



## Rabies: The Epidemic Continues in Georgia

Rabies is perhaps the oldest known infectious disease (Rupprecht, 2002); its ancient history is evidenced by Greek and Chinese writings (Woldehiwet, 2002). Significant scientific progress, including the identification of virus strains in bats and the development of effective vaccines, has led to its current status as a completely preventable disease. Nonetheless, 55,000 people die of rabies each year across the world.

Although human rabies is extremely rare in Georgia, rabies risk assessments and the administration of post-exposure prophylaxis (PEP) are an everyday occurrence. Since 1991 there have only been two confirmed cases of human rabies infection in Georgia; both were fatal. There are many reasons for the high frequency of risk assessments and PEP in Georgia, including the increasing contact between human populations and wildlife in expanding suburban areas, hyper-endemic raccoon rabies, and the high number of animal bites reported.

### The Virus

Rabies is caused by an RNA virus of the family Rhabdovirus, genus *Lyssavirus*. Typically, within a geographic area rabies viruses are maintained in a single wildlife reservoir species and spread primarily in intraspecies transmission cycles with occasional interspecies spillover. In Georgia, for example, the primary wildlife reservoir for rabies is the raccoon, with spillover of the raccoon rabies virus variant to other wildlife species (e.g. foxes, skunks, etc.) and domestic animals. Bat rabies virus variants are found all across the contiguous United States.

Since rabies is an enveloped RNA virus, it does not survive in the environment (CDC, 2003; Johnson, 2006). Once outside the host, the virus is rapidly deactivated by drying and ultraviolet radiation, making fomites and bodies of water (e.g. water bowls used by infected animals) ineffective for disease transmission (Rupprecht, 2002).

### Animal Reservoirs

Globally, dogs are the major reservoir and vector of rabies (Rupprecht, 2002). In North America, however, rabies control programs have nearly eliminated this reservoir. Consequently, skunks and raccoons serve as the primary reservoirs in North America, with raccoons being the dominant reservoir in the Eastern U.S. (Kahn, 2006). Figures 1-4 illustrate the distributions of the four animal species most commonly diagnosed with laboratory-confirmed rabies in Georgia during 2006. However, keep in mind that laboratory submissions for rabies testing in Georgia result only from either human or domestic animal contact (e.g. bite or deep scratch) with a potentially rabid animal. Consequently, these data cannot be used to estimate the prevalence of rabies in each of the reported species. Each year in Georgia raccoons represent 55-60%

of positive animal rabies tests (Table 1). Bats are also a common rabies reservoir and associated with most human cases of rabies in the U.S. (CDC, 2003).

Several factors may explain the association of bats with human cases of rabies. It is often difficult to confirm a bat bite. The mouth of a bat may be less than 5mm across, and many people may not be aware that they have been bitten (Rupprecht, 2002). A person may wake up from sleep to find a bat in the room with them, or they may feel they were simply "brushed" by a bat. In addition, there is a lack of public awareness that bats are reservoirs of rabies virus.

Livestock (including horses) are considered a low risk of rabies transmission to humans because of low infection rates and the reduced probability of an aggressive manifestation of rabies infection in these species. Small rodents (squirrels, hamsters, chipmunks, rats, and mice) and lagomorphs (rabbits and hares) represent a very low risk of rabies transmission to humans, as they are rarely infected with rabies and have never been reported to transmit rabies to humans (CDC, 2003; Rupprecht, 2002). In 2006, at least 25 non-carnivorous species (i.e. squirrels, opossums, mice, moles, groundhogs, or otters) were submitted for rabies testing in Georgia; none were found to have rabies.

### Common Misperceptions about Rabies Exposures

The highest risk of rabies transmission is associated with a bite exposure from an infected animal, in particular terrestrial carnivores and bats (Table 1). In addition, direct contact of an open cut with saliva or central nervous tissue from a rabid animal may result in rabies transmission. However, there are several misperceptions about rabies exposures.

**Table 1: Animal Species that tested positive for rabies in Georgia during 2002-2006**

Species	Year (% of total animals)					Total (%)
	2002 (%)	2003 (%)	2004 (%)	2005 (%)	2006(%)	
Bat	26 (6.33%)	16 (4.0%)	18 (5.2%)	23 (9%)	28 (10.5%)	111 (6.6%)
Beaver	1 (.24%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)
Bobcat	3 (.73%)	3 (.75%)	5 (1.5%)	4 (1.6%)	1 (.37%)	16 (1%)
Cat	14 (3.4%)	20 (5.0%)	10 (2.9%)	9 (3.5%)	17 (6.4%)	70 (4.2%)
Cow	6 (1.5%)	1 (.25%)	3 (.87%)	0 (0%)	0 (0%)	10 (0.6%)
Coyote	0 (0%)	1 (.25%)	1 (.29%)	2 (.78%)	1 (.37%)	5 (0.3%)
Dog	5 (1.2%)	3 (.75%)	4 (1.2%)	4 (1.6%)	7 (2.6%)	23 (1.4%)
Fox	59 (14.4%)	43 (10.7%)	35 (10.2%)	16 (6.3%)	16 (6%)	169 (10.1%)
Horse	0 (0%)	4 (1.0%)	2 (.58%)	2 (.78%)	0 (0%)	8 (0.5%)
Llama	0 (0%)	0 (0%)	1 (.29%)	0 (0%)	0 (0%)	1 (0.1%)
Mule	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (.37%)	1 (0.1%)
Pig	0 (0%)	1 (.25%)	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)
Raccoon	247 (60.1%)	242 (60.2%)	227 (66%)	156 (60.9%)	154 (57.7%)	1026 (61.1%)
Skunk	50 (12.2%)	68 (16.9%)	38 (11%)	40 (15.6%)	42 (15.7%)	238 (14.2%)
Total	411	402	344	256	267	1680

A few of these are addressed below:

- **Misperception 1:** A person or animal that was exposed to blood, urine, or feces of a rabid animal is at risk for the disease. Correction: No exposure to rabies occurs upon contact with blood, urine or feces of a rabid animal. Rabies can only be transmitted via direct contact with saliva or central nervous tissue.
- **Misperception 2:** A person who pets their dog after it was attacked by a rabid animal is at risk for rabies infection. Correction: Rabies virus is not able to penetrate unbroken skin. In addition, the virus does not survive on the coat of an animal, so there is no risk to a person who has not had direct contact with the rabid animal.
- **Misperception 3:** A pet was attacked by a rabid animal a couple of days ago. The pet is unvaccinated, and now it licked the cut hand of its owner. The pet needs to be tested to see if it exposed its owner to rabies. Correction: The incubation period of rabies is weeks to months. Consequently, a pet will be not be capable of exposing other pets or humans or test positive for rabies until it becomes sick with rabies—weeks to months after the attack.
- **Misperception 4:** A person found a bat in their child’s room and it tested positive for rabies. However, post exposure prophylaxis (PEP) is not needed because no bite can be found on the child. Correction: Assessing the risk for rabies transmission from bats can be difficult, because bat bites are very small. Consequently, if a person has spent the night in a room with a bat, or a bat is found in a room with an unattended child, rabies post-exposure prophylaxis should be initiated. Please see the Georgia Rabies Manual (available at <http://health.state.ga.us/epi/zvbd/zoonotic/index.asp>) for specific details on assessing rabies transmission risk.

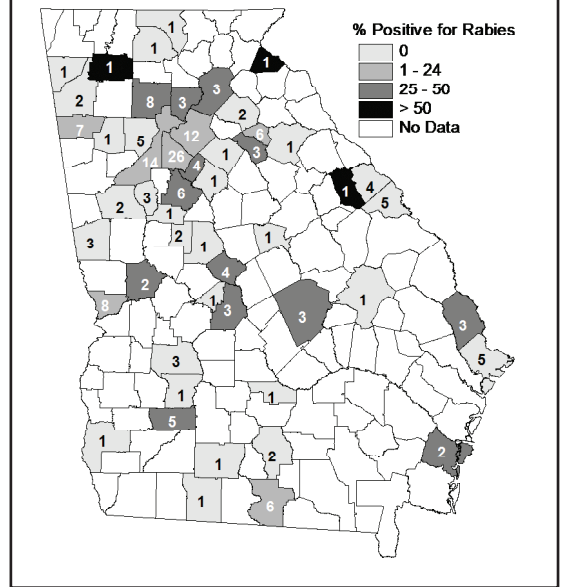
### Clinical Course and Diagnostic Testing for Human Rabies

The incubation period of the rabies virus in humans is variable and often lengthy, ranging from 2 weeks to years with an average of 2-3 months. The long incubation period contributes to the effectiveness of PEP for individuals exposed to rabies by allowing ample time to stimulate immunity (Kahn, 2006).

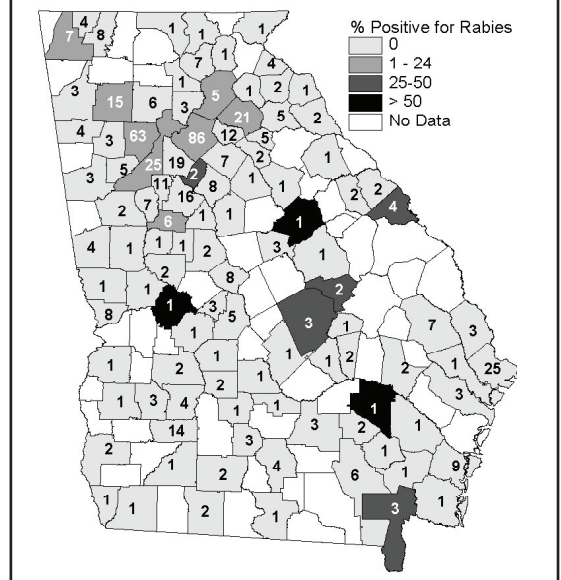
A person infected with rabies may initially present with nonspecific symptoms such as malaise, fever, or headache, which may last for days. Discomfort or paresthesias (pain or itching) may be experienced at the site of viral entry. As the disease progresses, signs of encephalopathy will be observed, commonly manifested by anxiety, confusion, and agitation (CDC, 2003). The symptoms most consistent with rabies are acute behavioral changes and unexplained progressive paralysis (Kahn, 2006). The acute clinical phase of rabies lasts 2 to 10 days. With rare exceptions, once clinical signs are observed, the disease is fatal. Treatment given at this point is typically supportive (CDC, 2003).

Prior to the onset of clinical signs, there are no tests to determine whether humans have been infected with the rabies virus. Serological testing (RFFIT) measuring the presence of antibodies in humans cannot be used to determine infection status prior to symptom onset. Diagnostic testing for suspected rabies infection requires several tests; no single test is sufficient for confirmation. Samples used for testing include saliva, nuchal skin biopsies, serum, and cerebrospinal fluid. All testing must be coordinated by the Georgia Division of Public Health, Notifiable Disease Epidemiology Section (404-657-2588).

**Fig. 1: Number of Bats Submitted for Testing and Proportion Confirmed Rabid in 2006**




**Fig. 2: Number of Cats Submitted for Testing and Proportion Confirmed Rabid in 2006**

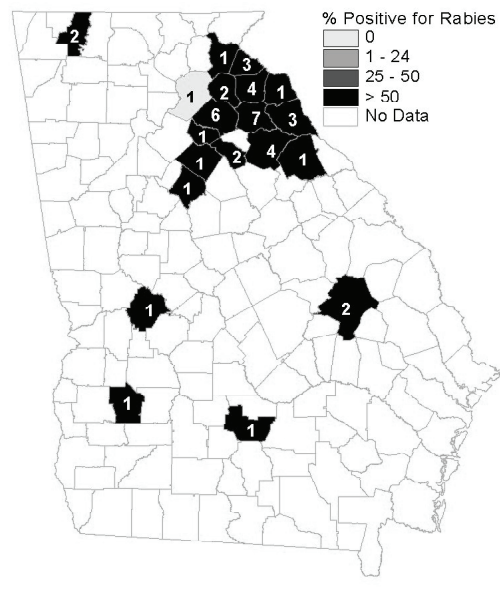


### Preventing and Treating Human Rabies

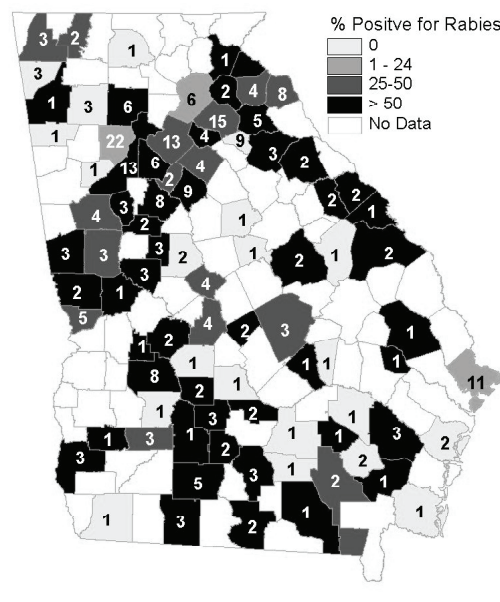
To prevent rabies, effective pre- and post-exposure prophylaxis regimens exist. Please see the Georgia Rabies Manual (available at <http://health.state.ga.us/epi/zvbd/zoonotic/index.asp>) for specific details regarding high risk sub populations and determining the need for PEP. If PEP is necessary, prophylaxis consists of administration of one dose

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**Fig. 3: Number of Skunks Submitted for Testing and Proportion Confirmed Rabid in 2006**



**Fig. 4: Number of Raccoons Submitted for Testing and Proportion Confirmed Rabid in 2006**



of human rabies immune globulin--HRIG and 5 doses of rabies vaccine over a 28-day period (except if persons have previously received complete pre-exposure or post-exposure vaccination regimens). Whenever the animal is available for testing, PEP should not be started before animal rabies test results are available because of the limited availability of HRIG. Likewise, PEP should not be started if an animal is in a 10 day quarantine. Modern rabies vaccines do not require painful intra-abdominal inoculation and are well tolerated with few systemic side effects. Consequently, there should be minimal fear associated with receiving PEP. To date, there have been no cases of human rabies documented in the U.S. after PEP was administered in an appropriate and timely manner after an exposure (CDC, 2003).

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September 8, 2007 is the Inaugural World Rabies Day. Go to [www.worldrabiesday.org](http://www.worldrabiesday.org) to get information about events planned all over the world to raise rabies awareness and promote prevention.

## Animal Bite Surveillance

As a component of injury prevention and rabies control, animal bites are reportable in Georgia. Animal bites are reported to the local health department and the Notifiable Disease Epidemiology Section (NDES) of the Georgia Division of Public Health. Many other zoonotic diseases can be spread from animals to humans as a result of an animal bite (e.g. bartonellosis, pasteurellosis, and streptobacillosis). However, rabies is considered the most dangerous of the zoonotic diseases, resulting in an encephalomyelitis that is essentially always fatal.

There are two systems used by NDES for the collection of animal bite surveillance data. Bites are directly reported from local health departments via on-line or mail-in submissions, through the state electronic notifiable disease surveillance system (SendSSS) and indirectly reported by phone to the Georgia Poison Center (GPC) (404-616-9000 or 1-800-222-1222). GPC provides advice regarding wound treatment, post exposure prophylaxis (PEP) for rabies, and animal quarantine/testing. Often, emergency room and medical personnel report animal bites to GPC whereas animal control agencies and county environmental health specialists report via SendSS.

When an animal bites a human or domestic animal and is considered likely to be rabid, it is quarantined or submitted to the Georgia Public Health Laboratory for testing. Animals confirmed to be rabid are reported to NDES and entered into SendSS. Of the 867 documented rabid animals in Georgia during 2004-2006, 184 (21% of all submissions) were reportedly associated with a human exposure. The species of rabid animals that bit/exposed a human are shown in the table below.

Animal	Number of Confirmed Human Exposures
Raccoons	63 (34.2%)
Bats	35 (19%)
Cats	31 (16.8%)
Foxes	25 (13.6%)
Dogs	10 (5.4%)
Skunks	9 (4.9%)
Livestock	5 (2.7%)
Coyotes	3 (1.6%)
Bobcats	3 (1.6%)

**Please look for our upcoming detailed report on animal bite surveillance in Georgia in the November 2007 issue of the GER.**

**This article was written by Dana Cole, D.V.M., Ph.D., and Laura Atkins, M.S.**



**Reported Cases of Selected Notifiable Diseases in Georgia, Profile\* for June 2007**

Selected Notifiable Diseases	Total Reported for June 2007	Previous 3 Months Total Ending in June			Previous 12 Months Total Ending in June		
	2007	2005	2006	2007	2005	2006	2007
Campylobacteriosis	77	187	139	189	607	576	617
<i>Chlamydia trachomatis</i>	21	8120	10121	3447	33484	37451	34318
Cryptosporidiosis	16	26	54	35	167	201	253
<i>E. coli</i> O157:H7	2	6	12	4	20	38	33
Giardiasis	59	168	140	148	850	685	692
Gonorrhea	4	3666	4994	1301	15837	18268	16163
<i>Haemophilus influenzae</i> (invasive)	10	26	27	32	114	111	125
Hepatitis A (acute)	8	37	15	20	189	87	70
Hepatitis B (acute)	11	44	65	25	334	186	164
Legionellosis	1	9	9	8	32	36	44
Lyme Disease	1	1	3	3	5	8	7
Meningococcal Disease (invasive)	2	5	6	4	18	17	19
Mumps	0	0	4	0	3	5	0
Pertussis	2	15	5	4	41	34	27
Rubella	0	0	0	0	0	0	0
Salmonellosis	149	408	360	362	1936	1902	1931
Shigellosis	196	128	259	631	555	888	1802
Syphilis - Primary	4	25	42	10	103	147	78
Syphilis - Secondary	14	141	104	56	487	486	433
Syphilis - Early Latent	5	108	98	31	350	401	311
Syphilis - Other**	36	264	260	150	957	992	863
Syphilis - Congenital	0	1	3	1	4	7	4
Tuberculosis	38	122	124	125	491	501	500

\* The cumulative numbers in the above table reflect the date the disease was first diagnosed rather than the date the report was received at the state office, and therefore are subject to change over time due to late reporting. The 3 month delay in the disease profile for a given month is designed to minimize any changes that may occur. This method of summarizing data is expected to provide a better overall measure of disease trends and patterns in Georgia.

\*\* Other syphilis includes latent (unknown duration), late latent, late with symptomatic manifestations, and neurosyphilis.

**AIDS Profile Update**

Report Period	Disease Classification	Total Cases Reported*			Percent Female	Risk Group Distribution (%)						Race Distribution (%)			
		<13yrs	>=13yrs	Total		MSM	IDU	MSM&IDU	HS	Unknown	Perinatal	White	Black	Hispanic	Other
Latest 12 Months**:	HIV, non-AIDS	34	3,454	3,488	28	28	4	2	10	55	0.9	24	70	6	<1
8/06-7/07	AIDS	12	1,988	2,000	26	29	6	1	10	53	0.5	25	68	6	<1
Five Years Ago:***	HIV, non-AIDS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/02-7/03	AIDS	1	1,677	1,678	25	37	9	3	15	36	-	19	74	6	1
Cumulative:	HIV, non-AIDS	265	11,586	11,851	32	28	7	2	11	50	2	23	73	4	<1
07/81-7/07	AIDS	279	37,067	37,346	20	43	15	5	13	23	0.7	31	66	3	<1

Yrs - Age at diagnosis in years      MSM - Men having sex with men      IDU - Injection drug users      HS - Heterosexual

\* Case totals are accumulated by date of report to the Epidemiology Section    \*\* Due to a change in the surveillance system, case counts may be artificially low during this time period

\*\*\*HIV, non-AIDS was not collected until 12/31/2003