ABSTRACT

PALAMAR, MARIA BARON. Challenges and Opportunities for Raccoon (*Procyon lotor*) Oral Rabies Vaccination and Public Health Campaigns in Urban Environments. (Under the direction of Drs. Maria T. Correa and Christopher S. DePerno.)

Beginning in the late 1970s, a strain of rabies associated with raccoons (*Procyon lotor*) rapidly spread along the East coast of the United States, with many states reporting over 500 cases a year. Raccoon-strain rabies can infect companion animals, livestock, other wildlife and even humans, and raccoons are the major vector of this disease in Eastern North America. Urban areas provide ideal environments for the spread of zoonotic diseases such as rabies from wildlife to human and domestic animal species. At the end of 2007, Guilford County, NC, had the highest number of rabies positive wildlife cases per county in the state. Pet vaccination, wildlife vector management and public health education may well be the most efficient ways to prevent a rabies epidemic in an urban environment.

Human behaviors play a fundamental role in the epidemiology of urban wildlife diseases, and those behaviors are shaped by knowledge and ethnicity. Guilford County, and in particular the city of Greensboro, has a total population of 237,423, of which 15,412 are Hispanic/Latino and 88,587 are African American. Ethnic minorities, particularly Latinos, are growing in numbers throughout the U.S. and are becoming critically important for wildlife management and public health outreach programs. We evaluated knowledge of rabies, transmission routes, vector species, and response to rabies exposure with a bilingual (English/Spanish) in person survey in Greensboro, North Carolina. Ethnicity, gender and

education level were predictors of rabies knowledge. Latinos and African Americans had less rabies knowledge than non-Latino Whites.

Non-Latino Whites and men had less rabies knowledge than women. Only 41% of African American respondents identified animal bites as a route of rabies transmission to humans, and less than half of all respondents knew that washing a bite wound with soap and water was useful prevention. Our knowledge scale was internally consistent (Cronbach's alpha = 0.73) and could be valuable for future studies of zoonotic disease knowledge. Future rabies educational campaigns should focus on developing culturally sensitive, language appropriate educational materials geared to minorities.

Guilford County also needed to assess the pet vaccination status and awareness of rabies vaccination clinics offered by the County. Furthermore, they needed to understand how the public would respond to rabid animals and how to deliver information about rabies and rabies clinics to them in the future. To address this need, we asked several outreach questions in addition to the knowledge questions as part of the initial bilingual (English/Spanish) survey of people residing in Greensboro, NC. Our results indicated that most pet owners report vaccinating their pet. Most Latinos were not aware of rabies vaccination clinics offered by the county and they preferred to obtain future rabies information through the radio and TV, as do African Americans. Most non-Latino whites were aware of the rabies clinics offered by the county and preferred to obtain future information through the internet.

The final aspect of controlling and eventually eradicating raccoon rabies from urban environments was to implement wildlife management measures that reduce the risk of rabies. Because raccoons are the most important rabies vector in eastern US, we developed a program for the control of rabies associated with raccoons in Greensboro, NC.

The U.S. Department of Agriculture - Wildlife Services has established the National Oral Rabies Vaccination (ORV) Program with the goal of limiting the westward expansion of raccoon rabies. In the ORV program, baits inoculated with rabies vaccination are distributed aerially. However, aerial vaccines are distributed primarily in rural areas where raccoon density is reported to be lower than in urban environments, aerial baiting limited effectiveness in urban/suburban environments. ORV baiting devices and the associated cost have not been extensively evaluated in urban environments. Additionally raccoon pre-vaccination serology is necessary to determine the prevalence of rabies virus neutralizing antibodies in raccoons before administering a rabies vaccine, and to accurately evaluate the effects of the oral vaccination in a specific population.

To determine efficacy and cost of baiting devices; the species attracted to the bait; and raccoon rabies titters pre ORV delivery, we established bait stations and trapping with trail cameras at 28 different locations within the city limits of Greensboro. We had 4 baiting and trapping periods to evaluate the effectiveness of the oral bait delivery stations and to obtain tissue samples from resident raccoons. Raccoons were captured in 83% of photographs and we observed raccoon activity in 27 out of 28 baiting stations. We sampled 80 unique raccoons and 3.6% of the samples were positive for rabies. Additionally we

calculated that it would cost the city of Greensboro $3,665 per year to build, install, bait and remove the required amount of bait stations for the amount of green space that they currently have.

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Challenges and Opportunities for Raccoon Oral Rabies Vaccination and Public Health Campaigns in Urban Environments

by
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DEDICATION

To my teachers, all of them, starting with my dad, Jorge, that taught me curiosity and wonder, my mother, Monica, that taught me compassion, my husband, John that taught me loyalty and perseverance, and my sons, Hazen and Gael, that made everything fall into perspective. To all of you I owe the person that I am today.

BIOGRAPHY

Maria Baron Palamar was born on June 25, 1980 in Bariloche, Argentina. Due to her father's academic career, Maria lived in Argentina, Spain and the United States before going back to Argentina to finish her high school studies and earn a Doctorate in Veterinary Medicine from the Universidad Nacional de Rio Cuarto. Since she can remember, Maria wanted to be a veterinarian, but after participating in a couple of wildlife related projects conducted by The Wildlife Conservation Society, she realized that she wanted to be a wildlife disease biologist as well. In 2006 she moved to the US after meeting her husband, John, in 2007 she started a PhD in the Fisheries and Wildlife Conservation Biology program at North Carolina State University. Maria has a passion for wildlife and education that she plans to continue to explore for the rest of her life.

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I would also like to thank my parents, who planted the seed of curiosity in me, a seed that has led to a life of learning. My parents have always supported every aspect of my life, being both my teachers and my greatest fans. Last, I would like to thank my husband, John, for believing in me even when things got hard, for always being on my side and for the patience and loyalty that he had for me during this whole process; I am so thankful for I having him in my life.

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Assessing Rabies Knowledge and Perceptions Among Ethnic Minorities in Greensboro, North Carolina

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ABSTRACT Human behaviors play a fundamental role in the epidemiology of urban wildlife diseases, and those behaviors are shaped by knowledge and ethnicity. We evaluated knowledge of rabies, transmission routes, vector species, and response to rabies exposure with a bilingual (English/Spanish) in-person survey in Greensboro, North Carolina. Ethnicity, gender, and education level were predictors of rabies knowledge. Latinos and African Americans had less rabies knowledge than non-Latino Whites. Non-Latino Whites and men had less knowledge than women. Only 41% of African American respondents identified animal bite as a route of rabies transmission to humans, and less than half of all respondents knew that washing a bite wound with soap and water was useful prevention. Our knowledge scale was internally consistent (Cronbach's alpha = 0.73) and could be valuable

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for future studies of zoonotic disease knowledge. Future rabies educational campaigns should focus on developing culturally sensitive, language appropriate educational materials geared to minorities.

KEY WORDS African American, bilingual, education, gender, Hispanics, Latino, public health, rabies, urban, zoonotic disease.

Urban areas often provide ideal environments for the spread of zoonotic diseases from wildlife because they host high densities of humans, pets, and wildlife vectors (Vandruff et al. 1994). In fact, urban environments that include minimal amounts of green space can host greater population densities of wildlife species considered zoonotic disease vectors than rural environments by facilitating greater reproduction rates and increased survival (Prange et al. 2003). Raccoons (*Procyon lotor*) are widespread in North America, present in high densities in urban environments (Riley et al. 1998, Smith and Engeman 2002), and hosts for a large number of pathogens (e.g., *Leptospira interrogans*, canine distemper, rabies, and feline panleukopenia) that can infect other wildlife, pets, and humans (Junge et al. 2007). The current rabies epidemic in the Eastern United States is associated with a raccoon variant of the rabies virus and raccoons are believed to be the primary reservoir (Rupprecht et al. 1988).

Humans play a fundamental role in the epidemiology of urban diseases by making personal decisions related to pet vaccination and feeding, trapping, and removing wildlife. Despite the critical role of these human behaviors, little information exists on urban residents' knowledge about rabies or other zoonotic diseases. Fontaine and Schantz (1989) noted that 63% of the residents in De Kalb County, Georgia, were not well informed about

health hazards associated with animals regardless of education level. Also, Bingham et al. (2010) concluded that dog owners believed the most common way for people to get rabies was wild animal bites and only 59% of the respondents were aware that without treatment, rabies exposure leads to death. Less educated people and males may be less familiar with companion animal health and vaccination needs than more educated people and females, respectively (Ramon et al. 2010). Lack of rabies knowledge and pet vaccination compliance are not directly related to income level, but they are related to gender and education level (Ramon et al. 2010). Non-vaccinated pets present a serious risk to people because they are usually most likely to contact wildlife rabies reservoirs such as raccoons and coyotes (*Canis latrans*) exposing the people around them to rabies (Ruprecht et al. 1995).

Research from the public health discipline indicates that ethnicity may be a crucial factor shaping disease knowledge (Williams and Ekundayo 2001, Altschuler et al. 2008). Ethnic minority populations, particularly Latinos, are growing much faster than the general United States population and becoming critically important for wildlife management and outreach programs (Lopez et al. 2005). Understanding and engaging minorities in wildlife management and public health programs requires the development of bilingual (Spanish/English) and culturally-sensitive educational materials. Developing these materials requires an understanding of how knowledge and perceptions of zoonoses differ among ethnically and culturally diverse publics. Although the association between cultural and ethnic background and knowledge of zoonotic diseases has not been thoroughly explored, disparities between the health knowledge of non-Latino Whites and minorities have been

documented repeatedly in other public health areas, such as sexually transmitted diseases (STDs) and oral health (Altschuler et al. 2008). For example, minorities living in urban settings have less knowledge and greater incidence of diseases like acquired immunodeficiency syndrome (AIDS) and syphilis due in part to the lack of culturally sensitive educational materials targeted for the specific audience at risk (Williams and Ekunday 2001, Altschuler et al. 2008). Research is needed to determine if similar ethnic disparities in zoonotic disease knowledge are emerging.

We began addressing this need with a bilingual (English/Spanish) survey of residents from Greensboro, North Carolina. In this survey, we assessed knowledge of rabies risk, transmission routes, vector species, and first response to rabies exposure. The city of Greensboro located in Guilford County, North Carolina, is a good case study because it is ethnically diverse with 6.5% of the total population being Hispanic/Latino and 37.3% African American (U.S. Census Bureau 2010 American Community Survey). Between 2006 and 2007, 57 animal rabies positive cases were confirmed in Greensboro; 33 were from raccoons. To evaluate rabies knowledge among ethnically diverse groups in Greensboro, North Carolina, we created a rabies knowledge scale and compared scores by the demographic characteristics of the respondents.

STUDY AREA

For our study, we surveyed 4 neighborhoods in Greensboro, North Carolina. We selected the neighborhoods based on income distribution and included 1 higher income neighborhood, 1 middle income neighborhood, and 2 lower income neighborhoods (median household

incomes for 2010 were $92,712, $53,860, and $31,995, respectively). The neighborhoods selected were located within the Northwest quadrant of the city of Greensboro because of the high number of rabies positive raccoon cases reported in 2006 and 2007 (Guilford county Environmental Health Department 2007).

METHODS

During October–November 2009, we administered a questionnaire to the adult (18 years or older) who answered the door of every third dwelling in 4 neighborhoods of Greensboro, North Carolina. Our face-to-face sampling strategy helped reduce sampling bias associated with telephone surveys because many households may not have land lines, especially in lower income neighborhoods (Nyhus et al. 2003, Peterson et al. 2008). We surveyed all selected neighborhoods on a weekday and a weekend day during mornings and afternoons to decrease bias associated with sampling during 1 time period. When no one was home or the person refused to answer the questionnaire in the selected house, we attempted to survey the next house and restarted the count. For survey administration, we hired 10 interviewers, 4 male and 6 female, who worked in pairs. To ensure consistency, the primary author trained all the interviewers. Each interviewer had English and Spanish copies of the questionnaire and at least 2 bilingual interviewers were available during sampling days. The interviewers asked each respondent which language, English or Spanish, he or she preferred; if Spanish was chosen, the respondent was asked if he or she wanted a bilingual interviewer.

We designed a Spanish and English version of the questionnaire to assess knowledge of rabies transmission and symptoms, how people learned about rabies, and pet vaccination

status. The questionnaire was initially developed in English, translated to Spanish by a native Spanish speaker, and translated back to English to check for accuracy and consistent meaning. We elicited information on the previous year's income divided in 9 categories (classified as: 0 ≤ $14, 999; 1 = $15,000–$19,999; 2 = $20,000–$24,999; 3 = $25,000–$29,999; 4 = $30,000–$34,999; 5 = $35,000–$39,999; 6 = $40,000–$49,999; 7 = $50,000–$59,999; and 8 ≥ $60,000), age, education divided in 5 categories (0 = completed grammar school, 1 = completed high school, 2 = incomplete college, 3 = completed college, and 4 = completed graduate level education), years of residence, number of household residents, gender, and ethnicity. We assessed ethnicity, as defined in United States Census Bureau (2010), by asking if they were Hispanic or Latino, followed by asking their race and gave the options of White, Asian, Black or African American, Native American, and Hawaiian or other Pacific Islander. Respondents could self-classify as Hispanic or Latino and then add race such as White or African American. All people that self-classified as Hispanic or Latino regardless of their race classification were considered Latino. When respondents did not self-classify as Hispanic or Latino and chose White for race, they were considered non-Latino Whites. Respondents that chose African American for race and did not self-classify as Hispanic or Latino were considered African American. Finally, we asked respondents if they would say they had no, some, or a lot of knowledge regarding rabies.

To help us understand the association between different ethnic and socio-economic groups and their knowledge of rabies transmission, we created a knowledge scale (Table 1) that was based on the rabies information available at the Center for Disease Control and

Prevention (CDC) webpage (http://www.cdc.gov/rabies/) and from the American Veterinary Medical Association rabies brochure (https://ebusiness.avma.org/EBusiness50/files/productdownloads/rabies_brochure.pdf). We generated 15 questions to assess knowledge needed to reduce risk of rabies exposure and infection (Table 1). For the first 14 questions, the answer choices available were "yes," "no," or "not sure;" we considered the "not sure" option to be incorrect (a person that did not know the answer to these specific questions is at higher risk of rabies exposure than one that knew the correct answer), and the correct answer could be yes or no, depending on the question (Table 1). For the last question, we considered the answer correct when the respondents choose the option "Call someone who can take care of it" (Table 1). Each respondent was given a knowledge score based on the number of correct answers to the 15 knowledge questions, the knowledge score values ranged from 0 to 15.

We used analysis of variance (ANOVA) or the Kruskal-Wallis test as appropriate to compare attributes of ethnic groups using SAS/STAT® software (SAS Institute, Cary, NC.) and Minitab 15 software (Minitab Inc., Taipei, China). We used Cronbach's alpha to determine the internal consistency of our knowledge scale. Finally, we used linear regression to identify variables predicting rabies knowledge.

RESULTS

We interviewed people in 301 households. Compliance rate was 79%. We identified respondents as non-Latino White (75%, $n = 220$), Latino (11%, $n = 33$), and African American (13%, $n = 40$; Table 1). Although we could not directly determine ethnicity of

non-respondents, we compared neighborhood-level response rates between 2 neighborhoods, 1 that had 72% White residents, 17% African American, and 8% Latinos, and 1 that had 41% White, 50% African American, and 8% Latino residents (U.S. Census 2010). Response rates were 84% and 80%, respectively, indicating response rates did not differ based on the demographic composition of neighborhoods. Males accounted for 51% of all respondents, 50% of Latinos, 65% of African Americans, and 49% of non-Latino Whites. Latino and African American respondents were relatively younger and lived in the area for less time compared to Non-Latino Whites (Table 2). Latinos and African Americans had lower income levels than Non-Latino Whites (Table 2) and 65% of the Latino respondents said that their household income was less than $20,000 a year. Most (77%) of the non-Latino White respondents reported earning more than $35,000 year. Latinos had lower education levels than African Americans and non-Latino Whites (Table 2), with 39% of the Latino respondents having only completed grammar school. College completion was 8 times greater among White respondents (65%) than African Americans (8%). Latino and African American respondents had lower rabies knowledge scores than non-Latino Whites (Table 2).

When we asked respondents what they considered their level of rabies knowledge, 88% indicated they had some knowledge of rabies, 9% had no knowledge, and 3% had a lot of knowledge. Interestingly, 24% of Latinos, 15% of African Americans, and 5% of non-Latino Whites believed they had no knowledge of rabies. We detected a high degree of internal consistency for the knowledge scale (Cronbach's alpha = 0.73).

The multivariate regression model suggested ethnicity, gender, and education level were the best predictors of rabies knowledge score (Table 3). Based on standardized coefficients, ethnicity was the most influential predictor, followed by education level and gender (Table 3). Latinos ($\bar{x}$ = 10.5, SE = 0.46) and African Americans ($\bar{x}$ = 11.2, SE = 0.46) had lower knowledge scores compared to non-Latino Whites ($\bar{x}$ = 13, SE = 0.15). Women ($\bar{x}$ = 12.6, SE = 0.21) had higher knowledge scores than men ($\bar{x}$ = 12.4, SE = 0.19). Finally, respondents with graduate or professional degrees had higher ($\bar{x}$ = 13, SE = 0.19) rabies knowledge scores than respondents who only finished grammar school ($\bar{x}$ = 10.37, SE = 0.6).

DISCUSSION

The rabies knowledge differences among ethnicities detected in this case study may be explained by rabies epidemiology and the availability of rabies education materials. Differing epidemiology and outreach associated with rabies in the United States and Latin America may influence low rabies knowledge scores among Latinos. The majority of the non-United States born Latinos residing in Greensboro were originally from Mexico (U.S. Census Bureau 2010). In Mexico, dogs are the primary rabies vector for humans (Schneider et al. 2011) and public health campaigns focus on dogs (World Health Organization 2005). Mexico started a nationwide dog vaccination campaign in 1990 and more than 150 million vaccines were administered to dogs between that year and 2005 (Lucas et al. 2008). The number of dog-mediated human cases of rabies decreased from 60

in 1990 to 0 in 2000 thanks to this very successful mass vaccination campaign (Lucas et al. 2008). In our study, 85% of Latino respondents knew that dogs were carriers of rabies and could infect humans, but when asked about raccoons and bats as rabies vectors, the number of correct answers declined by 30%. Lower rabies knowledge scores among Latino residents (compared to non-Latino Whites) could be due in part to lack of accessibility (language and cultural barriers) to educational efforts. At the time of this study, all educational materials related to rabies in North Carolina were in English. Educational materials are more likely to promote a behavioral change in Spanish speaking people when they are available in Spanish (Streit-Kaplan et al. 2011). Further, places where English education materials are distributed to the public (e.g., animal control organizations, environmental or public health departments, and CDC) are not typically frequented by Latinos (Essien et al. 2000). Officials in charge of rabies clinics in Guilford County showed some concern because they had not seen many Latinos at the clinics (personal communication with anonymous animal control official). Typically, the best way to reach Latinos is to disseminate information in forums they frequently attend such as churches, local Latino markets, and community groups and local non-governmental organizations with social action orientation (Livingston et al. 2008).

Although African Americans did not face a language barrier, they still had lower rabies knowledge scores than non-Latino Whites; African American scores were similar to Latinos in most cases. Notable differences occurred on questions about which species could be rabies vectors and whether humans could become infected, where African Americans

scored higher. The higher scores among African Americans for these questions may reflect the aforementioned differences in rabies information campaigns in Mexico. The shared low knowledge scores on other questions, however, may reflect distrust of the public health sector among African Americans (Thomas and Crouse Quinn 1991, Corbie-Smith et al. 2002). Research focusing on human health suggested Latinos were more receptive to new educational materials than African Americans (Altschuler et al. 2008). African Americans are more receptive to public health educational materials when they know and trust the information source (Aruffo et al. 1991, Corbie-Smith et al. 2002). For instance, offering condoms and educational materials to African Americans at their local barber shop or hairdresser was an effective way of reducing high risk sexual activities (Lewis et al. 2002, Charania et al. 2010). One option for addressing low rabies knowledge within the African American community would be building trust, but agencies associated with public health may face serious challenges associated with past abuses perpetrated against the African American community such as those associated with the Tuskegee syphilis experiment (Thomas and Crouse Quinn 1991, Corbie-Smith et al. 2002). Another option would be disseminating health messages through trusted outlets including community businesses and churches (Lieberman and Harris 2006, Charaniaet al. 2010). Future research should address the extent mistrust of the public health sector among African Americans explains their relatively low rabies disease knowledge.

Our results indicate that education level may predict knowledge of zoonotic diseases in ways similar to other public health and veterinary issues across ethnicities. For instance,

people with higher education knew more about AIDS transmission risks, prevention, and sources for information than people with less education (Aruffo et al. 1991, Essien et al. 2000). Further, individuals that attended school longer may have an increased ability to apply knowledge about disease risk and response (Aruffo et al. 1991). Also, people with higher education levels know more about animal behavior and health needs including vaccinations (Ramón et al. 2010). Because education level seems to be an important factor in rabies knowledge, educational materials related to zoonotic disease management should be modified to convey information that can be understood by a less educated public.

The relatively weak gender effect detected in this study with women having more rabies knowledge than men, which differs from previous research on wildlife knowledge (Peterson et al. 2008), but may be explained by this study's focus on health rather than wildlife identification. Although research assessing wildlife knowledge indicates that males have more wildlife knowledge than females (Kellert and Berry 1987, Kassilly 2006, Peterson et al. 2008), studies regarding pets have shown that women, especially mothers, are more knowledgeable about their pets' needs than males (Reisner and Shofer 2008). Our results suggesting women have more rabies knowledge than men may be explained by the tendency for women, even those who are employed full time, to take roles managing risk, and protecting the health of their children in United States households (Maume 2008). Generally, men take less time off work to manage the urgent care of their children (Maume 2008), which could lead to less contact with pediatricians and other sources of health information. Also, women are more likely to keep their pets longer (New et al.

2000) and show greater attachment to pets (Ramon et al. 2010), giving them more opportunities to encounter rabies information when they take their pets to the veterinarian or rabies clinics for vaccinations and checkups. In particular, Hispanic women are often responsible for domestic animals associated with a household (Peña 1998, Belknap and VandeVusse 2010), which indicates females may be a conduit for zoonotic disease related information. Future research should consider Latino women as outreach targets for education on zoonotic diseases and other public health issues; although, more research is needed in this area.

MANAGEMENT IMPLICATIONS

The knowledge scale developed for this study could be adapted and used for assessments of zoonotic disease knowledge in other areas and with other diseases to determine if the serious knowledge deficiencies associated with vectors, transmission, and first response occur for other diseases. This study highlighted key deficiencies in rabies knowledge that should be addressed. First, ethnic minorities need information highlighting potential for human infection by rabies. Similarly, less than half of the minority respondents knew humans could contract rabies through being bitten by an animal, a serious knowledge deficit that must be addressed by agencies charged with management of zoonotic diseases. Also, our results indicate need for emphasis on informing immigrant populations about local rabies vectors, as those populations may be encountering these wildlife species for the first time. Our results highlight some educational needs that are independent of ethnicity; for example, fewer than half of respondents from all ethnic groups knew that washing a bite

wound with soap and water was useful treatment for preventing rabies after being bitten by an animal. Even though educational campaigns should be careful not to suggest washing can replace post-exposure vaccination, the most efficient means of preventing rabies aside from vaccinations (http://www.cdc.gov/rabies/) should be relatively well known among the public. The high incidence of "not sure" answers in this study suggests education may be particularly effective in zoonotic disease education efforts since people are more receptive to outreach materials when they recognize they lack information about a health subject (Altschuler et al. 2008).

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Table 1. Rabies knowledge scale questions and frequency of correct answers (percentage) for each ethnic group, Greensboro, North Carolina, 2009.

Knowledge question	Percent correct (percent unsure[a])		
	Latino (*n* = 33)	African American (*n* = 40)	White (*n* = 220)
Do you think a house cat, dog or ferret can get INFECTED with RABIES in the ways listed below?			
1) Being bitten by an animal that has rabies	97 (0)	85 (0)	98 (0)
2) I do not think a house cat, dog or ferret can get infected with rabies	64 (9)	82 (5)	88 (4)
3) Only wildlife can became infected with rabies	79 (6)	90 (3)	98 (2)
Do you think that the following animal behaviors are SYMPTOMS of RABIES?			
4) The animal presents foam in the mouth, hyper salivation	88 (12)	82 (13)	95 (4)
5) Displays slight or partial paralysis (that is, loss of muscle control when walking)	39 (36)	41 (49)	74 (22)

Table 1. Continued

6) Strange behavior, such as walking in circles	64 (27)	59 (28)	80 (15)
7) Aggressive behavior, such as eager to bite	91 (6)	84 (3)	94 (5)
Do you think a human can become INFECTED with RABIES in the ways listed below?			
8) Being bitten by an animal that has rabies	67 (33)	41 (23)	74 (23)
9) I don't think a human can become infected with rabies	52 (9)	77 (8)	89 (1)
Do you think humans can get rabies from the animals listed below?			
10) Dogs	85 (3)	100 (0)	99 (0)
11) Cats	73 (18)	85 (13)	95 (4)
12) Raccoons	56 (31)	98 (3)	97 (2)
13) Bats	58 (27)	85 (13)	92 (5)
Which of the following procedures are useful for preventing rabies in humans after they have been bitten by an animal?			
14) Washing the wound with water and soap	45 (21)	40 (23)	49 (21)

Table 1. Continued

If you were to encounter a large dog you suspect has rabies in your neighborhood, what you do?			
15) Call someone who can take care of it	97	92	94

[a] Unsure answers were treated as incorrect because respondents did not know the correct answer.

Table 2. Comparison of Latino (*n* = 33), African American (*n* = 40), and White (*n* = 216) respondents' demographic information and knowledge score, Greensboro, North Carolina, 2009.

Variable	Mean (SE)			χ^{2a}	F^{b}	*P*
	Latinos	African Americans	Non-Latino Whites			
Age	34.58 (2.36)A[c]	43.2 (2.19)A	52.92 (1.11)B		23.20	<0.001
Education	0.84 (0.15)A	1.76 (0.16)B	2.64 (0.06)C	71.96		<0.001
Income level	$18,696 (0.48)A	$27,823 (0.46)A	$51,694 (0.21)B	57.65		<0.001
Years resident	9.52 (1.51)A	17.53 (2.74)A	24.50 (1.19)B		13.02	<0.001
Rabies knowledge score	10.52 (0.47)A	11.20 (0.46)A	12.98 (0.14)B		20.05	<0.001

[a] Kruskal-Wallis Test.

[b] Analysis of variance.

[c] Comparisons significant at the 0.05 level are indicated with different letter (A, B, C

Table 3. Linear regression model for prediction of rabies knowledge among survey respondents in Greensboro, North Carolina, 2009. (*n* = 232)

Variable	Age	Sex[a]	Latino[b]	African American[b]	Education level[c]	Income level[d]	Years resident	r^2
Coefficient (standardized coefficient)	0.001 (0.008)	0.460 (0.097)	-1.655 (-0.205)	-1.918 (-0.268)	0.356 (0.169)	0.009 (0.012)	0.009 (0.073)	0.203
P	0.905	0.105	0.005	0.000	0.032	0.873	0.290	

[a] Male = 0, Female = 1.

[b] Hispanic = 0, African American = 1, compared to White = 2.

[c] Completed grammar school = 0, completed high school = 1, incomplete college = 2, completed college = 3, and completed graduate level education = 4.

[d] ≤ 14, 999 = 0; $15,000–$19,999 = 1; $20,000–$24,999 = 2; $25,000–$29,999 = 3; $30,000–$34,000 = 4; $35,000–$39,999 = 5; $40,000–$49,000 = 6; $50,000–$59,999 = 7; and ≥ 60,000 = 8.

Public Preference Towards Rabies Pet Vaccination and Rabies Information Dissemination in Greensboro, North Carolina.

INTRODUCTION

Urban areas provide ideal environments for the spread of zoonotic diseases from wildlife to human and domestic animals because of the high wildlife population densities (VanDruff et al. 1994). Urban environments with minimal amounts of green space can host higher population densities of wildlife species than rural environments because of higher reproduction rates and increased survival (Prange et al. 2003). Rabies is an important zoonosis that affects wild and domestic animals and humans. The current rabies epidemic in the Eastern United States is associated with a raccoon (*Procyon lotor)* variant of the virus (Rupprecht, 1988). Raccoons are a widespread throughout North America and present in high densities in urban environments (Riley et al., 1998; Smith et al., 2002). Raccoons have adapted well to urban and suburban areas by using human housing to den and waste, scraps, pet food, residential gardens and urban proximate crops to feed (Rosatte, 1991). Furthermore, raccoons are hosts for a large number of pathogens (e.g., *Leptospira interrogans*, canine distemper, rabies and feline panleukopenia), that can infect animals and people (Junge et al. 2007). Therefore, interactions between raccoons, humans, and their companion animals have increased public health concern (Rosatte, 1989).

During 2007, Guilford County had 34 confirmed cases of wild animal rabies; 38% of these cases were associated with raccoons, the highest number of rabies positive raccoon

cases per county in North Carolina. Guilford County Environmental Health officers were concerned with raccoon population dynamics, public awareness, and the understanding of rabies

transmission, symptoms, and early treatment. Hence, there was a need to understanding what the public knew about rabies, pet vaccination status, how the public would respond to rabid animals and how to deliver information about rabies and rabies clinics to the public in the future.

Ethnic minorities, particularly Latinos, are increasing throughout the United States and are becoming critically important for wildlife management and outreach programs (Lopez et al, 2005). Engaging minorities in wildlife management and public health programs may require the creation of language appropriate and culturally-sensitive content and identification of appropriate outlets for their distribution. In a previous study, we determined that Latinos and African Americans know less about signs of rabies infection in animals, transmission routes and wildlife vectors, and first response after rabies exposure than Whites and concluded that Latinos and African Americans were at higher risk of being exposed to rabies (Palamar et al. 2013). However, finding appropriate outlets for public health materials to be disseminated successfully among an ethnically and culturally diverse public has not been thoroughly explored. The challenge of reaching minorities has been documented repeatedly in other public health areas such as for sexually transmitted diseases (STD's) and oral health (Altschuler et al. 2008). Guilford County, and in particular the city of Greensboro, has a total population of 237,423, of which 15,412 are Hispanic/Latino and

88,587 are Black (U.S. Census Bureau, 2005-2007 American Community Survey). This diverse audience makes the city of Greensboro a good case study for determining public understanding of rabies pet vaccination, rabies information dissemination preferences, and rabies clinic awareness and clinic attendance.

Pet vaccination, wildlife vector management and public health education may be the most efficient ways to prevent a rabies epidemic in urban environments (Rupprecht et al. 2002). Public health officials indicate that compliance with rabies vaccination laws is very low. For example, of the 11 cases of pets that had been in contact with a suspected rabid animal in 2012, 10 had to be euthanized or quarantined because they did not have the proper rabies vaccination (personal communication with Scott Green, Animal Control Director, Guilford County, NC. 2012). The poor enforcement of rabies vaccination and rabies vaccination reporting makes it very difficult to estimate the number of vaccinated pets against rabies in Greensboro, NC.

This study is part of a larger project in which we evaluated rabies knowledge (Palamar et al. 2013). As a result of the newly gained insight on rabies knowledge, we developed a bilingual (Spanish/English) educational rabies brochure (Apendix 1). In this educational document, we describe the signs of rabies in animals, the disease transmission routes to humans, the first response after a rabies exposure, how to report possible rabies exposure to the appropriate officials, the availability of low cost pet vaccination, and the appropriate reporting of rabid animals.

Public's perception of the importance of rabies vaccination and reporting of suspect rabid animals is important for rabies management and program planning. Public health education should focus on identifying the proper outlets for information dissemination of low cost rabies vaccination information and rabies educational materials with culturally relevant information. Consideration to language and cultural backgrounds is important when working with ethnically diverse populations. Therefore, we conducted a bilingual (English/Spanish) survey of people residing in Greensboro, NC to determine their compliance with pet vaccination recommendations

and requirements and awareness and use of low cost rabies vaccination clinics. We elicited information about people's understanding of the requirements for reporting suspected rabid animals, who would they report to, and ways they would like to receive rabies information in the future.

METHODS

During October-November 2009, we administered a questionnaire to the adult (18 years or older) who answered the door of every third dwelling in four neighborhoods of Greensboro, North Carolina. This sampling strategy helped us reduce bias associated with telephone surveys because many households, especially in low income neighborhoods, may not have land lines (Nyhus et al., 2003; Peterson et al., 2008). We surveyed the selected neighborhoods on a weekday and a weekend day during mornings and afternoons to avoid bias associated with sampling during one time period. We sampled four neighborhoods located within the Northwest quadrant of the city of Greensboro. We selected this quadrant

because of the high number of rabies positive raccoon cases reported in 2006 and 2007 (Guilford County Environmental Health Department White paper, 2007). When no one was home or the person refused to participate in the selected house, we re-started the sampling in the home immediately next to it. For survey administration ten interviewers were hired consisting of four male and six female who worked in pairs. To ensure consistency, all the interviewers were trained by the primary author. Each interviewer had English and Spanish copies of the questionnaire and at least 2 bilingual interviewers were available during sampling days. Each respondent was asked which language (English or Spanish) he or she preferred. If Spanish was chosen, the respondent was asked if he or she wanted to talk to one of the bilingual interviewers.

Questionnaire Design and Survey Administration — We designed Spanish and English versions of the survey. The objective was to assess how people learned about rabies, their attitudes towards reporting instances of encounters with rabid animals, and rabies pet vaccination status. We obtained demographic data for the previous year from the US Census. Income was classified into categories: $0 \leq \$14,999$ to $8 \geq \$60,000$); age (actual age of respondent), education (0 = grammar school to 4 = graduate degree); years of residence; number of household residents; and sex and ethnicity (male and female). We assessed ethnicity first (by asking if they were Hispanic or Latino) and race second (as defined in the UN Census 2010: White, Asian, Black or African American, Native American and Hawaiian or other Pacific Islander).

The questionnaire had specific outreach questions (12 close-ended and 1 open ended). These questions focused on pet vaccination status and knowledge, and use of rabies vaccination clinics in the county, people's understanding of their role when they observed a rabid animal, and elicited information about culturally appropriate outlets for public health information.

Data Analysis — We compared the general frequency of answers with the frequency by ethnicity using summary statistics and used Analysis of Variance (ANOVA) or the Kruskal-Wallis test depending on the type of data to compare demographic attributes of ethnic groups (SAS/STAT® software and Minitab 15 Statistical Software, 2007).

RESULTS

We sampled 301 people and 23 of the participants chose to answer the questionnaire in Spanish. As reported in a previous study (Palamar et al., 2013) respondents identified themselves as non-Latino White (75%, n = 220, henceforth referred as Whites), Hispanic/Latino

(11%, n =33), and African American (13%, n =40). Latinos and African American had lower income levels than Whites with Latinos reporting less than $20,000 a year (65%). Most of the White participants (77%) reported earning more than $35,000 year. Latino and African American respondents were younger and lived in the area for less time compared to Whites (Palamar et al., 2013). Latinos had lower education levels than African American and Whites, 39% of the Latino respondents completed just grammar school. College completion was eight times higher for Whites (65%) than African Americans (8%).

Approximately half of the respondents indicated owning one pet while 30% of the Latino respondents indicated owning a pet. Of the respondents that owned pets, 85% indicated they vaccinated their pets against rabies (Table 2.1). For those respondents who do not vaccinate their pets, the most common reason for not doing so was that only outdoors pets were vaccinated, vaccination was too expensive, the pet was too young or they could not catch the animal. African Americans (60%) and Latinos (89%) said that they were not aware of the low cost rabies vaccination clinics offered by Guilford County, while most White respondents (65%) were aware of the clinics. Of the people who were aware of the rabies clinics, 69% heard about them from the local media (i.e., radio, television or Newspaper) and only 38% had vaccinated their pets at the low cost clinics (Table 2.1).

When asked what they would do if they encountered an animal they suspected had rabies, most respondents regardless of ethnicity indicated that they would call someone to handle the animal. Latinos (61%) indicated they would call animal control but did not have the number. Conversely, African Americans (47%) and Whites (36%) indicated they would call animal control and said they did have the number available (Table 2.2). A total of 30% of respondents indicated they would call 911. Regardless of ethnicity respondents (60%) said they would go to the emergency room if they were bitten by a dog they suspected had rabies and 97% of the respondents would report the dog to Animal Control (Table 2.2).

A total of 53% of the White respondents indicated they would like receive future information about rabies over the internet, whereas Latinos (43%) and African Americans (51%) preferred the information to be mailed to them. When asked what would be the best

way to deliver information about future rabies clinics, most respondents (35%) chose local media outlets such as local radio and TV (Table 2.3).

DISCUSION

We identified the information needs for specific segments of the targeted population regarding county vaccination clinics, the agencies people will contact for reporting suspected rabid animals, and determined culturally appropriate outlets for rabies information dissemination in the city of Greensboro.

Most of the respondents that owned pets (85%) indicated the pets were vaccinated. This is interesting since it does not correspond with the anecdotal information provided by animal control officials, who indicated that pet vaccination is below 30%. The average of the high response rate for vaccination reported by survey respondents and the low value reported by animal control, leaves as in the 50% range, a coin toss probability. The reality is that no one knows and it is possible that both groups either over-estimate or under-estimate the vaccination prevalence. The self-reported vaccination compliance values are more indicative of the people´s

understanding about the requirement for vaccination than actual vaccination rates. Although rabies vaccination information reaches the public (efficacy), the effectiveness is questionable. Data on pet vaccination compliance is scarce due to poor reporting, passive data collection, and poor adherence to regulations and vaccination compliance enforcement. For example, veterinarians are required to inform Guilford County Animal Control of every rabies vaccine they apply. However, in the last ten years, there has been a breakdown in the reporting

process (as expressed by personal communications with Guilford County environmental health officials). We did not specifically study this issue and cannot confirm the extent of data transfer between agencies; therefore, estimating the percentage of vaccinated pets is difficult and results unreliable. Educating veterinarians on the importance of reporting this information to public health agencies is recommended if we aim at controlling rabies in domestic animals and pets. Veterinarians are the resource of choice to relay information about rabies to clients and the public and in data collection and epidemiology of urban rabies public health campaigns.

Most of the Latino respondents indicated they were not aware of the rabies vaccination clinics offered by the County. One possible explanation is the lack of rabies information in Spanish combined with information outlets not favored by Latinos. Through our outreach work with the Latino community we know they frequently listen to one Spanish language radio and read the free Spanish-languages newspaper available in Greensboro. Therefore, these outlets favored by Latinos should be considered as a viable alternative to main stream media outlets when trying to reach this specific segment of the population with rabies clinic information.

Although most respondents indicated they would report a rabid animal to Animal control,

most respondents were unaware of who to contact to report the animal. Many respondents (30%) indicated they would report their concerns to 911. We suggest Animal Control develops a message diffusion campaign and uses easy to spot or keep trinkets with a message

and telephone numbers to call them in case of suspicious animal behavior (e.g., refrigerator magnets or cards with information about who they are, what they do, and how to recognize and report suspicious animals). Furthermore, 911 emergency respondents should be provided with basic information on how to proceed with suspected rabid animals or exposure and direct callers to the most appropriate agency.

Latinos and African Americans asked to receive information through the mail, while Whites indicated they would prefer the Internet. We speculate this response is a reflection of internet usage differences among ethnicities. According to a recent Pew Research Center survey (2011), only 51% of Latinos and 49% of African Americans have a home Internet connection compared to 66% of non-Latino whites. Also, if we consider income and education levels, only 41% of people earning less than $30,000 have home internet access and only 22% of people that have not attained a high school diploma will have home internet access. The mean income for Latinos in our study was $19,000 a year, and Latinos had lower education levels than any other demographic group, with 39% of them not having a high school diploma. Most African Americans in our study are under the same income category as the Latinos (less than $30,000/year); however, they have higher education levels with most of them (45%) having a high school diploma and some college education. Although lower income - lower education Latinos and African Americans may not have a home internet connection, 50% of them have
mobile internet connection. Thus, the use of a mobile notification system could be a more appropriate outlet for public health information among these ethnic groups (Pew Research

Center, 2011). Cellular phones could be used to send information to the public about rabies, rabies vaccinations, and exposure notification.

It is important to understand differences in risk perception and communication of the target population due to the influence ethnicity, economic, and educational status may have on message decoding and interpretation. The use of mobile phone delivery as a system to reach public of all ages and levels of education or income seems to be a possible solution. Good and solid relations with media outlets in particular Spanish television, radio, or newspapers, offers more channels for communication with the Latino segment of the population. Additionally, the Greensboro Animal Control URL should be readily available through a basic internet search.

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TABLES

Table 2.1. Frequency of answers regarding pet vaccination status, and awareness and use of rabies vaccination clinics in Greensboro, North Carolina, 2009.

Questions and answers	Frequency percent (n)			
	General	Latinos	African American	White
Do you own or live with someone who owns a cat, dog or ferret?				
Yes	58.19 (174)	28.13 (9)	50 (20)	64.38 (141)
No	41.81(125)	71.88 (23)	50 (20)	35.62 (78)
Have these pet/s been vaccinated against rabies in the last 12 months?				
Yes, all of them	84.57 (148)	66.67 (6)	95 (19)	84.51 (120)
Yes, some of them	8.57 (15)	11.11 (1)	5 (1)	8.45 (12)
No	6.86 (12)	22.22 (2)	0	7.04 (10)

Table 2.1. Continued

Why did you not vaccinate some of your pets?				
I only vaccinate pets that live outside	6.67 (1)	0	0	9.09 (1)
I only vaccinate pets that live inside	13.33 (2)	33.33 (1)	0	9.09 (1)
It is too expensive	13.33 (2)	33.33 (1)	0	9.09 (1)
The pet is too young	13.33 (2)	0	0	18.18 (2)
The pet is too old	6.67 (1)	0	0	9.09 (1)
Three year vaccination	20 (3)	0	100 (1)	18.18 (2)
I have no time to take them to the vet	6.67 (1)	0	0	9.09 (1)
Can't catch the animal	13.33 (2)	0	0	18.18 (2)
Lack of attention to pets	6.67 (1)	33.33 (1)	0	0
Are you aware of the low cost/ free rabies clinics offered by Guilford County?				
Yes	60.34 (105)	11.11 (1)	40 (8)	65.96 (93)
No	39.66 (69)	88.89 (8)	60 (12)	34.04 (48)

Table 2.1. Continued

Have you ever vaccinated your pets in the low cost/free rabies clinics offered by Guilford County?				
Yes	38.1 (40)	50 (1)	71.43 (5)	34.41 (32)
No	61.9 (65)	50 (1)	28.57 (2)	65.59 (61)
How did you find out about the low cost/free rabies clinics offered by Guilford County?				
Media (Newspaper, radio, TV, internet, mail)	68.75 (66)	100 (1)	42.86 (3)	70.59 (60)
Family or friends	23.16 (22)	0	28.57 (2)	22.62 (19)
Veterinarian	18.75 (18)	0	28.57 (2)	16.47 (14)
Shelter	5.21 (5)	0	0	5.88 (5)

Table 2.2. Frequency of answers regarding rabid animal reporting and first response after rabies exposure in Greensboro, North Carolina, 2009.

Questions and answers	Frequency percent (n)			
	General	Latinos	African American	White
If you were to encounter a large dog you suspect has rabies in your neighborhood, what would you do?				
Try to capture the animal to try to help it	0.67 (2)	3.03 (1)	0	0.46 (1)
Try to scare the animal away	2.01 (6)	0	5.13 (2)	1.83 (4)
Try to kill the animal	2.34 (7)	0	2.56 (1)	2.74 (1)
I would not do anything	1 (3)	0	2.56 (1)	0.91 (1)
Call someone that can take care of it	93.65 (280)	96.97(4)	89.74 (35)	93.61 (205)
If you had to call someone about a rabid animal. Who would be the EASIEST for you to call?				
Family member, friend or neighbor	0.68 (2)	0	0	0.92 (2)
Animal control (I have their number)	35.37 (104)	12.9 (4)	47.37 (18)	36.41 (79)
Animal control (I don't have their number)	31.97 (94)	61.29 (19)	31.58 (12)	27.65 (60)
Local public health dept. (I have their number)	0.68 (2)	0	0	0.92 (2)

Table 2.2. Continued

Local public health dept. (I don't have their number)	0.68 (2)	0	2.63 (1)	0.46 (1)
Police/911	30.61 (90)	25.81 (8)	18.42 (7)	33.64 (73)
How would you respond to the dog biting your hand?				
Call a Doctor	16.67 (50)	15.15 (5)	10 (4)	18.72 (41)
Care for the wound yourself	4 (12)	3.03 (1)	0	5.02 (11)
Go to the emergency room	60.33 (181)	69.67 (23)	77.5 (31)	55.25 (121)
Find the dog's owner and ask for vaccination records	19 (57)	12.12 (4)	12.5 (5)	21 (46)
Would you report the dog to anyone?				
Yes	96.66 (289)	93.94 (31)	100 (40)	96.33 (210)
No	3.34 (10)	6.06 (2)	0	3.67 (8)

Table 2.2. Continued

If you had to report the dog. To whom would you report the dog?				
Family member, friend or neighbor	1.71 (5)	6.45 (2)	0	1.4 (3)
Animal control	71.92 (210)	51.61 (16)	84.21(32)	72.56 (156)
Local public health dept.	5.82 (17)	9.68 (3)	5.26 (2)	5.58 (12)
Police/911	20.55 (60)	32.26 (10)	10.53 (4)	20.47 (44)

Table 2.3. Frequency of answers regarding rabies information outlet preference in Greensboro, North Carolina, 2009.

Questions and answers	Frequency percent (n)			
	General	**Latinos**	**African American**	**White**
If you wanted to learn more about rabies, what would be the BEST way to deliver that information to you?				
Internet	47.98 (119)	32.14 (9)	32.43 (12)	53.11 (94)
Mail	34.27 (85)	42.86 (12)	51.35 (19)	29.94 (53)
TV	15.32 (38)	14.29 (4)	16.22 (6)	15.25 (27)
Radio	2.42 (6)	10.71 (3)	0	1.69 (3)
How would you like to be informed about future low cost/free rabies clinics offered by the Guilford County?				
Media (Newspaper, radio, TV, internet, mail)	35.34 (41)	75 (6)	20 (4)	35.63 (31)
Family or friends	17.24 (20)	0	20 (4)	17.24 (15)
Veterinarian	12.93 (15)	25 (1)	5 (1)	14.94 (13)

Effectiveness and Cost of a Raccoon Oral Rabies Vaccination Effort in Urban Environments Using Bait Stations

INTRODUCTION

Beginning in the late 1970s, a strain of rabies associated with raccoons (*Procyon lotor*) rapidly spread along the East Coast of the United States with many states reporting over 500 cases per year. Raccoon-strain rabies can infect companion animals, livestock, wildlife and humans and have become the major vector of this disease in Eastern North America (Rupprecht et al. 1998). Though the raccoon-strain rabies epizootic is now limited to areas east of the Appalachian Mountain ridge, the U.S. Department of Agriculture - Wildlife Services, has established the National Oral Rabies Vaccination (ORV) Program with the goal of limiting the westward expansion of raccoon rabies. Although the ORV program has been successful in rural areas, the aerial distribution of the rabies vaccine is generally not feasible for reducing transmission of raccoon rabies in urban/suburban environments (Riley et al. 1998; Slate at al. 2005).

Urban/suburban raccoons encounter little competition for resources, and have few predators, small home ranges, and high survival of kits (Prange et al. 2003). In urban/suburban environments, raccoons have been shown to opportunistically feed on garbage (Curran 1988, Prange et al, 2003), urban vegetable gardens, bird feeders and pet food (Boulanger et al, 2006) leading to high densities of raccoons, which increases the risk of rabies transmission to domestic animals and humans (Junge et al. 2007; Riley, 1998; Smith, 2002). Also, people have become accustomed to the presence of raccoons on their property

and have been known to feed them to ensure close encounters, thus increasing the risk of zoonotic disease transmission (Junge et al. 2007).

Agencies responsible for public health management of Guilford County, North Carolina, have become concerned about the increasing number of rabid raccoons in the urban areas. In 2006, there were 37 confirmed animal rabies positive cases, 20 of which were raccoons which primarily contributed to the rabies exposure to humans and companion animals (Guilford county white paper, 2007). To reduce the number of rabies positive animals and capitalize on the social feeding behavior of raccoons (Curran 1988), the use of portable ORV baiting stations may be a viable option for delivering vaccine baits in urban/suburban environments. However, the ORV baiting devices and their associated costs have not been extensively evaluated in these environments. Additionally, pre-vaccination serology is necessary to accurately evaluate the success of the oral vaccination program (Ramey et al. 2008). Therefore, our objectives were to determine the efficacy and cost of the portable ORV baiting stations, determine raccoon rabies pre-vaccination serology, and provide recommendations for an ORV program in an urban/suburban environment.

METHODS

Field samples

We established ORV bait stations at 28 locations in the northwest quadrant of Greensboro in Guilford County, North Carolina. The chosen sites were located where high numbers of positive raccoon cases had been previously reported (Figure 1). We selected

urban parks and private lands with high densities of raccoons due to the presence of water and den

areas. We divided the trapping events into four periods from 11/9/2009 to 1/29/2010, each consisting of a baiting period (5-6 nights) and a consecutive trapping period (3-5 nights), with seven locations for each period (Figure 1).

Bait Stations

At all sites, we used mobile oral bait delivery stations and trail cameras to determine visitation rates and the efficacy of the ORV baiting station. The ORV baiting stations consisted of lightweight PVC pipes that protected the bait from heat and rain, following the design of Boulanger et al. 2006. However, we modified the opening by fitting a bolt in both ends of the T-joint to allow bait access from both sides of the station (Figure 2) and by painting the PVC Army green. We installed the bait stations 20 cm above ground level to prevent rodents and water from entering the T connection. The baits consisted of a fish polymer case surrounding a plastic sachet, similar to those used for current ORV campaigns (Merial LTD, Duluth, Georgia). However, for our study, the sachettes contained water instead of the vaccine. Each baiting station was accompanied by two motion activated trail cameras (Moultrie Game Spy 4.0 MP Infrared Digital Camera) set to take two pictures every 10 minutes once triggered. The cameras registered time, temperature and moon phase for every photograph taken. We monitored baiting stations concurrently for 5-6 consecutive nights and visited the bait stations daily to refill bait and to ensure the cameras were working.

At the end of the baiting periods, we calculated the number of baits removed from each station.

After the 5-6 day baiting period, we removed the ORV bait stations and placed Havahart® cage traps to capture mesocarnivores for a total of 3-5 nights. We baited the traps with canned cat food. We set traps in the afternoon and checked them between 8 A.M. and noon. We anesthetized each captured raccoon, collected blood and fecal samples, and inserted a passive integrated transponder (PIT) tag subcutaneously. We released all captured animals at the capture location.

Sampling protocol

All animal handling methods were approved by the North Carolina State University Institutional Animal Care and Use Committee (IACUC ID# 09-100-O). We anesthetized trapped raccoons with a 5:1 combination of Ketamine and Xylazine through an IM jab while they were still in the cage. Once anesthetized, we removed raccoons from the cage and placed them in a supine position. We monitored respiration and heart rate and lubricated the eyes with a surgical eye lubricant. We shaved the venipuncture site, cleaned it with 98% alcohol, and collected a blood sample (3-6 cc.) with a 3 cc. syringe and a 25mm needle. When jugular veins were not easily accessible, we shaved and cleaned the anterior section for the front legs and attempted to obtain blood from the radial vein. We centrifuged the clotted samples at 3,000 RPM for 5 minutes. We divided the serum into 1.5 ml. aliquots which were stored in a -80 ° F freezer until they were shipped to laboratory at Kansas State University (Manhattan, Kansas) for analysis. Additionally, the Guilford County Animal Shelter

provided blood samples from raccoons that were surrendered to be euthanized. Collection procedures followed the Guilford County Animal Shelter protocols.

RESULTS

Infrared cameras recorded 1,871 photographs of animals in close proximity to the bait stations. Photographs included raccoons, humans, domestic cats (*Felis silvestris*), foxes, domestic dogs (*Canis familiaris*), opossums (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), and eastern cottontails (*Sylvilagus floridanus*). Raccoons were captured in 83% of photographs and we observed raccoon activity at 27 out of 28 baiting stations. Approximately 780 baits were removed from the bait stations during period I and period II (Table 3.1); the number of baits consumed from periods III and IV were compromised because of heavy rains (>20 cm) and poor weather conditions. Only raccoons and opossums were photographed consuming bait.

Each bait station cost of $76 including the materials ($46) and the person-hours (2 hours) needed for construction ($15/hour), installation, baiting, and removal. We used seven bait stations for a total building cost of $322 and an average of $210 for man hours of construction, installation, baiting and removal. Additionally, during our study, an average of 60 baits were removed from each bait station (Table 3.1), the cost of the bait was $1.43 per fish polymer bait, for a total baiting cost of $600 per 6 day baiting period.

From 11/9/2009 to 1/29/2010, we captured and sampled 32 unique raccoons and 4 opossums. From 7/17/2009 to 11/09/2009, we received samples from 48 raccoons and 1 red fox (*Vulpes vulpes*) from the Guilford County Animal Shelter. Of the raccoon samples, 3.8%

(n = 3) were positive for rabies, the rest presenting with titers below 0.125 UI/ml. All samples from the red fox and the opossums were negative for rabies.

DISCUSION

Based on our results, the use of portable baiting stations is a promising alternative to aerial ORV baiting in urban/suburban environments. Raccoons were attracted to the bait stations and were easily able to consume the bait. Additionally, the number of non-target species attracted to the bait was low and due to the modifications on the openings, they were unable to remove bait from the stations.

Aerial ORV baiting is being administered with a bait density of 75 baits/km² to ensure appropriate seroconversion (Recuenco et al. 2007; USDA/APHIS rabies report 2012). During our study, an average of 60 baits were removed from each of the stations. Blackwell et al. (2004) noted that raccoons, at a density of 24.5 individuals per km², each consumed 3.3 baits when baits were distributed at 75 baits/km², ensuring sufficient seroconversion. Although we had higher bait densities then previously reported and assuming urban raccoon densities were similar we believe that baits were consumed at sufficient levels to ensure seroconversion.

Most of the raccoon activity around the baits was observed during the first three days, we recommend operating the baiting stations for three days at a density of 1 baiting station/ km² of green areas. For example, Greensboro has 11.2 km² of parks and approximately 10 km² of open space, for a total of 20.2 km² of green areas (2010-2020 Countywide parks, open space and trails master plan, 2011). Thus, Greensboro would require a total of 20 baiting

stations, 40 person-hours, and 1,500 baits for a total cost of $3,665 for the first year. In Guilford county there are approximately 30 km² of parks and 20 km² of open green space, including the city of Greensboro (2010-2020 Countywide parks, open space and trails master plan, 2011), requiring 50 baiting stations, 100 person-hours, and 3,750 baits, at a cost of approximately $9,163.

The percentage of rabies positive raccoons (3.8%) is within the expected values for a non-vaccinated population (Ramey et al. 2008). For the first 2-3 years of the ORV campaign, raccoons should be routinely captured and sampled to evaluate the changes in rabies titers. If the campaign is successful, an increase of 25-77% in rabies titers should be observed within 3 years (Hanlon et al. 1998); the initial monitoring will allow management to make modifications to the baiting locations and regimes. After an appropriate vaccination regime has been achieved, raccoon testing and sampling can be conducted at longer intervals, thus reducing the overall cost of the ORV campaign.

MANAGEMENT IMPLICATIONS

We believe that a ground ORV vaccination campaign is a viable option for managing and controlling rabies in urban/suburban environments. The use of the portable ORV baiting stations reduces the amount of bait consumed by non-target species (Boulanger et al. 2006) and adds little to the overall cost of the vaccination campaign. Baiting stations are low weight, reusable and mobile and can protect the costly bait from rain and heat. Low-cost baiting stations could become a valuable tool for rabies management and eradication in urban environments that could be implemented yearly. We recommend that cities and counties

start ground ORV campaigns to manage and control rabies in urban/suburban environments. Baiting stations should be established in late summer to target the greatest number of raccoons possible, including the sub-adults that are starting to disperse. Additionally, we recommend a pre-vaccination trapping and sampling season be implemented and a post-vaccination trapping and sampling season be implemented 30 days after the third year of baiting to asses changes in rabies titers in the raccoon population. The serology results will help public health and wildlife management officials evaluate the success of the ground ORV campaign and guide any changes in the implementation of future campaigns (e.g., bait density, location and season) to further increase immunity.

Public Education and Engagement

Public education is intrinsically linked to a successful rabies control and eradication campaign. The ground ORV campaign is a great opportunity to engage and educate the public. Although not very conspicuous, the baiting stations can be seen by the public making the bait stations a unique educational tool. With proper public education and citizen science involvement, the costs of the ORV campaign can be reduced. Volunteers from garden clubs, bird watching clubs, schools and private citizens could assist in installing and monitoring bait stations. Engaging the public would help raise awareness of rabies and the role that humans and pets play in the epidemiology of the disease. When the bait stations are installed in parks and other green spaces, low-cost rabies clinics for pets could be promoted and operated near the baiting stations, linking wildlife, domestic animal, and rabies. Wildlife educators could

be present to explain the dangers of feeding wildlife, and public health materials could be distributed for people to know what to do if exposed to a rabid animal.

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TABLES

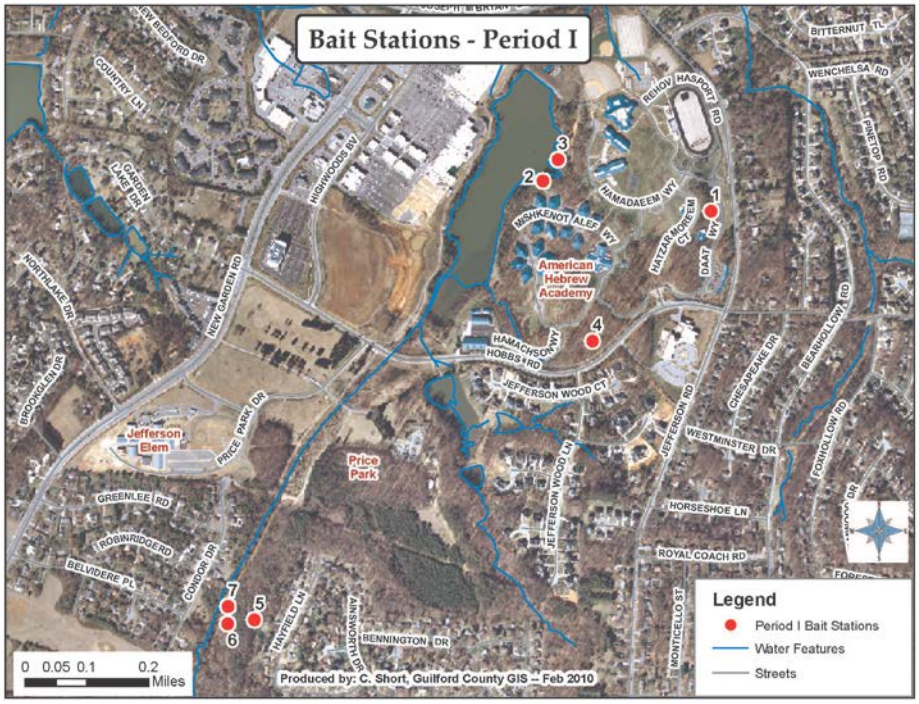
Table 3.1. Bait consumed from baiting stations by day, station number and baiting period, Greensboro, NC, 2009/10.

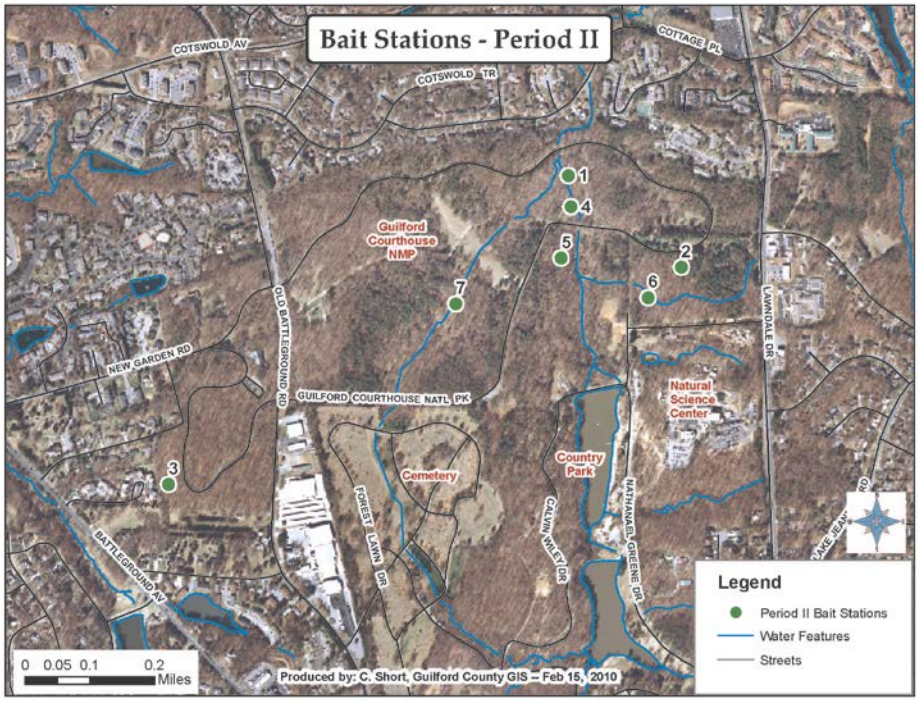
Period	Station #	Bait [a] added Day 1	Bait added Day 2	Bait added Day 3	Bait added Day 4	Bait added Day 5	Bait added Day 6	Total Bait added	Total Bait recovered	Total Bait consumed
11/2/2009	1	100	10	0	0	10	0	120	0	120
	2	60	10	20	0	0	0	90	77	13
	3	60	10	10	10	20	0	100	77	23
	4	60	10	30	10	0	0	110	72	38
	5	60	20	20	20	10	0	130	30	100
	6	60	10	0	10	0	0	80	40	40
	7	60	10	30	30	30	0	160	2	158
11/16/2009	1	30	10	20	0	5	0	65	30	35
	2	30	20	30	20	20	5	125	6	119
	3	30	20	40	10	15	10	125	27	98
	4	30	20	20	0	5	10	85	53	32
	5	30	0	30	5	5	0	70	46	24
	6	30	10	0	0	10	0	50	39	11
	7	30	0	20	5	30	15	100	11	89

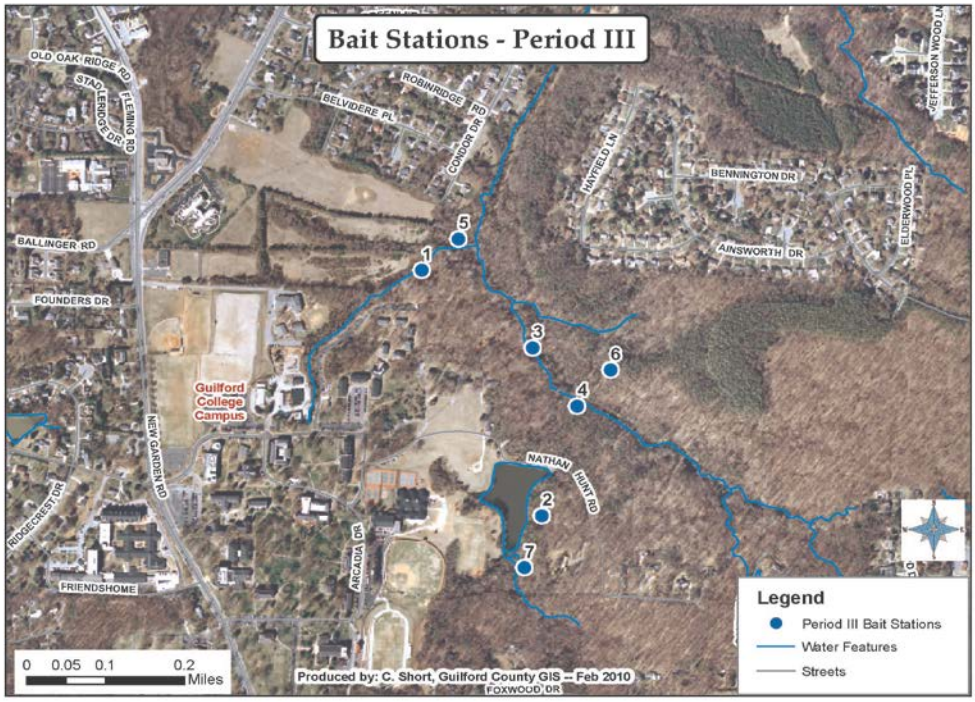
[a] Bait was added when there were signs of high consumption of baits, if there were no signs of activity or there seemed to be low consumption of baits, no bait was added.

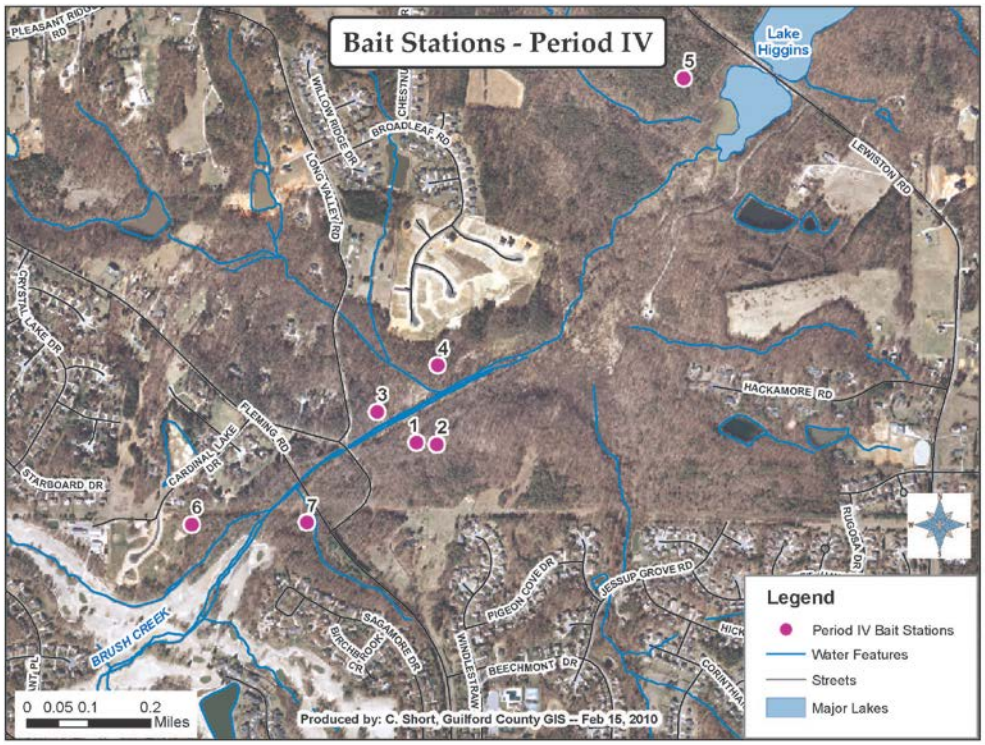
FIGURES

Figure 2: Location of bait stations in map for each of the 4 baiting periods in Greensboro, NC 2009/10.


Bait Stations - Period I
American Hebrew Academy
Jefferson Elem
Price Park
Legend
Period I Bait Stations
Water Features
Streets
0 0.05 0.1 0.2 Miles
Produced by: C. Short, Guilford County GIS -- Feb 2010


Bait Stations - Period II
Guilford Courthouse NMP
Natural Science Center
Country Park
Cemetery
GUILFORD COURTHOUSE NATL PK
Legend
Period II Bait Stations
Water Features
Streets
0 0.05 0.1 0.2 Miles
Produced by: C. Short, Guilford County GIS -- Feb 15, 2010


Bait Stations - Period III
OLD OAK RIDGE RD
STADLEIRIGGS DR
FLEMING RD
ROBINRIDGE RD
BELVIDERE PL
CONDOR DR
HATFIELD LN
BENNINGTON DR
JEFFERSON WOOD LN
ELDERWOOD PL
AINSWORTH DR
BALLINGER RD
FOUNDERS DR
Guilford College Campus
NEW GARDEN RD
NATHAN HUNT RD
RIDGECREST DR
ARCADIA DR
FRIENDSHOME
FOXWOOD DR
1
2
3
4
5
6
7
0 0.05 0.1 0.2 Miles
Produced by: C. Short, Guilford County GIS -- Feb 2010
Legend
Period III Bait Stations
Water Features
Streets


Bait Stations - Period IV
Lake Higgins
WILLOW RIDGE DR
BROADLEAF RD
LONG VALLEY RD
LEWISTON RD
HACKAMORE RD
FLEMING RD
CARDINAL LAKE DR
STARBOARD DR
RUGGAN DR
JESSUP GROVE RD
PIGEON COVE DR
BRUSH CREEK
SAGAMORE DR
BIRCHBROOK CIR
WINDLESTRAW
BEECHMONT DR
1
2
3
4
5
6
7
0 0.05 0.1 0.2 Miles
Produced by: C. Short, Guilford County GIS -- Feb 15, 2010
Legend
Period IV Bait Stations
Water Features
Streets
Major Lakes

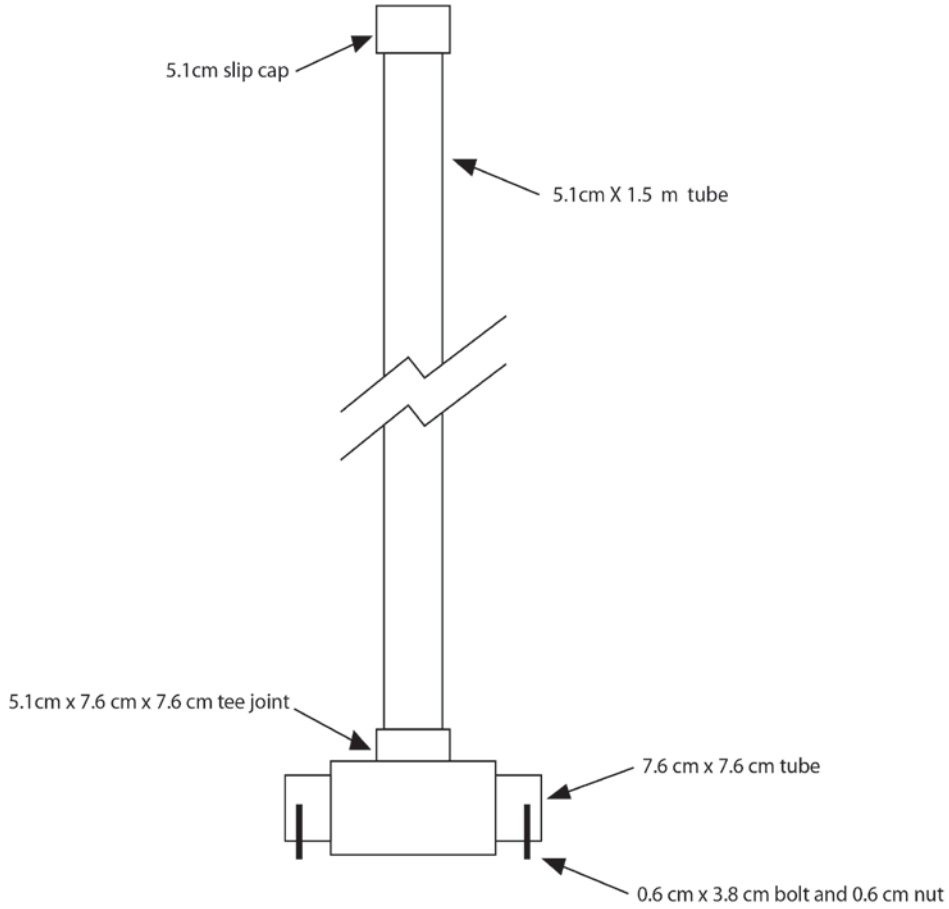


Figure 2: Design of a constructed PVC bait station with modification from Boulanger et al. (2006) original design.

APPENDICES

Appendix A

NC STATE UNIVERSITY

Reducing the Burden of Rabies in Urban Environments
Survey 2009
Greensboro, NC

For information please contact:
Maria B. Palamar, DVM. Fisheries and Wildlife Sciences, NCSU.
maria_palamar@ncsu.edu
(919) 412 0406

Participation in this survey is voluntary. The results from this survey will be used to develop rabies public health educational materials for Guilford County.

Your participation is of vital importance for the success of this survey. Thank you very much for your being part of this project!

1) Do you think a house cat, dog or ferret can get INFECTED with RABIES in the ways listed bellow? (Choose ONE option for EACH statement)

Playing with other cats, dogs or ferrets that have rabies	❑ Yes	❑ No	❑ Not sure
Being bitten by an animal that has rabies	❑ Yes	❑ No	❑ Not sure
Eating a dead animal that had rabies	❑ Yes	❑ No	❑ Not sure
Touching or playing with a dead animal that had rabies	❑ Yes	❑ No	❑ Not sure
Eating the feces of another animal that has rabies	❑ Yes	❑ No	❑ Not sure
I do not think a house cat, dog or ferret can get Infected with rabies	❑ Yes	❑ No	❑ Not sure
Only wildlife can became infected with rabies	❑ Yes	❑ No	❑ Not sure

2) Do you think that the following animal behaviors are SYMPTOMS of RABIES? (Choose ONE option for EACH statement)

The animal presents foam in the mouth, hyper salivation	❑ Yes	❑ No	❑ Not sure
Displays slight or partial paralysis (that is, loss of muscle control when walking)	❑ Yes	❑ No	❑ Not sure
Strange behavior, such as walking in circles	❑ Yes	❑ No	❑ Not sure
Aggressive behavior, such as eager to bite	❑ Yes	❑ No	❑ Not sure
Attacking the air, barking at invisible things	❑ Yes	❑ No	❑ Not sure
Change in the tone of barking	❑ Yes	❑ No	❑ Not sure

3) Do you think a human can become INFECTED with RABIES in the ways listed bellow? (Choose ONE option for EACH statement)

Touching a dead animal that had rabies	❑ Yes	❑ No	❑ Not sure
Being bitten by an animal that has rabies	❑ Yes	❑ No	❑ Not sure
Petting or holding an animal that has been bitten by a rabid animal	❑ Yes	❑ No	❑ Not sure
Touching feces of an animal that has rabies	❑ Yes	❑ No	❑ Not sure

I don't think a human can become infected with rabies	❑ Yes	❑ No	❑ Not sure

4) Do you think humans can get rabies from the animals listed bellow?
(Choose ONE option for EACH animal)

Dogs	❑ Yes	❑ No	❑ Not sure
Cats	❑ Yes	❑ No	❑ Not sure
Turtles	❑ Yes	❑ No	❑ Not sure
Domestic Birds	❑ Yes	❑ No	❑ Not sure
Raccoons	❑ Yes	❑ No	❑ Not sure
Bats	❑ Yes	❑ No	❑ Not sure
Wild Birds	❑ Yes	❑ No	❑ Not sure
Wild Reptiles	❑ Yes	❑ No	❑ Not sure

5) Which of the following procedures are useful for preventing rabies in humans after they have been bitten by an animal?
(Choose ONE option for EACH statement)

Washing the wound with water and soap	❑ Yes	❑ No	❑ Not sure
Spreading antibiotic treatment on the wound	❑ Yes	❑ No	❑ Not sure
Obtaining post exposure rabies vaccination	❑ Yes	❑ No	❑ Not sure
Bandage the area tightly until the doctor can see it	❑ Yes	❑ No	❑ Not sure
There is no way to prevent rabies once you have been bitten	❑ Yes	❑ No	❑ Not sure

6) How many people do you think DIE of RABIES annually in the US? (Choose ONE option)

❑ None
❑ 1-4 people
❑ 5-9 people
❑ 10 or more people

7) How much do you think that RABIES TREATMENT costs per person? (Choose ONE option)

❑ It is free
❑ $100- 499
❑ $500-999
❑ $1,000 or more

8) Have you ever encountered or seen an animal with rabies (in person)? (Choose ONE option)

- ❑ Yes
- ❑ No
- ❑ Not sure if the animal I am thinking of had rabies

9) If you were to encounter a large dog you suspect has rabies in your neighborhood, what you do? I would,
(Choose ONE option)

- ❑ Try to capture the animal so you could try to help it, such as finding its owner
- ❑ Try to scare the animal away, such as yelling at it or chasing it
- ❑ Try to kill the animal
- ❑ I would not do anything
- ❑ Call someone who can take care of it

10) If you had to call someone about a rabid animal. Who would be the EASIEST for you to call?
(Choose one)

- ❑ Family member, friend or neighbor
- ❑ Animal control **[Do you have this contact information? ❑ Yes ❑ No]**
- ❑ Local public health department **[Do you have this contact information? ❑ Yes ❑ No]**
- ❑ Police/911
- ❑ Other (Please specify)_____

11) Suppose you are walking in a local city park during the afternoon. No one else is in the park. You come across a dog that is alone. You reach out to pet the dog and try to read the dog's ID tag. The dog bites your hand hard enough to break the skin.

How would you respond to the dog biting your hand?
(Choose ONE option)

- ❑ Call your doctor to see if you should schedule an appointment
- ❑ Care for the wound yourself
- ❑ Go to the emergency room
- ❑ Find the dog's owner and ask for vaccination records

12) Would you report the dog to anyone?

- ❑ Yes
- ❑ No

13) If you had to report the dog. To whom would you report the dog?
(Choose ONE option)

- ❑ Family member, friend or neighbor
- ❑ Animal control
- ❑ Local public health department
- ❑ Police/911
- ❑ Other (Please specify):_____

14) In relation to your level of knowledge about rabies, would you say:
(Choose ONE option)

- ❑ I have NO Knowledge
- ❑ I have some knowledge
- ❑ I have a lot of knowledge

15) Where did you obtain your previous knowledge of rabies?

_____

_____

16) If you wanted to learn more about rabies, what would be the **BEST** way to deliver that information to you?
(Check only the BEST options for you)

- ❑ Internet
- ❑ Mail
- ❑ TV
- ❑ Radio
- ❑ Other (please specify): _____

17) Do you own or live with someone who owns a cat, dog or ferret?

- ❑ Yes
- ❑ No **[If you choose NO, then you are done with the survey. Thank you for your help!]**

18) In total, how many dogs, cats and ferrets live in your house/property? _____

19) Please indicate the number of pets that live with you and if they are indoor, outdoor or both

Pet	Indoor only	Outdoor only	Indoor and outdoor
Dogs			
Cats			
Ferrets			

20) Have these pet/s been vaccinated against rabies in the last 12 months?

❑Yes, all of them **[If you chose Yes, ALL of them, then skip to question 22]**

❑ Yes, some of them

❑No **[If you chose NO, then skip to question 22]**

21) Why did you not vaccinate some of your pets?
(Check the option that BEST fits your reasons)

❑ I only vaccinate the pets that live outside
❑ I only vaccinate the pets that live inside
❑ It is too expensive
❑ The pet is too young
❑ The pet is too old
❑ The vaccination clinic/veterinary office is too far away
❑ The vaccination clinic/veterinary office didn't have anyone who spoke Spanish
❑ I do not feel comfortable going to the Animal Control office
❑ I do not feel comfortable giving out my personal information to Animal Control officers
❑ Other: _____

22) Do you believe that the rabies vaccine protects a cat, dog or ferret from getting rabies?

❑Yes

❑No

23) Are you aware of the low cost/ free rabies clinics offered by Guilford County?

❑ Yes

❑ No **[If you chose NO, then skip to question 26]**

24) Have you ever vaccinated your pets in the low cost/free rabies clinics offered by Guilford County?

❑ Yes

❑ No

25) How did you find out about the low cost/free rabies clinics offered by Guilford County?
(Choose ALL the options that apply)

❑Newspaper ❑Radio ❑TV ❑Mail
❑A friend ❑ Internet ❑My veterinarian
❑Other: _____

26) How would you like to be informed about future low cost/free rabies clinics offered by the Guilford County?
(Choose only the BEST options for you)

❑Newspaper ❑Radio ❑TV
❑A friend ❑ Internet ❑ Mail
❑ The veterinarian
❑Other: _____

27) Please check the correct option for each of the sections bellow:

Sex: ❑Male ❑Female

Are you Hispanic or Latino? ❑Yes ❑No

Race/Ethnicity: ❑White ❑Asian
(Choose all that apply) ❑ American Indian ❑ Black or African American
❑ Native Hawaiian or other Pacific Islander

28) In what year were you born? 19___

29) How many years have you been living in Guilford County? _____

30) How many people live in your household? _____

31) What is your level of education? (Please check ONE)

❑Completed Grammar school
❑ Completed High School
❑ Incomplete College
❑ Completed College
❑ Completed Graduate level education

32) For statistical purposes only, which of the following BEST describes your total household income in the past year? (Choose ONE option)

- ❑ Less than $14,999
- ❑ $15,000-19,999
- ❑ $ 20,000-24,999
- ❑ $ 25,000-29,999
- ❑ $ 30,000- 34,999
- ❑ $35,000- 39,999
- ❑ $ 40,000-49,000
- ❑ $ 50,000-59,000
- ❑ $60,000 or more

Thank you very much for your help!!!!!!!

Su participación en este cuestionario es voluntaria. Los resultados provenientes de este cuestionario serán utilizados para desarrollar materiales educativos sobre para el condado de Guilford.

Su participación es de vital importancia para el éxito de este cuestionario. Muchísimas gracias por ser parte de este proyecto!

1) Cree usted que los gatos, perros y hurones pueden ser infectados por el virus de la RABIA de las siguientes maneras?
(Elija UNA opción para CADA oración)

Un animal sano juega con un animal infectado	❑ Si	❑ No	❑ No sé
Un animal sano es mordido por un animal infectado	❑ Si	❑ No	❑ No sé
Un animal sano se come a un animal muerto que estaba infectado	❑ Si	❑ No	❑ No sé
Un animal sano toca o juega con un animal muerto que estaba infectado	❑ Si	❑ No	❑ No sé
Un animal sano come fecas de un animal infectado	❑ Si	❑ No	❑ No sé
No creo que los gatos perros y hurones puedan infectarse con el virus de la rabia	❑ Si	❑ No	❑ No sé
Solo los animales salvajes pueden infectarse con el virus de la rabia	❑ Si	❑ No	❑ No sé

2) Cree usted que los comportamientos descriptos abajo son SINTOMAS de RABIA?
(Elija UNA opción para CADA oración)

El animal presenta espuma en la boca y salivación excesiva	❑ Si	❑ No	❑ No sé
El animal presenta una ligera parálisis parcial (No puede controlar bien sus músculos cuando camina)	❑ Si	❑ No	❑ No sé
El animal se comporta extraño, camina en círculos	❑ Si	❑ No	❑ No sé
El animal se presenta agresivo y quiere morder	❑ Si	❑ No	❑ No sé
El animal ataca el aire y le ladra a cosas invisibles	❑ Si	❑ No	❑ No sé
El animal presenta un cambio en el tono de su ladrido	❑ Si	❑ No	❑ No sé

3) Cree usted que los humanos pueden contagiarse con el virus de la RABIA de las siguientes maneras?
(Elija UNA opción para CADA oración)

Tocando un animal muerto que estaba infectado con rabia	❑ Si	❑ No	❑ No sé
Siendo mordido por una animal que tiene rabia	❑ Si	❑ No	❑ No sé
Acariciando o sosteniendo un animal que ha sido mordido por otro animal que tenia rabia	❑ Si	❑ No	❑ No sé
Tocando fecas de una animal que tiene rabia	❑ Si	❑ No	❑ No sé

No creo que los humanos se puedan contagiar con el virus de la rabia	❑ Si	❑ No	❑ No sé

4) Cree usted que los siguientes animales pueden contagiar el virus de la rabia los humanos? (Elija UNA opción para CADA oración)

Perros	❑ Si	❑ No	❑ No sé
Gatos	❑ Si	❑ No	❑ No sé
Tortugas	❑ Si	❑ No	❑ No sé
Pájaros Domésticos	❑ Si	❑ No	❑ No sé
Mapaches	❑ Si	❑ No	❑ No sé
Murciélagos	❑ Si	❑ No	❑ No sé
Pájaros Salvajes	❑ Si	❑ No	❑ No sé
Reptiles Salvajes	❑ Si	❑ No	❑ No sé

5) Cual de los siguientes procedimientos es útil para prevenir una infección de Rabia en humanos después de que han sido mordidos por un animal?
(Elija UNA opción para CADA oración)

Lavar la herida con agua y jabón	❑ Si	❑ No	❑ No sé
Aplicar una crema con antibióticos sobre la herida	❑ Si	❑ No	❑ No sé
Aplicar vacunación post-exposición contra la Rabia	❑ Si	❑ No	❑ No sé
Vendar le área hasta conseguir un turno con un medico para que vea la herida	❑ Si	❑ No	❑ No sé
No hay ninguna forma de prevenir la Rabia una vez que uno ha sido mordido	❑ Si	❑ No	❑ No sé

6) Cuantas personas cree usted que MUEREN de Rabia en los Estados Unidos por ANO? (Elija UNA opción)

❑ Ninguna
❑ 1-4 personas
❑ 5-9 personas
❑ 10 o más personas

7) Cuanto cree usted que cuesta el TRATAMIENTO contra la RABIA por persona? (Elija UNA opción)

❑ Es gratis
❑ $100- 499
❑ $500-999
❑ $1,000 o más

8) Alguna vez ha visto a un animal con rabia (en persona)? (Elija UNA opción)

❑ Si
❑ No
❑ No estoy seguro de que el animal que vi tenia rabia

9) Que haría usted si se encontrara con un perro grande en su barrio y sospecha que éste tiene rabia?
(Elija UNA opción)

❑ Trataría de capturar al animal para ayudarlo o tratar de encontrar a su dueño
❑ Trataría de asustar al animal para que se vaya
❑ Trataría de matar al animal
❑ No haría nada
❑ Llamaría a alguien que se pueda encargar del problema

10) Si usted decidiera llamar a alguien para informarle sobre un animal con rabia. A quien seria mas FACIL de llamar? (Elija UNA opción)

❑ A un miembro de la familia, un amigo o un vecino
❑ A un agente de Control de Animales **[Tiene usted el número de la oficina de control de animales? ❑ Si ❑ No]**
❑ A el Departamento de Salud Pública **[Tiene usted el número del Departamento de Salud Pública? ❑ Si ❑ No]**
❑ A la policía/911
❑ A otra persona (Por favor especifique a quien llamaría)
_____

11) Suponga que usted está caminando por un parque durante la tarde. No hay nadie mas en el parque. Usted encuentra un perro sin dueño y trata de agarrarlo para mirar si tiene la información del dueño en el collar. El perro lo muerde lo suficientemente fuerte para sacarle sangre.

Qué haría usted después de que el perro le muerde la mano?
(Elija UNA opción)

❑ Llamaría a mi médico para averiguar si debo pedir un turno para que vea la herida
❑ Me ocuparía de la herida yo mismo
❑ Iría a la sala de emergencias del hospital más cercano
❑ Buscaría al dueño del perro y le pediría la historia de vacunación del perro

12) Reportaría ese perro a alguien?

❑ Si
❑ No

13) Si usted decidiera reportar el perro a alguien. A quien llamaría?
(Elija UNA opción)

❑ A un miembro de la familia, amigo o vecino
❑ A un agente de Control de Animales
❑ A el Departamento de Salud Pública
❑ A la policía/911
❑ A otra persona (Por favor especifique a quien llamaría)
_____

14) Cuánto considera usted que sabe sobre la RABIA? (Elija UNA opción)

❑ No sé nada sobre la rabia
❑ Sé un poco sobre la rabia
❑ Sé mucho sobre la rabia

15) De donde obtuvo sus conocimientos sobre la rabia?
_____

_____

16) Si usted quisiera aprender más sobre la RABIA, cual seria la MEJOR manera de hacerle llegar esa información?
(Elija solo la MEJOR opción para usted)

❑ Internet
❑ Correo
❑ TV
❑ Radio
❑ Otra (por favor especifique la mejor manera): _____

17) Posee usted o alguien que vive en su casa gatos, perros o urones?
❑ Si
❑ No **[Si eligió NO, usted ha terminado con este cuestionario. Muchísimas gracias por su participación!]**

18) En total, cuantos gatos, perros o hurones viven en su propiedad? _____

19) Por favor indique cuantos de los animals que viven con usted viven adentro de la casa, afuera de la casa o adentro y afuera de la casa

Mascota	Solo adentro de la casa	Solo afuera de la casa	Adentro y afurea de la casa
Gatos			
Perros			
Hurones			

20) Ha vacunado a estos animales contra la rabia en los últimos 12 meses?

❑ Si, TODOS los animales han sido vacunados **[Si eligió Si, todos los animales han sido vacunados, continúe con la pregunta 22]**

❑ Si, ALGUNOS de los animales han sido vacunados

❑No **[Si eligió No, entonces continúe con la pregunta 22]**

21) Por que solo decidió vacunar a ALGUNO de sus animales?
(Elija la oración que MEJOR representa sus razones)

❑ Yo solo vacuno a los animales que viven AFUERA de la casa

❑ Yo solo vacuno a los animales que viven ADENTRO de la casa

❑ Es muy caro vacunar a mis animales

❑ Mi mascota es demasiado joven para ser vacunada

❑ Mi mascota es muy vieja para ser vacunada

❑ La clínica de vacunación/oficina del veterinario queda muy lejos

❑ La clínica de vacunación/oficina del veterinario no tenía a nadie que hablara español

❑ No me siento cómodo yendo a la oficina de Control de Animales

❑ No me siento cómodo dándole información personal a los oficiales de la oficina de Control de Animales

❑ Otras razones: _____

22) Cree usted que la vacuna de la rabia protege a sus animales contra la rabia?

❑ Si

❑No

23) Sabe usted de la existencia de clínicas gratis o de bajo costo de vacunación contra la rabia que son ofrecidas por el condado de Guilford?

❑ Si

❑ No **[Si eligió no, continúe con la pregunta 26]**

24) Ha vacunado alguna vez a sus animales en estas clínicas ofrecidas por el condado de Guilford?

❑ Si

❑ No

25) Como supo usted de estas clínicas ofrecidas por el condado de Guilford?
(Elija TODAS las opciones que correspondan)

❑Por el diario ❑Por la radio ❑Por la TV
❑Por un amigo ❑ Por internet ❑Por mi veterinario
❑Por otra forma: _____

26) Como le gustaría que le informáramos sobre clínicas de vacunación contra la rabia gratis o de bajo costo ofrecidas por el condado de Guilford en el futuro?
(Elija solo la MEJOR opción para usted)

❑Diario ❑Radio ❑TV
❑El veterinario ❑ Internet ❑ Mail
❑Otra forma: _____

27) Por favor indique la opción correcta para cada una de las siguientes secciones:

Sexo: ❑Hombre ❑Mujer

Es usted Hispano o Latino? ❑ Si ❑No

Raza/Herencia: (Elija las todas las opciones que correspondan)
❑Blanco ❑Asiático ❑ Indio Americano
❑ Negro o Afro-Americano ❑ Nativo de Hawaii u otra isla del Pacifico

28) Cual es el año de su nacimiento? 19___

29) Cuantos años ha vivido en el condado de Guilford? _____

30) Cuantas personas viven en su casa? _____

31) Cual de los siguientes montos es similar a los INGRESOS TOTALES de su casa? Esta pregunta es solo para estudios estadísticos
(Elija la MEJOR opción)

- ❑ Menos de $14,999
- ❑ $15,000-19,999
- ❑ $ 20,000-24,999
- ❑ $ 25,000-29,999
- ❑ $ 30,000- 34,999
- ❑ $ 35,000- 39,999
- ❑ $ 40,000-49,000
- ❑ $ 50,000-59,000
- ❑ $60,000 o más

Muchas gracias por su ayuda!!!!!!

Apendix B

RABIES
PREVENTION AND PROTECTION

HOW TO PROTECT YOU AND YOUR PETS FROM RABIES, A POTENTIALLY DEADLY DISEASE.

Raccoons are the main rabies vector in the eastern United States.

WHAT IS RABIES?

Rabies is caused by a virus and affects the nervous system of all mammals including cats, dogs, raccoons, bats and humans. The rabies virus enters the body through bites and scratches that draw blood and come in contact with infected saliva or through the mouth, nose and eyes. Once inside the body, the virus travels through the nervous system to the brain and salivary glands where it replicates to start shedding before the symptoms appear.

SYMPTOMS

Symptoms appear 2 weeks to 6 months after exposure and it is usually fatal if not treated in time. Animals that have rabies present unusual behavior:

- nocturnal animals are seen during the day
- animals become aggressive and lose their fear of humans
- animals attack humans and other animals without provocation
- animals may be limping or have paralysis and dogs may change the tone of barking

PREVENTION

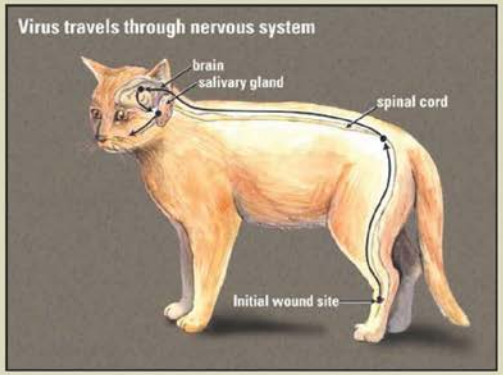
The best protection against rabies is vaccination of pets and avoiding contact with wild animals or unknown pets. Cats and dogs must be current in their rabies vaccination; unvaccinated pets are the main cause of rabies exposure to humans.
Do not attract wildlife to your yard by feeding them or leaving trash out.

FOR YOU

If you have been bitten or scratched by an unknown animal (pet or wildlife), wash the wound with warm water and soap and contact your doctor. Immediately report the animal to Animal Control! Do not try to scare or capture the attacking animal yourself. The doctor may recommend rabies post exposure prophylaxis; you will get 6 vaccines in your arm. Remember rabies is usually fatal if left untreated!

FOR YOUR PET

If your pet fights with a wild or unknown animal you should avoid touching places where saliva can be present such as the coat and face. Were gloves, wrap your pet in a towel and take it to the veterinarian. If your pet is current in its vaccinations he or she will receive a rabies vaccine booster. If your pet is not current in its vaccinations it will be quarantined. Avoid extra costs, vaccinate all your pets!
Report the animal to Animal Control! Do not try to scare or capture the attacking animal yourself.



FACTS ABOUT RABIES

- All mammals can get rabies, including humans
- Pet rabies can be prevented by vaccinating them every year
- In the US only 2-3 people die each year because of rabies, however 55,000 people will die of rabies globally this year, most of them under the age of 15
- Human exposure happens when unvaccinated pets or wild mammals bite people. Post exposure treatment for humans costs over $1,000

AVOID RABIES RISK, AVOID UNKNOWN ANIMALS AND VACCINATE YOUR PETS!

Want to learn more about rabies? Go to **http://www.cdc.gov/rabies/**

This educational brochure was developed by Maria Baron Palamar, DVM, Fisheries and Wildlife Sciences Program, NCSU. For more information, contact the Guilford County Animal Control.

IF YOU SEE AN ANIMAL ACTING STRANGE OR AGGRESSIVE CALL:

ANIMAL CONTROL: (336) 641-5990
If you get bitten or scratched by an unknown animal The Centers for Disease Control and Prevention recommends you:
WASH THE WOUND WITH SOAP AND WARM WATER AND CALL YOUR DOCTOR
DR. _____
(Fill out with your Dr's name and number)
LOW COST VACCINATION INFORMATION: (336) 641-7777

DON'T FORGET TO VACCINATE YOUR PETS!

Disclaimer: These educational materials have been developed as general information using the best knowledge of the authors. The authors are not responsible for the disease or harm that may occur due to the use of these educational materials.

RABIA
PREVENCIÓN Y PROTECCIÓN

PANFLETO INFORMATIVO PARA PROTEGERLO A USTED Y A SUS MASCOTAS DE LA RABIA, UNA ENFERMEDAD POTENCIALMENTE FATAL.

En el este de los Estados Unidos, los mapaches son el principal vector de rabia.

¿QUÉ ES LA RABIA?

La rabia es causada por un virus y afecta el sistema nervioso de cualquier mamífero incluyendo gatos, perros, mapaches, murciélagos y humanos. El virus de la rabia penetra el cuerpo por heridas y rasguños que toman contacto con la saliva de un animal infectado o por los ojos, la nariz o la boca. Dentro del cuerpo, el virus viaja a través del sistema nervioso hasta el cerebro y las glándulas salivales a donde se replica para ser dispersado antes de que aparezcan los síntomas.

SÍNTOMAS

Los síntomas aparecen de 2 semanas a 6 meses luego de haber sido expuesto al virus, la enfermedad es generalmente fatal si no se trata a tiempo. Los animales infectados con rabia presentan comportamiento extraño:

- los animales nocturnos salen durante el día
- presentan agresividad y pierden el miedo hacia las personas
- atacan a otros animales y personas sin ser provocados
- pueden presentar cojera o parálisis y cambios en el tono de su ladrido en el caso de los perros.

PREVENCIÓN

La mejor manera de prevenir la rabia es vacunado a las mascotas y evitando el contacto con animales desconocidos o salvajes. Los perros y gatos deben estar al día con su vacunación antirrábica; el contacto con mascotas no vacunadas es culpable por la mayoría de los casos de exposición en humanos.

PARA USTED

Si ha sido mordido o rasguñado por un animal desconocido (mascota o salvaje), lave bien la herida con agua tibia y jabón y llame a su doctor. ¡Debe reportar el animal al servicio de Control de Animales! No trate de asustar o capturar al animal atacante por su cuenta.
El doctor puede recomendarle tratamiento profiláctico post exposición contra la rabia; este tratamiento consta de 6 vacunas que se colocan en el brazo. ¡Recuerde que la rabia puede ser fatal si no se la trata correctamente!

PARA SU MASCOTA

Si su perro o gato pelea con un animal desconocido o salvaje trate de evitar tocarlo en los lugares a donde pueda haber saliva, como la cara y el pelaje. Use guantes, envuelva a su mascota en una toalla y llévela al veterinario. Si su mascota está al día con la vacunación antirrábica, el veterinario le dará una nueva dosis de la vacuna, pero si no está al día con la vacunación antirrábica, el veterinario la dejará en cuarentena. ¡Evite gastos excesivos, vacune a todas tus mascotas!
¡No se olvide de reportar el animal al servicio de Control de Animales! No trate de asustar o capturar al animal atacante por su cuenta.

DATOS SOBRE LA RABIA

- Todos los mamíferos pueden contraer rabia, incluyendo a los humanos
- La vacunación anual de mascotas es la forma más fácil de prevenir la rabia
- Solo 2 o 3 personas mueren cada año debido a la rabia en USA, pero 55,000 morirán de rabia este año en el resto del mundo, la mayoría serán niños menores de 15 años
- La exposición en humanos ocurre luego de ser mordidos o rasguñados por mascotas que no están vacunadas o por animales salvajes. El tratamiento post exposición en humanos cuesta más de $1,000.

EVITE RIESGOS RELACIONADOS CON LA RABIA, NO TOQUE ANIMALS DESCONOCIDOS Y VACUNE A SUS MASCOTAS!

¿Quiere aprender más sobre la rabia?
Visite http://www.cdc.gov/rabies/

Autores: María Barón Palamar, DVM.
Fisheries and Wildlife Ciencias Program, NCSU

SI VE UN ANIMAL QUE ACTÚA EXTRAÑA O AGRESIVAMENTE LLAME AL:

SERVICIO DE CONTROL DE ANIMALES: (336) 641-5990
Si ha sido mordido o rasguñado por un animal que usted no conoce el centro de prevención y control de enfermedades recomienda que:
LAVE LA HERIDA CON AGUA Y JABON Y LLAME A SU MEDICO
DR._____
(Escriba el nombre y el número telefónico de su médico)

INFORMACION SOBRE VACUNACION DE BAJO COSTO: (336) 641-7777

NO SE OLVIDE DE VACUNAR A SUS PERROS Y GATOS

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