty inherent in confirming a diagnosis of idiopathic ITP in dogs. None of the dogs with presumptive ITP were tested for antiplatelet antibodies and some of the dogs may have had thrombocytopenia of non-immune-mediated origin. However, this possibility is considered low given that all dogs had thorough diagnostic testing to exclude most underlying causes of thrombocytopenia, the majority of dogs survived to discharge, and the majority of dogs had a good response to immunosuppressive treatment. Some ITP cases could have had thrombocytopenia secondary to a tick-borne disease that was not identified via antibody testing. However, all cases were negative for *E. canis*, one of the more common tick-borne causes of thrombocytopenia in our geographic region, and only 2 ITP cases did not have testing for antibodies against *R. rickettsii*. Those 2 cases did not have any other clinical signs typically associated with *R. rickettsia* infection such as fever, vasculitis, edema, or lymphadenomegaly making Rocky Mountain Spotted Fever very unlikely to be the cause of thrombocytopenia.²³ Although 4 cases of presumptive idiopathic ITP (8%) did not have testing for *B. burgdorferi* and 1 (2%) had a 1 : 60 antibody titer, a negative antibody titer for *B. burgdorferi* was not required for inclusion into the study because, to our knowledge, Lyme dis-

ease has not been definitively associated with thrombocytopenia. A negative antibody titer for *B. canis* was not required for inclusion despite its well-documented effect on platelet counts as it is uncommonly seen in this geographic area. In addition, the 7 cases that lacked titer submission did not have any laboratory findings consistent with *B. canis* infection such as evidence of hemolysis or autoagglutination.³⁵ *Anaplasma phagocytophilum* is a tick-borne disease frequently associated with thrombocytopenia and unfortunately, very few cases in the ITP group were tested for this infection. Most presumptive idiopathic ITP cases did not have convalescent antibody titers either, therefore, some may have in fact, been cases of secondary ITP. Antinuclear antibody testing was not performed in these dogs because they did not fit the diagnostic criteria for systemic lupus erythematosus.³⁶ Complete laboratory testing for DIC was not available as tests, such as antithrombin activity, fibrinogen concentrations, fibrin degradation product concentrations, and D-dimer concentrations, were not routinely performed.³⁷ It is possible that thrombocytopenia in some dogs in the ITP group could have been attributed to the presence of occult DIC. This possibility was considered unlikely given that most cases of DIC have an identifiable underlying disease process known to lead to activation of coagulation and no such disease process was identified in the presumptive ITP population, nor did the dogs have clinical signs associated with severe disease other than bleeding. The small sample size was also a limiting factor in our study and further studies examining the vaccination status of larger populations of idiopathic ITP are warranted.

Our findings raise the question of whether clinicians should be avoiding or advocating routine vaccination of dogs with a history of ITP. Unfortunately, this study was not designed to answer this specific question. In humans, the majority of children with previously diagnosed ITP did not develop recurrence of thrombocytopenia following further immunization.^{17,25,30,38,39} However, sporadic reports of ITP relapses after revaccination do exist.⁴⁰ Further case-control studies with a larger sample population should be performed to determine whether further vaccination of dogs with a history of ITP is recommended.

This study failed to find a clinically significant relationship between recent vaccination and ITP in dogs; however, the possibility of an infrequent association cannot be ruled out. Although the relationship exists in humans, the incidence of ITP following vaccination is rare,³² which might also be the situation in the canine population. The results of this study suggest that the incidence of ITP within 42 days of vaccination could be considered too small to be clinically relevant. Thus, we conclude that the benefits of routine vaccination in dogs likely outweigh the risk of vaccine-associated ITP. Although vaccination should continue to be advocated, the decision to vaccinate should be determined on an individual basis. In addition, this study did not rule out the possibility of a transient, nonclinical ITP postvaccination. Whether previously diagnosed

cases of idiopathic ITP should be revaccinated requires further investigation.

Footnotes

^a Veterinary Medical Database, School of Veterinary Medicine, Purdue University, West Lafayette, IN (<http://www.vmdb.org>); VMDB does not make any implicit or implied opinion on the subject of the article or study

^b Cell-Dyn 3700, Abbott Laboratories, Abbot Park, IL

^c Vitros 5.1 Chemistry System, Ortho-Clinical Diagnostics, Rochester, NY

^d STA Compact, Diagnostica Stago, Parsippany, NJ

^e STATA SE 11.1 StataCorp, College Station, TX

Acknowledgment

The study was not supported by any grants.

References

1. Scott MA. Immune-mediated thrombocytopenia. In: Feldman VB, Zinkl FG, Jain NC, eds. *Schalm's Veterinary Hematology*. Philadelphia, PA: Lippincott Williams and Wilkins; 2005:478-486.
2. Scott MA, Kaiser L, Davis JM, et al. Development of a sensitive immunoradiometric assay for detection of platelet surface-associated immunoglobulins in thrombocytopenic dogs. *Am J Vet Res* 2002;63:124-129.
3. Lewis DC, Meyers KM, Callan MB, et al. Detection of platelet-bound and serum platelet-bindable antibodies for diagnosis of idiopathic thrombocytopenic purpura in dogs. *J Am Vet Med Assoc* 1995;206:47-52.
4. Lewis DC, Meyers KM. Studies of platelet-bound and serum platelet-bindable immunoglobulins in dogs with idiopathic thrombocytopenic purpura. *Exp Hematol* 1996;24:696-701.
5. Grindem CB, Breitschwerdt EB, Corbett WT, et al. Epidemiologic survey of thrombocytopenia in dogs: A report on 987 cases. *Vet Clin Pathol* 1991;20:38-43.
6. Botsch V, Küchenhoff H, Hartmann K, et al. Retrospective study of 871 dogs with thrombocytopenia. *Vet Rec* 2009;164:647-651.
7. Lewis DC, Meyers KM. Canine idiopathic thrombocytopenic purpura. *J Vet Intern Med* 1996;10:207-218.
8. Waner T, Leykin I, Shinitzky M, et al. Detection of platelet-bound antibodies in Beagle dogs after artificial infection with *Ehrlichia canis*. *Vet Immunol Immunopathol* 2000;77:145-150.
9. Bexfield NH, Villiers EJ, Herrtage ME. Immune-mediated haemolytic anaemia and thrombocytopenia associated with *Anaplasma phagocytophilum* in a dog. *J Small Anim Pract* 2005;46:543-548.
10. Sullivan PS, Arrington K, West R, et al. Thrombocytopenia associated with administration of trimethoprim/sulfadiazine in a dog. *J Am Vet Med Assoc* 1992;201:1741-1744.
11. Bloom JC, Thicm PA, Sellers TS, et al. Cephalosporin-induced immune cytopenia in the dog: Demonstration of erythrocyte-, neutrophil-, and platelet-associated IgG following treatment with cefazodone. *Am J Hematol* 1988;28:71-78.
12. Jones DR. Canine systemic lupus erythematosus: New insights and their implications. *J Comp Pathol* 1993;108:215-228.
13. Keller ET. Immune-mediated disease as a risk factor for canine lymphoma. *Cancer* 1992;70:2334-2337.
14. Bianco D, Armstrong PJ, Washabau RJ. Treatment of severe immune-mediated thrombocytopenia with human IV immunoglobulin in 5 dogs. *J Vet Intern Med* 2007;21:694-699.
15. France EK, Glanz J, Xu S, et al. Risk of immune thrombocytopenic purpura after measles-mumps-rubella immunization in children. *Pediatrics* 2008;121:687-692.
16. Demicheli V, Jefferson T, Rivetti A, et al. Vaccines for measles, mumps and rubella in children. *Cochrane Database Syst Rev* 2005;4:1-47.
17. Black C, Kaye JA, Jick H. MMR vaccine and idiopathic thrombocytopenic purpura. *Br J Clin Pharmacol* 2003;55:107-111.
18. Pincau S, Belbeck LW, Mooreet S. Levamisole reduces the thrombocytopenia associated with myxovirus vaccination. *Can Vet J* 1980;21:82-84.
19. McAnulty JF, Rudd RG. Thrombocytopenia associated with vaccination of a dog with a modified-live paramyxovirus vaccine. *J Am Vet Med Assoc* 1985;186:1217-1219.
20. Dircks BH, Schubert H-J, Mischke R. Underlying diseases and clinicopathologic variables of thrombocytopenic dogs with and without platelet-bound antibodies detected by use of a flow cytometric assay: 83 cases (2004-2006). *J Am Vet Med Assoc* 2009;235:960-966.
21. Williams DA, Maggio-Price L. Canine idiopathic thrombocytopenia: Clinical observations and long-term follow-up in 54 cases. *J Am Vet Med Assoc* 1984;185:660-663.
22. Rozanski EA, Callan MB, Hughes D, et al. Comparison of platelet count recovery with use of vincristine and prednisone or prednisone alone for treatment for severe immune-mediated thrombocytopenia in dogs. *J Am Vet Med Assoc* 2002;220:477-481.
23. Low RM, Holm JL. Canine Rocky Mountain spotted fever. *Compendium* 2005;27:1-8.
24. Putsche JC, Kohn B. Primary immune-mediated thrombocytopenia in 30 dogs (1997-2003). *J Am Anim Hosp Assoc* 2008;44:250-257.
25. Rajantie J, Zeller B, Treutiger I, et al. Vaccination associated thrombocytopenic purpura in children. *Vaccine* 2007;25:1838-1840.
26. Neau D, Bonnet F, Michaud M, et al. Immune thrombocytopenic purpura after recombinant hepatitis B vaccine: Retrospective study of seven cases. *Scand J Infect Dis* 1998;30:115-118.
27. Benz R, Krause M, Taverna C. Immune thrombocytopenic purpura reactivation after tick-borne encephalitis vaccination. *Vaccine* 2009;27:5172-5173.
28. Dias PJ, Gopal S. Refractory thrombotic thrombocytopenic purpura following influenza vaccination. *Anaesthesia* 2009;64:444-446.
29. Pugno G, Ysebaert L, Bagheri II, et al. Immune thrombocytopenic purpura following human papillomavirus vaccination. *Vaccine* 2009;27:3690.
30. Miller E, Waight P, Farrington CP, et al. Idiopathic thrombocytopenic purpura and MMR vaccine. *Arch Dis Child* 2001;84:227-229.
31. Nieminen U, Peltola H, Syrjälä MT, et al. Acute thrombocytopenic purpura following measles, mumps and rubella vaccination. A report on 23 patients. *Acta Paediatr* 1993;82:267-270.
32. Bertuola F, Morando C, Menniti-Ippolito F, et al. Association between drug and vaccine use and acute immune thrombocytopenia in childhood: A case-control study in Italy. *Drug Saf* 2010;33:65-72.
33. Duvař D, Giger U. Vaccine-associated immune-mediated hemolytic anemia in the dog. *J Vet Intern Med* 1996;10:290-295.
34. Carr AP, Panciera DL, Kidd L. Prognostic factors for mortality and thromboembolism in canine immune-mediated

hemolytic anemia: A retrospective study of 72 dogs. *J Vet Intern Med* 2002;16:504-509.

35. Boozer AL, Macintire DK. Canine babesiosis. *Vet Clin North Am Small Anim Pract* 2003;33:885-904.

36. Smee NM, Harkin KR, Wilkerson MJ. Measurement of serum antinuclear antibody titer in dogs with and without systemic lupus erythematosus: 120 cases (1997-2005). *J Am Vet Med Assoc* 2007;230:1180-1183.

37. Wiinberg B, Jensen AL, Johansson PI, et al. Thromboclastographic evaluation of hemostatic function in dogs with disseminated intravascular coagulation. *J Vet Intern Med* 2008; 22:357-365.

38. Wang JD, Huang FL, Chen PY, et al. Acute immune thrombocytopenic purpura in infants: Associated factors, clinical features, treatment and long-term outcome. *Eur J Haematol* 2006;77:334-337.

39. Mantadakis E, Farmaki E, Buchanan GR. Thrombocytopenic purpura after measles-mumps-rubella vaccination: A systematic review of the literature and guidance for management. *J Pediatr* 2010;156:623-628.

40. Vlachy V, Forman EN, Miron D, et al. Recurrent thrombocytopenic purpura after repeated measles-mumps-rubella vaccination. *Pediatrics* 1996;97:738-739.