THE EFFECTS OF DEMOGRAPHICS AND PET OWNERSHIP ON ATTACHMENT TOWARDS AND OPINION ABOUT OWNED AND UNOWNED FREE-ROAMING CATS

A Thesis

by

MELANIE ELAINE RAMON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2006

Major Subject: Epidemiology

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Approved by:

Chair of Committee, Margaret Slater
Committee Members, Michael Ward
Roel Lopez
Head of Department, Evelyn Tiffany-Castiglioni

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ABSTRACT

The Effects of Demographics and Pet Ownership on Attachment towards and Opinion about Owned and Unowned Free-roaming Cats. (August 2006)

Melanie Elaine Ramon, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Margaret Slater

A telephone questionnaire was developed to collect information on pet owners, cat ownership patterns, and people's opinions about homeless pets. A 7-day observation log was also developed to gather information about free-roaming cats in Caldwell, TX. The objectives of this research were: (1) to evaluate the reliability of the telephone questionnaire, (2) to assess general cat ownership patterns, (3) to evaluate attachment level of pet owners to their pets, (4) to determine general opinions about free-roaming cats, (5) to determine if demographics were associated with opinions about free-roaming cat and dog problems and (6) to investigate free-roaming cat activity in a community.

Telephone questionnaire information collected from 100 subjects was tested for reliability. Reliability was fair to good for cat level questions (sex, age, breed, length of time owned, indoor/outdoor status, litter, number of vet visits, vaccinated). Reliability was good for questions concerning subjects' knowledge of cat and dog behavior and levels of attachment to their pets. Reliability was excellent for all household level (demographic) variables. Reliability was moderate for questions regarding subjects' opinions about homeless animals.

Telephone questionnaire responses collected from 441 subjects were checked for associations using exploratory logistic and linear regression models. A cat's role as a pet, vaccination status, and the length of time owned were associated with a cat's sterilization status. A cat's role as a pet was associated with the cat's indoor/outdoor status. Household size, education level and ethnicity of the owner were associated with cat ownership. Having children was associated with a negative opinion about homeless cats. Education level was associated with subjects' knowledge about dog and cat behavior. Gender, household size, and knowledge score were associated with subjects' attachment to their pets.

Descriptive information on free-roaming cat activity was collected from 21 subjects using the 7-day observation log. Subjects made 382 cat sightings during the study period. Slightly more cat sightings were made during the morning than in the evening and afternoon. Most cats were spotted in neighborhoods and were resting or eating. Most of these cats that were eating were seen during the morning or evening hours.

DEDICATION

I would like to dedicate this thesis to my mother, father, and brother, Stephen. Without their constant love and support, the last 20 years of my education would not have been possible. My family has offered me encouragement to no end and has always pushed me to push myself to great lengths. They have greatly contributed to my happiness and well-being and for all that they have given me I will be forever grateful. I would also like to dedicate this work to my dog, Cesar, as he has been both a source of relaxation and strength for me during this research process. Lastly, I would like to dedicate this work to my dear friends, Brenda, Alice, Holli, and Jesse who forced me to believe in myself during stressful times.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Margaret Slater, for being an excellent mentor to me and for her guidance and support throughout the research process. I would also like to express my appreciation to my committee members, Dr. Michael Ward and Dr. Roel Lopez, for their availability to help at all times.

Thanks also to the patient and kind-hearted residents of Caldwell, TX, for this research would not have been possible without their willingness to participate. I also want to extend my gratitude to the Public Policy and Research Institute at Texas A&M University for administering the telephone survey, to Lisa Halperin for organizing the survey administration, and to Mary Landreth and Paige Hill for their help in writing the observation log instrument.

Lastly, a special thanks to Brenda Jacklitsch and Vit Janousek for their help with response coding and data entry.

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CHAPTER I

INTRODUCTION: THE IMPORTANCE OF THE RESEARCH

Free-roaming cats have recently become the central focus of the issue of pet overpopulation (Slater, 2004). Free-roaming cats, when not sterilized, largely contribute to this overpopulation problem. Free-roaming cats are cats that have been living outdoors for any period of time, regardless of the amount of human contact they have had (Slater, 2002). Feral cats are wild cats, whether they were born wild or were abandoned and have reverted back to being wild cats (Levy and Crawford, 2004). Current knowledge and understanding of cat populations are confused by the fact that cats can move from 1 population to another. Free-roaming cats can become domesticated or feral and can become owned or unowned (Slater, 2004). Because ownership status and socialization cannot be clearly defined for free-roaming cats, it is difficult to create adequate solutions and control methods for the pet overpopulation problem (Slater, 2004).

This project consisted of 3 parts. The first was the development and evaluation of a telephone questionnaire designed to collect information on pet owners, cat ownership patterns, and people's opinions about homeless pets. The repeatability study involved administering the same questionnaire to the same subjects 1 to 2 months apart. Responses were compared from these interviews and were used to determine

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This thesis follows the style of the journal, Preventive Veterinary Medicine.

which questions were reliable enough to be used in the modeling portion of the study.

The second part of this project involved exploratory modeling using the telephone questionnaire. For the modeling portion, the questionnaire was administered to a larger group of subjects. Models examined the effects of cat level and household level variables on pet ownership patterns, attachment level to pets, knowledge about cats and dogs, and on being a pet owner. In addition, specific concerns about homeless animals were examined in this portion of the study.

The third part of the project involved the collection of data on free-roaming cat counts using a 7-day observation log. This portion of the study included a separate set of owners who had participated in the telephone interview before completing the observation log. The observation log collected data on free-roaming cat counts, as well as patterns and demographics of the free-roaming cats at the study site.

This project is 1 of many studies that have examined pet ownership demographics in relation to cat ownership patterns. However, there has not been any previous collection of data on free-roaming cat counts by the untrained public prior to this study.

CHAPTER II

LITERATURE REVIEW

2.1 Pet overpopulation

2.1.1 Pet overpopulation: causes and concerns

One dictionary definition of overpopulation notes that an overpopulation problem occurs when a population surpasses the space and resources that an environment can provide (Dictionary.LaborLawTalk.com, June 2005). Pet overpopulation occurs when the number of pets is greater than the number of owners who want them (Dictionary.LaborLawTalk.com, June 2005). Solutions to the problem of pet overpopulation have become topics of great concern because the causes of pet overpopulation are many and varied.

2.1.1.1 Relinquishment/abandonment of animals

There are several causes of pet overpopulation that should be noted. One of the largest contributors of pet overpopulation is the relinquishment or abandonment of animals by their owners. People relinquish animals to shelters for a variety of reasons that are both human and animal related. Several studies have noted that relinquishment is associated with the physical and behavioral characteristics of the animals as well as the characteristics, knowledge, experience, and expectations of the owners (Miller et al. 1996; New et al. 2000; Patronek et al. 1996). Factors beyond the control of the owner may also cause them to relinquish their animals. For example, changes in housing, income, or a decline in health may all be factors in an owner's decision to relinquish their pets to a shelter. Oftentimes pet owners will purchase an animal only to relinquish

the animal shortly thereafter. One study found that dogs and cats being relinquished to shelters were more likely to be young, mixed breed, intact, and had been owned for a short time before they were relinquished to shelters (New et al. 2000).

2.1.1.2 Animal shelters

The frequent relinquishment of animals creates increasing populations of unowned pets living in animal shelters. In addition, shelters are expected to house free-roaming cats and dogs. If these free-roaming animals have not been sterilized this creates an even larger problem. Without enough room for free-roaming animals in shelters, the number of cats and dogs increases when these free-roaming animals reproduce. In addition, owners who do not sterilize their pets and then later abandon them further contribute to the problem of pet overpopulation. Intact animals that have been abandoned increase the pet population by mating with other free-roaming cats and dogs.

2.1.1.3 Birth rates of intact animals

The birth of new litters by owned cats and dogs is another cause of pet overpopulation which should be examined (New et al. 2004; Olson and Moulton, 1993). Some believe that the problem is rooted in the lack of awareness of pet owners about the benefits of sterilizing their pets (Allen, 1992). The reason why pet owners refrain from having their pets "fixed" remains elusive. One study found that the most popular reason why owners did not sterilize their dogs was because they were planning to breed the dogs; the most popular reason for cat owners was that they had forgotten or had not gotten around to it yet (Patronek et al. 1997). Another study found, interestingly enough,

that Catholics and pet owners from a South American or European ethnic background were more likely to leave their pets intact than people of other ethnicities and religious backgrounds (Manning and Rowan, 1992). When owners do not sterilize their pets, new litters of intact animals further add to the growing population of dogs and cats (Olson and Moulton, 1993). Both planned and unplanned litters greatly contribute to pet overpopulation. One study found that the majority of kitten litters was unplanned compared to puppy litters (New et al. 2004). In this study, the crude birth rate estimate for 1996 was 11.2 kittens/ 100 cats in households and 11.4 puppies/ 100 dogs in households (New et al. 2004). This study suggests that owned animals are, in fact, contributors to pet overpopulation. With high birth rates for owned dogs and cats, and with a large portion of the litters being unplanned, countless animals are being born to owners who do not want them (New et al. 2004). Without neutering these animals, the high birth rates of dogs and cats will continue to contribute to the problem of pet overpopulation (New et al. 2004).

The birth of new litters by unowned pets is another cause of pet overpopulation. Animals that have recently become unowned often remain intact and have limitless opportunities to mate with other intact homeless animals. Intact free-roaming cats are an issue of specific concern in regard to pet overpopulation. In 1 study, free-roaming cats were found to have 1.4 litters per year (Nutter et al. 2004). The litters produced from these free-roaming cats alone largely contribute to pet overpopulation. In another study 57% of the free-roaming cats being investigated were kittens that had been recently born

at the study site (Levy et al. 2003). It is vital that unowned pets be sterilized early in life to prevent further litters from adding to the pet overpopulation problem.

2.1.1.4 Pet overpopulation concerns

Pet overpopulation, with specific regard to free-roaming cats and dogs, has become such an important topic because of the human and animal related concerns that surround this problem. The concern for the welfare of the unowned animal is 1 of the most important issues related to pet overpopulation. Welfare issues that affect these free-roaming animals include: diseases and disease transmission, companionship, food and shelter, and injury. Most of these free-roaming animals that do not have caretakers or have not been through trap-neuter-return programs will not receive veterinary care and do not live healthy, safe lives.

Pet overpopulation has raised several public health issues as well. Although diseases do not appear to occur often, several diseases can possibly be transmitted between stray cat populations especially when a large number of homeless cats is involved. Zoonotic diseases are of course most important in human public health. Two of the specific foci for public health officials are rabies and animal bites (Slater, 2004). Cats have become the most commonly rabies-infected domestic species; reasons for this could be that cats are not vaccinated as frequently and that they are usually allowed more outdoor freedom than dogs (Krebs et al. 2003). Another important public health concern is animal bites (Levy and Crawford, 2004; Slater, 2004). A growing cat population further adds to this problem. Cat bites can be much more dangerous than dog bites because they are more likely to become infected (Moore et al. 2000). Stray cat

populations have become the most reported source of cat bites, with most of these bites usually taking place after stray cats are provoked (Patrick and O'Rourke, 1998). This could mean that the risk of bites might be lowered if the stray cat population was controlled. Vaccinating and sterilizing the cats may help to resolve some of these concerns (Levy and Crawford, 2004).

2.1.2 Pet population control strategies

Current management strategies to control the cat population problem include education, removal of the cats, trap-neuter-return programs (TNR), or a lack of action. Education of pet owners is very important in attempting to control the pet population. Pet owners must be knowledgeable about the value of pet identification and sterilization in order to prevent further growth of the pet population. In the past, euthanasia has been a common method of controlling pet overpopulation. However, the way that animals are perceived has changed significantly in recent years. Since companion animals are now thought to feel pain, euthanasia of companion animals is no longer a widely accepted choice for population control (Slater, 2004). Despite this shift in attitude about companion animals, euthanasia of unowned pets is still widely practiced. One source estimated that every year as many as one-quarter of the pets in the U.S. are killed because of pet overpopulation (Olson and Moulton, 1993). Although the total number of dogs and cats humanely killed in the U.S. has decreased in the past few decades due to a change in attitude towards these animals, humane killing still remains the number 1 cause of pet death in the U.S. (Olson and Moulton, 1993).

Trap-neuter-return (TNR) programs are a fairly recent approach that attempts population control through sterilization. The goal of TNR programs is to trap, sterilize, and return the cats to their colonies. Most TNR programs are run by volunteers and include some form of identification that indicates that the cat has gone through the program, such as ear notching (Levy and Crawford, 2004; Slater, 2004). TNR has been shown by several studies to be a practical and successful alternative to lethal methods of population control not only in the U.S., but also in Italy and the United Kingdom (Gibson et al. 2002; Levy et al. 2003; Natoli,1994; Neville and Remfry, 1984). These studies stress the importance of monitoring the cats before and after they go through the TNR program that was instituted, as well as place emphasis on the public health implications of overpopulation. TNR programs highlight the significance of increasing the quality of life for these cats by the volunteers who care for them. Although the above mentioned pet population control strategies have been implemented and proven successful in some areas, more often than not, a lack of action exists in most communities with regard to the pet overpopulation problem.

2.2 Pet owner surveys

Since owned pets can eventually lead to an increase in unowned pets and can contribute to pet overpopulation, it is necessary to examine the relationship between pet owners and their pets. Pet ownership patterns, level of attachment to the pet, and demographics of the pet owner, can provide a great deal of general information about people and their pets. This information is useful to public health and animal control

officials because it conveys the general trends in pet ownership and indicates which areas may require possible education about sterilization and pet health for pet owners.

Several surveys have examined cat and dog ownership patterns and pet owner demographics for this reason. One such study was conducted by the American Pet Products Manufacturers Association (APPMA, 2005). The APPMA study found that pet owners in the U.S. are more likely to be a "traditional family," live in a household with children, own their home, have a higher income, and have more people living in their household than non-pet owners (APPMA, 2005). This study also found that cat owners, when compared to the rest of the U.S. population, are less likely to have children living in the home, more likely to have a lower household income, and are more likely to be single women or widowed (APPMA, 2005). Most cat owners identified themselves as white and reported owning a mixed breed cat and also reported that their cat stayed indoors at all times (APPMA, 2005). The average age of the cats in this study was found to be 4.2 years in 2004 (APPMA, 2005). Most cat owners had obtained their cats from a friend/relative, followed by adopting their cats as strays (APPMA, 2005). Two important cat-related trends were noted in the APPMA study: a decrease in percentage of pet cats vaccinated for rabies and an increase in percentage of pet cats sterilized from 1998 to 2004 (APPMA, 2005). Dog owners were found to be more likely to be white, married individuals who owned their residence and lived in a "traditional family" home (APPMA, 2005). Most dog owners had also obtained their dogs from a friend/relative, followed closely by obtaining their dogs from breeders (APPMA, 2005). Most dog

owners reported owning only 1 dog (APPMA, 2005). The proportion of owned male and female pets was about equal for both cats and dogs in this study (APPMA, 2005).

A similar study conducted by the American Veterinary Medical Association also examined pet owner demographics in the U.S (AVMA, 2002). This study found that most pet owning households considered their pets to be companions, followed closely by households that considered their pets to be family members (AVMA, 2002). Only 2.2% considered their pets to be property (AVMA, 2002). Pet owners were more likely to be female than male, with 72.8% of primary caretakers being female in this study (AVMA, 2002). There was a decreasing trend found in this study for percentage of number of pets owned per household, with most pet owning households owning just 1 pet (AVMA, 2002). More households owned only dogs than only cats (AVMA, 2002). Most pet owners were found to be couples, living in a 4-member household, were college graduates, owned their residence, and lived in a community of less than 100,000 people (AVMA, 2002). This study also found that the likelihood of owning a pet increases with household income (AVMA, 2002). Cat owners were most likely to be parents, living in a 5 or more member household, who owned their residence, had a college degree, had an income of $55,000 to $84,999, and lived in a community of less than 100,000 people (AVMA, 2002). This same study also found that in the state of Texas, 61% of households owned pets (AVMA, 2002). About 44% of households in Texas owned dogs and 33% of households in Texas owned cats in 2001 (AVMA, 2002). The average number of dogs owned per Texas household was 1.8 and the average number of cats owned was 2.2 (AVMA, 2002)

2.3 Reliability

Surveys on pet owner demographics and pet ownership patterns provide a lot of insight into the relationships between people and the pets that may contribute to pet overpopulation over time. However, the data obtained from these studies cannot be properly or easily interpreted as accurate data if non-random error is introduced into these studies.

Three specific kinds of avoidable errors can be introduced during measurement assessment. Error can be introduced into studies due to differences within subjects (Gordis, 2004). This kind of error can result from a subject's inability to understand the instrument questions or inability to recall information. Within subject error can also result from measurement instability, or the subjects' characteristics changing with the passage of time (Carmines and Zeller, 1979). Secondly, error can result from differences between evaluators (Gordis, 2004). Differences between evaluators can occur if a subject's response to a certain question is interpreted by 2 survey interviewers in different ways. Lastly, error can be introduced by differences within evaluators (Gordis, 2004). This type of error can occur, for example, if an interviewer emphasizes subjects' responses differently for 2 identical surveys. Errors incurred by evaluators are easier to avoid than those incurred by subjects. For this reason it is crucial that all evaluators be properly and thoroughly instructed on the methods of the study in the same manner.

Reliability is the capability of an instrument to create similar results when the instrument is administered at different times (Carmines and Zeller, 1979). If an instrument is not reliable then repeated results obtained from the instrument will not

provide consistent findings. Therefore, it is essential that the reliability of survey instruments be evaluated before the data collected is analyzed.

There are 4 methods of assessing reliability of an instrument. The alternative form method looks at the scores on different tests from the same subjects. Both tests are created to measure 1 concept. This form of reliability assessment can be difficult to carry out because it can be tricky to create 2 different instruments with different questions that measure the same thing (Carmines and Zeller, 1979). The split-halves method incorporates all the elements of 1 instrument and splits them into 2 halves that have similar components and are administered at 1 time. Reliability is measured by testing to see if the halves scores are correlated. Because halves of the instruments can be split several different ways through random selection, using this method of reliability assessment can become problematic (Carmines and Zeller, 1979). The internal consistency method of reliability assessment administers a single instrument at 1 time and calculates the average level of reliability among all elements of the instrument using the mean correlation to calculate Cronbach's alpha. Because this method of reliability assessment does not take into account any responses that may change with time, this may not be a useful assessment tool (Streiner and Norman, 1995). The method of reliability assessment used in this study, the test-retest method, involves the administration of the same instrument to the same people at 2 different times. The 2 scores are then correlated to estimate the reliability of the instrument (Carmines and Zeller, 1979).

There are several limitations to consider when using the test-retest method of reliability assessment. Responses that will inevitable change over time, like age, can become problematic to evaluate with this method. This problem is referred to as measurement instability (Carmines and Zeller, 1979). This variability in responses can become of important concern if the length of time between instrument administrations is long (Carmines and Zeller, 1979). With questions that may change with time, it is difficult to tell if the data are unreliable or if the disagreements are representative of real changes that occurred over time. Another problem associated with the test-retest method is the influence of the first survey on the responses of the follow-up survey. For example, a respondent may report that his or her cat is not sterilized during the first interview, and then may report owning a spayed cat during the follow-up interview because the subject may have realized the importance of having his pet sterilized as a result of the first interview. This disagreement between responses can lead to a lowered estimate of reliability. A subject's inability to recall actual data during the second interview can lead to reporting results that are identical to those from the first interview. In this case, the level of reliability would be overestimated because real data may not have even been reported.

The level of reliability can be calculated using the kappa statistic. Kappa measures the amount of agreement between 2 responses to 1 question and adjusts for agreement based purely on chance (Dohoo et al. 2003). Kappa can range from -1 to 1, with 0 being no agreement other than chance, -1 being complete disagreement, and 1 being complete agreement. Using the kappa statistic as a measure of agreement can be

complicated. One of the issues that can arise with the use of kappa is prevalence. Low or high prevalence of a certain response can cause kappa values to drop and make variables appear unreliable even if they have a high level of agreement (Dohoo et al. 2003). Another problem with using kappa involves the correction of chance agreement. If both the agreement expected by chance and the observed agreement are large, then the kappa may be low because of this correction process (Feinstein and Cicchetti, 1990). Therefore, for 2 variables with equivalent observed agreements and different expected agreements, the kappa for 1 of the variables could be 2 times higher than the kappa for the other variable (Feinstein and Cicchetti, 1990). Kappa can also be influenced by the number of categories for the element being examined. Because there is a smaller chance of disagreement for variables with fewer subcategories, deceptively larger kappa values may result from the analysis of these variables (Maclure and Willet, 1987). Kappa is heavily influenced by sample size. Small sample sizes can make perfect levels of agreement result in small kappas and seem unreliable. Because kappa does not consider partial agreement when giving an overall estimate of reliability, weighted kappa can be used with ordinal categorical data. However, weighted kappa can be skewed by the size of the weights placed on certain categories and does not always show where disagreement is occurring as a result (Maclure and Willet, 1987).

2.4 Animal count studies

The present study will investigate the activity of free-roaming cats and will specifically examine the number of cats seen. To my knowledge there have been no prior

studies that have measured cat counts using daily diaries. To date there have not been many studies that have involved the counting of free-roaming animals or animal sightings by the untrained public. One of the few studies that dealt with animal counts is the Audubon Society's Christmas Bird Count. The Christmas Bird Count takes place on Christmas day every year and it is the largest survey in the world (Pennisi, 1990). Thousands of civilian volunteers have collected data on different species of birds for this study since 1900 (Pennisi, 1990). Every year an area is defined for data collection and the area is then broken up into territories. Participants are assigned a territory and count only the birds that they see within their designated spot. The numbers of birds and the information on bird population patterns that bird counters provide is used to determine which species are in danger (Pennisi, 1990). Another study that examines number of birds is the Backyard Bird Count conducted by Cornell University. This study involves counting the maximum number of bird species seen at 1 time on 2 consecutive days every 2 weeks (Cornell University, 2003). Both studies deal with counting specific species of birds. Counting numbers of birds can become complicated because of multiple sightings of the same birds.

Counts of free-roaming cats would be invaluable in determining if a TNR program would be helpful in a particular area. Data on free-roaming cat patterns and data on cat sterilization status would be extremely useful in determining course of action for animal control, public health officials, and even veterinarians. This kind of data could also be helpful to government officials in creating policies about owned and unowned animals in a population. Veterinarians could also benefit from the knowledge that data on free-

roaming cats could provide, especially because they are charged with the task of helping clients make decisions about the care of their pets. In order to gather sufficient information about these cats a multi-day instrument is required. Several factors such as weather conditions, temperature, cat injuries, pregnancies, and hunger (hunting patterns), could cause differences in data from day to day. For these reasons using a multi-day instrument to collect data on cat counts will provide a more accurate depiction of free-roaming cats in the community.

In this pilot study, a 7-day observation log was used to obtain information about free-roaming cats in Caldwell, TX.

2.5 Objectives

The objectives of this research were: (1) evaluate the reliability of a telephone questionnaire, (2) to assess general cat ownership patterns, (3) to evaluate attachment level of pet owners to their pets, (4) to determine general opinions about free-roaming cats, (5) to determine if demographics are associated with opinions about free-roaming cat and dog problems and (6) to investigate free-roaming cat activity in a community. This study was a portion of a larger project that also examined population dynamics of free-roaming cats at the study site, Caldwell, Texas. The project was a pilot study for the analysis of cat populations in a community. The main goal of this research was to make associations between demographics and perceptions of free-roaming cats so that cat populations may be better studied in the future.

CHAPTER III

AN EVALUATION OF THE RELIABILITY OF A TELEPHONE QUESTIONNAIRE ON ATTITUDES TOWARDS CATS IN A COMMUNITY

3.1 Introduction

In epidemiology, data collected by any instrument is useless if the instrument cannot produce results that can be repeated over time (Gordis, 2004). Findings of any study cannot be considered precise if its results do not ultimately remain consistent and reliable. Reliability evaluates the random error that occurs during a test (McDowell and Newell, 1996). Depending on the amount and types of error introduced into a study, the results may not be valuable or meaningful.

Four different methods are used to assess reliability: the alternative form method, the split-halves method, the internal consistency method, and the test-retest method. The test-retest method was used in this portion of the study because it was the least difficult method to implement and took into account data that may have changed with time. Only results that are reliable can be reported as relevant findings of the study. Because the overall goal of this study was to test these methods of analysis so that they could be used in other communities of pet owners and communities with free-roaming cat populations, the reliability of the instrument must be performed beforehand. The objective of this portion of the study was to evaluate the reliability of a telephone questionnaire on cat ownership patterns and attitudes towards unowned free-roaming cats in a community.

3.2 Methods

3.2.1 Study design, study site, and study population

This study utilized a cross-sectional study design with simple random sampling administered by telephone interview. The community of Caldwell, Texas was chosen for this study so that data could be collected from an area where a general lack of action existed in regard to pet overpopulation control. By using this type of community for this study the findings would give a baseline picture of the scope of pet overpopulation in an area with limited control methods. There was only 1 part time animal control officer and no animal shelter in the city. Animal control methods in Caldwell only include euthanasia with occasional adoption of dogs and cats through the local veterinary hospital. Caldwell is located in Burleson County, TX. Results from the year 2000 census (United States Census Bureau, February 2006) indicated that Caldwell had a population of 3,449 people. The ethnic breakdown of the community was as follows: Anglo (71.24%), Black/African-American (12.64%), Native American (0.17%), Asian (0.09%) and all other groups (13.71%). Hispanics/ Latinos of any race made up 22.96% of the total population. Caldwell contained 1322 households. About 36.5% of all households contained children and the average household size was 2.61 people per household. Females comprised 54.6% of the population, while males comprised 45.4% of the population. The age breakdown was as follows for people 18 and older: 18-24 years (13.3%), 25-44 years (37.5%), 45-64 years (28.8%), and 65+ years (20.4%).The median household income in Caldwell was $29,936 in the year 2000 and almost 18% of the population lived below the poverty line (United States Census Bureau, February 2006).

The subjects for the telephone questionnaire were chosen by the Public Policy and Research Institute (PPRI), a survey administration organization of Texas A&M University. PPRI used all listed telephone numbers in Caldwell and screened them for being within the city limits. After screening, all telephone numbers that were non-residences were excluded from the study. The study population included 441 households. Eligible subjects included 1 person from each of the 441 selected households, either a male or a female of age 18 or older. The survey was administered to the 441 subjects beginning June 6, 2005 and ending June 28, 2005. At the end of the survey, the subjects were asked to participate in a second administration of the survey by PPRI that would take place in 4-8 weeks. At the end of the interview, 360 subjects (1 per household) agreed to participate in the follow-up interview. These subjects were telephoned and those that were available to participate and completed the telephone questionnaire a second time became a member of the follow-up survey population.

3.2.2 Telephone survey instrument

The telephone questionnaire (Appendix A) was administered as a centrally monitored computer-assisted telephone interview (CATI). All interviewers that administered the survey to subjects were trained by PPRI. The telephone survey had 4 sections and evaluated pet ownership patterns and demographics of the free-roaming cats in the city of Caldwell. At the start of the survey, interviewers asked to speak to a member of the household who was knowledgeable about the pets in the house. The first section, which included 20 questions, was only administered to subjects who owned cats. This first part of the survey assessed cat lifestyles, cat ownership patterns, reproductive

status and health status of the cats. There were 2 open-ended questions in this section that asked about where the cat had come from and why the owner had not had their cat sterilized. The second section of the questionnaire was administered to all subjects and measured the respondents' opinions about homeless dog and cat problems, as well as assessed feeding patterns and demographics of stray animals. Twenty-four questions were administered in part 2 of the survey. This section also included a set of questions from a knowledge deficit scale that was used by the National Council on Pet Population Study and Policy that evaluated the respondents' general knowledge about cats and dogs (Salman et al. 1998). One question regarding opinion of keeping cats indoors was added to this set of knowledge questions. Opinions about free-roaming cat problems was categorized into 4 types of concerns (nuisance, household safety, animal welfare, and public health) and were measured by subjects' responses to being asked to what extent they believed that homeless cats were a problem in their area. The same was done with subjects' opinions about stray dogs. The third section of the questionnaire was administered to all pet owners and measured their attachment to their pet (Zasloff, 1996). This section was taken from the Comfort from Companion Animals Scale (CCAS) that was used and validated in a previous study (Zasloff, 1996). Subjects were asked to score their agreement with 11 different statements regarding the stability, love, trust, and companionship that they felt as a pet owner. The responses in this section were based on a Likert scale from 1 to 4 (strongly disagree to strongly agree) (Zasloff, 1996). The last section of the questionnaire was administered to all respondents and included 9 questions regarding the subjects' basic demographics and household, including a

question about any young children in the home. Most questions that were included in the survey were closed response questions but there were 2 open-ended questions in the pet ownership section. For these questions the interviewers had a short list of the most common responses. Three questions were added to the end of the survey asking for permission to re-contact the subjects for a follow-up interview, for their consent to participate in the observation log portion of this study, and for their consent to have their cat radio collared and tracked in a separate study. All of the survey responses were confidential and were coded once all the data were collected. The telephone questionnaire was reviewed and approved by the Institutional Review Board- Human Subjects in Research, Texas A&M University (Protocol Number 2005-0286).

3.3 Data analysis

3.3.1 Data manipulation

The responses about the number of children living in the household were dichotomized so that the results could be compared to other studies (APPMA 2005, AVMA 2002). In the previous study that examined knowledge of animal care and behavior, each of the questions were evaluated individually (Salman et al. 1998). For the present study, total knowledge scores were calculated in order to evaluate an overall measure of knowledge level for the initial and follow-up surveys. These scores were calculated by adding up the number of correct responses to the statements testing subjects' levels of knowledge about cats and dogs. A higher knowledge score indicated that the subject was more knowledgeable about cats and dogs. There was 1 knowledge

question regarding the number of times per year that female cats are able to breed that could be argued to be a true or false statement because cats are polyestrous. All subjects who answered true or false to this question received a point. As was done in the previous study, attachment level scores were calculated by adding up the numbers (1 to 4) given by the subjects in response to the 11 statements included in the attachment scale (Zasloff, 1996). The "don't know" responses to the question regarding cat breed were re-categorized as "mixed breed" because it was believed that any human subjects who did not know the breed of their cat, owned a mixed breed cat. In addition, all responses of "don't know," "refusal to answer," or "other" that would prevent reliability measures from being calculated, due to unequal number of variable categories between survey 1 and 2, were excluded from this portion of the study.

3.3.2 Reliability analysis

The variables that were tested included: cat level variables (sex, breed, age, time owned, indoor/outdoor status, source, role, sterilized, litter, collar, vet visits, and vaccinated), opinions about stray animals variables, and all household level variables (number of cats and dogs owned, knowledge score, attachment score, and demographic information). It is important to note that during the second survey the interviewers asked the subjects questions in reference to the present time period, not the same time period as the first interview. Because responses to some of these cat level variables could have changed with time, it was necessary to check for logical changes between the first and second surveys. Opinions about stray animals variables were of specific concern because

a change in attitude towards these homeless animals could indicate a change in the stray animal population or possibly a lack of test reliability.

Not all variables were included in the reliability analysis. Only attachment scores from dog owners and cat owners were examined for reliability because no information was desired on attachment levels to other types of pets. Four variables from the cat owner section of the survey were excluded from the reliability study (planned/accidental litter, litter before sterilized, reason for not sterilizing, non-annual vet visits). Three of these questions were asked as subset questions (after "has your cat had a litter") and were excluded because of their small sample size ($n < 10$). Non-annual vet visits was excluded from the reliability analysis because only descriptive information was desired on this variable. Twelve of the variables that evaluated homeless cat and dog patterns from the homeless pets section of the survey were excluded from the reliability analysis. These variables indicated frequency of stray dog and cat sightings, sightings of stray puppies and kittens, and feeding patterns. Responses to the questions were expected to be extremely variable with time, which would have made reliability analysis difficult.

For categorical data with less than 4 categories or for nominal categorical data, the kappa statistic was used. Kappa was calculated using commercially available software (SPSS, Version 11.5, Chicago, IL) and the 95% confidence intervals were used to determine if the agreement beyond chance between the variables was statistically significant. Ranges of kappa agreement were based on Fleiss et al. 2003. Kappa values < 0.40 were considered poor agreement, values between 0.40 and 0.75 were considered fair to good agreement, and values greater than 0.75 were considered strong agreement

beyond chance for this study (Fleiss et al. 2003). For nominal categorical variables with 4 or more categories, cross tabulations were performed on the variables from the first and second surveys to see where the disagreement occurred. Continuous variables were graphed and examined to determine if the responses were normally distributed. For continuous variables that were not normally distributed Spearman's rank correlation coefficients were calculated based on the responses from the first and second interviews. All ordinal variables with 4 or more categories were also examined using Spearman's rank correlation. A Spearman correlation value that was greater than 0.6 or smaller than -0.6 indicated that a strong relationship existed between the 2 variables being examined (Ott and Longnecker, 2001). The asymptotic standard errors were used to calculate 95% confidence intervals for kappa and Spearman estimates. For variables which did not include zero in the confidence intervals, this indicated that there was a level of agreement that was significantly better than due to chance at the 0.05 level.

3.4 Results

3.4.1 Response rates

The follow up interviews began on July 19, 2005 and ended on August 11, 2005. For the first interview, 441 people completed the survey, 27 people only partially completed the survey, 333 people refused to participate in the study, and 7 people were unable to complete the survey due to physical or mental inability or incompetence. At the end of the first survey, 360 people agreed to participate in the second interview. Of these 360 people, 160 were randomly selected and telephoned. For the follow-up

interview, 100 people completed the survey, 1 person only partially completed the survey, 17 people refused to participate in the follow-up survey, and 1 person was unable to complete the follow-up survey due to physical or mental inability. There were 15 people who could not be reached and 26 people were not eligible to participate in the study because of disconnected or non-working telephone numbers. The mean and median amount of time that passed between the first and second interviews for all subjects were about 48 and 50 days. The minimum and maximum amount of days that passed between these interviews was 25 and 64 days. The response rate was 84% (100/119) among those contacted and 75% (100/134) among all eligible respondents for the follow-up survey.

3.4.2 Findings

Frequency information collected during the initial and follow-up surveys on variables for reliability testing are shown in Tables 3.1, 3.2, and 3.3. Thirty-three of the subjects were cat owners and provided data on cat level variables. The variable litter was a subset question of the question about sterilized cats, so data was only collected on 26 cats for this question. All 100 subjects responded to the initial questions about opinions of stray dogs and cats. However, since the questions about specific types of stray animal problems were asked as subset questions, information about stray dogs and stray cats was obtained from only 12 and 36 subjects. All 100 subjects responded to the knowledge deficit questions. Because 62 subjects reported being cat or dog owners, information on attachment and pet numbers was available from only these subjects. All 100 subjects responded to the demographic section of the survey.

Table 3.1: Frequency information collected from 33 cat owners during the initial and follow-up telephone questionnaires (n = 56 cats).

Variables	Survey 1 (N)	Survey 2 (N)
Sex		
Male	23	26
Female	33	30
Don't Know	0	0
Refuse	0	0
Breed		
Mixed breed	53	55
Purebred	3	1
Don't Know	0	0
Refuse	0	0
Age		
< 6 months	0	0
6 months to 1 yr	6	3
2 to 5 yrs	20	22
6 to 10 yrs	15	15
10 + yrs	14	14
Don't Know	1	2
Refuse	0	0
Time owned		
< 3 months	1	0
3 to < 6 months	0	1
6 months to < 1 yr	5	3
1 yr to < 2 yrs	4	6
2 yrs to < 4 yrs	11	14
4 to < 10 yrs	22	19
10 yrs to < 15 yrs	9	10
15 + yrs	4	3
Don't Know	0	0
Refuse	0	0

Table 3.1 (continued).

Variables	Survey 1 (N)	Survey 2 (N)
Indoor/Outdoor status		
Indoor only	20	17
Outdoor only	7	9
Both	29	30
Don't Know	0	0
Refuse	0	0
Source*		
Found as stray	15	18
Born at home	7	8
Given by friend/relative	24	19
From shelter	3	7
In front of store/flea market	5	4
Other	0	0
Don't Know	1	0
Refuse	1	0
Role		
Companion	50	50
Mouser	5	5
Don't Know	1	1
Refuse	0	0
Sterilized		
No	2	2
Yes	54	54
Don't Know	0	0
Refuse	0	0
Litter		
No	18	19
Yes	7	7
Don't Know	1	0
Refuse	0	0

Table 3.1 (continued).

Variables	Survey 1 (N)	Survey 2 (N)
Collar		
No	22	23
Yes	34	33
Don't Know	0	0
Refuse	0	0
Vet visits		
4 +	1	1
2 to 3	7	8
1	33	29
0	12	18
Don't Know	3	0
Refuse	0	0
Ever vaccinated		
No	6	6
Yes	49	49
Don't Know	1	1
Refuse	0	0

* Denotes open-ended question.

Table 3.2: Opinions of stray animals, knowledge score and demographic data collected from all subjects during the initial and follow-up telephone questionnaires (n = 100).

Variables	Survey 1 (N)	Survey 2 (N)
Stray dogs are a problem		
No	77	79
Yes	23	21
Don't Know	0	0
Refuse	0	0
Which dog problem is most important		
Nuisance	7	6
Household safety	1	1
Animal welfare	3	3
Public health	1	2
Don't Know	0	0
Refuse	0	0
Stray cats are a problem		
No	49	54
Yes	49	44
Don't Know	1	2
Refuse	0	0
Which cat problem is most important		
Nuisance	16	17
Household safety	4	2
Animal welfare	9	11
Public health	7	6
Don't Know	0	0
Refuse	0	0
Knowledge score[a]		
1	1	0
2	6	5
3	12	11
4	20	21
5	18	17
6	24	35
7	19	10
8	0	1

Table 3.2 (continued).

Variables	Survey 1 (N)	Survey 2 (N)
Person age		
18-24	8	9
25-34	12	13
35-44	14	12
45-54	21	22
55-64	18	18
65 +	27	26
Don't Know	0	0
Refuse	0	0
Gender		
Male	21	20
Female	79	80
Don't Know	0	0
Refuse	0	0
Household size[a]		
1	24	23
2	30	32
3	18	18
4	17	19
5	5	5
6	6	2
8	0	1
Number of adults[a]		
0	0	1
1	28	27
2	53	52
3	15	14
4	3	5
5	1	1

Table 3.2 (continued).

Variables	Survey 1 (N)	Survey 2 (N)
Number of children[a]		
0	75	74
1	11	12
2	12	11
3	1	2
4	1	1
Education level		
< High school	7	12
High school/GED	32	31
Some college	33	25
Completed college	22	23
Advanced degree	5	8
Other	1	1
Don't Know	0	0
Refuse	0	0
Ethnicity		
Black/African-American	9	9
Anglo	80	75
Hispanic	8	13
Other	1	1
Don't Know	2	0
Housing		
House	86	84
Duplex	1	1
Townhouse	0	2
Apartment	6	5
Mobile	7	7
Don't Know	0	1
Refuse	0	0
Refuse	0	2

Table 3.2 (continued).

Variables	Survey 1 (N)	Survey 2 (N)
Income		
< $20,000	10	14
$20,000 - $34,999	18	16
$35,000 - $54,999	17	20
$55,000 - $84,999	27	21
$85,000 +	10	9
Don't Know	6	5
Refuse	12	15

[a] Denotes continuous variable.

Table 3.3: Frequency information collected from dog owners and/or cat owners during the initial and follow-up telephone questionnaires (n = 62 owners).

Variables	Survey 1 (N)	Survey 2 (N)
Number of dogs owned[ab]		
0	18	16
1	28	30
2	8	9
3	6	6
4	1	1
5	1	0
Attachment score[ab]		
Mean	38.6	37.2
Median	40	37
Range	26 , 44	25 , 44
Number of cats owned[ab]		
0	31	31
1	12	13
2	12	11
3	6	6
4	1	1

[a] Denotes continuous variable.
[b] Denotes variable answered only by dog owners and cat owners (n = 62).

Table 3.4 shows the results of the reliability assessment. For both surveys combined, there were 5 variables (source, litter, vet visits, ethnicity, and housing) with data categories that were excluded (other, don't know, or refuse) so that kappa could be calculated. Each variable had fewer than 5 of these responses and the median number of excluded values for these variables was 2.

In general the level of agreement between the survey and follow-up survey was fair to good. An overall unweighted kappa is shown for all dichotomous or nominal categorical variables in Table 3.4. All continuous or ordinal variables that were tested for reliability were determined to be not normally distributed. Spearman's correlation values are listed for these variables in Table 3.4. Data from all cross tabulations are shown in Appendix B.

Cat level variables were fairly reliable (Table 3.4). However, the kappa for the variables breed, role, and sterilized were lowered due to the distribution among response categories. For these questions, the majority of subjects answered the questions 1 way. Of the 56 cats, 53 were mixed breed, 47 served as companions, and 53 were sterilized. The percent agreement was 96% (54/56) for the variable "breed," 89% (50/56) for "role," and 96% (54/56) for "sterilized." Vaccinated was the variable with the highest level of agreement ($\kappa = 0.84$) among the cat level variables.

Opinions of stray dogs and opinions of stray cats variables were not very reliable (Table 3.4). However, the question on strays being a problem in the community was more reliable for stray cats than for stray dogs. The percent agreement for the initial dog problems question, "stray dogs are a problem" was 80% (80/100), while the percent

agreement for “stray cats are a problem” was 77% (77/100). Cross tabulations for the subset questions regarding individual stray cat and dog problems are shown in Appendix B.

The levels of agreement between the 2 surveys for the variables knowledge score and attachment score were good at $\kappa = 0.52$ and $\kappa = 0.60$ (Table 3.4).

The level of agreement for the household level variables was excellent with most variables at levels above $\kappa = 0.90$ (Table 3.4). Both housing and cat owner were at 100% agreement. The kappa for the variable gender indicates a 92% agreement between the first and second surveys. This is due to the 3 subjects who had another member of the household do the follow-up survey.

Table 3.4: Reliability measures between the first and second telephone questionnaires.

Variable	% Agreement*	Spearman's Correlation	Kappa	95% CI[a]
Cat level variables				
Sex	84	….	0.67	0.48 - 0.86
Breed	96	….	0.49	(-)0.11 - 1.00
Age		0.54	….	0.29 - 0.79
Time owned		0.56	….	0.32 - 0.80
Indoor/Outdoor status	82	….	0.70	0.53 - 0.87
Source[b]	52	….	0.36	0.19 - 0.53
Role	89	….	0.45	0.09 - 0.81
Sterilized	96	….	0.48	(-)0.13 - 1.00
Litter[b]		….	0.80	0.58 - 1.00
Collar	77	….	0.52	0.29 - 0.75

Table 3.4 (continued).

Variable	% Agreement*	Spearman's Correlation	Kappa	95% CI[a]
Vet visits[b]		0.52	….	0.28 - 0.76
Vaccinated		….	0.84	0.62 - 1.00
Opinions of stray dog Problems				
Dogs are a problem	80	….	0.42	0.21 - 0.63
Which dog problems are important[c]	75	….	0.60	0.20 - 1.00
Opinions of stray cat problems				
Cats are a problem[b]	77	….	0.57	0.41 - 0.73
Which cat problems are important[d]	64	….	0.47	0.23 - 0.70
Household level variables				
Number of cats		0.99	….	0.97 - 1.00
Number of dogs		0.95	….	0.90 - 1.00
Knowledge score		0.52	….	0.37 - 0.67
Attachment score		0.60	….	0.47 - 0.81
Person age		0.98	….	0.96 - 1.00
Gender		….	0.91	0.81 - 1.00
Household size		0.95	….	0.90 - 1.00
Number of adults		0.81	….	0.67 - 0.95
Children		….	0.82	0.69 - 0.95
Education level		0.84	….	0.74 - 0.94
Ethnicity[b]	92	….	0.71	0.55 - 0.87
Housing[b]		….	1.00	1.00 - 1.00
Income		0.69	….	0.52 - 0.86

* Percent agreement listed for variables with $\kappa \leq 0.75$.
[a] 95% confidence interval for the reliability estimate.
[b] Values (don't know and refuse) excluded from calculations.
[c] Sample size (n) for this question = 12.
[d] Sample size (n) for this question = 36.

3.5 Discussion

3.5.1 Response rates

Overall response rates for the reliability portion of the study were very good at 84% among those contacted and 75% among all those eligible to participate. This high level of response was likely due to the fact that the people who participated in the second survey agreed to do so at the end of the first survey.

3.5.2 Analysis

Although reliability can be measured in several different ways, in this study Spearman's rank correlation coefficient and kappa statistic were used. Pearson's correlation coefficient could have been used to evaluate the continuous variables if the data had been normally distributed. However, since this was not the case for any of the continuous variables, Spearman was used to assess reliability for these variables. Because of all the issues associated with using the kappa statistic, percent agreements were calculated for all variables with $\kappa \leq 0.75$. These percent agreement values were used in order to confirm the level of agreement between responses for the 2 interviews.

3.5.3 Cat level variables

The frequency data collected from the telephone interviews indicated that 56% (56/100) of subjects were cat owners, 44% of subjects were dog owners (44/100), 67% (67/100) of subjects owned pets, and 62% (62/100) owned dogs and/or cats. For 3 of the cat level variables (breed, role, and sterilized) kappa was low. For the breed question, only 2 subjects gave different responses for the initial and follow-up surveys. Subjects seemed to have difficulty with the term "mixed breed" in this question. Re-writing the

question so that it would read, “Is your cat a purebred?” with response categories yes/no may eliminate this confusion in the future. For the questions about role and sterilized, all subjects gave identical answers to both the initial and follow-up surveys. The low kappas that resulted for these variables (breed, role, sterilized) therefore occurred because of the highly skewed distribution of response categories. For each of these 3 variables the majority of respondents answered the questions in the same manner. Most people reported that their cats were sterilized mixed breeds that they considered companion animals. If the responses to these questions had been more equally distributed between response categories, a higher kappa would have resulted.

For a few variables, subjects gave different responses to certain survey questions during the follow-up interviews. The influence of time on certain variables could cause a discrepancy in responses to these questions and therefore a lowered kappa. For example, during the first survey a subject’s cat may have been less than 6 months old and might have turned 6 months old by the time the subject responded to the follow-up interview. In this case, the subject’s response would have changed from less than 6 months old to the next response category, 6 months old to 1 year. When reporting their cat’s age, 6 subjects changed their response to the next age category, indicating that their cat had possibly aged across 1 category between the first and second interviews. Several other cat level variables could be influenced by time in this way including owned time, and vet visits. Nine plausible response changes were reported for the variable “owned time” by subjects who changed their response to the next “owned time” category. These subjects’ cats may have changed categories for the length of time that had been owned. Another 9

respondents reported owning their cat for a shorter length of time or a much longer period of time during the second interviews. In addition, 10 subjects indicated that their cat was younger during the second interview, indicating a certain level of unreliability for this question. Subjects may not have known the age of their cat or were unable to recall how long they had owned their cat and may have guessed instead of responding "I don't know."

Responses to other variables like indoor/outdoor status and collar may have changed simply because of a change in the owner's ideas about cat ownership. These changes may or may not have been influenced by responding to the first survey. Most subjects who gave different responses for the first and second interviews for cat indoor/outdoor status owned cats that had gone from indoor only or outdoor only to both indoor and outdoor. However, 1 subject reported that his/her cat had gone from indoors only to outdoors only. Although this shift in response could have been due to error, it is possible that the owner had to move the cat outside for health reasons. Changes in responses to the "collar" variable may have been due to the cat changing indoor/outdoor status. For example, a cat may have gone from not wearing a collar to now wearing a collar simply because he became an outdoor cat. The question regarding the number of visits to the vet in the last year seemed to be more influenced by the subjects' inability to recall information than by the passage of time. Three subjects changed their answers from "don't know" to zero vet visits, while another 3 subjects dropped their answers from 1 vet visit during the initial survey to zero vet visits in the follow-up survey. Including an initial question, "has your cat been to the vet in the last year?" beforehand

may have helped to prevent this problem. The question regarding where the subjects obtained their cats had a particularly low kappa. The greatest change in subjects' responses to this question occurred between the categories "given to me by a friend/ relative" and "born at my home" (Appendix B). I am uncertain about the reason why this question was unreliable. The question was left as an open-ended question for the subjects to answer, which could explain why the reliability of this particular question was low. Subjects who changed their responses to this question may have been confused by the lack of guidance from the open-ended question or simply could not remember the origins of their cat. There were 2 responses of "other" for the variable "source" that were re-categorized into the main response categories. Both of these responses indicated that the owners had received their cats from an acquaintance and so these responses were included in the group "given to me by a friend or relative." The initial exclusion of the 2 responses, "given to me by an acquaintance," from the "given to me by a friend or relative" group could have occurred due to some confusion on the part of the interviewers. Perhaps the interviewers did not understand the list of response choice categories that was provided to them. In order to avoid future confusion with this response choice, perhaps it would be better to use the wording, "given to me by someone outside my household." Re-wording or re-categorizing the response choices for this question and making the question closed-ended will be necessary for further examination.

3.5.4 Opinions of stray animal problems variables

In the homeless pets section of the initial and follow-up surveys, the first question administered to the subjects was "Do you think stray dogs (cats) are a problem?" For the second interview there was a 2% decrease in subjects who believed that stray dogs were a problem and a 5% decrease in subjects who believed that stray cats were a problem from the first interview. Only subjects who answered yes to the general homeless animals questions were asked about the types of problems that were of specific concern. The 4 types of concerns that followed the initial question about strays being a problem were originally designed to be 4 separate yes/no questions to the subjects (i.e. "Are you concerned about the animals' welfare?" etc.). These 4 questions were asked by the PPRI interviewers as 1 question in which the respondent was to pick which problem (nuisance, household safety, animal welfare, or public health) they believed was the most important. Because of the small sample sizes that resulted for the questions following, the kappa values were fair. The kappa value for the specific dog related concerns was higher than for the cat related concerns. Only 1 subject changed responses regarding dog related concerns, while 3 subjects changed responses regarding cat related concerns during the follow-up survey (Appendix B). As a result, there was a higher percent agreement (75%) among the dog related concerns than the cat related concerns (64%). Because the sample sizes were so small for the variables in this section, it will be necessary to ask each concern as a separate question in order to evaluate the reliability of these variables in the future. All of the homeless pets concerns could vary with time because recent events could influence a person's opinions about stray cats and

dogs. During the first interview, a subject may have not believed that stray cats or dogs were a problem. However, if a stray cat had left footprints on her car windshield or a stray dog had left feces in her yard during the time between the 2 telephone interviews, she may respond differently to the same questions during the second interview. The amount of variation in people's opinions about stray animals over a period of time is invaluable to animal control officers and public health officials. However, this information must be gathered using an instrument that has been determined to be reliable.

3.5.5 Knowledge score and attachment score

Some of the variability in knowledge scores between the first and second telephone surveys might be due to subjects doing their own research to find out the correct answers to the questions during the time between the 2 survey administrations. The scores improved for questions 1 (dogs and cats need shots or they can become seriously ill and even die), 4 (it is necessary to catch a dog or cat in the act of doing something wrong in order to correct them), 5 (female cats come into heat/season twice a year), and 8 (it is cruel to keep cats indoors and never let them outside). The scores for question 2 (female dogs come into heat/season twice a year) remained the same. The scores decreased for questions 3 (dogs or cats will misbehave to spite their owner), 6 (a female dog or cat will be better off if she has 1 litter before being fixed/spayed), and 7 (cats may pounce or scratch or bite as a form of play). For all the questions with scores that differed between the initial and follow-up surveys, there were not more than 4 people whose scores changed.

Attachment scores were more reliable than knowledge scores but responses still varied between the initial and follow-up surveys. Changes could have been variable simply due to the passage of time. Pet owners would seemingly become more attached to their pets as time passed. However, in the present study the mean and median attachment scores for the second survey were slightly lower (lower level of attachment) than for the first survey that was administered a month earlier. Most of the changes occurred between the categories strongly agree and somewhat agree. Frequencies for the strongly agree categories decreased for all individual attachment questions during the follow-up survey. The last attachment question (my pet makes me feel trusted) experienced the largest decrease in strongly agree responses (34 in the initial survey to 22 in the follow-up survey). Attachment score was expected to be variable, not only due to the passage of time, but also because of the influence of the interviewers on the subjects. Subjects may have felt a greater need to please the interviewer during the first interview than during the second interview and therefore may have reported a higher attachment to their pets.

3.5.6 Household level variables

All household level variables were very reliable. The variables gender and ethnicity should not have changed between the first and second surveys. Upon further investigation it was noted that for 3 households, 2 different people from the same household may have each answered 1 of the surveys. Although PPRI was instructed to interview the same person for both interviews, this was most certainly not the case with at least 3 of the households. Three subjects reported a change in gender and age between the initial and follow-up surveys. Five subjects reported a change in ethnicity from

Anglo to Hispanic during the follow-up interviews. These changes could be due to different subjects from the same household participating in the surveys or subjects may have simply been confused by the terms Anglo and Hispanic. Although the categories used in the present study were taken from a similar pet owner study (APPMA, 2005), in the future, the distinction should be made between the categories Caucasian (Hispanic) and Caucasian (non- Hispanic).

Passage of time or providing dishonest responses may have influenced the subjects' responses to certain questions, such as those pertaining to children, income, and education level. One subject reported a change in the presence of children during the follow-up interview. This subject seemingly became a new parent during the time between the initial and follow-up interviews. For the variables income and education level, there seemed to be no recognizable pattern in the change of responses during the follow-up survey. Some subjects actually reported a drop in income and/or education level during then second survey interview. Although a drop in income is plausible, a drop in education level is not. Upon further investigation it was discovered that 3 of these subjects who had reported a lower level of education during the second interview were the same subjects who had reported a change in gender. Other subjects may have been embarrassed or simply did not want to provide responses to these questions. I believe that most of the variability between the household level variables for the 2 surveys is due to the subjects' discomfort with admitting that they did not know the answers to the survey questions.

3.5.7 Overview

Overall, the reliability of most of the variables analyzed was good. Fairly reliable cat level variables resulted from this study, including the variables sex, age, time owned, indoor/outdoor status, litter, vet visits, and vaccinated. Cat level variables that were reliable but did not produce acceptable kappas included breed, source, role, sterilized, and collar. Knowledge and attachment scores were reliable and reliability was excellent for all household level variables.

Generally, opinions of stray dogs and cats variables produced lower kappas but moderate levels of % agreement. Because the individual dog and cat problems variables were subset questions of other variables (dogs/cats are a problem), the sample sizes were very small. These variables may have been more reliable if people's opinions were not directly impacted by recent events. When a subject reported that they felt that stray cats were a problem, this response was likely influenced by events that occurred recently. This type of response was more likely to be the subject's opinion on the day of the interview, not his or her general opinion about the stray cats in the area. Because this type of data is subject to a great deal of change, it is important to note that the results may not always be accurate. Inability to obtain reliable data on homeless animals can make it very challenging for animal control officials and policy makers to create adequate solutions to pet overpopulation problems. Without a clear and accurate picture of the scope of the dilemma surrounding stray cats and dogs, policies cannot be instituted to reverse the problem of pet overpopulation.

For future studies, several improvements can be made to increase the reliability of the survey questions. Certain questions should be re-written and/or re-categorized in order to eliminate confusion of the subjects (i.e. cat breed and cat source). Rewriting these and other questions may have resulted in a greater understanding on the part of the subject, which may have produced a higher kappa or Spearman correlation value. Perhaps only variables that do not vary with time should be examined in future studies. In addition, more care should be taken to prevent 2 members from the same household from participating in the study.

For the most part, I believe that the lowered reliability of some of the variables was due to changes that occur with the passage of time or due to small sample sizes of responses for certain variable categories. These issues are unavoidable for some variables. In general, the subjects were very willing to participate in this study and were happy to share their information with the telephone interviewers.

CHAPTER IV

AN EXPLORATORY MODELING STUDY INVESTIGATING PET OWNERSHIP PATTERNS AND DEMOGRAPHICS USING A TELEPHONE SURVEY

4.1 Introduction

Two national studies have been performed that examine demographics of pet owners (APPMA, 2005; AVMA, 2002). The APPMA study found that most pet owners in general were married, owned their residence, lived in the larger households, had children under 18 living at home, and reported larger household incomes than non pet owners (APPMA, 2005). This same study found that cat owners were more likely to report a slightly lower household income, live in a 1 family home, and be widowed when compared to the total U.S. population. Cat owners were also found to be less likely to have young children living at home. A higher percentage of single women reported being cat owners in this study. Owners of multiple cats were more likely to live in rural areas, live in larger households, and be divorced or separated than owners of 1 cat. Most cat owners reported that their cats were mixed breed, stayed indoors only, had been sterilized but had not been to the veterinarian in the past year. Most cat owners had obtained their cat from a friend or relative, followed by adopting the cat as a stray. There were no important differences between the number of male and female cats owned in this study. The average length of time that the cats had been owned in this study was 17 years (APPMA, 2005). There was no difference in average age of cat owners and dogs owners (47 years). Cat owners and dog owners were more likely to be married than single in both cases. However, the difference was less extreme among cat owners. Respondents who reported

being White were more likely to own cats and dogs than respondents who reported belonging to any other ethnic group. On the average, cat owners had a lower income than dog owners. Dog owners were more likely to have children living in the same household than cat owners (APPMA, 2005). The AVMA study found that households with parents and children, and households of non-related roommates were more likely to be pet owners. In this study pet owners were also more likely to live in larger households of 4 or more people. However, most pet owners had an income of $54,999 or more in this study, which was contrary to the findings of the APPMA study. The AVMA study did find that pet owners were more likely to own their residence. Households most likely to own pets lived in smaller communities of less than 100,000 people and the head of these households was more likely to have graduated from college than non-pet owning households. This study found that cat owners most often lived in small communities, had graduated from college, lived in larger households, and had an income of $55,000 to $84,999 (AVMA, 2002).

Because owned pets can become unowned pets, which contribute to pet overpopulation, it is important to examine the relationships between pets and the people that care for them. If inferences could be made about the animal-human bond this could help to determine what kinds of people own pets. From these results it may be possible to lessen the problem of pet overpopulation by educating these pet owners. Educated pet owners may be less likely to resort to actions such as abandoning their pets or relinquishing their animals to a shelter. Prevention of these actions is necessary to reduce pet overpopulation. The objective of this cross-sectional study was to determine the predictors of several of the cat level and household level variables using logistic and linear

regression and data obtained from a telephone questionnaire about cats in a community in order to establish what kinds of people own pets. This study was designed to be a pilot research project for the potentially exploring these pet related issues in other communities.

4.2 Methods

4.2.1 Study design, study site, and study population

This study used a cross-sectional study design with simple random sampling and a telephone questionnaire regarding the free-roaming cats in the community. The community of Caldwell, Texas was chosen for this study because there was only 1 part-time animal control officer and no animal shelter existed in the city. In addition, Caldwell possessed very simple, basic animal control methods during the study.

Results from the year 2000 census (United States Census Bureau, February 2006) indicated that Caldwell has a population of 3,449 people. The ethnic breakdown of the community was as follows: Anglo (71.24%), Black/African-American (12.64%), Native American (0.17%), Asian (0.09%) and all other groups (13.71%). Hispanics/Latinos of any race made up 22.96% of the total population. Caldwell contains 1322 households. About 36.5% of all households contained children and the average household size is 2.61 people per household. Females comprised 54.6% of the population, while males comprised 45.4% of the population. The age breakdown was as follows for people 18 and older: 18-24 years (13.3%), 25-44 years (37.5%), 45-64 years (28.8%), and 65+ years (20.4%). The median household income in Caldwell was $29,936 in the year 2000.

About 18% of the population was below the poverty line (United States Census Bureau, February 2006).

The subjects for the telephone questionnaire were chosen by the Public Policy and Research Institute (PPRI), a survey administration organization of Texas A&M University. PPRI used all listed telephone numbers in Caldwell and screened them for living within the city limits for eligibility. After screening, all telephone numbers that were non-residences were excluded from the study. The sample size for this study was estimated using a proportion of 0.5 with a 95% confidence level and 0.05 error rate. The necessary sample size was calculated to be 384. However, because 57 more subjects could be interviewed at no extra cost, the study population included 441 households. Eligible subjects included 1 person from each of the 441 selected households, either a male or a female of age 18 or older. The CATI survey was administered to the 441 subjects during the period of June 6, 2005 to June 28, 2005.

4.2.2 Telephone survey instrument

Details regarding the telephone survey instrument can be found in Section 3.2.2 in Chapter III and in Appendix A.

4.3 Data analysis

4.3.1 Data manipulation

Attachment and knowledge scores were calculated in Section 3.3.2 in Chapter III. The variable "children" was dichotomized so that the findings of this study could be more easily compared to previous study results. In addition, all responses of "don't know"

or “refuse” and “other” were not included in the modeling portion of the analysis. Certain variable categories had to be collapsed in order to avoid groups with sample size of 0 during the modeling process. The variable indoor/outdoor status was collapsed from 3 groups (indoor only, outdoor only, indoor and outdoor) into 2 groups in 2 different ways: indoor only and outside at any time (Indoor only/Outdoor status) and indoor at any time and outdoor only (Indoor/Outdoor only status). This dichotomous indoor/outdoor status variable was used only as the outcome variable for 1 logistic regression model. In all other models where indoor/outdoor status was an independent variable, the original 3 category variable was used. The time owned variable was re-categorized into 3 groups by collapsing the 4 lowest levels (< 3 months, 3 to < 6 months, 6 months to < 1 year, and 1 year to < 2 years) into 1 group and the 3 highest levels (4 years to < 10 years, 10 years to < 15 years, and 15 + years) into another group, resulting in the groups: < 2 years, 2 years to < 4 years, and 4 + years. For the variable vet visits, the 2 highest levels were collapsed (4 + and 2 to 3) into 1 group, 2 +. For the variable housing, apartment and townhouse were collapsed into 1 group. Lastly, the 2 highest levels (6 to 10 years and 10 + years) of the variable age were collapsed into 1 group (6 + years).

4.3.2 Data analysis: modeling

Only variables that were determined to be reliable in the previous chapter (Chapter III) of this study were tested in this chapter. However, certain variables of particular interest to the researcher that were found to be only moderately reliable in the previous chapter, such as opinions of stray cat and dog problems, were included in this part of the study and were analyzed for exploratory purposes only. Cat level variables that were tested

included sex, breed (mixed breed or pure bred), age, time owned (length of time the subject has owned the cat), indoor only/outdoor status and indoor/outdoor only status, role (companion animal or mouser), sterilized (reproductive status), vet visits (number of visits to the veterinarian in the last year), and ever vaccinated (for rabies). Opinions of stray cat and dog problems that were tested included the variables cats are a problem, dogs are a problem, cat and dog-household safety, cat and dog-animal welfare, and dog-public health. Household level variables included: cat owner, dog owner, person age, gender, house size (number of inhabitants), number of adults, children (dichotomized), education level (highest education level attained), ethnicity, housing, and income. All variables that were not analyzed in this portion of the study were variables that were less reliable or were not of particular interest to the researcher.

For this portion of the study, the modeling guidelines from Hosmer and Lemeshow (Hosmer and Lemeshow, 2000) were followed during the analysis. First, univariable analysis (Appendix C) was performed using chi-squared analyses in order to test the associations between categorical variables. Independent variables were screened for inclusion in the models with a cut-off of $p \leq 0.25$. Depending on the sample size of each variable group, a Fisher's exact test was used if needed. Chi-squared analyses required that no more than 20% of the variable groups have expected values of less than 5 and that there were no expected values less than 1 (Dohoo et al. 2003). Fisher's exact test was used when the data did not follow this rule. Continuous variables were checked to make sure that they were linear in the logit. These variables were collapsed into categories and then tested against the outcome variables using univariable logistic regression. When

variable categories had a linear relationship with the outcome variable, the variable was assumed to be continuous in the logit. All variables that were confirmed to be continuous in the logit were tested individually against the outcome variables with univariable logistic regression using the likelihood ratio statistic and its associated p-value with a cut-off of $p \leq 0.25$. All variables that were not continuous in the logit were categorized and tested with the outcome using chi-square analyses with the same cut-off of $p \leq 0.25$.

Logistic regression with backwards-stepwise elimination procedure was performed on each model in STATA (STATA, Version 9.1, College Station, TX) and significance of variables in the model was tested using the p-value associated with the likelihood ratio test. A significant likelihood ratio test indicated that the independent variables in the model had a significant contribution to the outcome variable (Dohoo et al. 2003). Variables with $p < 0.05$ were considered statistically significant (Hosmer and Lemeshow, 2000). Odds ratios and 95% confidence intervals were calculated for variables in the final model. Assessment of model fit was done by calculating the Pearson chi-square goodness-of-fit test and its associated p-value and the pseudo R^2 for the model. For goodness-of-fit tests with significant p-values, it was assumed that there was a problem with the model (Hosmer and Lemeshow, 2000). The above logistic regression models had to meet the following assumptions: (1) observations were independent and (2) outcome and predictors had a linear relationship (Dohoo et al. 2003). After the modeling process, interaction terms were created between all independent variables in the model. These interactions were then added to the final model and tested for significance using the p-value from the likelihood ratio test.

Five of the models examined were logistic regression models. The first 2 logistic regression models included cat level data. In the first model "sterilized" was the outcome variable and the independent variables were all other cat level variables that were included in this part of the study. The second model used "indoor only/outdoor status" and "indoor/outdoor only status" as outcome variables to see if the 2 final models differed. The independent variables for this second model were all other cat level variables that were included in this part of the study. The third and fourth logistic regression models looked at household level data as predictors of cat and dog ownership. Cat owner was the outcome variable in the first of these logistic regression models and dog owner was the outcome variable in the second logistic regression model. For both of these models the independent variables were person age, gender, house size, number of adults, children (dichotomized), education level, ethnicity, housing, and income. The fifth logistic regression model examined predictors of opinions that stray cats were a problem. Cats are a problem was the outcome variable for this model and the independent variables were person age, gender, house size, number of adults, children (dichotomized), education level, ethnicity, housing, income, cat owner, and dog owner. (See Appendix C for univariable analysis results.)

Because of their small sample sizes, only univariable analyses were performed on the remaining concerns about stray animals variables. These analyses looked at person level data and examined the influence of pet ownership and demographics on subjects' opinions regarding free-roaming cat and dog problems. The 6 somewhat reliable questions about stray cats and stray dogs included the general question about dogs being a problem, 2 remaining stray cat related concerns (cat-household safety and cat-animal welfare), and

3 remaining dog related concerns (dog-household safety, dog-animal welfare, and dog-public health) as outcome variables. The independent variables for these analyses were cat owner, dog owner, person age, gender, house size, number of adults, children (dichotomized), education level, ethnicity, housing, and income. (See Appendix C for univariable analysis results.)

For the linear regression models, independent variables were screened for inclusion using a cut-off of $p \leq 0.25$ (Appendix C). Each continuous independent variable was tested individually with the outcome variables using the t-test and its associated p-value. Categorical independent variables were tested individually with the outcome variables using the f-test and its associated p-value. Linear regression models were performed in STATA with backwards elimination procedure and significance of variables in the models were tested using the p-values associated with the F-tests given for the models. The size of the coefficient for each independent variable indicated the size of the effect that the variable had on the dependent variable, and the sign on the coefficient (positive or negative) indicated the direction of the effect. These linear regression models had to meet the following assumptions: errors had equal variances, errors were independent of each other, errors were normally distributed, and errors all had expected value zero. These assumptions were checked by graphing the linear models using SPSS software (SPSS, Version 11.5, Chicago, IL). After the modeling process, interaction terms were created between all independent variables in the model. These interactions were then added to the final model and tested for significance using the p-value from the F-test. All interactions that caused the p-value to become insignificant were dropped from the model.

The last 2 models were linear regression models. The first linear regression model had knowledge score as the outcome variable and the independent variables were number of cats owned, number of dogs owned, person age, person sex, house size, number of adults, children (dichotomized), education level, ethnicity, housing, and income. The last model was a linear regression model and examined attachment levels of pet owners to their pets. Attachment score was the outcome variable and the independent variables were all household level variables: knowledge score, cat owner, dog owner, person age, gender, house size, number of adults, children (dichotomized), education level, ethnicity, housing, and income.

All variable coding was performed by STATA software, with the baseline or referent group being the categories with the lowest code when the sample size was not considerably smaller than other categories. When STATA designated a category with a small sample size as the baseline, these categories were re-coded so that the category with the largest sample size became the referent group. All Yes/No variables had No as the baseline value for that variable.

4.4 Results

4.4.1 Response rates

The study population consisted of 441 people who completed the telephone survey. There were 27 people who only partially completed the telephone survey, 333 people who refused to participate in the study, and 7 people who were unable to complete the survey due to physical or mental inability or incompetence. There were 13 people who could not be reached. Among those that were not eligible to take part in the survey, 44 did not speak English. The overall response rate was 55% (441/808) among households that were reached and 54% (441/821) among all eligible households.

4.4.2 Summary data

Table 4.1 shows summary data on all cat level variables included in the telephone questionnaire stratified by the variable “sterilized”. Table 4.2 shows summary data from the homeless pets section of the telephone questionnaire stratified by the variable pet owner. Table 4.3 shows summary data from the knowledge section of the telephone questionnaire stratified by pet owner. Table 4.4 shows summary data from the attachment section stratified by cat owner and dog owner. Table 4.5 shows summary data from the demographics section of the telephone survey stratified by pet owner. Table 4.6 shows the variables that were collapsed and variables that were dichotomized for this study. The cross tabulation for number of cats and dogs owned can be seen in Appendix B.

Table 4.1: Summary data of cat level variables from 235 cats in 123 households stratified by sterilization status.

	Non-Sterilized		Sterilized		Sterilization Unknown		Total	
Variables	n	%	n	%	n	%	n	%
Cat sex								
Male	23	40	80	46	2	50	105	45
Female	30	53	94	54	2	50	126	54
Don't know	4	7	0	0	0	0	4	2
Refuse	0	0	0	0	0	0	0	0
Breed								
Mixed breed	40	70	152	87	1	25	193	82
Purebred	4	7	10	6	1	25	15	6
Don't know	13	23	12	7	2	50	27	11
Refuse	0	0	0	0	0	0	0	0
Cat age								
< 6 months	6	11	1	1	0	0	7	3
6 months to < 2 yr	13	23	15	9	1	25	29	12
2 to 5 yrs	17	30	80	46	2	50	99	42
6 to 10 yrs	7	12	46	26	0	0	53	23
10 + yrs	0	0	28	16	0	0	28	12
Don't know	14	25	4	2	1	25	19	8
Refuse	0	0	0	0	0	0	0	0
Time owned								
< 3 months	10	18	1	1	1	25	12	5
3 to < 6 months	5	9	0	0	1	25	6	3
6 months to < 1 yr	11	19	13	7	1	25	25	11
1 yr to < 2 yrs	3	5	16	9	0	0	19	8
2 yrs to < 4 yrs	15	26	50	29	1	25	66	28
4 yrs to < 10 yrs	8	14	66	38	0	0	74	31
10 yrs to < 15 yrs	0	0	18	10	0	0	18	8
15 + yrs	0	0	9	5	0	0	9	4
Don't know	5	9	1	1	0	0	6	3
Refuse	0	0	0	0	0	0	0	0

Table 4.1 (continued).

	Non-Sterilized		Sterilized		Sterilization Unknown		Total	
Variables	n	%	n	%	n	%	n	%
Owned since kitten[a]								
No	4	80	1	100	0	0	5	83
Yes	0	0	0	0	0	0	0	0
Don't know	0	0	0	0	0	0	0	0
Refuse	1	20	0	0	0	0	1	17
Indoor/Outdoor status								
Indoor only	16	28	52	30	1	25	69	29
Outdoor only	31	54	41	24	1	25	73	31
Indoor and outdoor	10	18	81	47	2	50	93	40
Don't know	0	0	0	0	0	0	0	0
Refuse	0	0	0	0	0	0	0	0
Source (where cat is from)*								
Found as stray	22	39	58	33	1	25	81	34
Born at home	14	25	21	12	0	0	35	15
Given by a friend/relative	17	30	55	32	3	75	75	32
From a shelter	1	2	12	7	0	0	13	6
In front of store/flea market	0	0	6	3	0	0	6	3
Other[b]	3	5	20	11	0	0	23	10
Don't know	0	0	1	1	0	0	1	0
Refuse	0	0	1	1	0	0	1	0
Role (of cat)								
Companion	30	53	141	81	4	100	175	74
Mouser	24	42	30	17	0	0	54	23
Don't know	3	5	3	2	0	0	6	3
Refuse	0	0	0	0	0	0	0	0
Sterilized								
No	….	….	….	….	….	….	53	24
Yes	….	….	….	….	….	….	174	74
Don't know	….	….	….	….	….	….	4	2
Refuse	….	….	….	….	….	….	0	0

Table 4.1 (continued).

Variables	Non-Sterilized		Sterilized		Sterilization Unknown		Total	
	n	%	n	%	n	%	n	%
If no, reason cat is not sterilized[f*]								
Too young	6	13	….	….	0	0	6	11
Costs too much	11	23	….	….	0	0	11	20
Want to breed cat	10	21	….	….	0	0	10	18
Haven't gotten around to it	3	6	….	….	0	0	3	5
Other[g]	18	38	….	….	0	0	18	32
Don't know	3	6	….	….	0	100	7	13
Refuse	1	2	….	….	0	0	1	2
Litter[c]								
No	15	44	68	72	1	50	84	65
Yes	16	47	21	22	0	0	37	28
Don't know	3	9	5	5	1	50	9	7
Refuse	0	0	0	0	0	0	0	0
If yes, was the litter accidental[d]								
Planned	3	19	2	10	0	0	5	13
Accidental	13	81	18	86	0	0	31	84
Don't know	0	0	1	4	0	0	1	3
Refuse	0	0	0	0	0	0	0	0
If yes, had litter before spay [d e]								
No	1	100	1	5	0	0	2	9
Yes	0	0	20	95	0	0	20	91
Don't know	0	0	0	0	0	0	0	0
Refuse	0	0	0	0	0	0	0	0
Collar								
No	45	79	75	43	2	50	122	52
Yes	12	21	99	57	2	50	113	48
Don't know	0	0	0	0	0	0	0	0
Refuse	0	0	0	0	0	0	0	0

Table 4.1 (continued).

	Non-Sterilized		Sterilized		Sterilization Unknown		Total	
Variables	n	%	n	%	n	%	n	%
Vet visits (in past year)								
4 +	0	0	5	3	0	0	5	2
2 to 3	11	19	35	20	0	0	46	20
1	12	21	92	53	3	75	107	46
0	29	51	38	22	1	25	68	29
Don't know	5	9	4	2	0	0	9	4
Refuse	0	0	0	0	0	0	0	0
Non-annual vet visits[h]								
No	21	87	99	75	2	67	122	77
Yes	2	13	33	25	1	33	36	23
Don't know	0	0	0	0	0	0	0	0
Refuse	0	0	0	0	0	0	0	0
Ever vaccinated (for rabies)								
No	36	63	10	6	0	0	46	20
Yes	20	35	162	93	3	75	185	79
Don't know	1	2	2	1	1	25	4	1
Refuse	0	0	0	0	0	0	0	0

Table 4.1 (continued).

Continuous Variables	Non-sterilized	Sterilized	Sterilization unknown	Total
Number of owned dogs				
Mean	….	….	….	1.3
Median	….	….	….	1
Range	….	….	….	0 , 15
Number of owned cats				
Mean	2.5	1.9	1.3	2.0
Median	1	2	1	1
Range	1 , 11	1 , 8	1 , 2	1 , 11
Number of litters				
Mean	2.9	1.5	….	2.1
Median	2	1	….	1
Range	1 , 10	1 , 3	….	1 , 10

[a] n = 6. Denotes question only administered to subjects who answered "don't know" to time owned.
[b] Other included: given by acquaintance (n = 7), given by vet (n = 4), from animal rescue program (n = 5), newspaper ad (n = 4), from breeder (n = 1), internet (n = 1), and unclear answer (n = 1).
[c] n = 130. Denotes question only administered to subjects who had female cats or did not know the cat's sex.
[d] n = 37. Denotes question only administered to subjects who answered "yes" to litter.
[e] Missing information on 15 cats.
[f] Denotes question only administered to subjects who answered "no" to sterilized. N = 52. Missing information on 1 cat.
[g] Other included: did not want to chase cats (n = 7), cat is in heat (n = 6), personal preference (n = 4), cat is pregnant (n = 1).
[h] n = 158. Denotes question only administered to subjects whose cats had been to the vet in the last year. Non-annual vet visits were all vet visits that occurred for reasons other than vaccinations and check-ups.
[*] Denotes open-ended question.

Table 4.2: Summary data from homeless pets variables from all 441 subjects stratified by pet owner.

	Non-pet owner		Pet owner		Total	
Variables	n	%	n	%	n	%
Stray dogs are a problem						
No	120	70	213	79	333	76
Yes	49	28	54	20	103	23
Don't know	2	1	2	1	4	1
Refuse	1	1	0	0	1	0
Concerns about stray dogs[a]						
Nuisance	24	49	14	26	38	37
Household safety	7	14	12	22	19	18
Animal welfare	5	10	16	30	21	20
Public health	10	20	10	19	20	19
Don't know	3	6	2	4	5	5
Refuse	0	0	0	0	0	0
Stray cats are a problem						
No	98	57	152	57	250	57
Yes	71	41	113	42	184	42
Don't know	2	1	4	1	6	1
Refuse	1	1	0	0	1	< 1
Concerns about stray cats[b]						
Nuisance	39	55	38	34	77	42
Household safety	2	3	11	10	13	7
Animal welfare	11	15	28	25	39	21
Public health	14	20	30	27	44	24
Don't know	5	7	4	4	9	5
Refuse	0	0	2	2	2	1
Seen stray cats in Caldwell						
No	56	33	72	27	128	29
Yes	112	65	188	70	300	68
Don't know	4	2	9	3	13	3
Refuse	0	0	0	0	0	0

Table 4.2 (continued).

Variables	Non-pet owner n	Non-pet owner %	Pet owner n	Pet owner %	Total n	Total %
Seen stray dogs in Caldwell						
No	94	55	130	48	224	51
Yes	75	44	134	50	209	47
Don't know	3	1	5	2	8	2
Refuse	0	0	0	0	0	0
If yes to seeing stray dogs or cats, seen stray puppies/kittens[c]						
No	71	59	121	57	192	58
Yes	50	41	90	42	140	42
Don't know	0	0	1	1	1	< 1
Refuse	0	0	0	0	0	0
If yes to seeing stray dogs or cats, location of strays[c]						
Near home	69	57	111	52	180	54
Near businesses	7	6	15	7	22	7
Open areas	8	7	13	6	21	6
By the road	26	21	52	25	78	23
Other[d]	9	7	19	9	28	9
Don't know	2	2	2	1	4	1
Refuse	0	0	0	0	0	0
Frequency of sighting strays[c]						
Daily	45	37	72	34	117	35
Once a week	27	22	32	15	59	18
1-3 times a month	22	18	53	25	75	23
Less often	26	21	54	25	80	24
Don't know	1	1	1	0	2	1
Refuse	0	0	0	0	0	0

Table 4.2 (continued).

Variables	Non-pet owner n	Non-pet owner %	Pet owner n	Pet owner %	Total n	Total %
Know others feeding stray cats						
No	142	83	202	75	344	78
Yes	24	14	61	23	85	19
Don't know	6	3	6	2	12	3
Refuse	0	0	0	0	0	0
Are you feeding stray cats						
No	158	92	224	83	382	87
Yes	14	8	44	16	58	13
Don't know	0	0	1	1	1	< 1
Refuse	0	0	0	0	0	0
If yes to feeding stray cats, are you feeding stray kittens[e]						
No	80	73	120	71	200	72
Yes	14	13	22	13	36	13
Don't know	3	3	5	3	8	3
Refuse	12	11	21	13	33	12
Time feeding stray cats[e]						
Less than 6 months	8	58	12	27	20	34
6 months to < 1 yr	2	14	6	14	8	14
1 yr to < 2 yrs	2	14	5	11	7	12
2 yrs +	0	0	16	36	16	28
Don't know	2	14	5	11	7	12
Refuse	0	0	0	0	0	0
Number of stray cats feeding[e]						
1 to 2	9	65	22	50	31	53
3 to 5	1	7	14	32	15	26
6 to 9	1	7	1	2	2	3
10 to 15	1	7	1	2	2	3
15 +	0	0	2	5	2	3
Don't know	2	14	3	7	5	9
Refuse	0	0	1	2	1	2

Table 4.2 (continued).

Variables	Non-pet owner n	Non-pet owner %	Pet owner n	Pet owner %	Total n	Total %
Had any stray cats fixed						
No	161	94	235	87	396	90
Yes	7	4	24	9	31	7
Don't know	1	< 1	4	2	5	1
Refuse	3	2	6	2	9	2
Willing to get strays spayed/neutered						
No	134	78	173	64	307	70
Yes	28	16	76	28	104	24
Don't know	10	6	18	7	28	6
Refuse	0	0	2	1	2	0

[a] n = 103. Denotes question only administered to subjects who considered stray dogs a problem.
[b] n = 184. Denotes question only administered to subjects who considered stray cats a problem.
[c] n = 333. Denotes question only administered to subjects who reported seeing stray dogs or cats.
[d] Other included: vacant houses (n = 2), around town (n = 3), parking lots (n = 2), schools (n = 2), churches (n = 1), barns (n = 3), outside city (n = 4), everywhere (n = 11).
[e] n = 58. Denotes question only administered to subjects who were feeding stray cats.

Table 4.3: Summary data from knowledge questions from all 264 pet owners (212 dog owners and 123 cat owners (with overlap of 71 cat and dog owners)) stratified by dog owner and cat owner.

	Dog owner		Cat owner		Total	
Variables	n	%	n	%	n	%
Dogs and cats need shots						
True*	202	95	113	92	315	94
False	6	3	5	4	11	3
Don't know	4	2	5	4	9	3
Refuse	0	0	0	0	0	0
Female dogs go into heat twice/yr						
True*	141	67	75	61	216	64
False	30	14	17	14	47	14
Don't know	41	19	31	25	72	22
Refuse	0	0	0	0	0	0
Dogs/cats misbehave out of spite						
True	137	65	82	67	219	65
False*	58	27	34	28	92	28
Don't know	17	8	7	5	24	7
Refuse	0	0	0	0	0	0
Must catch dog doing wrong to correct him						
True*	171	81	101	82	272	81
False	36	17	17	14	53	16
Don't know	5	2	5	4	10	3
Refuse	0	0	0	0	0	0
Female cats go into heat twice/yr[a]						
True*	77	36	49	40	126	38
False*	43	20	34	28	77	23
Don't know	92	44	40	32	132	39
Refuse	0	0	0	0	0	0

Table 4.3 (continued).

Variables	Dog owner n	%	Cat owner N	%	Total n	%
Better to have 1 litter before spaying						
True	60	28	34	28	94	28
False*	91	43	59	48	150	45
Don't know	61	29	30	24	91	27
Refuse	0	0	0	0	0	0
Cats scratch/pounce/bite as play						
True*	200	94	120	98	320	96
False	3	1	2	2	5	1
Don't know	9	5	1	< 1	10	3
Refuse	0	0	0	0	0	0
Cruel to keep cats indoors						
True	87	41	39	32	126	38
False*	109	51	76	62	185	55
Don't know	16	8	8	6	24	7
Refuse	0	0	0	0	0	0
Total knowledge score						
Mean	5.1	….	5.4	….	5.2	….
Median	5	….	5	….	5	….
Range	0 , 8	….	0 , 8	….	0 , 8	….

* Denotes correct answers to the questions.

[a] Due to some debate about the number of times female cats go into heat/season per year, both true and false answers were considered correct for this question.

Table 4.4: Summary data from attachment questions from all 212 dog owners and all 123 cat owners (264 pet owners) stratified by dog owner and cat owner.

	Dog owner		Cat owner		Total	
Variables	n	%	n	%	n	%
Pet provides companionship						
Strongly agree	123	87	107	87	230	87
Somewhat agree	15	11	13	11	28	11
Somewhat disagree	3	2	1	1	4	2
Strongly disagree	0	0	2	2	2	1
Don't know	0	0	0	0	0	0
Refuse	0	0	0	0	0	0
Pet is something to care for						
Strongly agree	100	71	88	72	188	71
Somewhat agree	34	24	28	23	62	23
Somewhat disagree	6	4	5	4	11	4
Strongly disagree	1	1	2	2	3	1
Don't know	0	0	0	0	0	0
Refuse	0	0	0	0	0	0
Pet provides pleasure						
Strongly agree	96	68	82	67	178	67
Somewhat agree	37	26	31	25	68	26
Somewhat disagree	5	4	8	7	13	5
Strongly disagree	1	1	2	2	3	1
Don't know	2	1	0	0	2	1
Refuse	0	0	0	0	0	0
Pet is source of stability						
Strongly agree	71	50	53	43	124	47
Somewhat agree	39	28	42	34	81	31
Somewhat disagree	19	13	17	14	36	13
Strongly disagree	10	7	9	7	19	7
Don't know	4	3	2	2	6	2
Refuse	0	0	0	0	0	0

Table 4.4 (continued).

	Dog owner		Cat owner		Total	
Variables	n	%	n	%	n	%
Pet makes me feel needed						
Strongly agree	74	52	58	47	132	50
Somewhat agree	44	31	38	31	82	30
Somewhat disagree	13	9	19	15	32	12
Strongly disagree	8	6	5	4	13	5
Don't know	5	4	3	2	8	3
Refuse	0	0	0	0	0	0
Pet makes me laugh/play						
Strongly agree	105	74	89	72	194	73
Somewhat agree	29	21	26	21	55	21
Somewhat disagree	6	4	8	7	14	5
Strongly disagree	1	1	0	0	1	0
Don't know	0	0	0	0	0	0
Refuse	0	0	0	0	0	0
Pet gives me something to love						
Strongly agree	97	69	73	59	170	64
Somewhat agree	31	22	40	33	71	27
Somewhat disagree	7	5	7	6	14	5
Strongly disagree	6	4	2	2	8	3
Don't know	1	1	1	1	2	1
Refuse	0	0	0	0	0	0
I get comfort from touching my pet						
Strongly agree	83	59	77	63	160	61
Somewhat agree	39	28	28	23	67	25
Somewhat disagree	8	6	12	10	20	8
Strongly disagree	9	6	6	5	15	6
Don't know	2	1	0	0	2	< 1
Refuse	0	0	0	0	0	0

Table 4.4 (continued).

	Dog owner		Cat owner		Total	
Variables	n	%	n	%	n	%
I enjoy watching my pet						
Strongly agree	110	78	84	68	194	73
Somewhat agree	28	20	35	28	63	24
Somewhat disagree	1	1	4	3	5	2
Strongly disagree	1	1	0	0	1	0
Don't know	1	1	0	0	1	1
Refuse	0	0	0	0	0	0
Pet makes me feel loved						
Strongly agree	93	66	77	63	170	64
Somewhat agree	30	21	33	27	63	24
Somewhat disagree	10	7	10	8	20	8
Strongly disagree	7	5	2	2	9	3
Don't know	2	1	1	1	3	1
Refuse	0	0	0	0	0	0
Pet makes me feel trusted						
Strongly agree	84	60	68	55	152	58
Somewhat agree	39	28	40	33	79	30
Somewhat disagree	8	6	8	7	16	6
Strongly disagree	6	4	5	4	11	4
Don't know	5	4	2	2	7	2
Refuse	0	0	0	0	0	0
Total attachment score						
Mean	39.3	….	39.8	….	39.4	….
Median	40	….	40	….	40	….
Range	30 , 44	….	30 , 44	….	30 , 44	….

Table 4.5: Summary data on demographics from all 441 subjects stratified by pet owner.

	Non-pet owner		Pet owner		Total		Caldwell Census
Variables	n	%	n	%	n	%	%
Person age							
18-24	10	6	22	8	32	7	13
25-34	15	9	31	12	46	10	} 38
35-44	15	9	61	23	76	17	
45-54	33	19	54	20	87	20	} 29
55-64	31	18	50	19	81	18	
65+	63	37	48	18	111	25	20
Don't know	1	1	1	0	2	0	
Refuse	4	2	2	1	6	1	
Gender of respondent							
Male	50	29	77	29	127	29	55
Female	122	71	192	71	314	71	45
Don't know	0	0	0	0	0	0	
Refuse	0	0	0	0	0	0	
Education level							
< High school	27	16	23	9	50	11	…
High school/GED	75	44	83	31	158	36	…
Some college	28	16	60	22	88	20	…
Completed college	29	17	69	26	98	22	…
Advanced degree	8	5	30	11	38	9	…
Other[a]	1	1	2	1	3	1	…
Don't know	0	0	0	0	0	0	
Refuse	4	2	2	1	6	1	
Ethnicity							
Black/African-American	21	12	14	5	35	8	13
Anglo	112	65	226	84	338	77	71
Hispanic	24	14	20	7	44	10	*
Other[b]	3	2	0	0	3	1	*
Don't know	5	3	5	2	10	2	
Refuse	7	4	4	1	11	2	

Table 4.5 (continued).

Variables	Non-pet owner n	Non-pet owner %	Pet owner n	Pet owner %	Total n	Total %	Caldwell Census %
Housing							
House	129	75	241	90	370	84	…
Duplex	5	3	4	1	9	2	…
Townhouse	6	3	1	0	7	2	…
Apartment	13	8	12	4	25	6	…
Mobile	16	9	9	3	25	6	…
Don't know	0	0	0	0	0	0	…
Refuse	3	2	2	1	5	1	…
Income							
< $20,000	29	17	23	9	52	12	
$20,000 - $34,999	28	16	24	9	52	12	
$35,000 - $54,999	24	14	50	19	74	17	Median household income = $29, 936
$55,000 - $84,999	27	16	68	25	95	22	
$85,000 +	7	4	40	15	47	11	
Don't know	17	10	19	7	36	8	
Refuse	40	23	45	17	85	19	

Continuous Variables	Non-pet owner	Pet owner	Total	Caldwell Census
Household size				
Mean	2.3	2.9	2.7	2.6
Median	2	3	2	…
Range	1 , 7	1 , 11	1 , 11	…
Adults				
Mean	1.8	2.1	2.0	…
Median	2	2	2	…
Range	0 , 5	0 , 5	0 , 5	…
Number of children				
Mean	0.4	0.6	0.5	….
Median	0	0	0	…
Range	0 , 3	0 , 7	0 , 7	…

Table 4.5 (continued).

	Non-pet owner		Pet owner		Total	
Variables	n	%	n	%	n	%
Pet owner (cat/dog/other)						
No	….	….	….	….	172	39
Yes	….	….	….	….	269	61
Don't know	….	….	….	….	0	0
Refuse	….	….	….	….	0	0
Willing to be re-contacted to answer questions about stray cats you see/feed	….	….	….	….		
No	….	….	….	….	58	19
Yes	….	….	….	….	244	79
Don't Know	….	….	….	….	5	2
Refuse	….	….	….	….	2	< 1
Willing to be re-contacted regarding a cat collar study						
No	….	….	….	….	25	37
Yes	….	….	….	….	39	58
Don't Know	….	….	….	….	2	3
Refuse	….	….	….	….	1	2
Willing to be re-contacted for follow-up survey						
No	….	….	….	….	74	17
Yes	….	….	….	….	360	82
Don't Know	….	….	….	….	1	1
Refuse	….	….	….	….	6	< 1

[*] Specific percentages could not be determined due to the format of the 2000 census.
[a] Other included: technical school, police training, and no school.
[b] Other included: Native American.

Table 4.6: Summary data of collapsed variables and dichotomized variables.

	Non-sterilized		Sterilized		Total	
Variables	n	%	n	%	n	%
Age						
< 6 months	6	14	1	1	7	3
6 months to < 2 yr	13	30	15	9	28	13
2 to 5 yrs	17	40	80	47	97	46
6 + yrs	7	16	74	44	81	38
Time owned						
< 2 yrs	29	56	30	17	59	26
2 yrs to < 4 yrs	15	29	50	29	65	29
4 + yrs	8	15	93	54	101	45
Vet visits						
2 +	11	21	40	24	51	23
1	12	23	92	54	104	47
0	29	56	38	22	67	30
Indoor only/Outdoor status						
Indoor only	16	28	52	30	68	29
Outdoor	41	72	122	70	163	71
Indoor/Outdoor only status						
Indoor	26	46	133	76	159	69
Outdoor only	31	54	41	24	72	31

Table 4.6 (continued).

	Non-pet owner		Pet owner		Total	
Variables	n	%	n	%	n	%
Children						
No	134	79	182	68	316	72
Yes	35	21	85	32	120	28
Housing						
House	129	76	241	90	390	86
Duplex	5	3	4	2	9	2
Townhouse/Apartment	19	11	13	5	32	7
Mobile	16	10	9	3	25	5

4.4.3 Exploratory modeling

Six of the 7 models that were tested resulted in significant associations between the outcome and independent variables. The univariable analyses for all the models tested including analyses for the stray cat and stray dog related concerns are listed in Appendix C. All continuous variables were confirmed to be linear in the logit.

The first logistic regression model was a cat level model that had sterilized as the outcome variable. In the univariable analysis, sex ($p = 0.72$) and breed ($p = 0.50$) of the cat were not significant. The variables role, vaccinated, time owned, indoor/outdoor status, age, and vet visits were all significant with $p < 0.001$. All these variables were included in

the saturated model. After the modeling process, the variables that remained in the model included role, vaccinated, and time owned. Interaction terms were created and tested in the model. None of these interaction terms were found to be significant. Table 4.7 shows the final model for the outcome variable sterilized. The goodness of fit test for this model demonstrated that the observed and expected values for the data in the model were not statistically different.

Table 4.7: Final logistic regression model* for predictors of cats being sterilized (N=201).

Variable	Categories	Odds Ratio	95% Confidence Interval
Role	Companion	1.00	….
	Mouser	0.49	0.2 , 1.3
Vaccinated	No	1.00	….
	Yes	15.04	5.4 , 41.8
Time owned	< 2 yrs	1.00	….
	2 yrs to < 4 yrs	3.90	1.4 , 11.3
	4 + yrs	8.77	3.00 , 25.8
Intercept	….	-1.70[a]	-2.8 , -0.6

* Likelihood ratio statistic for the model = 61.10 with $p < 0.001$.
** Goodness of fit test = 7.58 with $p = 0.37$.
*** Pseudo $R^2 = 0.31$.
[a] Coefficient for the intercept.

The second logistic regression model was a cat level model that tested indoor only/outdoor status and indoor/outdoor only status as outcome variables. In the univariable analysis, sex ($p = 0.47$), breed ($p = 0.87$), vaccinated ($p = 0.77$), time owned ($p = 0.80$), sterilized ($p = 0.78$), and vet visits ($p = 0.89$) were not significantly associated with indoor only/outdoor status. The variables role, and age were significant with $p \leq 0.25$. These 2 variables were included in the saturated model. After the modeling process, the only variable that remained in the model was role. Table 4.8 shows the final model for the outcome variable indoor only/outdoor status. In this model, the outcome of interest was outdoor status. The alternative model with indoor/outdoor only status as the outcome variable (with indoor as the outcome of interest) was performed with similar results (Appendix D).

The third logistic regression model was a household level model that had cat owner as the outcome variable. In the univariable analysis, gender ($p = 0.30$) and children (dichotomized) ($p = 0.56$) were non-significant. The variables house size, number of adults, person age, education level, ethnicity, housing, and income were all significant with $p \leq 0.25$. All these variables were included in the saturated model. Interaction terms

Table 4.8: Final logistic regression model* of predictors of indoor only/outdoor status of cats (N=229).

Variable	Categories	Odds Ratio	95% Confidence Interval
Role	Companion	1	….
	Mouser	16.13	3.8 , 68.4
Intercept	…	0.47[a]	0.2 , 0.8

* Likelihood ratio statistic for the model = 30.27 with $p < 0.001$.
** Goodness of fit test = 9.43 with $p = 0.49$.
*** Pseudo $R^2 = 0.08$.
[a] Coefficient for the intercept.

were created and tested in the model. None of these interactions were found to be significant. Table 4.9 shows the final model for the outcome variable cat owner. The goodness of fit test demonstrated that the observed and expected values for the data in the model were not statistically different.

Table 4.9: Final logistic regression model* of predictors of cat owner (N=411).

Variable	Categories	Odds Ratio	95% Confidence Interval
House size[a]	….	1.30	1.1 , 1.5
Education level	< High school	1.00	….
	High school/GED	1.66	0.6 , 4.4
	Some college	1.47	0.5 , 4.1
	Completed college	1.95	0.7 , 5.4
	Advanced degree	4.67	1.5 , 14.2
Ethnicity	Black/African-American	0.26	0.1 , 0.8
	Anglo	1.00	….
	Hispanic	0.18	0.1 , 0.5
Intercept	….	-2.04[b]	-3.0 , -1.1

* Likelihood ratio statistic for the model = 41.11 with $p < 0.001$.
** Goodness of fit test = 53.24 with $p = 0.58$.
*** Pseudo $R^2 = 0.11$
[a] Modeled as continuous variable.
[b] Coefficient for the intercept.

The fourth logistic regression model was a household level model that had dog owner as the outcome variable. In the univariable analysis, house size ($p = 0.46$), number of adults ($p = 0.93$), gender ($p = 0.27$), children (dichotomous) ($p = 0.31$), education level ($p = 1.00$), ethnicity ($p = 0.51$), housing ($p = 0.35$), and income ($p = 0.37$) were not significant. The variable person age was significant with $p \leq 0.25$ and was included in the

saturated model. However, person age dropped out of the model with a non-significant value of $p = 0.16$, so no final model resulted from this analysis.

The fifth logistic regression model was a household level model that had cats are a problem as the outcome variable. In the univariable analysis, household size ($p = 0.30$), number of adults ($p = 0.45$), person age ($p = 0.26$), gender ($p = 0.28$), education level ($p = 0.28$), ethnicity ($p = 0.44$), housing ($p = 0.37$), and income ($p = 0.86$), and dog owner ($p = 0.33$) were non-significant. The variables children (dichotomous) and cat owner were both significant with $p \leq 0.25$. Both of these variables were included in the saturated model. Interaction terms were created and tested in the model. None of these interactions were found to be significant. Table 4.10 shows the final model for the outcome variable cats are a problem. The goodness of fit test for this model demonstrated that the observed and expected values for the data in the model were not statistically different.

Table 4.10: Final logistic regression model[*] of predictors of cats are a problem (N=429).

Variable	Categories	Odds Ratio	95% Confidence Interval
Children	No	1.00	….
	Yes	1.62	1.1 , 2.5
Intercept	….	-0.43[a]	-0.7 , -0.2

[*] Likelihood ratio statistic for the model = 4.95with p = 0.03.
[**] Goodness of fit test = 53.24 with p = 0.58.
[***] Pseudo $R^2 = 0.01$
[a] Coefficient for the intercept.

The first linear regression model was a household level model that had knowledge score as its outcome variable. In the univariable analysis, gender (p = 0.76) was insignificant. The variables house size, number of adults, person age, children (dichotomous), education level, ethnicity, housing, income, number of cats owned and number of dogs owned were all significant with $p \leq 0.25$. All these variables were included in the saturated model. Interaction terms were created and tested in the model. None of these interaction terms were found to be significant. Table 4.11 shows the final model for the outcome variable knowledge score.

Table 4.11: Final linear regression model* of predictors of knowledge score (N=202).

Variable	Categories	Coefficient	95% Confidence Interval
Education level	< High school	Baseline	….
	High school/GED	0.62	-0.2 , 1.4
	Some college	0.46	-0.4 , 1.3
	Completed college	1.10	0.3 , 1.9
	Advanced degree	1.02	0.1 , 1.9
Intercept	….	2.76	1.9 , 3.6

* F-test statistic for the model = 2.78 with p= 0.03
** $R^2 = 0.30$.

The last model was a linear regression model that had attachment score as the outcome variable. In univariable analysis of household level variables, children (dichotomized) ($p = 0.30$), ethnicity ($p = 0.49$), and income ($p = 0.45$) were insignificant. The variables house size, number of adults, person age, gender, education level, housing, number of cats owned, number of dogs owned, and knowledge score were all significant with $p \leq 0.25$. All these variables were included in the saturated model. Interaction terms were created and tested in the model. None of these interaction terms were found to be significant. Table 4.12 shows the final model for the household level predictors of the outcome variable attachment score.

Table 4.12: Final linear regression model* of household level predictors of attachment score (N = 264).

Variable	Categories	Coefficient	95% Confidence Interval
Gender	Male	Baseline	….
	Female	2.67	1.2 , 4.1
House size[a]	….	-0.46	-0.9 , -0.004
Knowledge score[a]	….	0.44	-0.003 , 0.9
Intercept	….	36.13	33.2 , 39.1

* F-test statistic for the model = 6.55 with $p < 0.001$.
** $R^2 = 0.46$.
[a] Modeled as continuous variable.

4.5 Discussion

4.5.1 Response rates

In general, the response rate for this portion of the project was good. The number of refusals (245) to participate in the interview was higher than expected. People who refused to participate may have been called at inopportune times and as a result, they may have been less willing to answer questions than those who were telephoned at times that were more convenient. The 27 people who only partially completed the survey may have been more likely to complete the questionnaire if it was shorter in length. Because only English-speaking interviewers administered the telephone survey, the 44 non-English-

speaking residents were not eligible to participate. Although preparations were not made for a Spanish language telephone survey, it would have been useful in this study.

4.5.2 Study site demographics

Generally, the study population was somewhat representative of Caldwell, TX. Anglo subjects made up 77% of the study population, which is similar to the 71% of Caldwell citizens that reported being White during the 2000 census (United States Census Bureau, February 2006). However, because of the way that the census is broken down into race and then ethnicity, there is no way to tell what percentage of people reported their race as White who was also Hispanic. In addition, Blacks/African-Americans were slightly underrepresented in the study population. Twenty-eight percent of households in the study population contained children, while 36.5 % of households have children in Caldwell, TX. The average household size for the study population was similar to household size of Caldwell at 2.7 and 2.61. Females made up a much larger percentage of the study population (71%) than the population of the city (54.6%). At the start of the survey, the interviewers asked to speak to someone who was knowledgeable about the pets in their household. This larger percentage of females in the study population could be due to a larger percentage of pet owners who are female. Also, females are most commonly the responsible caretaker for the pets in the household, which could have led to their overrepresentation in the study population. The median household income category for the study population ($35,000 - $54,999) was higher than that of the Caldwell population ($29,936). Data collected on ages of the members of the study population were consistent

with the data on ages from the Caldwell census (United States Census Bureau, February 2006).

Most of the variability in the demographics was likely due to the phone coverage in Caldwell, TX. Residents of Caldwell that were not eligible to participate in the study because they did not own a phone were likely low income residents of non-Anglo backgrounds. Perhaps future studies can better address the level of phone coverage at study sites by doing door to door sampling.

4.5.3 Summary information on pet owners

Findings from this study regarding percentages of pet owners were fairly consistent with results from previous studies. The number of subjects who reported being pet owners was 269 (61%), with 264 of these subjects owning cats, dogs or both. These findings were consistent with the AVMA study findings. The AVMA study showed that about 58.3% of households in the U.S. and about 61% of households in Texas owned pets in 2001 (AVMA, 2002). The average number of dogs and cats owned per household in the present study was 1.3 and 2.00, with 51% (63/123) of all cat owning households owning 1 cat. These findings were similar to the findings of the APPMA study (APPMA, 2002). The AVMA study showed percentages of dog owners and cat owners in Texas (43.8% and 33.0%) and in the U.S. (36.1% and 31.6%) that were similar to those in the present study (48% and 28%). Perhaps cat owners and dog owners were overrepresented in the present study because a greater number of non-pet owners refused to participate in the study at the start of the telephone interview.

Only a few of the cat level variables could be compared to previous studies because the main focus of these studies was pet ownership demographics. Findings on cat sex and length of time the cat had been owned could not be compared to previous studies because the question was not addressed, or asked using multiple questions (AVMA, 2002; APPMA 2005). The results on cat breed from the APPMA study were similar to the findings of the present study with the majority of subjects reporting mixed breed cats (APPMA, 2005). Indoor/outdoor status was measured during the day time and also at night by the APPMA study. Although the data from the present study could not directly be compared to the APPMA results, the APPMA study showed that a greater percentage of subjects reported their cats as indoor only cats and a smaller percentage of subjects reported their cats as outdoor only and indoor and outdoor cats during both times of day (APPMA, 2005). In the present study, the greatest percentage of cats were found as strays or given to the subject by a friend/relative. The APPMA study had included several additional categories, yet resulted in similar data with 43% of cats given to the subject by a friend/relative and 34% of cats found as strays (APPMA, 2005). The APPMA study also showed that a greater percentage of cats were sterilized (86%) than in the present study (74%). In the present study the greatest percentage of cats had visited the veterinarian once in the last year. The AVMA and APPMA studies showed that the majority of cats had not been to the vet in the last year (AVMA, 2002; APPMA, 2005). Because the APPMA study did calculated a yearly percentage instead of a total percentage of cats that had ever been vaccinated for rabies, the information on the variable vaccinated could not be directly compared (APPMA, 2005). Results from the present study and the APPMA study were

similar with regard to mean number of dogs and cats owned per household (APPMA, 2005).

A general pattern of level of care for pet cats existed in the results from the present study. Cats that had been sterilized appeared to have a higher level of care when compared to cats that had not been sterilized. A higher percentage of cats that were sterilized were considered to be companion animals, wore a collar, had visited the veterinarian more frequently (for annual and non-annual check-ups), and had been vaccinated for at least rabies. Owners of these sterilized cats may have been more likely to take their cat to the vet and have their cat vaccinated because of increased contact with their veterinarian. At the veterinarians' urging there may have been a higher level of care implemented for these animals by their owners. This general pattern of care could also be related to the idea that people who take their animals to the veterinarian have different perceptions about their pets than pet owners who do not take their animals to the veterinarian.

I am not aware of any studies published in the U.S. that have examined opinions about free-roaming dogs and cats. In this study, a greater percentage of subjects reported seeing stray dogs and cats than the percentage of subjects who considered them to be a problem in their area. These subjects who had seen strays but did not think that they were a problem may have cared for the strays or may not have had any negative experiences with the stray animals. It is important to note that in the present study most of the subjects who were feeding stray cats had been feeding them for less than 6 months or for more than 2 years. Thirty-one people reported that they had had at least 1 stray cat fixed. Although

this was a very small percentage of the people surveyed, this number may someday continue to increase with the development and dissemination of educational resources.

Only individual questions in the knowledge scale could be compared to previous studies (New et al. 2000; Salman et al. 1998). Results from the questions 1 (dogs and cats need shots), 2 (dogs go into heat twice a year), 3 (dogs and cats misbehave out of spite), 4 (must catch dog doing wrong in order to correct him), 5 (cats go into heat twice a year), 6 (better to have 1 litter before female is spayed), and 7 (cats may scratch, pounce, or bite as play) of the present study were all consistent with 1 of the previous studies (Salman et al. 1998). Question 2 and question 5 of the present study were administered as 1 combined question regarding the estrous cycle of cats and dogs in a second previous study (New, Jr., et al 2000), so these results were not directly comparable. Question 8 (it is cruel to keep cats indoors) of the present study was not included in either of the previous studies.

Because the previous studies that used the CCAS did not publish individual questions on the attachment scale, only the mean overall attachment score of dog and cat owners could be compared to the present study (Castelli, et al 2001; Zasloff, 1996). In 1 previous study the mean attachment score was 39.6 for dog owners and 40.1 for cat owners (Zasloff, 1996). Results from a second previously conducted study showed that the mean attachment score for dog owners was 37.1 and the mean attachment score for cat owners who owned 1 cat was 41.6 (Castelli et al. 2001). The data from the present study showed similar results with the mean attachment score for cat owners (39.8) being similar to the mean attachment score for dog owners (39.3). Results from 1 of the previous studies also showed that subjects who owned 2 or more cats reported the highest mean attachment

score to their pets (Castelli et al. 2001). The mean scores from the present study were consistent with the findings of both previous studies (Castelli et al. 2001; Zasloff, 1996).

Most of the data from the demographics section of the questionnaire could be compared to the findings of previous studies (APPMA, 2005; AVMA 2002). The present study showed a greater percentage of female pet owners over male pet owners. The APPMA study showed that more males owned pets than females (APPMA, 2005). The findings on subject's age could not be compared to the AVMA study because "life stages" were used to measure age in this study (AVMA, 2002). However, person age data could be indirectly compared to the APPMA study which reported an average age for pet owners (APPMA, 2005). The median age in the present study was within the age group 45-54, while the APPMA reported an average age of 47 years in their study. Data on education level of pet owners could not be compared to the APPMA study, which did not address education level of the subject (APPMA 2005). When compared to the AVMA results, the results of the present study had a higher percentage of pet owners with advanced degrees (AVMA, 2002). Results on ethnicity of pet owners were consistent with the findings of the APPMA study (APPMA, 2005). Both studies showed that subjects who reported being White/Anglo made up the majority of pet owners, followed by Black/ African-American and Hispanic subjects (APPMA, 2005). The present study showed that subjects living in houses made up 84% of pet owners. This information was consistent with the results of the APPMA study which showed that the majority (76%) of pet owners live in houses (APPMA, 2005). The AVMA study and the present study showed that the largest percentage of pet owners had incomes of $55,000 - $84,999 (AVMA, 2002). These

findings could not further be compared to the APPMA study due to differences in income response categories (APPMA, 2005).

4.5.4 Modeling

Cats that were companion animals were more likely to be sterilized than mousers. Since the majority of the mouser cats in this study (52/54) were cats that had been outdoors for some period of time and that these cats were more likely to still be intact indicates that these cats may contribute to the pet overpopulation problem. Pet cats that have not been sterilized and have spent time outside, have many opportunities to mate with other intact, outdoor cats. There was an increasing trend between length of time a cat had been owned and the likelihood of a cat being sterilized. Cats that had been vaccinated for rabies were 15 times more likely to be sterilized than cats that had not been vaccinated for rabies. These cats may have been vaccinated and sterilized during the same visit to the veterinarian. Cats that had been owned the longest (4+ years) were almost 9 times more likely to be sterilized than a cat that had been owned for less than 2 years. The variable age may have been a significant variable in this analysis, had more subjects known how old their cats were.

The second logistic regression model tested both re-categorizations of the indoor/outdoor status outcome variable. The odds ratio for the role variable in the first indoor/outdoor status model showed that cats who were mousers were 16 times more likely to be outdoor cats than companion cats. The second indoor/outdoor status model showed similar results (Appendix D). The odds ratio for the role variable in this second model showed that companion cats were 33 times more likely to be inside cats than

mouser cats. The belief that mouser cats are more likely to be outside cats was supported by this analysis. In a previous national study it was found that more people keep their cats inside only than outside only and that there was a slight increase in the number of cats that remained indoors at night time compared to during the day (APPMA, 2005). The differences in the data for indoor/outdoor status in the present study could be attributable to the rural location of the study site. For future studies, surveys for cat owners should include 2 separate indoor/outdoor status questions for day time and night time. Previous analysis (see Table 3.4) showed that the indoor/outdoor status question was reliable, thus inclusion of indoor/outdoor status questions for day and night would be helpful in determining more precise data on cats.

The third logistic regression model tested cat owner as the outcome variable. Results from the cat owner model showed that cat ownership is related to household size. For each 1 person increase in house size, there was a 1.3 increase in likelihood of owning a cat. The AVMA study showed similar results that the likelihood of being a cat owner increased with household size (AVMA, 2002). Households with 5 or more members made up the largest percentage of cat owners compared to every other household size below 5 (AVMA, 2002). However, the more recent APPMA study showed that the largest percentage of cat owners came from subjects who lived with only 1 other person (APPMA, 2005). The differences between these 2 studies could be due to a shift in cat ownership patterns over the past few years.

In the current study, subjects with an advanced degree were more likely to be cat owners than subjects who did not complete high school. Results from the AVMA study

showed that college graduates, followed by subjects with advanced degrees made up the largest percentage of cat owners (AVMA, 2002). In both the current study and the APPMA study (APPMA, 2005), White or Anglo subjects comprised the vast majority of cat owners. Results from the cat owner model showed that subjects who reported being Anglo were more likely to be cat owners than subjects who reported being Black/African-American. The strong association between cat ownership and Anglo subjects could be due to the large distribution of White residents residing at the study site. Subjects of different ethnic backgrounds may also have different definitions of the word "ownership" in terms of pets. Further investigation is necessary to determine what defines a pet as "owned" by a certain person.

The fourth logistic regression model tested dog owner as the outcome variable. Surprisingly, none of the independent variables were significantly associated at the $p \leq 0.05$ level. The results of this analysis were not consistent with the findings of the APPMA study or the AVMA study (APPMA, 2005; AVMA, 2002). The APPMA study showed that dog owners were more likely to be White, without children living at home, and lived in a household with 2 people (APPMA, 2005). The AVMA study showed that dog owners were more likely to be female, with incomes of $85,000 or more and a college degree (AVMA, 2002).

The fifth logistic regression model tested cats are a problem as the outcome variable. Results from this model showed that subjects with children were slightly more likely to think that stray cats were a problem in their area compared to subjects who did not have children. These results could not be compared to the results of previous studies

because opinions of stray cats had not been previously examined in regard to subject demographic information.

The first linear regression model tested had knowledge score as the outcome variable. Results from this model demonstrated that when compared to the baseline (less than a high school diploma), subjects who completed college had the highest knowledge scores, followed by subjects who had an advanced degree. The coefficients indicate that subjects who completed college and subjects who had an advanced degree had about a 1 point increase in knowledge score over the baseline group (subjects with less than a high school diploma). The previous studies that used the same set of knowledge questions did not evaluate the effect of education of the subjects on their knowledge level about cats and dogs, nor did they calculate a total knowledge score for each subject as was done here (New, Jr., et al 2000; Salman et al. 1998). For future studies, more information may be gained from analyzing the responses of each of the knowledge questions separately with special attention to the influence that being a pet owner has on a person's knowledge about cat and dogs.

The last model tested was a linear regression model that had attachment score as the outcome variable. Attachment score values increased with increased amount of attachment of owners to their pets. Being female led to a 3 point increase in attachment score over the male subjects in this study. In the AVMA study, subjects were asked if they considered their pets to be family members, companions/pets, or property (AVMA, 2002). More subjects considered their dogs family members than subjects who considered their cats family members (AVMA, 2002). Generally, 1 could assume that a greater bond

existed between people and their family members or companions than between people and their property. However, because no direct comparison could be made between these findings and the results of the attachment model, perhaps in the future it would be helpful to include family member as a response choice to the question regarding the role of the subjects' cats. House size tended to have an inverse relationship with attachment score. The model results indicated that for every 1 person increase in household size that the subjects' attachment score would drop about half a point. Perhaps subjects who lived in larger households are less attached to their pets because they are surrounded by the company of other members of the household. Knowledge score was positively associated with attachment score. The results indicated that for every 1 point increase in knowledge score, the attachment score would increase about half a point. The small coefficient of the knowledge score variable in the model could be due to the existence of a smaller possible range for the knowledge score (1-8) and a larger possible range for the attachment score (11-44). The belief that people who knew more about their pets were also more attached to them was supported here. The small study population ranges for the knowledge score (0-8) and attachment scores (30-44) contribute to the small size of the knowledge score coefficient in the model.

4.5.5 Overview

In general, a considerable amount of information was obtained from this portion of the study. However, since the study population for this survey was not entirely representative of the population of Caldwell, it may not be possible to extrapolate the data to the general population in that community. Many of the associations made between the outcome and predictors may have been influenced by sparse data or a disproportionate amount of data among variable categories. I believe that if the opinions about stray animals section of the survey had been asked as was originally intended, that a greater number of viable models containing variables would have resulted. Because most of the survey questions were reliable, this project should be repeated in new locations so that common patterns in the data can be identified.

CHAPTER V

AN INVESTIGATION OF FREE-ROAMING CAT POPULATIONS USING A 7-DAY OBSERVATION LOG

5.1 Introduction

Many different types of observation logs are used to collect information on human and animal activity level and food intake (Willett, 1998). This information is useful in determining risk factors for disease and evaluating dietary habits. Several studies have validated the use of observation logs for collecting information on nutrition and activity level (Hickling et al. 2005; Slater et al. 1992; Stel et al. 2004; Wendel-Vos et al. 2003). Seven-day diaries can be used to provide an accurate description of what is occurring in an area. One of the most well known 7-day diaries is the Consumer Expenditure Diary Survey that is used by the USDA (United States Department of Agriculture, March 2006). This diary is used to collect data on the spending patterns of households in America, with special attention to items that are purchased often (food, tobacco, fuels, utilities, personal care products, non-prescription drugs, etc). From the data collected over the 7-day period, information can be obtained on diet quality and household health, in addition to money-spending choices. In most cases 7-day diaries give a better picture of purchases than a 24-hour recall diary because data can vary from day to day.

To date there have not been many studies that have involved the counting of animals or animal sightings by the untrained public. One of the few studies that has dealt with animal counts is the Audubon Society's Christmas Bird Count. The Christmas Bird Count takes place on Christmas day every year and it is the largest survey in the world

(Pennisi, 1990). Since 1990 thousands of civilian volunteers have collected data on different species of birds for this study (Pennisi, 1990). Every year an area is defined for data collection and the area is then broken up into territories. Participants are assigned a territory and count only birds that they see within their designated territory during a 24 hour period (on Christmas day). The numbers of birds and the information on bird population distribution that bird counters provide is used to determine which species are in danger (Pennisi, 1990). A second study, the Backyard Bird Count, also collects information on bird counts and bird species (Cornell University, 2003). This study, which is conducted by Cornell University every 2 weeks, uses bird counting on 2 consecutive days. Participants collect data by counting the maximum number of a species of bird seen at a single time for this study.

To my knowledge, there have not been any previous studies that counted numbers of free-roaming cats using the untrained public. Counts of free-roaming cats would be invaluable in determining if a TNR program is necessary in a particular area. Data on free-roaming cats, especially sterilization, would be extremely useful in determining course of action for animal control or public health officials. In order to gather sufficient information about these cats a multi-day instrument is required.

In this pilot study, a 7-day observation log was used to obtain information about free-roaming cats in Caldwell, TX. The objective of this portion of the study was to investigate the activity of these free-roaming cats in order to determine the scope of the overpopulation problem in the community.

5.2 Methods

5.2.1 Study design, study site, and study population

This study had a cross-sectional study design with simple random sampling and used a 7-day observation log to record details about free-roaming cat populations in the community. The subjects for the observation log portion of this study were chosen from subjects who answered a telephone questionnaire on cats in the community. Subjects for the initial telephone survey were chosen by the Public Policy and Research Institute (PPRI), a survey administration organization of Texas A&M University. This population included 441 households. Eligible subjects included 1 person from each of the 441 selected households, either a male or a female of age 18 or older. The survey was administered to the 441 subjects beginning June 6, 2005 and ending June 28, 2005. At the end of the survey the subjects that reported seeing homeless cats (300/441 = 68%) were asked to participate in an observation study in which they would record their observations about the free-roaming cats in their community for 7 days. At the end of the telephone survey 244 subjects (1 per household) agreed to participate in the observation log study. A random sample of these subjects was later telephoned to see if they were still willing to participate in the observation log study. Subjects were offered $50 as compensation for their participation. These phone calls began on October 11, 2005 and ended on October 22, 2005. Observation logs were mailed to subjects who agreed to participate, along with a stamped self addressed envelope in which to return the diary. The observation logs were mailed out on October 25, 2005 and the last observation log was returned on November 28, 2005. Calls to participants were made at 1 week intervals

in order to remind subjects to complete and return their observation logs so that they could receive compensation.

5.2.2 Observation log instrument

The observation log was conceptually modeled after the 7-day food diaries taken from previous studies (Willett, 1998). The observation logs were given to twenty individuals for testing before the study began. The testers included people of both genders, from ages 18 to 89, with education levels from high school graduate to professional school graduate. None of these testers had any difficulty in answering the questions. The observation logs (Appendix E) contained 14 questions which were primarily closed-ended so that participants could easily check off their observations on the observation logs they received in the mail. The observation log packet contained an information sheet, instruction sheet, example page, and 1 page for each of the 7 days with an extra 8th page in case of errors in filling out the diary. Respondents were asked to record the details and locations of the cats they saw (and any births or deaths as well), the activity of the cats, and their feeding patterns for 1 week. Participants were also asked to report if they were feeding these cats and if the cats they were seeing were the same cats they see daily. All responses were recorded according to the time of day at which the cat sighting occurred (morning, afternoon, or evening). In addition subjects were asked to write any notable insights about the cats on the back of the daily observation pages. For the purposes of the study all responses were coded and remained confidential. The observation log observation log was approved by the Institutional

Review Board- Human Subjects in Research, Texas A&M University (Protocol Number 2005-0395).

5.3 Data analysis

Summary data was collected and graphed from each of the 21 useable observation logs that were returned to the researcher using commercially available software (Microsoft Excel, Version 2002). The observations were entered into categories according to the time of day at which each observation occurred (morning, afternoon, and evening). Percentages were calculated for all questions for each time category and across all times. Since the total number of actual cats seen could not be determined from the data obtained in the observation logs, the total number of cat sightings was used instead to determine during which time of day the greatest amount of free-roaming cat activity occurred. These cat sightings were graphed by time of day and were also graphed according to number of people seeing these cats.

5.4 Results

5.4.1 Response rates

The first 30 subjects who agreed to take part in the study were mailed an observation log packet to record their observations of free-roaming cats. Sixty households were telephoned in order to reach our desired sample size of 30. From the list of the 30 subjects who agreed to participate, 22 individuals returned completed observation logs. However, only 21 of the observation logs could be used for the

purposes of this study. One subject wrote out her responses in narrative form and only provided general information about the cats that she saw during the week. Since she did not adequately answer the questions contained in the observation log pages for each day, no useful data could be analyzed from this observation log. One subject returned a completed observation log but refused compensation. One subject lost the observation log and so a second was mailed to her. Eight participants did not return the observation logs. Multiple calls were made to these subjects and messages were left when the subject was unavailable to take the phone call. Subjects were called on weekdays and weekends so that they could be reached at a time when they would be at home. Six of the 8 subjects who did not return their observation logs were not reached by phone in an attempt to remind them. Reminder letters were mailed out to these 6 subjects. None of these subjects returned their observation logs. The overall response rate for the observation log study was 73% (22/30) who agreed to participate.

5.4.2 Findings

Table 5.1 shows the descriptive information obtained from the observation logs, categorized by time of day. Two of the observation logs had missing values for 1 time slot on 1 day. A total of 382 cat sightings were made by the 21 subjects during the 7 days that they recorded their observations in the observation logs (18 cat sightings per person per week or 3 cats per person per day). The greatest percentage of cat sightings occurred during the morning hours, followed by the evening hours, and lastly, during the afternoon. The sex of the cats was not often recognized by the subjects. However, the number of male cats seen was almost equal to the number of female cats seen when the sex of the cat was reported. Very few cats were spotted that had been ear notched or had suffered some sort of injury. Only 3 sightings of cats with notched ears were reported. The most commonly reported noticeable characteristic of the cats was "thin." As suspected, the majority of the cats were spotted in or near neighborhoods and most often the cats were alone, instead of with other cats. There were more reports of cats resting than of cats doing any other kind of activity, although 22% of the cats seen were eating. There was a fairly equal distribution of cat sightings where cats were eating off the ground and out of a dish, with most of these sightings occurring during the morning and then the evening hours. Four of the 21 sightings of cats seen eating out of a dish were also reported to be owned cats.

Table 5.1: Descriptive information from the 7-day observation logs[a].

	Morning[b]		Afternoon[c]		Evening[d]		Total	
Variable	N	%	N	%	N	%	N	%
Cat sightings	138	36	115	30	129	34	382	100
Collar sightings								
Cats with collars	17	12	25	22	17	13	59	15
Cats without collars	98	71	77	67	99	77	274	72
Don't Know	23	17	13	11	13	10	49	13
Radio collar sightings[e]								
Cats with radio collars	0	0	2	8	1	6	3	5
Cats without radio collars	5	29	8	32	2	12	15	25
Don't Know	12	71	15	60	14	82	41	70
Cat sex								
Male sightings	5	4	7	6	5	4	17	4
Female sightings	6	4	5	4	5	4	16	4
Both males and females	13	9	12	11	12	9	37	10
Don't Know	114	83	91	79	107	83	312	82
Noticeable markings								
Ear notch	1	10	1	33	1	100	3	21
Injury[f]	5	50	2	67	0	0	7	50
Thin	4	40	0	0	0	0	4	29
Location of cat sightings								
Near neighborhood	64	77	48	71	53	78	165	76
Near work	12	15	9	13	4	6	25	11
Near stores	5	6	4	6	6	9	15	7
Near restaurant	1	1	3	5	3	4	7	3
Other[g]	1	1	3	5	2	3	6	3
Were the cats alone								
Alone	65	71	31	65	51	65	147	67
With other cats	27	29	17	35	27	35	71	33

Table 5.1 (continued).

	Morning		Afternoon		Evening		Total	
Variable	N	%	N	%	N	%	N	%
What were the cats doing								
Resting	31	27	29	43	25	30	85	32
Nursing	0	0	0	0	0	0	0	0
Hunting	26	23	9	13	15	18	50	19
Eating	30	26	8	12	20	24	58	22
Fighting	5	4	3	4	4	5	12	5
Playing	22	19	16	24	18	22	56	21
Other[h]	0	0	2	3	0	0	2	1
Where were the cats eating[i]								
Out of dumpster	10	33	4	50	7	35	21	36
Off ground	11	37	0	0	5	25	16	28
Out of dish	9	30	4	50	8	40	21	36
Do cats eat there regularly[i]								
Yes	12	40	6	75	8	40	26	45
No	10	33	0	0	3	15	13	22
Don't Know	8	27	2	25	9	45	19	33
Sightings of owned cats								
Owned cats	24	34	20	35	18	30	62	33
Non-owned cats	8	11	14	25	19	31	41	22
Don't Know	39	55	23	40	24	39	86	45
Sightings of abandoned cats								
Abandoned cats	0	0	1	2	0	0	1	< 1
Non-abandoned cats	2	3	6	11	21	34	29	15
Don't Know	69	97	50	87	40	66	159	84
Sightings of sterilized cats								
Sterilized cats	9	12	10	18	11	18	30	16
Non-sterilized cats	5	7	4	7	3	5	12	6
Don't Know	57	81	43	75	47	77	147	78

Table 5.1 (continued).

	Morning		Afternoon		Evening		Total	
Variable	N	%	N	%	N	%	N	%
Sightings of cats that have had a litter								
Cats with litter	7	10	6	11	6	10	19	10
Cats without litter	20	28	16	28	18	30	54	29
Don't Know	44	62	35	61	37	60	116	61
Sightings of dead cats	5	….	1	….	2	….	8	2
Number of subjects who fed cats	….	….	….	….	….	….	5	24
Number of subjects who reported seeing repeat cats	….	….	….	….	….	….	15	71

[a] All data based on sightings of cats, not individual cats seen.
[b] Morning hours designated 6:00 am – 11:59 am.
[c] Afternoon hours designated 12:00 pm – 5:00 pm.
[d] Evening hours designated 5:01 pm – 5:59 am.
[e] Only answered by people who saw cats with collars. N = 59.
[f] Injuries reported included paw (n = 1), eye (n = 1), ear (n = 1), tail (n = 2), patches of missing hair (n = 2).
[g] Other locations reported included near church (n = 1), near school (n = 1).
[h] Other cat activities reported included wandering.
[i] Only answered by people who saw cats eating. (N = 58).

Seventy-six percent of the sightings of cats occurred in or near neighborhoods, followed by 11% near the subjects' work. The largest percentage of cats that were seen were resting (32%), while most others were seen eating (22%), playing (21%), or hunting (19%). Twenty-two percent of the subjects who reported seeing cats eating also reported that the cats did not eat at the site regularly, while 45% reported the opposite. Sixteen percent of the cat sightings were reported to be sightings of owned cats. Only 1 sighting of an abandoned cat and 30 sightings of sterilized cats (16%) were reported during the study period. There were 19 sightings of cats (10%) that had recently had a litter and 8 sightings of dead cats (2% of all cat sightings) seen during the study period, all seen dead on the side of the road. Five of the subjects (24%) admitted to feeding the free-roaming cats that they saw and 15 subjects (71%) reported that most of the cats they had seen during the study period had been the same cats.

The graphed results of the number of cat sightings by time of day are shown in Figure 5.1. Figures 5.2, 5.3, and 5.4 show the y number of people that saw x number of cats for each time of day.

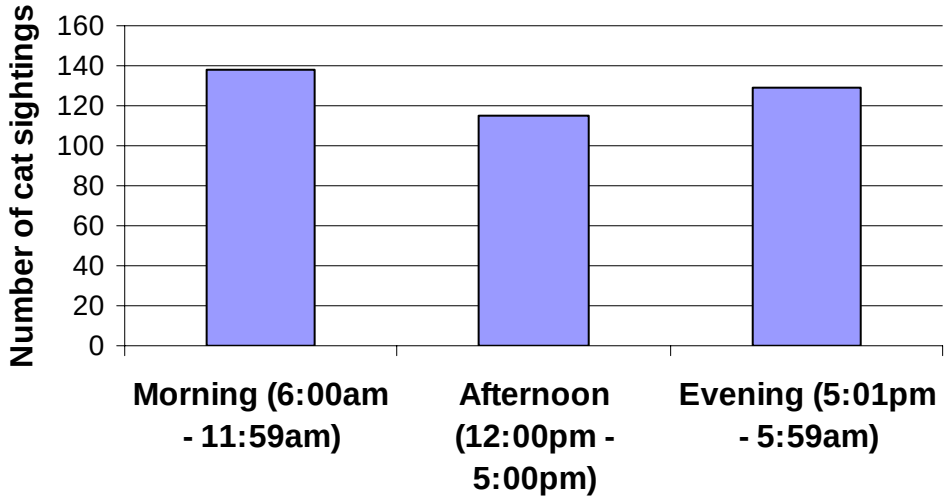

Figure 5.1. Number of free-roaming cat sightings recorded by 21 subjects during morning, afternoon, and evening hours, using a 7-day cat observation diary.

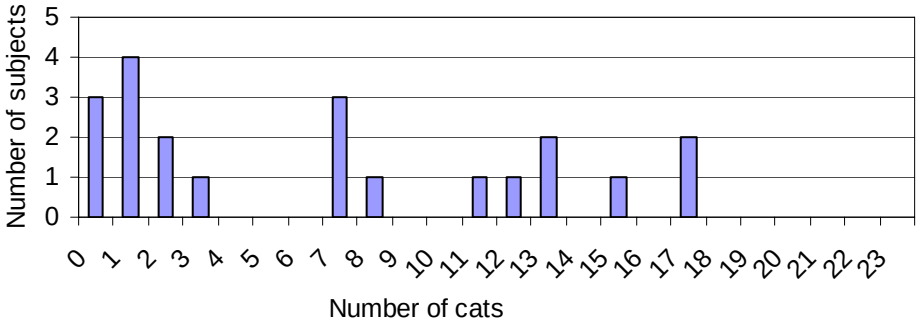

Figure 5.2. Number of subjects reporting number of free-roaming cat sightings during the morning hours, using a 7-day cat observation diary.

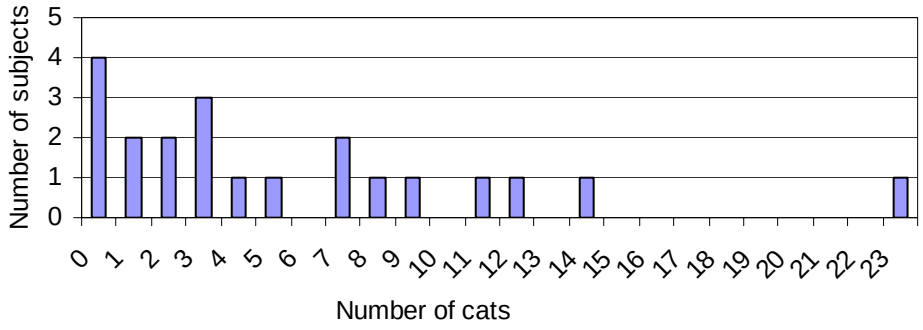

Figure 5.3. Number of subjects reporting number of free-roaming cat sightings during the afternoon hours, using a 7-day cat observation diary.

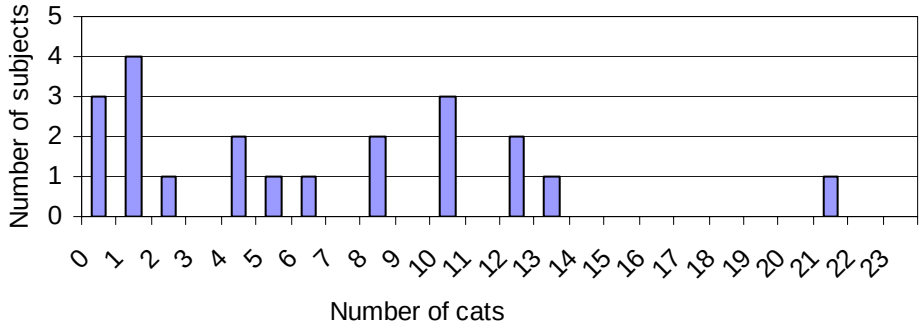

Figure 5.4. Number of subjects reporting number of free-roaming cat sightings during the evening hours, using a 7-day cat observation diary.

Figure 5.1 indicates that the cats were slightly more likely to be spotted during the morning hours than during the evening hours. Figures 5.2, 5.3, and 5.4 show that the majority of subjects saw 0 cats or had 10 or less cat sightings during 1 time of day in the week that they were recording their observations in the observation logs. Figure 5.2 shows that most of the subjects saw 0-4 cats or 7-13 cats during the morning hours of the study period. Figure 5.3 illustrates that the greatest number of subjects saw 0-5 cats during the afternoon hours. Figure 5.4 shows findings similar to Figure 5.2 with most subjects seeing 0-4 cats or 8-13 cats during the evening hours. Only 2 subjects reported seeing more than 20 cats during 1 time of day. One subject reported 23 cat sightings in the afternoon hours during the week that she was recording her observations and another subject reported seeing 21 cats during the evening hours.

5.5 Discussion

5.5.1 Response rates

The response rate for completing and returning the observation log was not as high as I had hoped, especially since compensation was being offered to subjects who fulfilled these requirements. More subjects could have been telephoned and encouraged to complete and return their observation logs if more time had been available to perform the study.

5.5.2 Analysis

Because the number of individual cats seen during the study period could not be determined, it was difficult to analyze the data contained in the observation logs. Subjects could not distinguish between different cats from a distance, and were not expected to do so. As a result summary data based on the number of cat sightings seemed to be a more useful approach to the data analysis. For future studies it might be helpful to have the participants collect data in a way similar to the bird counting studies (Pennisi, 1990; Cornell University, 2003). Perhaps subjects could count the largest number of cats seen at a single location at 1 time. Subjects could still provide information on cat location and activity, especially feeding times and locations. Collecting data in this manner may eliminate the possibility of data on repeat cats. Because this part of the study was conducted during relatively consistent sunny weather, we were not able to examine the effect of weather on free-roaming cat patterns. Perhaps in the future more information could be obtained about seasonal cat patterns by conducting a longitudinal study across all seasons for 1 year. Or annual studies could be performed to look at long term trends.

5.5.3 Findings

The findings regarding cat sightings could not be directly compared to the telephone interview findings. However, the majority of subjects reported seeing stray cats on a daily basis during the interviews. This data is consistent with the findings of the cat diary portion (3 cat sightings per person per day).

Generally, there were slightly more sightings of cats during the morning and evening than in the afternoon. I believe that the distribution of cat sightings across all

times of day may have been skewed by the fact that most employed people were probably at work during the afternoon hours. So for these people, there would be less opportunity to see cats during this time period. For future studies an additional question should be added to the observation logs asking about the subject's hours of employment in order to determine if this was the cause of decreased cat sightings in the afternoon. Another explanation for the uneven distribution of cat sightings across times of day is that free-roaming cats are probably more likely to be out around dawn or dusk.

Since it is difficult to recognize characteristics such as reproductive status, sex, and owned status without previous knowledge of the cats, these questions were difficult for most subjects to answer. Many subjects repeatedly reported a response of "don't know" to these questions.

Twenty-four percent (5/21) of the subjects who participated in the observation log study reported that they were feeding stray cats, while only 13% (58/441) of the subjects who participated in the telephone survey admitted to feeding stray cats. The percent difference between the survey results and the observation log results for this question could be attributed to differences in the populations who completed these 2 measures. Since the observation log subjects were selected from a group of people who had reported seeing homeless cats and consented to participate in the study on free-roaming cat populations, they may have been more likely to see and feed free-roaming cats than those who were selected by random digit dialing to participate in the general telephone survey. Several participants noted in their observation logs that the stray dogs in their community should be of greater concern than the stray cats.

The largest obstacle encountered during this portion of the study was repeated attempts to get the participants to return their observation logs. Perhaps subjects lost the envelopes with the return address and so they were unable to send back their observation logs. Extending the length of the study time may have resolved this problem. However, because a 100% response rate would still be unlikely, I believe that a larger sample size will be necessary in future studies in order to prevent a small amount of returned data.

Another obstacle was that some subjects had trouble understanding how to fill out the observation logs. A few of the questions seemingly confused the subjects. For example, 1 subject reported that he saw 2 cats and that the cats were both alone, but he reported only 1 time at which he saw these 2 cats. Whether the subject forgot to report the 2 different times at which he saw these cats or whether he did not understand the question about the cats being alone could not be determined. In order to avoid this confusion in the future, the question about cats being alone or with other cats should be excluded from the observation logs or the terms “alone” and “with other cats” should be better defined for the subjects.

Some of the findings of the observation logs did not contain any useful information. Generally, the questions regarding cat sex, owned/abandoned status, and sterilization status produced little data on the free-roaming cats seen in Caldwell. Subjects were not instructed to approach the cats and so sex and sterilization status of the animals was hard for subjects to determine. Other questions, like whether the cat was owned or abandoned, could not be answered if subjects had not had contact with the cats for an extended period of time. When subjects could tell that a cat had recently had a litter, this

information was useful. However, this question could have been less valuable if subjects had not seen kittens with the other free-roaming cats that they had seen.

5.5.4 Overview

Overall, the summary information obtained from the observation logs was useful in assessing the frequency of cat sightings and the patterns of the free-roaming cats that live in Caldwell, TX. I believe that the data collection of the observation log study was more problematic than that of the surveys simply because of the format of the observation log. Although the subjects agreed to participate in the observation log portion of the study, I believe that the level of participation would have been much lower had compensation not been offered to willing participants. I was surprised by the number of people who were called and were unwilling to participate despite the offer of compensation. Most of these people gave no reason for declining to participate, but a few of the older people who were called mentioned that they were not able to participate due to illness. Although the information obtained from this study was useful in investigating free-roaming cat activity, more information is needed on the patterns of these cats in order to analyze the validity of the telephone survey.

CHAPTER VI

CONCLUSIONS

Overall, the telephone questionnaire was effective at collecting data on household level variables and certain cat level variables for this study. The results demonstrated that in future studies a few of the questions should be re-written or re-formatted as closed-ended questions to avoid misinterpretation of response choices (especially the question regarding where the owners had obtained their cats). In addition interviewers should be provided with more specific instructions in order to administer the survey questions as the researcher intended and to avoid response coding problems. Generally, the reliability was good for most of the questions that were examined from the telephone survey. Most questions regarding household demographics and cat level demographics were highly reliable. The less reliable questions dealt with where cats came from and variables that changed with time, such as opinions about homeless animals. In future studies the follow-up interview should be administered in reference to the same time period as the first interview so that certain responses will be less variable with time and may result in more reliable findings. Although opinions are highly variable due to the influence of recent events, it is important that the questions regarding stray animals be somewhat consistent in future studies. Although it is impossible to obtain reliable results from opinion-based questions, relatively consistent information on stray animals, perhaps with details on what the problem was, will assist animal control and public health officials in getting a better picture of the scope of pet overpopulation and in creating adequate solutions to the problem.

Results from the modeling portion produced models that, according to the goodness of fit tests, the observed and expected values of the data were not statistically different. Cats that were companion animals, were vaccinated, and had been owned for more than 4 years were most likely to be sterilized. Cats that were mousers were most likely to be outdoor cats. Cat owners were most likely to be Anglo people with an advanced degree. People who thought that stray cats were a problem in their area were slightly more likely to have children living in their household. A subject's knowledge about cats was influenced by the level of education they had received. Females were more likely than males to have a higher level of attachment to their cats and dogs. Most of these findings were consistent with previous studies. However, because many of the variables in this study may be correlated, additional statistical methods might be useful to further explore general patterns of pet care.

Free-roaming cat counts by the public had not previously been done. Levels of participation were lower than expected for the observation logs. Further investigation into the frequency of cat sightings and patterns of free-roaming cats is necessary to gain more relevant information. In the future the observation log questions should be more compatible with the telephone survey questions regarding frequency of feeding and seeing homeless animals so that comparisons can be made between the data of these 2 instruments and the validity of the telephone survey can be assessed. Perhaps conducting a longitudinal study would help to distinguish between new cats and repeat cats so that cat abundance, not cat sightings, can be studied. By using a longitudinal study, the effect of the weather on free-roaming cat patterns can be examined.

All portions of the project were fairly well received with moderate to high levels of response. Subjects who participated were more than willing to share their information and a few were even curious about the outcome and results of the study. However, because the study population was not entirely representative of the city of Caldwell it is difficult to determine if the study results can be extrapolated to the community. Studies conducted in Caldwell and in other locations with complementary approaches may help to further understand the changing dynamics of cat ownership and free-roaming cat patterns. Identifying what kinds of patterns exist in certain locations may facilitate the creation and implementation of adequate solutions to pet overpopulation.

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APPENDIX A

TELEPHONE QUESTIONNAIRE

INTRODUCTION:
Hello my name is _____. I'm calling from Texas A&M University to conduct a confidential survey on cats and dogs in Caldwell. Do you live within the city limits of Caldwell? [RESPONDENTS LIVING OUTSIDE THE CITY LIMITS ARE NOT ELIGIBLE. STOP AND ASSIGN DISPOSITION.]

We are conducting research about the cats and dogs in Caldwell. The purpose of the study is to evaluate the population habits of the dogs and cats in your area. Your answers will be confidential and you may refuse to answer any question. The survey will only take a few minutes. The research has been reviewed by the Institutional Review Board for Human Subjects in Research, Texas A&M University. Should you have any questions or concerns regarding this research, I can give you the telephone number of the Investigator or the human subjects review board at Texas A&M University.

Do you own any pets? Yes No Don't Know Refused IF YES, GO TO NEXT QUESTIONS, IF NO TO HOMELESS PETS SECTION

THESE 2 QUESTIONS GO INTO THE DATA TABLE WITH THE HOMELESS PETS SECTION.
How many dogs do you have at this time? Number Don't Know Refused (GO TO NEXT QUESTION FOR ANY ANSWER)

How many cats do you have at this time? Number Don't Know Refused (IF NONE, GO TO HOMELESS PETS SECTION)

Is your cat: Male Female Don't Know Refused (EACH CAT SHOULD BE IN A NEW ROW IN THE DATA SET WITH A NUMBER AND THE HOUSEHOLD ID ENTERED IN ITS OWN COLUMN FOR EACH CAT AND EACH CAT SHOULD HAVE EACH QUESTION ANSWERED)

Please describe the breed of your cat. Is it:
Mixed breed purebred or with a pedigree Don't Know Refused

What is the age of your cat?
< 6 months 6 month to1 year 2 to 5 years 6 to 10 years > 10 years Don't know Refused

How long have you had your cat?
< 3 months 3 to < 6 months 6 months to < 1 year 1 year to < 2 years
2 years to < 4 years 4 to < 10 years 10 years to < 15 years 15 or more years
Don't Know Refused

IF DON'T KNOW, Have you had the cat since it was a kitten Y/N Don't Know
Refused

Is your cat: indoor only outdoor only both Don't Know Refused

How did you originally obtain your cat? (DO NOT READ LIST)
Found as a stray
Born at my home
Given to me by a friend or relative
From a humane society or shelter
In front of a store or flea market
Other _____
Don't Know
Refused
Do you consider your cat primarily a companion or primarily a mouser?

Has your cat been "fixed" or neutered so he or she cannot have kittens? (SPAYED (FEMALE) NEUTERED (MALES))
Yes No Don't Know Refused GO TO NEXT QUESTION REGARDLESS OF ANSWER FOR FEMALE CATS

Did this female have a litter? Yes No Not sure Refused
If yes, was it planned or accidental?
If yes, was it prior to being spayed? Yes No Don't Know Refused
If yes, how many litters?

IF CAT NOT "FIXED"
What was the reason for not fixing your cats? INDICATE REASON FOR EACH CAT (DON'T READ ANSWERS)
Too young
Costs too much
Want to breed cat
Just haven't gotten around to it but plan to
Other _____
Don't Know
Refused

Does your cat have identification such as a collar and tag, microchip or tattoo? Y/N Don't Know Refused

Approximately how many times in the past year has each cat been to the veterinarian?
More than three times
Two to three times
Once
Not been in the last year
Don't Know
Refused

If yes, have they been to the vet for reasons other than shots and check-ups? Yes No Don't Know Refused

Has your cat been vaccinated for rabies? YES NO Don't know Refused

HOMELESS PETS
NEXT SECTION: ONE ROW PER HOUSEHOLD
FOR ALL RESPONDENTS

Do you think stray or homeless dogs are problem in your area? YES NO Don't Know Refused
If yes which of the following problems do you feel are important? (EACH ANSWER IS A NEW COLUMN) Refused

They cause a nuisance by making noise or leaving feces
I am concerned for my safety or that of my family or my own pets
I worry about the animal's welfare or health
I am concerned about diseases they might spread

Do you think stray or homeless cats are problem in your area? YES NO Don't Know Refused
If yes which of the following problems do you feel are important? (EACH ANSWER IS A NEW COLUMN) Refused

They cause a nuisance by making noise or leaving feces
I am concerned for my safety or that of my family or my own pets
I worry about the animal's welfare or health
I am concerned about diseases they might spread

In the past year have you seen any stray or homeless cats in Caldwell? Yes no Don't Know Refused
In the past year have you seen any stray or homeless dogs in Caldwell? Yes no Don't Know Refused

If yes to either, do you see puppies or kittens as well as adults? Yes No don't know refused
If yes to either, do you see them
Near your home, near businesses, in open areas like farms, by the road, other Don't Know refused
If yes to either, about how often?
Almost daily, about 1/week, about 1-3 a month, less often don't know refused

Do you know of any neighbors, coworkers or others who are feeding stray, homeless cats? Yes no don't know refused
Do you feed any stray or homeless cats that you do not own? Yes no don't know refused
If yes, how long have you been feeding these cats?
< 6 months 6 months to < 1 year 1 to < 2 years 2 years or more don't know refused
If yes, about how many cats are you feeding?
1-2 3-5 6-9 10-15 more than 15 don't know refused
Have you ever had any stray cats or kittens fixed/ neutered? Yes no don't know refused
ONLY IF FEEDING STRAY CATS, Have you seen any kittens among the cats you are feeding? (KITTENS ARE SMALLER/LESS THAN ABOUT 6 MONTHS OLD) Yes No don't know refused
Would you be willing to get stray or homeless cats fixed/neutered if someone taught you how to trap them and the cost was low? YES NO don't know refused

The following true/false questions ask about basic dog and cat health and behavior. (TRUE, FALSE, DON'T KNOW OR REFUSED ARE ACCEPTABLE ANSWERS)
Dogs and cats need shots or they can become seriously ill and even die
In general, female dogs can come into heat (season) about twice year
Dogs or cats will misbehave to spite their owner
It is necessary to catch a dog or cat in the act of doing something wrong in order to correct them
In general, cats come into heat (season) about twice year
A female dog or cat will be better off if she has one litter before being fixed (spayed)
Cats may pounce or scratch or bite as a form of play
It is cruel to keep cats indoors and never let them outside

ONLY FOR PET OWNERS: ATTACHMENT
Based upon the following scale, please answer each question.
1 STRONGLY AGREE 2 SOMEWHAT AGREE 3 SOMEWHAT DISAGREE 4 STRONGLY DISAGREE Don't Know Refused

My pet provides me with companionship.
Having a pet gives me something to care for.
My pet provides me with pleasurable activity.
My pet is a source of constancy or stability in my life.
My pet makes me feel needed.
My pet makes me laugh and play.
Having a pet gives me something to love.
I get comfort from touching my pet.
I enjoy watching my pet.
My pet makes me feel loved.
My pet makes me feel trusted.

DEMOGRAPHICS: FOR ALL RESPONDENTS
What is your age?
18-24 25-34 35-44 45-54 55-64 65+ Refused
What is your sex? male female Refused

Please tell me the number of people living in your household including yourself:
number Refused
How many adults are living in your household? Number Refused
How many children age 12 or under are living in your household? Number Refused

What is the highest grade or level you reached in school?
< High school high school/GED some college completed college advanced degree
other Refused

With which ethnic group do you identify?
Black or African-American, Anglo, other (specify _____) Refused

Do you live in a single-family home, duplex, townhouse, apartment or mobile home?
Refused

What is your total household income range: This information is confidential and only for the purposes of our study.
Less than $20,000 $20,000-$34,999 $35,000-$54,999 $55,000-$84,999
$85,000 or more Refused

Are you employed outside the home? YES NO Refused

How long have you been living in Caldwell?
Less than 1 year 1 to 3 years 4-6 years 7 to 10 years 11 to 20 years
More than 20 years Don't Know Refused.

Would you be willing to be contacted to tell us more about the cats you see or feed? Yes no

If yes, when would be the best time to reach you? Could you please give me your name so that we can contact you again later? Could we contact you by email?

IF BOTH TO INDOOR/OUTDOOR CAT QUESTION, Would you be willing to be contacted about a study involving the lifestyle of your pet cat? It would involve keeping a special collar on the cat for 1 year. The collar won't hurt the cat. You will be paid $100 for participating in the study. Would you be interested? Do we have your permission to give out you contact information to the researcher working on this part of the project?

Do we have your permission to contact you in 4-8 weeks to re-interview you as part of our study on survey design? YES, NO If YES, when is the best time to call?

APPENDIX B

CROSS TABULATIONS

Table B-1: Cross tabulation for variable "source."

	Responses to "source" from 1st interview						Total
		Found as a stray	Born at my home	Given by friend/ relative	Adopted from a shelter	In front of store/ flea market	
Responses to "source" from 2nd interview	Found as a stray	10	3	3	0	1	17
	Born at my home	1	2	4	0	1	8
	Given by friend/ relative	2	0	14	1	2	19
	Adopted from a shelter	1	2	2	2	0	7
	In front of store/ flea market	1	0	1	0	1	3
Total		15	7	24	3	5	54

Table B-2: Cross tabulation for variable "dog problems."

	Responses to "dog problems" from 1st interview					Total
		Nuisance	Household safety	Animal welfare	Public health	
Responses to "dog problems" from 2nd interview	Nuisance	5	0	1	0	6
	Household safety	0	1	0	0	1
	Animal welfare	1	0	2	0	3
	Public health	1	0	0	1	2
Total		7	1	3	1	12

Table B-3: Cross tabulation for variable "cat problems."

	Responses to "cat problems" from 1st interview					Total
		Nuisance	Household safety	Animal welfare	Public health	
Responses to "cat problems" from 2nd interview	Nuisance	11	1	1	4	17
	Household safety	0	2	0	0	2
	Animal welfare	3	1	7	0	11
	Public health	2	0	1	3	6
Total		16	4	9	7	36

Table B-4: Cross tabulation for variable "ethnicity."

	Responses to "ethnicity" from 1st interview					Total
		Black/ African-American	Anglo	Hispanic	Other	
Responses to "ethnicity" from 2nd interview	Black/ African-American	9	0	0	0	9
	Anglo	0	72	2	0	75
	Hispanic	0	7	6	0	13
	Other	0	0	0	1	1
Total		9	80	8	1	98

Table B-5: Cross tabulation for variable "housing."

	Responses to "housing" from 1st interview					Total
		House	Duplex	Townhouse/ Apartment	Mobile home	
Responses to "housing" from 2nd interview	House	84	0	0	0	84
	Duplex	0	1	0	0	1
	Townhouse/ Apartment	0	0	5	0	5
	Mobile home	0	0	0	7	7
Total		84	1	5	7	97

Table B-6: Cross tabulation for 276 cats and dogs owned by 269 pet owners.

		# cats owned												Total
		0	1	1	1	2	3	4	5	6	7	8	11	
# dogs owned	0	6	0	34	0	15	2	1	0	0	0	0	0	58
	1	92	0	19	0	10	8	1	0	1	0	1	0	132
	1	0	1	0	0	0	0	0	0	0	0	0	0	1
	1	0	0	0	1	0	0	0	0	0	0	0	0	1
	2	32	0	6	0	6	2	0	1	2	1	0	0	50
	3	14	0	4	0	2	2	0	0	0	0	0	0	22
	4	3	0	0	0	0	0	1	0	0	0	0	0	4
	5	1	0	0	0	0	1	0	0	0	0	1	0	3
	7	0	0	0	0	1	0	0	0	0	0	0	0	1
	12	1	0	0	0	0	0	0	0	0	0	0	0	1
	15	0	0	0	0	0	0	0	0	0	0	0	3	3
Total		149	1	63	1	34	15	3	1	3	1	2	3	276

APPENDIX C

UNIVARIABLE ANALYSIS FOR EXPLORATORY MODELING STUDY

Table C-1: Univariable analysis for outcome variable "sterilized."

Predictors of sterilized cat	Data Type	Chi-square	p
Sex	Categorical	0.13	0.72
Male			
Female			
Breed	Categorical	0.45	0.50
Mixed breed			
Purebred			
Role*	Categorical	16.28	0.00
Companion			
Mouser			
Vaccinated*	Categorical	89.16	0.00
No			
Yes			
Time Owned*	Ordinal	52.76	0.00
< 2 yrs			
2 yrs to < 4 yrs			
4 + yrs			
Indoor/Outdoor Status*	Categorical	22.92	0.00
Indoor only			
Outdoor only			
Indoor and Outdoor			
Age*	Ordinal	37.41	0.00
< 6 months			
6 months to 1 yr			
2 to 5 yrs			
6 + yrs			
Vet Visits*	Ordinal	22.72	0.00
2 +			
1			
0			

* Variables included in the saturated model.

Table C-2: Univariable analysis for outcome variable "indoor/outdoor status."

Predictors of Indoor/Outdoor Status	Data Type	Chi-square	p
Sex	Categorical	0.52	0.47
Male			
Female			
Breed	Categorical	0.03	0.87
Mixed breed			
Purebred			
Role*	Categorical	23.44	0.00
Companion			
Mouser			
Vaccinated	Categorical	0.08	0.77
No			
Yes			
Time Owned	Ordinal	3.11	0.80
< 2 yrs			
2 yrs to <4 yrs			
4 + yrs			
Age*	Ordinal	5.99	0.11
< 6 months			
6 months to 1 yr			
2 to 5 yrs			
6 + yrs			
Sterilized	Categorical	0.08	0.78
No			
Yes			
Vet Visits	Ordinal	0.23	0.89
2+			
1			
0			

*Variables included in the saturated model.

Table C-3: Univariable analysis for outcome variable “cat owner.”

Predictors of cat ownership	Data Type	LR test	Chi-square	p
House size*	Continuous	6.82	….	0.01
Number of adults*	Continuous	3.65	….	0.06
Person age*	Ordinal	….	13.30	0.02
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	1.08	0.30
Male				
Female				
Children	Categorical	….	0.33	0.56
No				
Yes				
Education level*	Ordinal	….	17.41	< 0.001
< high school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity*	Categorical	….	15.91	< 0.001
Black/African-American				
Anglo				
Hispanic				
Housing*	Categorical	….	6.77	0.15
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income*	Ordinal	….	11.00	0.03
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				

* Variables included in the saturated model.

Table C-4: Univariable analysis for outcome variable “dog owner.”

Predictors of dog ownership	Data Type	LR test	Chi-square	p
House size	Continuous	0.55	….	0.46
Number of adults	Continuous	0.01	….	0.93
Person age*	Ordinal	….	7.59	0.18
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	1.20	0.27
Male				
Female				
Children	Categorical	….	1.02	0.31
No				
Yes				
Education level	Ordinal	….	0.15	1.00
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	1.35	0.51
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….	3.87	0.35
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	4.30	0.37
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				

* Variables included in the saturated model.

Table C-5: Univariable analysis for outcome variable “cats are a problem.”

Predictors of cats are a problem	Data Type	LR test	Chi-square	p
House size	Continuous	1.06	….	0.30
Number of adults	Continuous	0.57	….	0.45
Person age	Ordinal	….	6.52	0.26
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	1.15	0.28
Male				
Female				
Children*	Categorical	….	4.98	0.03
No				
Yes				
Education level	Ordinal	….	5.03	0.28
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	1.66	0.44
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….	4.27	0.37
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	1.33	0.86
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Cat owner*	Categorical	….	2.39	0.12
No				
Yes				
Dog owner	Categorical	….	1.74	0.33
No				
Yes				

* Variables included in the saturated model.

Table C-6: Univariable analysis for outcome variable “dogs are a problem.”

Predictors of dogs are a problem	Data Type	LR test	Chi-square	p
House size	Continuous	3.10	….	0.08
Number of adults	Continuous	3.79	….	0.05
Person age	Ordinal	….	7.68	0.18
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	0.04	0.85
Male				
Female				
Children	Categorical	….	1.11	0.29
No				
Yes				
Education level	Ordinal	….	2.09	0.72
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	1.05	0.59
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….	2.01	0.73
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	4.42	0.35
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Cat owner	Categorical	….	1.03	0.39
No				
Yes				
Dog owner	Categorical	….	5.64	0.24
No				
Yes				

Table C-7: Univariable analysis for outcome variable "cat-household safety."

Predictors of concern for house safety (cat)	Data Type	LR test	Chi-square	p
House size	Continuous	0.72	….	0.47
Number of adults	Continuous	1.45	….	0.15
Person age	Ordinal	….	3.29	0.51
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	1.54	0.22
Male				
Female				
Children	Categorical	….	2.55	0.11
No				
Yes				
Education level	Ordinal	….	1.72	0.63
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	0.16	0.92
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….	….	0.71[a]
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	1.13	0.89
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Cat owner	Categorical	….	2.96	0.09
No				
Yes				
Dog owner	Categorical	….	0.00	0.95
No				
Yes				

[a] Fisher's exact test used.

Table C-8: Univariable analysis for outcome variable "cat-animal welfare."

Predictors of concern for cat welfare	Data Type	LR test	Chi-square	p
House size	Continuous	0.90	….	0.37
Number of adults	Continuous	-1.09	….	0.23
Person age	Ordinal	….	6.81	0.24
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	3.81	0.05
Male				
Female				
Children	Categorical	….	2.20	0.14
No				
Yes				
Education level	Ordinal	….	3.36	0.50
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	3.22	0.20
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….	….	0.73[a]
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	2.68	0.61
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Cat owner	Categorical	….	4.37	0.04
No				
Yes				
Dog owner	Categorical	….	0.17	0.68
No				
Yes				

[a] Fisher's exact test used.

Table C-9: Univariable analysis for outcome variable "dog-household safety."

Predictors of concern for house safety (dog)	Data Type	LR test	Chi-square	p
House size	Continuous	0.00	….	1.00
Number of adults	Continuous	0.60	….	0.55
Person age	Ordinal	….	2.95	0.57
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	4.11	0.04
Male				
Female				
Children	Categorical	….	0.09	0.76
No				
Yes				
Education level	Ordinal	….	4.20	0.38
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	1.60	0.45
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….		0.56[a]
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	4.91	0.18
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84.999				
$85,000+				
Cat owner	Categorical	….	0.15	0.70
No				
Yes				
Dog owner	Categorical	….	0.60	0.44
No				
Yes				

[a] Fisher's exact test used.

Table C-10: Univariable analysis for outcome variable "dog-animal welfare."

Predictors of concern for dog welfare	Data Type	LR test	Chi-square	p
House size	Continuous	0.63	….	0.53
Number of adults	Continuous	-0.08	….	0.94
Person age	Ordinal	….	8.51	0.08
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	0.43	0.51
Male				
Female				
Children	Categorical	….	1.37	0.24
No				
Yes				
Education level	Ordinal	….	6.18	0.19
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	2.11	0.35
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….	7.12	0.15
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	6.93	0.07
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Cat owner	Categorical	….	4.88	0.03
No				
Yes				
Dog owner	Categorical	….	0.15	0.70
No				
Yes				

Table C-11: Univariable analysis for outcome variable "dog-public health."

Predictors of concern for public health (dog)	Data Type	LR test	Chi-square	p
House size	Continuous	0.65	….	0.52
Number of adults	Continuous	0.64	….	0.52
Person age	Ordinal	….	3.97	0.55
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	1.31	0.25
Male				
Female				
Children	Categorical	….	0.81	0.37
No				
Yes				
Education level	Ordinal	….	4.07	0.25
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	2.27	0.32
Black/African-American				
Anglo				
Hispanic				
Housing	Categorical	….	….	0.97[a]
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	4.61	0.33
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Cat owner	Categorical	….	0.00	0.95
No				
Yes				
Dog owner	Categorical	….	2.03	0.15
No				
Yes				

[a] Fisher's exact test used.

Table C-12: Univariable analysis for outcome variable "knowledge score."

Predictors of knowledge score	Data Type	T-test	F-test	p
House size*	Continuous	22.32	….	< 0.01
Number of adults*	Continuous	36.30	….	< 0.01
Person age*	Ordinal	….	5.49	< 0.01
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender	Categorical	….	0.10	0.76
Male				
Female				
Children*	Categorical	….	1.83	0.18
No				
Yes				
Education level*	Ordinal	….	2.82	0.02
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity*	Categorical	….	2.69	0.07
Black/African-American				
Anglo				
Hispanic				
Housing*	Categorical	….	2.13	0.08
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income*	Ordinal	….	3.75	0.01
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Number of cats owned*	Continuous	32.09	….	< 0.01
Number of dogs owned*	Continuous	27.11	….	< 0.01

* Variables included in the saturated model.

Table C-13: Univariable analysis for outcome variable “attachment score.”

Predictors of attachment score	Data Type	T-test	F-test	p
House size*	Continuous	46.42	….	< 0.01
Number of adults*	Continuous	50.76	….	< 0.01
Person age*	Ordinal	….	1.59	0.16
18-24 yrs				
25-34 yrs				
35-44 yrs				
45-54 yrs				
55-64 yrs				
65+ yrs				
Gender*	Categorical	….	12.46	< 0.01
Male				
Female				
Children	Categorical	….	0.68	0.30
No				
Yes				
Education level*	Ordinal	….	4.75	0.20
< High school				
High school/GED				
Some college				
Completed college				
Advanced degree				
Ethnicity	Categorical	….	1.00	0.49
Black/African-American				
Anglo				
Hispanic				
Housing*	Categorical	….	3.58	0.24
House				
Duplex				
Townhouse/Apartment				
Mobile				
Income	Ordinal	….	0.71	0.45
< $20,000				
$20,000-$34,999				
$35,000-$54,999				
$55,000-$84,999				
$85,000+				
Number of owned cats*	Continuous	41.89	….	< 0.01
Number of owned dogs*	Continuous	40.25	….	< 0.01
Knowledge score*	Continuous	38.87	….	< 0.01

* Variables included in the final model.

APPENDIX D

ALTERNATIVE MODELS FOR EXPLORATORY MODELING STUDY

Table D-1: Alternative final logistic regression model* for predictors of cats being sterilized (vet visits included in the saturated model instead of vaccinated) (N = 201).

Variable	Categories	Odds Ratio	95% Confidence Interval
Role	Companion	1.00	….
	Mouser	0.33	0.1 , 0.8
Time owned	< 2 yrs	1.00	….
	2 yrs to < 4 yrs	4.87	1.9 , 12.3
	4 + yrs	10.01	3.9 , 25.8
Intercept	….	1.70[a]	0.6 , 2.8

* Likelihood ratio statistic for the model = 40.55 with $p < 0.001$.
** Goodness of fit test = 0.10 with $p = 0.95$.
*** Pseudo $R^2 = 0.18$.
[a] Coefficient for the intercept.

Table D-2: Alternative final logistic regression model for predictors of indoor/ outdoor only status of cats (N = 229).

Variable	Categories	Odds Ratio	95% Confidence Interval
Role	Companion	1.00	….
	Mouser	0.03	0.01 , 0.06
Intercept	…	5.63[a]	4.46 , 6.80

[*] Likelihood ratio statistic for the model = 100.92 with $p < 0.001$.
[**] Goodness of fit test = 10.13 with $p = 0.56$.
[***] Pseudo $R^2 = 0.36$.
[a] Coefficient for the intercept.

APPENDIX E

OBSERVATION LOG

Day _____ _____	Morning 6:00am-11:59pm	Afternoon 12:00pm-5:00pm	Evening 5:01pm-5:59-am
1. How many free roaming cats did you see?			
2. Please write down the time that you saw free-roaming cats.			
3. Were any of the cats wearing a collar?	Yes No Don't Know	Yes No Don't Know	Yes No Don't Know
3a. If 'yes' to #3 , were any of the collars radio collars?	Yes No Don't Know	Yes No Don't Know	Yes No Don't Know
4. Did you see male or female cats?	Male Female Don't Know Both	Male Female Don't Know Both	Male Female Don't Know Both
5. Describe any noticeable markings you saw (ear notch, injury, etc.)			
6. Where did you see the cats? (circle all that apply)	Neighborhood Near work Near stores Near restaurants Other _____	Neighborhood Near work Near stores Near restaurants Other _____	Neighborhood Near work Near stores Near restaurants Other _____
7. Were the cats alone or with other cats?	Alone With other cats	Alone With other cats	Alone With other cats
8. What were the cats doing? (circle all that apply)	Resting Nursing Hunting Eating Fighting Playing Other _____	Resting Nursing Hunting Eating Fighting Playing Other _____	Resting Nursing Hunting Eating Fighting Playing Other _____
8a. If the cats were eating, where were the cats eating?	Out of a dumpster Off of the ground Out of a dish/ bowl	Out of a dumpster Off of the ground Out of a dish/ bowl	Out of a dumpster Off of the ground Out of a dish/ bowl

8b. If the cats were eating, do cats eat there regularly?	Yes No Don't Know	Yes No Don't Know	Yes No Don't Know
9. Do any of the cats have owners?	Yes No Don't Know	Yes No Don't Know	Yes No Don't Know
10. Were any of the cats recently abandoned?	Yes No Don't Know	Yes No Don't Know	Yes No Don't Know
11. Were the cats fixed (spayed/ neutered)?	Yes No Don't Know	Yes No Don't Know	Yes No Don't Know
12. Did any of the cats recently have a litter or did you see any kittens?	Yes No Don't Know	Yes No Don't Know	Yes No Don't Know
13. Did you see any dead cats today?	No Yes- on the side of the road Yes- Other _____	No Yes- on the side of the road Yes- Other _____	No Yes- on the side of the road Yes- Other _____

Are you feeding any of the cats described on this page? Yes No

If yes, put a * by the information that applies to these cats.

Please add any additional comments you would like to share with us about these cats. You may use the back of this page or another sheet of paper.

VITA

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