

RABIES: "ONE HEALTH" IN ACTION

Kimberly Signs, DVM
Michigan Department of Community Health

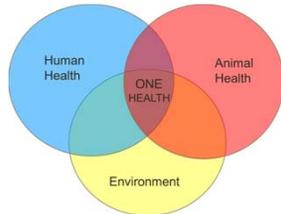
Michele Schalow, DVM
Michigan Department of Agriculture and Rural Development

Dave Marks, MS
United States Department of Agriculture/Wildlife Services



What is "One Health"?

- Recognizes the interconnected nature of animals and humans with their common environment.
- Prevention and control of infectious diseases requires focus on the complex interaction between human and animal health and the environment.
- Rabies is a classic example of One Health in action. Control of the disease in animals has reduced the burden of disease in people.



Rabies Virus



- All species of mammals are susceptible
- Virus is found in saliva or brain tissue of infected animals
- Only a few species are important reservoirs of the virus
 - Bats
 - Dogs (Africa, Asia)
- In the U.S., several distinct variants have been identified in terrestrial animals (mesocarnivores): raccoons, skunks, fox

Public Health Importance of Rabies

- One of the oldest described infectious diseases, known for over 4,000 years.
- Rabies has the highest case fatality rate of any conventional etiologic agent
- Global Distribution
- Developed countries (like the U.S.) expend veterinary and public health resources to protect domestic animals and prevent human disease, resulting in the occurrence of only sporadic human cases

Rabies Infection in Mammals

- Incubation period is highly variable, but averages 1-3 months
- Rabies virus enters the body through a bite contaminated with infected saliva
- The virus travels up the nerves to the spinal cord and brain (incubation period)
- Once in the brain, it multiplies rapidly and then spreads to the salivary glands
- Infected animals usually die within 7 days of showing symptoms.



Signs and Symptoms in Humans

- Initial symptoms are flu-like and include generalized weakness, fever or headache
- There may be discomfort or unusual sensations such as itching or prickling (called paresthesia) at the site of the bite
- Progression within days to symptoms of brain dysfunction including anxiety, confusion, and agitation, perhaps progressing to delirium, hallucinations, and insomnia.

Presence/absence of rabies in 2007

Global Burden of Rabies

Developing world remains highly impacted by rabies, primarily in dogs

Global Statistics

- More than 15 million post-exposure prophylaxis treatments are administered each year.
- 40% of children in Africa and Asia receive rabies PEP, the majority are male.
- Most deaths from rabies occur in Africa and Asia, associated with dog rabies variant.
- Over 50% of rabies deaths are in children under 15 years of age.
- An estimated 20 million dogs are killed every year in attempts to control rabies.

U.S. Annual Public Health Burden of Disease

- On average, 1-2 cases of human rabies are diagnosed
- An estimated 25,000-35,000 human rabies post-exposure treatments administered
- 4500-5000 pre-exposure vaccines administered
- 200,000-220,000 doses of human rabies vaccine administered
- Over \$300 million spent to prevent rabies

Issues for Public Health

- Rabies is a fatal disease
- No effective treatment once symptoms begin
- Rabies is prevented through timely administration of post-exposure treatment (PEP)
 - ▣ Treatment is costly, including biologics and professional fees
 - ▣ A series of vaccines must be completed
 - ▣ Supply of biologics for PEP are limited, both in the U.S. and in developing countries

Characteristics of Rabies in the U. S.

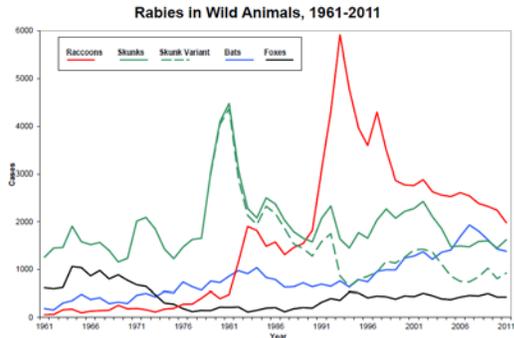


- Endemic in all states except Hawaii
- Since 1980, wildlife account for >90% of rabid animals reported
- Primary reservoir species (responsible for maintaining the disease in the wild) are raccoons, bats, skunks, foxes and mongooses (Puerto Rico)
- Rabies virus variants associated with terrestrial mammals tend to occur in geographically distinct regions
- Human mediated translocation is threat to control programs

Rabies in Wildlife-U.S.

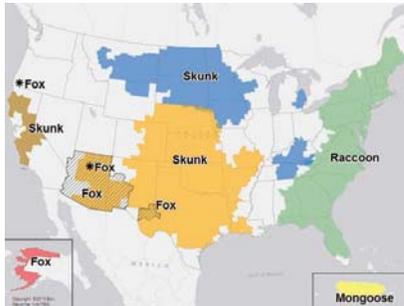
Dave Marks, MS
US Department of Agriculture/Wildlife Services

Trends in Wildlife Rabies



Source: Centers for Disease Control and Prevention, January 2014

Distribution of Terrestrial Rabies, 2008-2012



Source: JAVMA, Vol. 243, No. 6, September 15, 2013

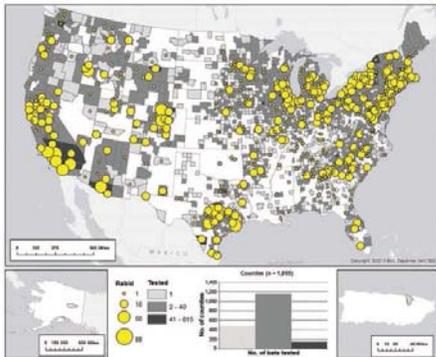
2011 Animal Rabies Stats

- Of 99,890 animals tested for rabies, 6,031 animals tested positive
 - ▣ 33% raccoons
 - ▣ 27% skunks
 - ▣ 23% bats
 - ▣ 7% fox
 - ▣ 5% cats
 - ▣ 1% dogs
 - ▣ 1% cattle

Bat Rabies Variants

- More than 30 species of bats have been reported with rabies in the U.S., from which more than 8 rabies virus lineages have been identified
- Spillover of bat variants to other animal species is rare, but does occur
- These events can result in a bat variant becoming enzootic in a new reservoir species
 - ▣ Recent outbreak of rabies in skunks in AZ has lead to a bat strain becoming enzootic in skunks in the region
 - ▣ Ancestral relation to raccoon strain rabies and south central skunk strain rabies

Rabid Bats, U.S. --2012



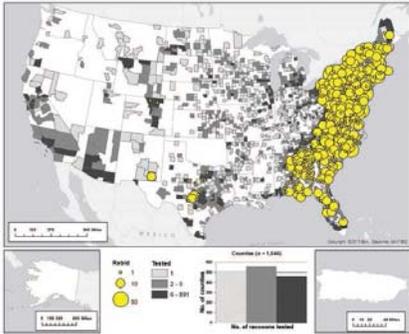
Source: JAVMA, Vol. 243, No. 6, September 15, 2013

Rabies in Raccoons



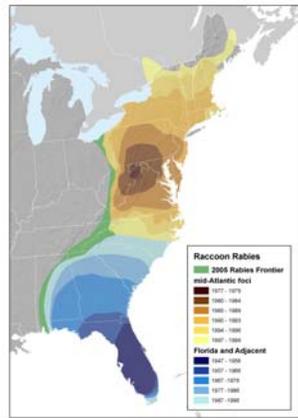
- Raccoons are now the species most often testing positive for rabies in U.S. (followed by skunks and bats)
- Raccoons are more likely than other wild animals to be near people and pets. Therefore the risk for human exposure becomes greater
- Raccoon-strain rabies is more likely to spillover into a wide variety of animals
- Rabid raccoons outside the eastern U.S. are typically found to be infected with the regional circulating mesocarnivore strain
- Rabies has not been detected in raccoons in Michigan in many years

Rabid Raccoons, U.S.--2012



Source: JAVMA, Vol. 243, No. 6, September 15, 2013

The Expanding Epizootic of Raccoon Rabies in the Eastern United States, 1977-2005



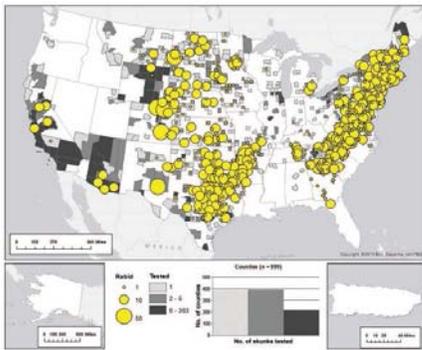
USDA National Rabies Program



Rabies in Skunks

- Just over 50% of rabies in skunks is due to strains that are enzootic in skunks
- The remainder are due to spillover, primarily **raccoon strain**
- California and North Central skunk strains are ancestrally related to canine rabies variants
- South Central skunk strain is ancestrally related to bat rabies variants
- AZ skunk rabies represents a recent adaptation of a bat strain to a terrestrial species

Rabid Skunks, U.S.-- 2012



Source: JAVMA, Vol. 243, No. 6, September 15, 2013

Enhanced Surveillance = Early Detection

- Need samples from raccoons, skunks, coyote, fox
- Priority area – SE Michigan
- Target “Suspect” animals for testing
 - Aimless wandering, incoordination
 - Loss of fear towards humans or pets
 - Weakness/paralysis in hind legs
 - Shaking/tremors
 - Self-mutilation



Human Rabies Prevention

Kimberly Signs, DVM
Michigan Department of Community Health

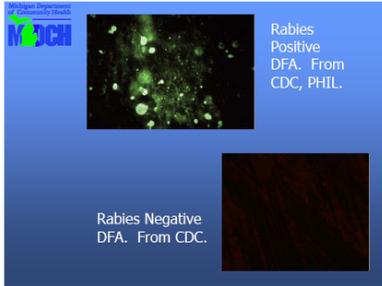
Human Rabies in the U.S.

- Became rare in the 20th century (following control in dogs)
- Of the 33 human rabies cases reported in the U.S. since 2002:
 - 24 (72%) were due to rabies virus variants endemic in the U. S.
 - 21 of 24 (87.5%) were due to bat variants
 - 17 (71%) of patients were male
 - Median age of 35 years
- Of the 24 domestically acquired cases, four were associated with organ transplantation
 - 17 of the remaining 20 patients (65%) reported a bite or direct contact with the exposing animal species.

Rabies Diagnostic Testing

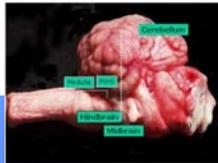
- **Human Testing**-exclusively performed at the Centers for Disease Control and Prevention
 - Required specimens: CSF, serum, saliva and skin biopsy (antemortem); brain tissue (postmortem)
- **Animal Testing**-performed primarily at State Health Department laboratories
 - Required specimens: brain and spinal cord

MDCH Laboratory Guidelines, Animal Testing



Rabies Pathogenesis – Rational for Specimen Collection

- Rabies viral antigen is widespread in most infected animals.
- BUT, may be unilateral especially in large animals (livestock).
- Thorough examination of the brain stem and cerebellum is necessary for accurate diagnosis.
- A cross-section through the brain stem will maximize ascending and descending nerve tracts.



Specimen Collection

- Humane Euthanasia (2013 AVMA Humane Euthanasia Guidelines at www.avma.org)
 - Who performs this?
 - Animal control
 - Animal shelter/Humane Society
 - Licensed veterinarian
- Vaccinated personnel
- Use of appropriate PPE (gloves, eye and mouth protection, clothing protection)
- Dedicated area for specimen processing
- Preserve the brain for testing
- Timely transport to MDCH BOL

Michigan Department of Community Health
 Specimen Collection Pitfalls

- Damage to brain from improper euthanization techniques.
 - Shooting in head.
 - Stepping on bat.
- Damage to brain from improper storage after death.
 - Burial for days or weeks.
- Freezing the brain.
- Incomplete spinal cord or cerebellum.

Michigan Department of Community Health
 Specimen Submission

- Appropriate packaging.
 - Must not be leaking.
 - Place in securely sealed plastic bag.
 - Place test request form in small plastic bag.
 - Ship in plastic bucket in cardboard box.
- Label as diagnostic specimen.
- Ship by fastest means to lab: Express Mail, private courier or FedEx.

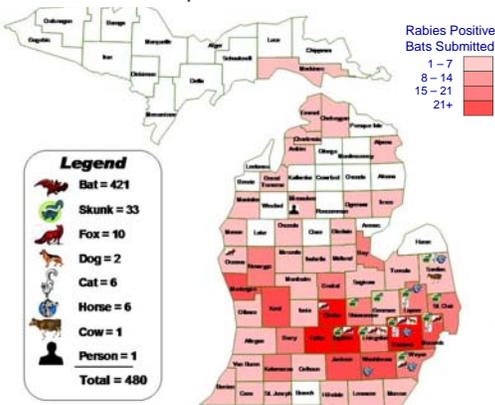
Special Features of MDCH Rabies Specimen Testing

- Rabies testing supported by state public health funds
- MDCH Laboratory can test rabies specimens 7 days a week, including holidays and weekends (by special arrangement)
- Individual results are provided to the submitter via phone each day
- Specimens received by 8 AM are usually completed the same day

Epidemiology of Rabies in Michigan

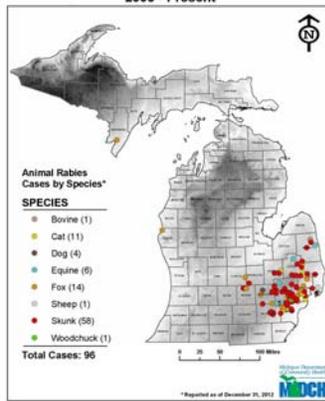


Rabies Positive Animals, 2006-2010

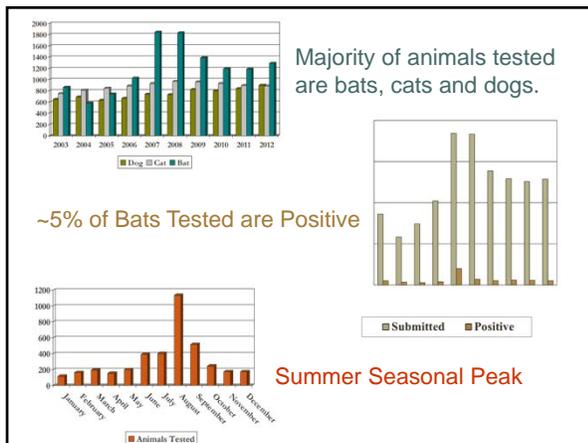


Terrestrial (Non-Bat) Rabies

All Terrestrial Animal Rabies Cases in Michigan: 2003 - Present







Important Reference Documents

Animal Bite Reporting;

Communicable Disease Rules

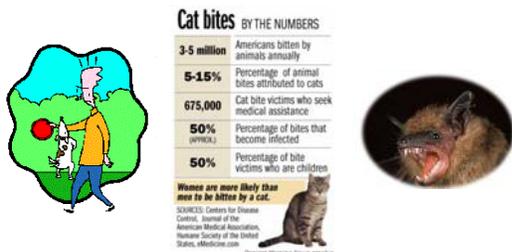
(Promulgated under the Authority of Michigan's Public Health Code)

"Any person who has knowledge of an animal bite where rabies is suspected shall, within 24 hours of the biting incident, report the bite to the appropriate local health department and to the local health department where the bite occurred. The report shall include all of the following information:

Communicable Disease Rules (con't)

- Animal species inflicting the bite
- Animal owner's name, address, and telephone number
- Vaccination status of animal
- Date and location of biting incident
- Name, address, and telephone number of the person bitten
- Site of the bite on the body
- Name of the reporter of bite"

Evaluation of Potential Exposures



Transmission

- Virus is found in saliva or brain tissue of infected animals **NOT** blood, urine, feces
- Documented modes of transmission include:
 - ▣ Through a bite or broken skin
 - ▣ Contamination of mucous membranes
 - ▣ Tissue transplantation
 - ▣ Aerosol transmission



Risk Assessment

- Species of animal?
 - ▣ Wild
 - ▣ Rodent
 - ▣ Dog, cat, ferret
- Animal available for testing/observation?
- Michigan epidemiology for that species?
 - ▣ www.michigan.gov/rabies
- Observed health and behavior of the animal?
- Circumstances of the bite?



Courtesy of Dr. W. F. Andrew Frazer

Type of Exposure

- Bite?
 - ▣ Site
 - ▣ Severity
 - ▣ Immediate cleansing
- Non-bite?
 - ▣ Mucous membrane exposure
 - ▣ Non-intact skin
 - ▣ Bat in room with sleeping person, or witnessed in room with an unattended child, mentally disabled or intoxicated person



Severity and Site of Bite

- Head/neck?
- Length of time to receive test results on animal?
- 24/7 testing available for emergencies
 - MDCH BOL can generally have results within 24-48 hours, and in most cases, PEP can wait for results
 - If testing is delayed, PEP may need to be started



Provoked on Non-provoked?

- Examples of provoked exposures:
 - Attempting to feed animal
 - Entering animals territory
 - Breaking up a fight between two animals
 - Handling an injured or wild animal
 - Walking, running, or riding a bike past an animal
- Unprovoked exposure:
 - Animal crossed neutral territory to initiate contact
- DETAILS ARE CRUCIAL!!**



Animals not likely to carry rabies

- | | |
|-------------------------------------|--------------------------------------|
| <input type="checkbox"/> Chipmunk | <input type="checkbox"/> Muskrat |
| <input type="checkbox"/> Gerbil | <input type="checkbox"/> Prairie Dog |
| <input type="checkbox"/> Gopher | <input type="checkbox"/> Rabbit |
| <input type="checkbox"/> Guinea Pig | <input type="checkbox"/> Rat |
| <input type="checkbox"/> Hamster | <input type="checkbox"/> Shrew |
| <input type="checkbox"/> Mole | <input type="checkbox"/> Squirrel |
| <input type="checkbox"/> Mouse | <input type="checkbox"/> Vole |



Zoo/Exotic Animal Bites

- Difficult and sometimes emotional situations
- Misconceptions about rabies vaccination and testing in zoo/exotic animals
 - No approved vaccines exist
 - Animal rabies testing requires brain tissue
- Public health risk for rabies or other communicable diseases is primary concern
- Prevention is key
- FAQ and Bite Protocols found at www.michigan.gov/rabies -- "Laws and Regulations"

Primate Bite – Special Concern

- Certain primate bites (macaques) are a concern for B virus, which can cause a potentially fatal encephalitis in people. It is important to determine the species of primate inflicting the bite - take pictures if possible and consult with an infectious disease physician.

If the animal is a macaque:

- Perform viral culture of the wound
- Draw blood for baseline serology for B virus exposure
- Initiate antiviral therapy



Java Macaque

“Grey” areas

- Do not fit into given protocols
- Require careful assessment of situation
- “Worried well”
- Must assess the risk of exposure verses the potential risk of treatment
- Some people are more risk averse than others
- Want to avoid unnecessary PEP if possible

Rabies Biologics Issues

- Periodic Short Supply
- Expense: \$10,000-15,000 for one PEP course
- Who has it?
- Indigent Care

Post-Exposure Prophylaxis

- Standard PEP Procedure
 - Rabies Immune Globulin (RIG) on day 0
 - Series of four vaccinations, day 0, 3, 7, 14
- PEP for Immunosuppressed Individuals
 - RIG on day 0
 - Series of five vaccinations, day 0, 3, 7, 14, 28
 - Check for virus neutralizing titer 1-2 weeks after completion of series
- PEP for Previously Immunized Individuals
 - No RIG
 - Series of two vaccinations, day 0 and 3



Rabies and Domestic Animals: The Furry Side of the Story

Michele Schalow, DVM
Michigan Department of Agriculture and Rural Development

MDARD's Role

- Responsibility: to protect animal health in order to safeguard animal agriculture, public health, and animal well-being.
- State Veterinarian is responsible to maintain a list of reportable diseases in animals.
 - List includes rabies
 - www.michigan.gov/mdard, "Animal Health & Care," "Animal Diseases," "2013 Michigan Reportable Animal Disease List."
- Anyone suspecting or discovering a reportable disease is required to immediately report it to our office
 - (1-800-292-3939).

MDARD's Investigation

- MDARD required to investigate each report.
- With rabies, MDARD emphasis is controlling and preventing spread to other animals as well as people.
- MDARD has authority to:
 - Enter premises
 - Examine animals
 - Quarantine animals
 - Collect samples
 - Seize animals

MI-048 (Rev. 11/02)
DISTRIBUTION:
White - Lansing Office Copy
Cream - Owner's Copy
Pink - Field Rep's Copy

MICHIGAN DEPARTMENT OF AGRICULTURE
ANIMAL INDUSTRY DIVISION
P.O. Box 30017, Lansing, Michigan 48909
(517) 375-1077
500-212-3939

QUARANTINE

BY AUTHORITY CONFERRED UPON THE DIRECTOR OF THE MICHIGAN DEPARTMENT OF AGRICULTURE, THIS QUARANTINE IS IMPOSED ON Rabies AND IS EFFECTIVE FROM THE DATE OF THIS ORDER.

Animal Bites: Dogs, Cats, and Ferrets

- An animal with rabies/showing signs of rabies (e.g. biting/aggressive behavior), will die within a few days of onset.
- Dogs, Cats and Ferrets: Isolate from other animals and people for **10 DAYS** from the date of bite. If the animal shows signs of rabies or dies, test the animal for rabies.
 - Maybe euthanized if not wanted, but "strays" must be held unless ill

Animal Bites: Other Animals

- Handled on a case by case basis--contact MDARD for guidance
- Questions to ask/information to obtain for MDARD:
 - Circumstances behind bite (Was bite unprovoked?)
 - Is animal healthy/showing signs of rabies? (And has animal been evaluated by a veterinarian?)
 - How is the animal housed (e.g. on pasture, in a barn)? Does animal have the potential for contact with wildlife?
 - Has animal had any known expose to a wild or rabid animal?
 - Is animal currently vaccinated against rabies?
 - Has animal traveled, either within the state or out of state recently (past 6 months)? If so, where and when?
 - Are any other animals at the property currently showing signs of rabies?

Dogs, Cats, Ferrets, or Livestock Exposed to Wild Animals

- Currently vaccinated?
 - Revaccinate ASAP
 - Observe for 45 days from day of exposure
- Not currently vaccinated/unvaccinated?
 - Test the animal, if available
 - If cannot, or tests positive,
 - Euthanize animal
 - Alternatively, quarantine for 6 month and vaccinate (immediately or at month 5 of quarantine)

Advised Quarantine Criteria

- Animal kept away from other animals and people, aside from 1-2 caregivers
 - Caregiver to monitor for signs of rabies
- Restricted to a room/building with at least one added "layer" to the outdoors.
- Animal only allowed outdoors for necessary purposes (eliminate, veterinary care) and if under control of caregiver.
- No medical procedures unless deemed urgent by a veterinarian.

Where Does the Animal Need to be Quarantined?

- Not specified in state law
- There may be local ordinances/laws requiring the quarantine occur at a specific location/type of facility



State Animal Laws

- Dogs
 - All dogs 6 months and older required to be licensed
 - Proof of current rabies required for individual dog license (rabies certificate)
 - Certificate must include month and year vaccine expires and are advised to meet the criteria of the compendium (<http://naspvh.org/Documents/RabiesVacCert.pdf>)
 - Vaccine must be USDA approved and be given by licensed and accredited veterinarian (Accredited? Call 517-337-4700)
 - Nosodes are not vaccines and not approved!
- Ferrets
 - All ferrets 12 weeks and older are required to be vaccinated against rabies by a licensed veterinarian
 - Rabies certificates required to be issued by veterinarian
- Cats
 - No state rabies vaccination requirement

Note: State law does not mandate the issuance of rabies tags.

Push to Print Form
Push to Reset Form

RABIES VACCINATION CERTIFICATE					
NASPVH Form 01 (Revised 2017)					
Owner's Name & Address <small>Print Clearly</small>			RABIES TAG #		
LAST FIRST MI.			MICROCHIP #		
NO. STREET CITY STATE ZIP			TELEPHONE #		
SPECIES		AGE	SIZE	PREDOMINANT BREED	PREDOMINANT COLORS-MARKINGS
<input type="checkbox"/> Dog <input type="checkbox"/> Cat <input type="checkbox"/> Ferret <input type="checkbox"/> Other: _____		Months _____ Years _____	<input type="checkbox"/> Under 20 lbs. <input type="checkbox"/> 20-50 lbs. <input type="checkbox"/> Over 50 lbs.	_____	_____
SEX		ANIMAL NAME			
<input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Neutered		_____			
National Control License		DATE VACCINATED		Veterinarian's Name	
<input type="checkbox"/> 1 Yr <input type="checkbox"/> 3 Yr <input type="checkbox"/> 4 Yr		Product Name: _____ Manufacturer: (print & letters) _____		License Number: _____ Veterinarian's Signature _____ Address: _____	
Month / Day / Year _____ / _____ / _____		<input type="checkbox"/> Initial dose <input type="checkbox"/> Booster dose		NEXT VACCINATION DUE BY: _____ <input type="checkbox"/> 1 Yr USDA Licensed Vaccine <input type="checkbox"/> 3 Yr USDA Licensed Vaccine <input type="checkbox"/> 4 Yr USDA Licensed Vaccine	

Sample Rabies Certificate from NASPHV

Not specified in state law.
There may be local ordinances/laws requiring the quarantine occur at a specific location/type of facility.

Please Note...

- MDARD advises vaccinating all animals to which there is an approved rabies vaccine.
- Rabies vaccines are currently approved for the following species:
 - ▣ Dogs -- as early as 12 weeks of age
 - ▣ Cats -- as early as 8 weeks of age
 - ▣ Ferrets -- as early as 12 weeks of age
 - ▣ Horses -- as early as 12 weeks of age
 - ▣ Cattle -- as early as 12 weeks of age
 - ▣ Sheep -- as early as 12 weeks of age
- Vaccine may be good for: 1yr, 3yr, 4yr



What if the vaccine poses a serious, life-threatening risk?

- Determination must be made by a veterinarian
- Letter can be issued in lieu of rabies certificate
 - ▣ Include animal's information (species, breed, sex, age, name, ID)
 - ▣ Include owner's information (name and address)
 - ▣ Detail the health concern and when, if ever, animal can be vaccinated again
- Owner advised to keep animal away from other animals and people as much as possible
- Please note that state law does not allow for titers

A Word About Administering Vaccinations

- Vaccines are to only be administered by or under the supervision of a veterinarian.
 - ▣ Animal Industry Act, 1988, PA 466, as amended, Section 43
 - ▣ Public Health Code, 1978, PA 368, as amended, Section 18805
- Exemption only given to:
 - ▣ Livestock owners, to vaccinate their livestock only
 - ▣ Research



Contact Information



- Michigan Department of Community Health:
 - Daytime: 517-335-8165
 - Evening/weekend: 517-335-9030

- Michigan Department of Agriculture:
 - 800-292-3939

- United States Department of Agriculture/Wildlife Services-Lansing Office:
 - 517-336-1928

- Michigan Department of Natural Resources, Wildlife Disease Laboratory:
 - 517-336-5030

Important Websites

- www.cdc.gov/rabies/

- www.michigan.gov/rabies

- www.nasphv.org “Publications”

Questions?