Rabies Surveillance and Prevention

Recommendations for Veterinarians and Veterinarian Technicians

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Michelle Feist

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HUMAN RABIES PREVENTION

Rabies - Background

- Lyssavirus belonging to the Rhabdoviridae family
  - "bullet-shaped virus"
  - RNA virus
- Rabies is a virus that affects the central nervous system in mammals
  - Virus travels within the nerves
  - Within the brain, virus multiplies rapidly
    - Signs of disease begin to develop

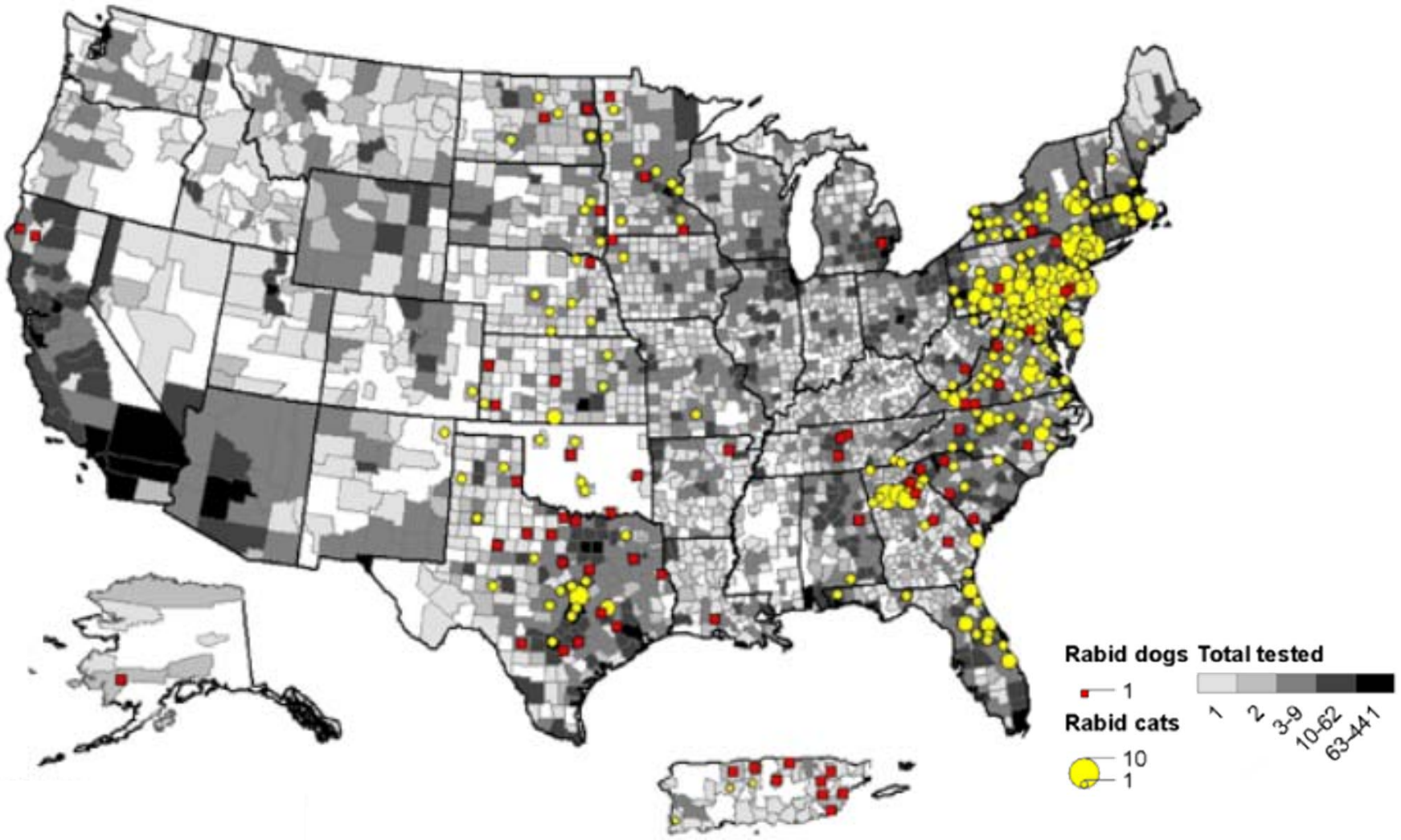
Rabies - Background

- More than 90 percent of rabies cases reported each year in the United States occur in wildlife
  - 36.5% raccoons
  - 23.5% skunks
  - 23.2% bats
  - 7% foxes
  - 1.8% other species
- Raccoons and skunks are responsible for most reported animal cases in the United States
  - In ND – skunks
- Different variants (bat, skunk, raccoon, etc.)

Terrestrial Rabies Reservoirs(2010)

http://www.cdc.gov/rabies/location/usa/surveillance/wild_animals.html

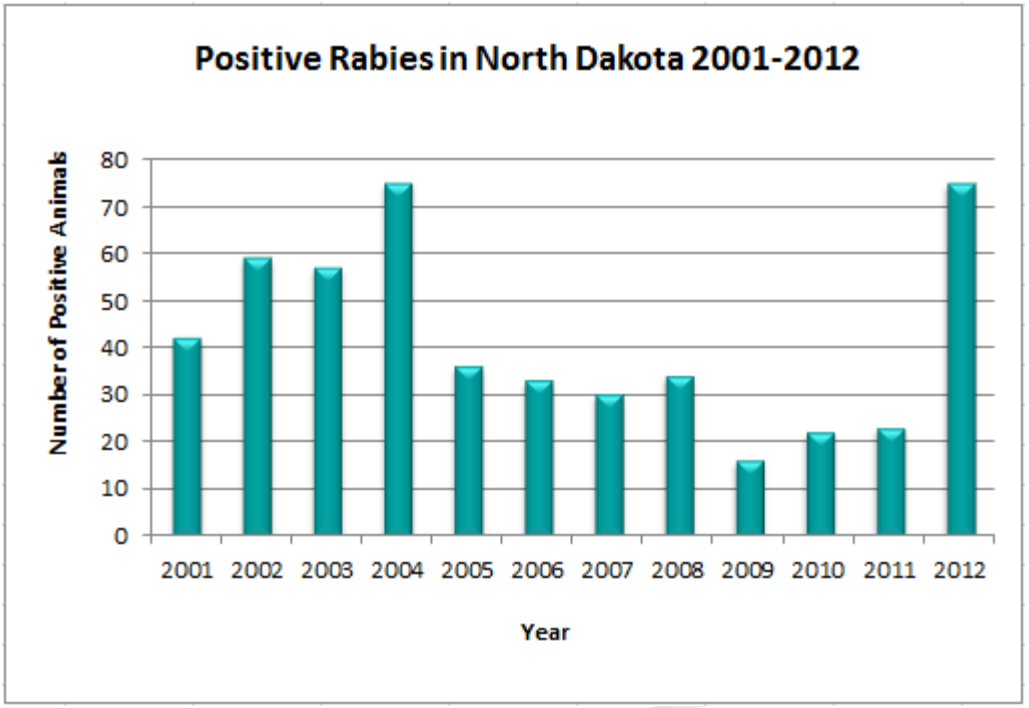
Rabid Cats and Dogs Reported in the U.S. (2010)



http://www.cdc.gov/rabies/resources/publications/2010-surveillance/cats-and-dogs.html

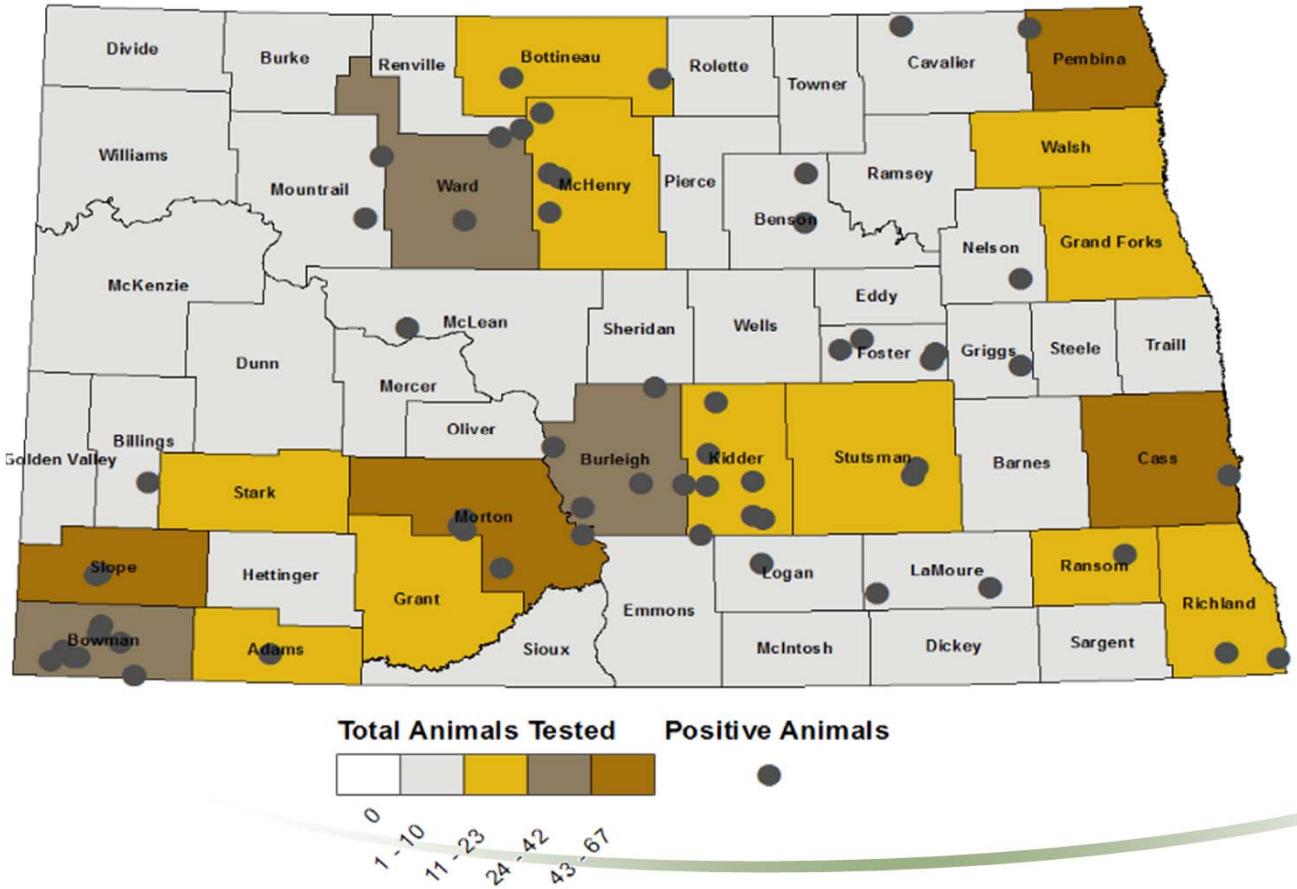
Rabies in North Dakota

- ~ 350 to 450 animals tested per year
  - 729 animals tested in 2012
- ~ 30 positive rabies animals per year
  - 8% positive



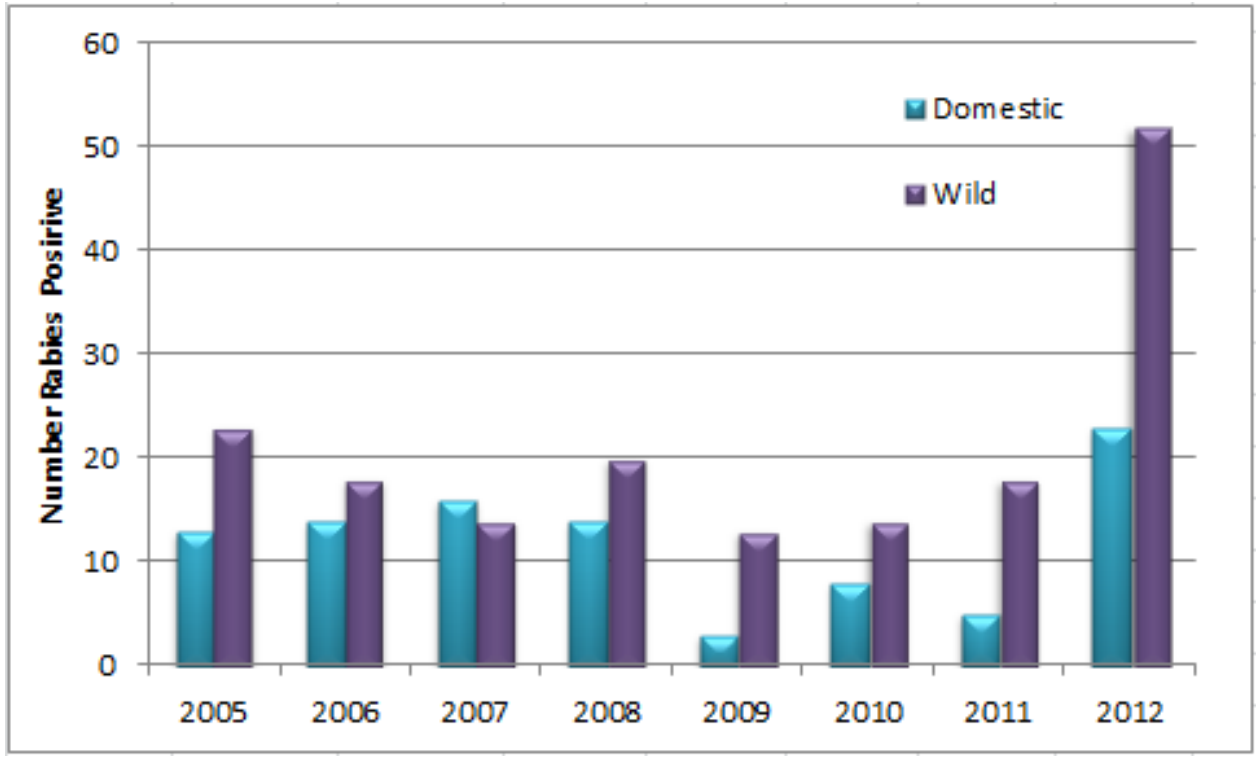
Rabies in North Dakota

- Positive Animals Rabies Cases by County, North Dakota, 2012



Species	Number Confirmed
Bat	2
Cat	6
Cow	12
Horse	4
Sheep	1
Skunk	50
Total	75

Positive Rabies in Domestic and Wild Animals



Human Rabies Around the World

- Rabies is a global health issue
- Human cases are underreported
  - Most rabies cases occur in countries with inadequate diagnostic facilities and surveillance systems for rabies
- Exposure to rabid dogs is the cause of over 90% of human exposures and over 99% of human rabies deaths[1]
- Limited access to healthcare and resources

1- http://www.cdc.gov/rabies/location/world/index.html

US soldier dies of rabies after dog bite in Afghanistan

Published May 03, 2012 / NewsCore

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Comments (1)

WASHINGTON – A 24-year-old American soldier died of rabies after being bitten by a dog last year in Afghanistan, US health officials said Thursday following an investigation into the rare case.

The otherwise healthy soldier started experiencing symptoms of shoulder and neck pain and tingling sensations in his hands soon after arriving at Fort Drum, N.Y., in mid-August 2011.

His condition escalated to include nausea, vomiting, anxiety and trouble swallowing. By the time he was admitted to an emergency room, he was dehydrated and hydrophobic, meaning he developed an intense fear of drinking liquids because of the painful muscle spasms he experienced while swallowing.

This Week in *MMWR*

Photo/CDC

This issue of *MMWR* includes a report on human rabies diagnosed in a U.S. soldier who reported being bitten by a dog in Afghanistan.

Rabies in the U.S.

- Human cases – 1 to 3 each year
  - 49 human cases since 1995[1]
    - Variant Type
      - Bat(35), Dog(11), Fox(1), Raccoon(1), unknown (1)
    - Exposure Type
      - Bite (17), Transplant (4), unknown (28)
- Estimated 25,000 to 35,000 human exposures[1]
  - Most from domestic animal exposure
- Cases of human and animal rabies are mandatory reportable conditions to the NDDoH
  - Website - www.ndhealth.gov/disease/Rabies/

1- http://www.cdc.gov/rabies/location/usa/surveillance/human_rabies.html

Exposures and PEP, North Dakota, 2000

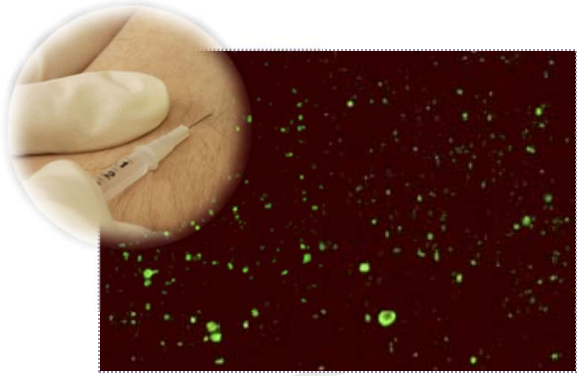
- PEP initiated by exposure species
  - Dog – 70
  - Cat – 27
  - Cow – 12
  - Horse – 8
  - Muskrat - 6
  - Skunk – 4
  - Skunk/dog – 3
  - Bat – 2
  - Raccoon, Mink, Unknown – 3

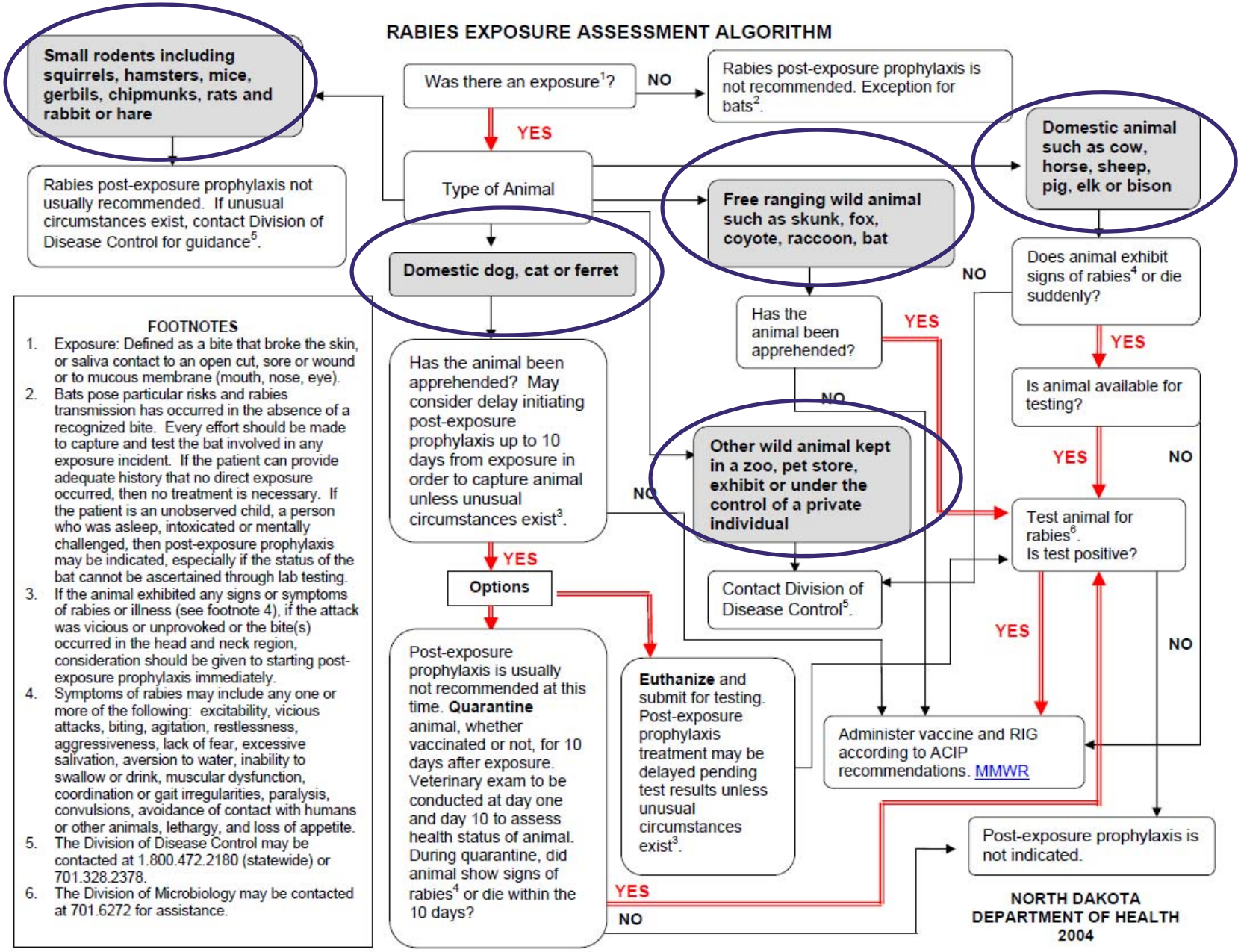
- Cost to fully vaccinate is variable, average of $2,500[1] to $5,000
  - Approx. $506,250 in vaccination costs
  - Est. $364,000 potentially avoided costs by vaccinating pets, quarantine, etc.

1-Vaidya, Sagar A, et al: **Estimating the risk of rabies transmission to humans in the U.S.: a delphi analysis.** *BMC Public Health* 2010, 10:278

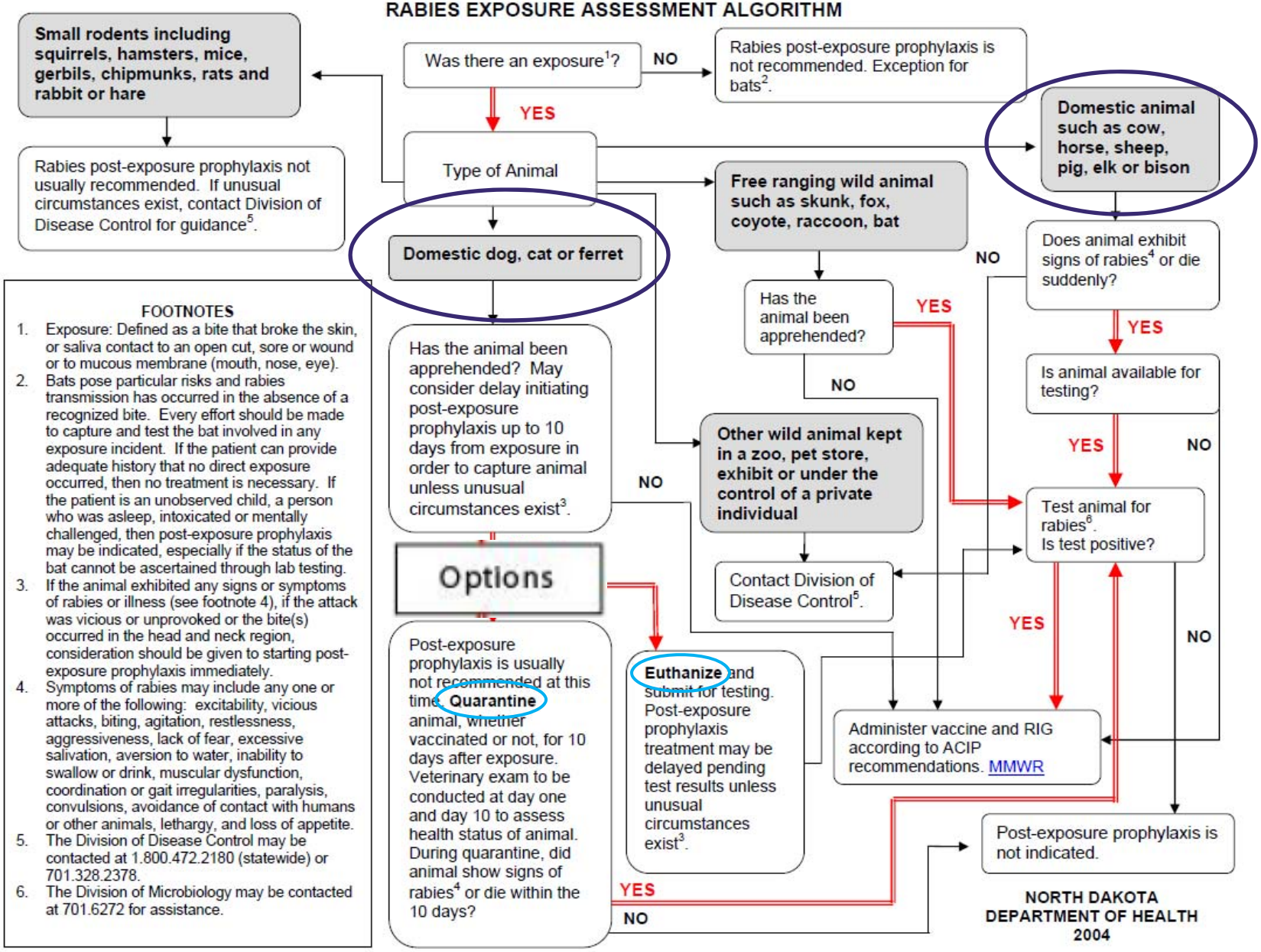
Rabies Exposure

- Definition of rabies exposure
  - Introduction of virus-laden saliva into the body through a bite or contact of the virus-laden saliva or neural tissue with an open wound or the mucous membranes.
    - *Blood is not infectious*
- All animal bites or other possible exposures should be assessed by a healthcare provider!




RABIES EXPOSURE ASSESSMENT ALGORITHM
Was there an exposure[1]?
NO
Rabies post-exposure prophylaxis is not recommended. Exception for bats[2].
YES
Type of Animal
Small rodents including squirrels, hamsters, mice, gerbils, chipmunks, rats and rabbit or hare
Rabies post-exposure prophylaxis not usually recommended. If unusual circumstances exist, contact Division of Disease Control for guidance[5].
Domestic dog, cat or ferret
Free ranging wild animal such as skunk, fox, coyote, raccoon, bat
Domestic animal such as cow, horse, sheep, pig, elk or bison
Has the animal been apprehended? May consider delay initiating post-exposure prophylaxis up to 10 days from exposure in order to capture animal unless unusual circumstances exist[3].
Has the animal been apprehended?
Other wild animal kept in a zoo, pet store, exhibit or under the control of a private individual
Does animal exhibit signs of rabies[4] or die suddenly?
Is animal available for testing?
Test animal for rabies[6]. Is test positive?
Contact Division of Disease Control[5].
Options
Post-exposure prophylaxis is usually not recommended at this time. Quarantine animal, whether vaccinated or not, for 10 days after exposure. Veterinary exam to be conducted at day one and day 10 to assess health status of animal. During quarantine, did animal show signs of rabies[4] or die within the 10 days?
Euthanize and submit for testing. Post-exposure prophylaxis treatment may be delayed pending test results unless unusual circumstances exist[3].
Administer vaccine and RIG according to ACIP recommendations. MMWR
Post-exposure prophylaxis is not indicated.
YES
NO
FOOTNOTES
1. Exposure: Defined as a bite that broke the skin, or saliva contact to an open cut, sore or wound or to mucous membrane (mouth, nose, eye).
2. Bats pose particular risks and rabies transmission has occurred in the absence of a recognized bite. Every effort should be made to capture and test the bat involved in any exposure incident. If the patient can provide adequate history that no direct exposure occurred, then no treatment is necessary. If the patient is an unobserved child, a person who was asleep, intoxicated or mentally challenged, then post-exposure prophylaxis may be indicated, especially if the status of the bat cannot be ascertained through lab testing.
3. If the animal exhibited any signs or symptoms of rabies or illness (see footnote 4), if the attack was vicious or unprovoked or the bite(s) occurred in the head and neck region, consideration should be given to starting post-exposure prophylaxis immediately.
4. Symptoms of rabies may include any one or more of the following: excitability, vicious attacks, biting, agitation, restlessness, aggressiveness, lack of fear, excessive salivation, aversion to water, inability to swallow or drink, muscular dysfunction, coordination or gait irregularities, paralysis, convulsions, avoidance of contact with humans or other animals, lethargy, and loss of appetite.
5. The Division of Disease Control may be contacted at 1.800.472.2180 (statewide) or 701.328.2378.
6. The Division of Microbiology may be contacted at 701.6272 for assistance.
NORTH DAKOTA DEPARTMENT OF HEALTH
2004

RABIES EXPOSURE ASSESSMENT ALGORITHM



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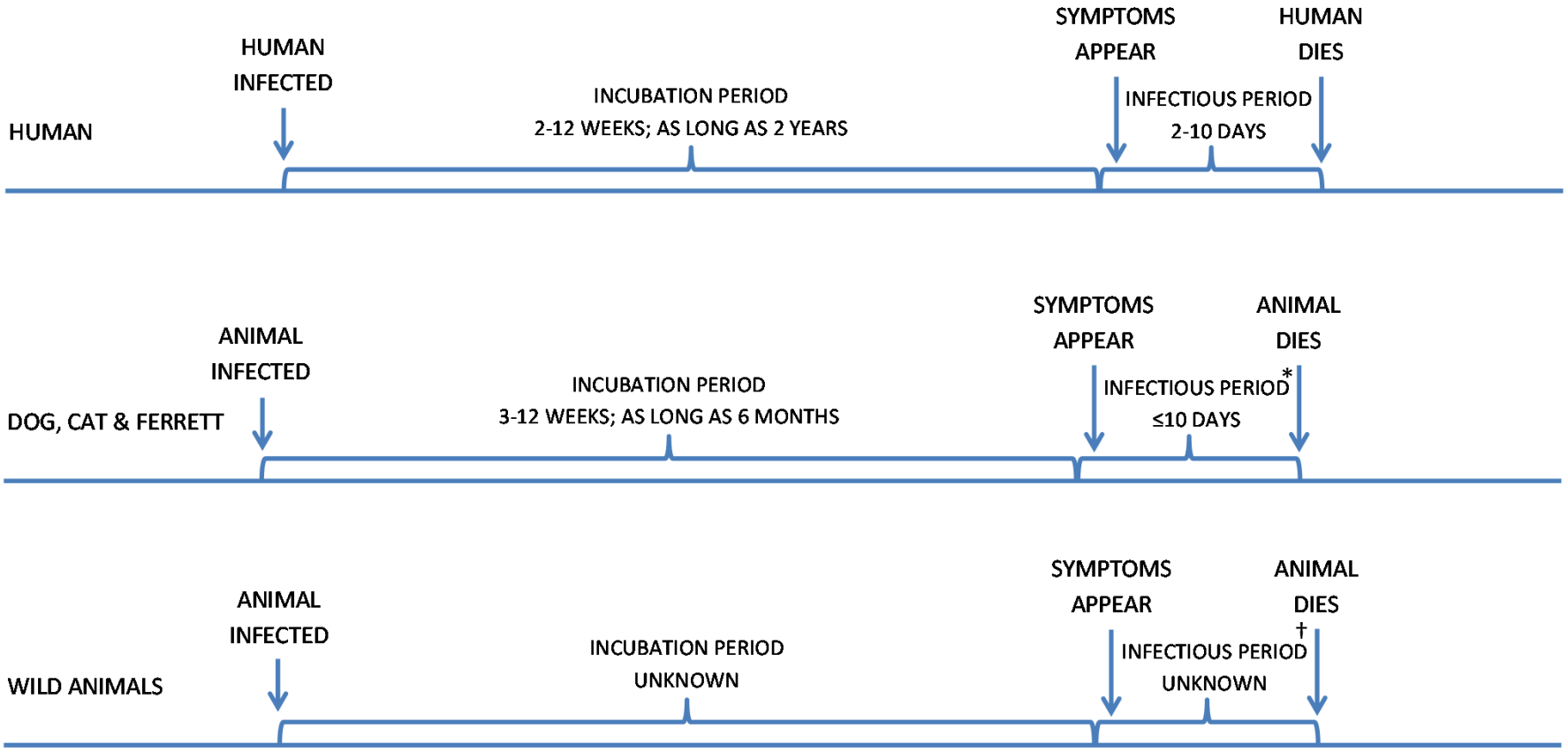
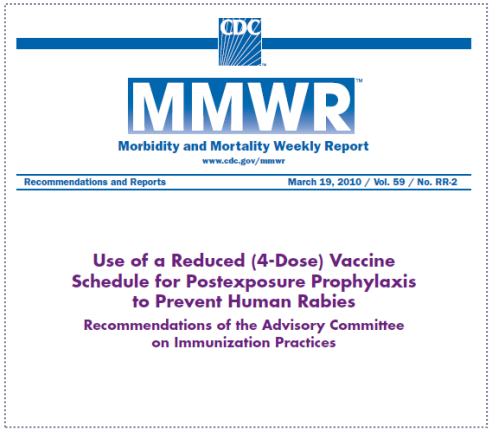
Rabies Exposure Timeline



* May be infectious for a number of days before clinical signs appear. When investigating human exposures, it is recommended to consider the 10 days prior to onset of clinical signs (or date of death if no signs of illness) as part of the animal's infectious period.

† It is unknown as to how long a wild animal can shed rabies virus in its saliva before clinical signs of illness appear. Any exposure to a wild animal that cannot be tested, even if apparently healthy, should be treated as if the animal is rabid.

Treatment of Wounds & Vaccination



- Not-previously vaccinated
  - Wound cleansing
    - Soap & Water, wound irrigation.
  - Rabies immune globulin (RIG)
    - 20 IU/kg body weight
    - If possible, full dose should be infiltrated around the wound site.
      - Remainder in anatomical site distant from vaccination site.
  - Vaccine *
    - 1 mL, IM (deltoid area, or outer thigh for small children).
    - 4-doses: Days 0, 3, 7 & 14.
    - Immunosuppression: 5 doses on days 0, 3, 7, 14 and 28

Treatment of Wounds & Vaccination

- Previously vaccinated
  - Wound cleansing
    - Soap & Water, wound irrigation.
  - Rabies immune globulin (RIG)
    - Should NOT be administered!
  - Vaccine
    - 1 mL, IM (deltoid area, or outer thigh for small children).
    - 2-doses: Days 0 & 3.

Rabies Vaccination

- Pre-exposure vaccination
  - 3-doses of 1 mL, IM (deltoid area, or outer thigh for small children).
    - Days 0,7 & 21 or 28.
  - NO RIG
- Booster doses
  - 1-1mL, IM booster dose if does not have evidence of virus neutralizing antibodies in serum at 1:5 serum dilution by the RFFIT (rapid fluorescent focus inhibition test).

Rabies Serologic Testing

- Rapid Fluorescent Focus Inhibition Test (RFFIT)
  - Recommended for persons with continuous exposure every 6 months.
    - Rabies research laboratory workers, rabies biologics workers.
  - Recommended for persons with frequent exposure every 2 years.
    - Rabies diagnostic lab workers, cavers, veterinarians & staff, animal control & wildlife workers in areas where rabies is enzootic. All persons who frequently handle bats.
    - Vet students, people who work with animals in places where rabies is rare and travelers who receive pre-exposure vaccination do NOT need routine serology

One-Health Concept

- Coordinated and integrated approach to public and animal health with relationships across multiple sectors and disciplines
  - Partnerships between human and veterinary medicine

Beth W. Carlson, DVM
Deputy State Veterinarian

RABIES IN DOMESTIC ANIMALS

Rabies in Domestic Animals

- Before 1960, 90% of animal rabies cases were in domestic animals
- Since 1975, <20% of animal rabies cases have been in domestic animals
- Worldwide, dogs cause 90% of human exposures and 99% of human rabies deaths
- Canine rabies variant eliminated from US ~2004
- Any variant can cause disease in any mammal

Rabies in North Dakota

- Cattle, horses, cats and dogs most frequently affected domestic animals
- Sheep, goats, ferrets, swine, bison, elk have been reported
- Ownership of skunks and raccoons is expressly prohibited by law except for by licensed zoos.
- Skunks and raccoons held in violation are confiscated, euthanized, and tested for rabies.

Rabies in North Dakota: Historical Case Perspective

- 1950s 481 cases
- 1960s 826 cases
- 1970s 1471 cases
- 1980s 1386 cases
- 1990s 958 cases
- 2000s 425 cases

Compendium of Animal Rabies Prevention and Control, 2011

- Issued by the National Association of State Public Health Veterinarians (NASPHV)
- Reviewed and revised as necessary
- Includes recommendations for vaccination and management
- Can be found at: http://www.nasphv.org/Documents/RabiesCompendium.pdf

Prevention

- Multiple vaccines available
- Duration of immunity ranges from 1-4 years
- Varying vaccine types, administration routes, minimum ages, etc.

Vaccination

- Vaccination is inexpensive and highly effective
- Rabies is very rare in vaccinated animals
- Vaccines available for dogs, cats, ferrets, cattle, horses, and sheep
- Generally given after 3 months of age, 1 year later, and then triennially for dogs, cats, and sheep
- Annual vaccination required for cattle, horses, and ferrets
- Vaccine only available from a licensed veterinarian

Vaccination

- Veterinary records critical

- **Just because an animal had a vaccination doesn't mean it is currently vaccinated!**

Pre-Exposure Vaccination

- Pareneteral animal rabies should be administered by or under the direct supervision of a licensed veterinarian
- The veterinarian signing the certificate must ensure that the person administering vaccine is identified on the vaccination certificate and is appropriately trained.

Pre-Exposure Vaccination

- Peak titers are reached within 28 days
- Animals not considered immunized until 28 days AFTER initial vaccination
- All animals should be boosted one year after initial vaccination
- According to NASPHV, no lab or epi data exist to support annual or biennial administration of 3- or 4-year vaccines after the initial series
- Booster schedule should be based on the vaccine label *

Factors to Consider in Establishing a Vaccination Schedule

- Exposure Risk
  - Indoor vs. Outdoor pets
  - Likelihood of unknown exposure
    - Farm Animals (including dogs and cats)
    - Hunting Dogs
    - Lake/River Dogs

Pre-Exposure Vaccination

- Previously vaccinated animals overdue for booster should be revaccinated.
- Animals are considered currently vaccinated immediately after booster, regardless of whether or not the booster was overdue.

Pre-Exposure Vaccination: Livestock

- All horses should be vaccinated against rabies
- Other livestock that have frequent contact with humans should also be vaccinated
  - Petting zoos
  - Show animals
- Consider vaccinating especially valuable livestock
  - Breeding bulls, etc.

Pre-Exposure Vaccination: Captive Wild Animals and Hybrids

- NASPHV recommends that wild animals and hybrids should not be kept as pets
- No parenteral rabies vaccines are licensed for use in wild animals or hybrids

- Exotic pets may benefit from vaccination, but will not be considered vaccinated.

Interstate Animal Movements

- Animals in transit should be accompanied by a current rabies vaccination certificate, or a health certificate that includes all the information from the vaccination certificate.
- Additional requirements may exist for states of destination

RABIES VACCINATION CERTIFICATE

NASPHV FORM 51 (revised 2007)

RABIES TAG #

MICROCHIP #

Owner's Name & Address Print Clearly

LAST FIRST M.I.

TELEPHONE #

NO. STREET CITY STATE ZIP

SPECIES
Dog ☐
Cat ☐
Ferret ☐
Other: ☐ _____ (specify)

AGE
_____ Months ☐ Years ☐

SEX ☐ Male ☐ Female ☐ Neutered

SIZE
Under 20 lbs. ☐
20 - 50 lbs. ☐
Over 50 lbs. ☐

PREDOMINENT BREED

ANIMAL NAME

PREDOMINANT COLORS/MARKINGS

Animal Control License ☐ 1 Yr ☐ 3 Yr ☐ Other _____

DATE VACCINATED

_____
Month / Day / Year

Product Name:

Manufacturer: (First 3 letters) ☐☐☐

☐ 1 Yr USDA Licensed Vaccine
☐ 3 Yr USDA Licensed Vaccine
☐ 4 Yr USDA Licensed Vaccine

☐ Initial dose ☐ Booster dose

Vaccine Serial (lot) Number

Veterinarian's Name:

License Number:

Veterinarian's Signature

Address:

NEXT VACCINATION DUE BY:

_____
Month / Day / Year

Post-Exposure Management

Animals exposed to confirmed or suspected rabid animal

- Unvaccinated dogs, cats and ferrets should be euthanized immediately
- If owner is unwilling, animal should be placed in strict isolation for 6 months
- Animals overdue for a booster should be evaluated on a case-by-case basis
- Currently vaccinated dogs, cats and ferrets should be revaccinated immediately and observed by the owner for 45 days.

Post-Exposure Management

Animals exposed to confirmed or suspected rabid animal

- Unvaccinated livestock should be euthanized immediately.
- If not euthanized, animal must be confined and observed for 6 months.
- Currently vaccinated livestock should be revaccinated immediately and observed for 45 days.
- Herbivore-herbivore transmission is rare; not necessary to restrict the rest of the herd

Post-Exposure Management

Animals exposed to confirmed or suspected rabid animal

- Handling and/or consumption of tissues from exposed animals may be risk for rabies transmission
- Custom slaughter may be done immediately after exposure, with all tissues being thoroughly cooked.
- Federal meat inspection guidelines indicate animals exposed within 8 months should be rejected.

Post-Exposure Management

Animals exposed to confirmed or suspected rabid animal

- Rabies virus is widely distributed in tissues of rabid animals.
- Tissues and products from rabid animals should not be used for human or animal consumption.
- Pasteurization and complete cooking will inactivate virus.

Management of Animals that Bite Humans

- 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.
- Healthy dogs, cats or ferrets which bite humans should be confined and observed daily for 10 days from the time of the exposure.
- Any illness/abnormality should be investigated by a veterinarian immediately.
- If signs suggestive of rabies develop, animal should be euthanized and tested

Management of Animals that Bite Humans

- Stray or unwanted dogs, cats, and ferrets which expose a person may be euthanized immediately and tested.
- Other animals that may have exposed a person will be evaluated on a case-by-case basis.

Titers

- “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 should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations in animals”

Samples Wanted!

- 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 tissues should be shipped on dry ice to:

  Dr. Charles Rupprecht

  DASH, Bldg. 18, Room SSB218

  Centers for Disease Control and Prevention

  1600 Clifton Road, NE

  Atlanta, GA 30333

  406-639-1050

Clinical Signs

© CD-ROM ILLUSTRATED LECTURE NOTES ON TROPICAL MEDICINE

Rabies in an Animal Shelter

- 3/31/10 – North Dakota Department of Health notified by local public health department of a dog testing positive for rabies at the state vet diagnostic lab
- Dog resided in a ND animal shelter prior to being placed with a foster family
- Investigation launched with State Veterinarian's office to identify contacts and prevent transmission to both animals and humans

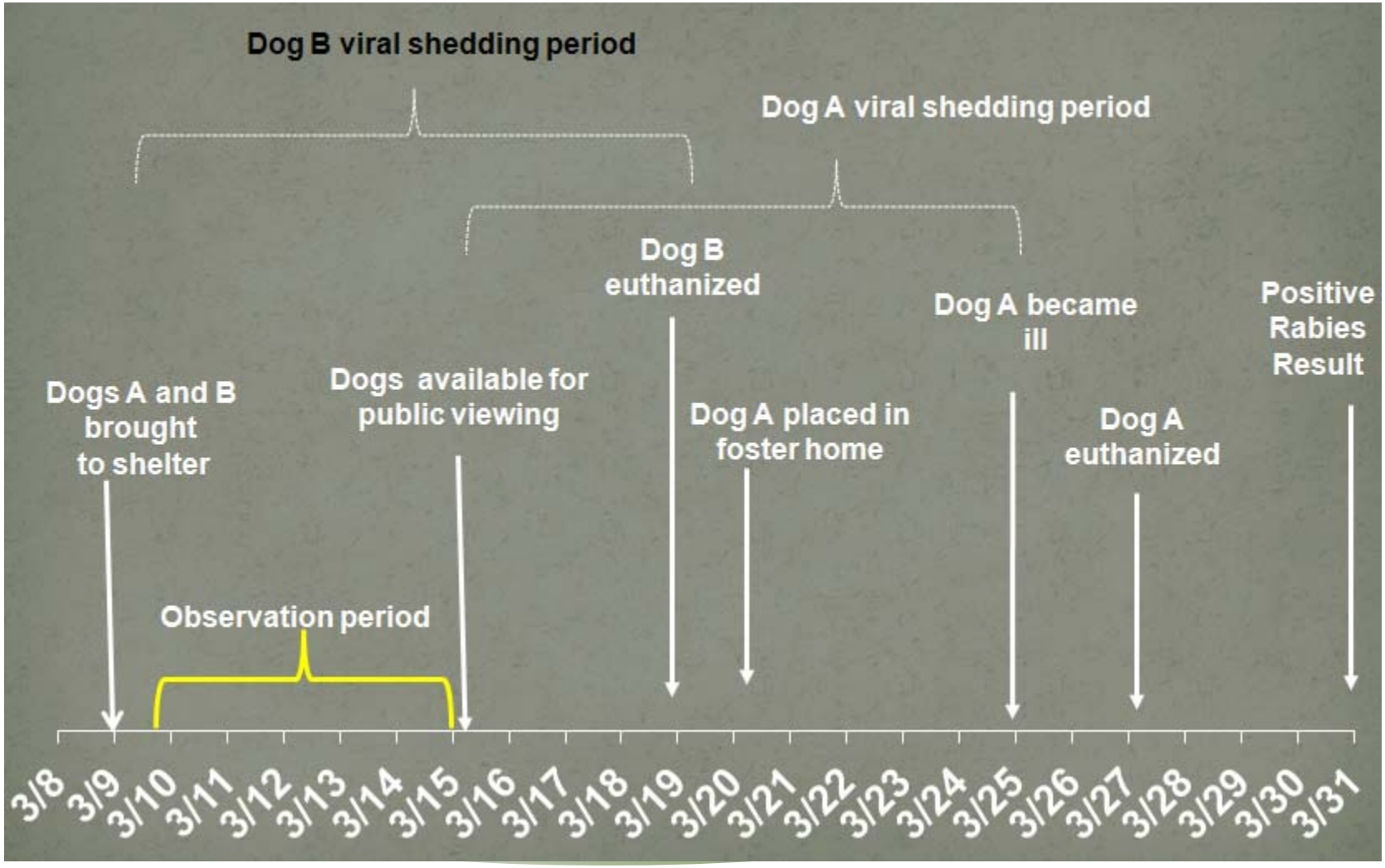
Public Health Investigation

- Establish timeline of events
- Identify human contacts through the use of employee records, volunteer logs, and a news release to the general public
- Identify animal contacts by obtaining a description of animal handling practices at the shelter and utilizing adoption and claimed pet records

Description of Dogs A and B

- Brought in together from neighboring Minnesota county
- Both blue heeler mix
- Dog A – 8-12 months old, 32 pounds, seemed fearful and dependent on Dog B
- Dog B – 72 pounds, dominant and aggressive
- Likely had shared exposure

Timeline of Events



Human Contact Investigation

- 32 employees and volunteers with potential exposure from 3/9-3/20
  - 10 (9 employees, 1 volunteer) received post-exposure prophylaxis (PEP)
- 11 others received PEP
  - 5 members of Dog A foster family
  - 1 neighbor child to Dog A foster family
  - 3 members of family who found Dogs A and B in MN
  - 2 members of the general public

Types of Exposures

- No bites
- Majority of employees/volunteers were licked and may have had open cuts or sores on their hands
- Young children, autistic child

Animal Handling Practices

Animal Handling Practices

- Always taken out on leashes
- Could not guarantee that dogs did not interact even while on leashes

Animal Contact Investigation

- 25 dogs remaining in the shelter euthanized
  - All tested negative for rabies
- 39 adopted or claimed dogs assessed in ND and MN (33 ND, 5 MN, 1 MI)
  - 12 up to date on rabies vaccination (inc. 1 MN and 1 MI dog)
  - 11 euthanized*
  - 13 placed in 6 month isolation period (inc. 4 MN dogs)
  - 2 not exposed
  - 1 undecided (dog HBC prior to owner's decision)

Recommendations

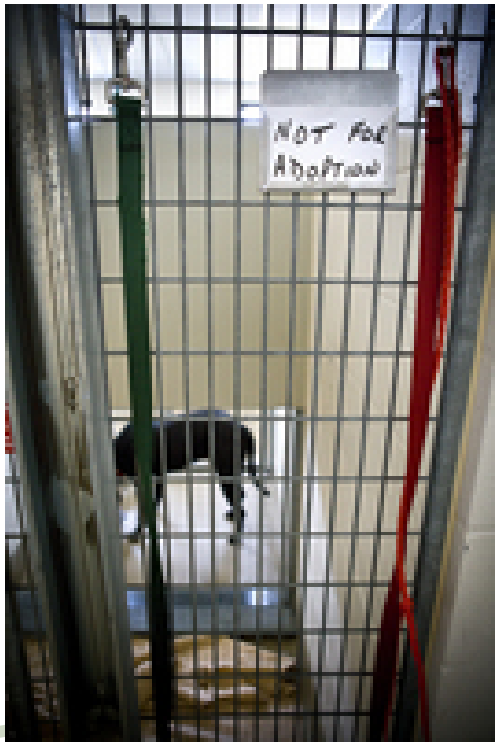
- Consider pre-exposure rabies vaccination of animal shelter employees
- Enforce animal handling practices within the shelter
- Continue to encourage responsible pet ownership, including rabies vaccination
- Warn adoptees about unknown history of animals and the potential for rabies exposure
- Waivers
- Require foster family pet vaccination

Officials ‘err on the side of caution’

More than 20 dogs likely will be euthanized this week, and about 15 people have been referred to their physician after a rabid dog was brought to Grand Forks’ Circle of Friends Humane Society, officials said Monday.

By: Ryan Johnson, Grand Forks Herald

- Grand Forks Herald Editorial:
  - “Agencies act decisively in response to rabid dog”
  - “The authorities did the right thing”



IF YOU WATCH OLD YELLER
BACKWARDS, ITS A FAMILY CLASSIC
ABOUT A ZOMBIE DOG WHO BECOMES
FRIENDS WITH A YOUNG BOY.
watchbackwards.com

Resources

- Disease Control – 800.472.2180 or 701.328.2378
- CDC MMWR Human Rabies Prevention -- http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf
- CDC MMWR Reduced 4-Dose Schedule -- http://www.cdc.gov/mmwr/pdf/rr/rr5902.pdf
- CDC Rabies website -- http://www.cdc.gov/rabies/
- NDDoH Rabies website -- http://www.ndhealth.gov/disease/Rabies/
- NASPHV Compendium on Animal Rabies Prevention and Control-- http://www.nasphv.org/Documents/RabiesCompendium.pdf