

## **Introduction:**

# **The Epidemiology of Rabies in North Carolina**

## **Human Rabies**

Since 2001, there have been 21 human cases of rabies infections acquired in the United States; 15 cases (71%) were caused by rabies virus variants associated with bats (1). (For a review of recent human rabies cases, see the Centers for Disease Control and Prevention web site at [www.cdc.gov/rabies/location/usa/surveillance/human\\_rabies.html](http://www.cdc.gov/rabies/location/usa/surveillance/human_rabies.html).)

In North Carolina, the major reservoirs of rabies are bats and raccoons. Official records of the N.C. Division of Public Health indicate that 25 human cases of rabies were reported in the state between 1918 and 1955.

The fact that there have been no reported human rabies cases in North Carolina since 1955 can be attributed to effective public health rabies laws, domestic animal rabies vaccination programs, diligent animal control programs focused on the elimination of stray animals, implementation of leash regulations and laws, appropriate assessments of human exposures, and judicious use of human post-exposure treatment when indicated based on careful assessments of human exposures. But rabies is not eradicated in the state.

Approximately 6 percent of bats captured for testing in the United States in 2010 were infected with rabies virus (2, 3). In 2010 and 2011, respectively, 3.0 percent and 1.5 percent of bats submitted to the North Carolina State Laboratory of Public Health for testing were positive for rabies virus. The prevalence of rabies in healthy bats is most likely lower, because bats submitted for public health testing are those that are easily captured, found in unusual locations and may be sick. Nonetheless, bats can be carriers of the virus. Therefore, a bat seen active during daylight hours or in an area where bats are not normally found – such as in living quarters of a dwelling or in a hospital – should be submitted for rabies testing if there have been potential human and/or domestic animal exposures, in order to determine if the exposed person(s) or domestic animal(s) require medical treatment to prevent possible development of rabies disease and death.

## **Animal Rabies**

Limited surveillance systems and lack of sensitive diagnostic tests for both human and animal rabies made it difficult to accurately estimate the number of rabies cases prior to the mid-1950s, but evidence of rabies in the United States goes back hundreds of years. In the late 1700s, rabies outbreaks in dogs and foxes were reported in the mid-Atlantic colonies of our country. In the 1800s, dogs and red foxes (*Vulpes vulpes*) were introduced by the British for fox hunting in New England; individual reports indicated a high incidence of dog rabies in the United States at the time. Although at that time there was no national surveillance system and human deaths were not commonly reported, a 1890 survey of death certificates showed 143 human deaths from rabies. In the 1920s, rabies prevention programs in the nation began to change from focusing solely on human vaccination to the development of animal vaccination and stray animal removal programs, as well as leash and muzzle ordinances. As a result, dog rabies in domestic animals decreased in incidence; however, cases in wild species began to increase. In 1938, when rabies in humans and other animals

became nationally reportable, up to 9,412 cases of animal rabies were reported per year (mostly in domesticated species), along with 47 human deaths. By 1960, wildlife were diagnosed more frequently with rabies than were domesticated animals. In 2008, canine variant rabies was declared eradicated from the United States by the Centers for Disease Control and Prevention (CDC). At the same time, other rabies variants were spreading.

In 1947, raccoon (*Procyon lotor*) rabies was first documented in Florida. The disease spread northward, entering South Georgia during the 1960s. Nettles et al. (1979) reported the translocation of rabies-positive raccoons into North Carolina from Florida by raccoon hunting clubs. It was not until 1991, however, that significant numbers of rabid raccoons in the wild were being reported in North Carolina. Such epidemic outbreaks of disease in animal populations, particularly diseases that may spread to humans, are called epizootics. The mid-Atlantic raccoon rabies epizootic is believed to have started with an outbreak of raccoon rabies in 1977 that was detected on the West Virginia-Virginia border. Again, translocation of rabid raccoons from Florida to a West Virginia hunting club was implicated. The disease subsequently spread from raccoon to raccoon at a rate of 18-24 miles each year from that West Virginia-Virginia focus northward to Canada and southward to North Carolina. The first counties experiencing the increase were in the northeastern portion of the state as the mid-Atlantic epizootic crossed into North Carolina. At the same time, the Florida epizootic of raccoon variant rabies was spreading northward from Georgia into the southeastern portion of the state; by 1992 several cases had showed up in Brunswick and Bladen Counties, and by 1993 the disease had spread into the southern piedmont and coastal plains. During 1995, spread of rabies into the northwestern corner of the state was attributed to a third distinct epizootic outbreak from southwestern Virginia that may have originated from the northern mid-Western states. The spread of rabies in North Carolina over time can be followed on maps on the N.C. Communicable Disease web site at <http://epi.publichealth.nc.gov/cd/rabies/figures.html#graph>.

### **Oral Rabies Vaccination (ORV) Program**

Rabies epizootics progress more quickly in preferred raccoon habitats, and the disease spills over into other mammalian species, mainly susceptible carnivores that share the same eco-niche including foxes, skunks, coyotes, bobcats, beavers and groundhogs. Major physiographic barriers, such as rivers and mountain ranges, can hinder the spread of terrestrial rabies. Although the Appalachian Mountains slowed the westward progression of the epizootic for a time, counties in western Virginia and western North Carolina now report raccoon rabies cases. The National Oral Rabies Vaccination (ORV) Program to inoculate wild raccoons against rabies began in 1997 and is administered by the Wildlife Services of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service ( APHIS USDA). It was developed to prevent the spread of raccoon rabies westward into the Ohio valley. Learn more about the National Rabies Management Program at [www.aphis.usda.gov/ws/rabies/background.html](http://www.aphis.usda.gov/ws/rabies/background.html). For details on the ORV program in North Carolina, see [www.aphis.usda.gov/wildlife\\_damage/oral\\_rabies/oral\\_rabies\\_info\\_by\\_state/north\\_carolina/index.shtml](http://www.aphis.usda.gov/wildlife_damage/oral_rabies/oral_rabies_info_by_state/north_carolina/index.shtml).

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