"PETS: DO THEY ENHANCE OUR IMMUNITY?"

A Pilot Study on Pet Ownership and the Incidence of Illness by Age and Ethnicity.

Tag Words: Pets, Pet Ownership, Breed of Pets, Human Immunity, Analysis

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Summary
Pets can be highly beneficial to the human health and may even aid in the development of the human immune system. Our study specifically targets the area of pet ownership and its effects on the immune system's capabilities of different age and ethnic groups. To examine this, we conducted a survey at pet events and Rutgers University. In our pilot study of 136 responses, we found that pet ownership decreased the frequency of illness which varied amongst ethnic groups when compared to non-pet owners as blacks and hispanics had a higher rate of sickness than any other ethnic groups. Children ages 3 to 6 had the lowest rates of sickness, sickness length and allergies and may have developed a stronger immune system as a result of pet exposure at an early age. For a significant result, a big sample size, possibly nationwide, study and further research must be performed. We recommend that a much larger study be conducted to determine whether household pets affect the duration and frequency of illness across age and suggest that a separate, more definitive, survey be done to examine how ethnicity affects the relationship between pet ownership and immunity.

Video Link
http://youtu.be/Jz0FhEz9vJ0

Pet Ownership (VD)

Pets are domestic, usually tamed, animals that are owned for a variety of reasons. Reasons can range from having companionship, to protecting the household property, to the attractive or playful nature of the animal. In today's world, pet ownership has become a trend. Lately, pet ownership has become more and more popular due to pets' therapeutics effects. The 2006 US Census records show that the number of pet population and household pets in the millions. In comparison with the 1998 US Census, the pet population has significantly risen. From the following data, one can conjecture the two most common pets in US as well as the world are dogs and cats.[1]

In addition, in 2006 around the world, there were 202 million cats kept as pets, making them the number one pet of choice in commonality and popularity before dogs. However, other animals such as fish, birds, turtles, snakes and other reptiles and rodent pets have also become popular. In the US, about 4.7 million households have owned cold blooded pets such as tiny gecko lizards, alligators and snakes. Avian pets have been popular around the world. In 2006, China had more than 71 million bird pets such as the cuddling love birds, homing pigeons, budgies, and talkative macaws. For the small animal pets or rodent pets, the number of household owning those are remarkably high. In United Kingdom, the households that have

small, furry pets like ferrets, guinea pigs, gerbils, rabbits, bunnies, etc., are over two million while in the US, the number is over five million households. Aquatic pets are usually fishes and the more popular ones are goldfish, guppies and other freshwater fishes.[2] In 2006, the US population of fishes was 170 million in over 13 million household and other locations. Fishes as pets usually are high in number due to their short lives and small size which makes having a number of fishes as pets very common.

While pet ownership is highly dominant around the world and specifically in the United States, there are still households that do not want pets. Individuals who don't keep pets have reasons ranging from animals are filthy to no time or place for pets to high cost of maintenance. According to B E Leslie's article, the "highest ranked reason for non-ownership was 'pets are a problem when I go away,' followed by 'I don't have enough time to devote to a pet' and 'poor housing'."[3]

Table 1204. **Household Pet Ownership: 2006**					
See notes.					
Item	Unit	Dogs	Cats	Birds	Horses
2006					
Total companion pet population \1	Million	72.1	81.7	11.2	7.3
Number of households owning pets	Million	43.0	37.5	4.5	2.1
Percent of households owning companion pets \1	Percent	37.2	32.4	3.9	1.8
Average number owned per household	Number	1.7	2.2	2.5	3.5
Percent of households owning pets					
Annual household income: Under $20,000	Percent	30.7	30.1	4.4	1.5
$20,000 to $34,999	Percent	37.3	33.6	4.2	1.7
$35,000 to $54,999	Percent	39.8	34.1	4.4	2.1
$55,000 to $84,999	Percent	42.8	35.5	3.7	1.9
$85,000 and over	Percent	42.1	33.3	3.7	2.3
Household size: \1 One person	Percent	21.9	24.7	2.1	0.8
Two persons	Percent	37.6	33.4	3.9	1.7
Three persons	Percent	47.5	39.1	5.1	2.3
Four persons	Percent	51.9	38.5	5.4	2.7
Five or more persons	Percent	54.3	40.0	6.6	3.6
Veterinary care and expenditures					
Households obtaining veterinary care \2	Percent	82.7	63.7	13.9	61.1
Average visits per household per year	Number	2.6	1.7	0.3	2.2

Veterinary expenditures					
Expenditures per household per year (mean)	Dollars	356	190	25	360
Expenditures per animal (mean)	Dollars	200	81	9	92
Source: American Veterinary Medical Association, Schaumburg, IL,					
U.S. Pet Ownership and Demographics Sourcebook, 2007 (copyright).					

Myths and problems encountered with pet ownership (VD)

There are many myths surrounding pets and their ownership. It is thought that immunocompromised children cannot keep pets as they pose a high risk from zoonotic-transmitted diseases that can be fatal. However, with proper handling and husbandry of the pets, immunocompromised patients can have pets and should take advantage of the beneficial effects of human-animal bond.[4] Problems that have been encountered with pet ownership are aggravated allergic reactions, asthma, falling due to pets, and suffering from parasitic/ zoonotic-transmitted diseases. However, in a study at birth in children who are at higher risk of obtaining allergic diseases due a strong family history, it was found that having cats or dogs during birth does not increase the chances of getting allergic diseases. On the contrary, they found that these children either had no effect on or decreased the chances of contracting allergies.[5] A study data from Finland and Russia showed that exposure to farm animals and certain animals like cats prenatally showed a higher risk for asthma while individuals who had dogs as pets showed a protection against the asthma.[6] With pet birds, an analysis of zoonotic transmission of diseases in species likes psittacine, passerine and columbiform showed a notable existence of Chlamydophila psittaci transmitted to humans as well as allergic responses such as pneumonitis and contact dermatitis.[7]

General Benefits of Pet Ownership (VD)

So just what benefits can be obtained with pet ownership? It has been observed that pet ownership has proven to be highly beneficial in humans both physically and mentally. In a 10 month study performed by Serpell J, 71 adult subjects were given a new pet, either a dog or cat. The results showed a significant reduction in minor health problems such as common cold and flu, headaches, hay fever and even indigestion for the first month of the ownership and continued after for only dogs.[8] There has also been major evidence that pet ownership decreases risk and slows progression of coronary heart disease as well as potential improvements in the health of obese individuals.[9] This specific study not only showed improvement in human health behavior, such as more exercising, walking, eating healthy, etc., but it also showed that the subjects improved in general health knowledge when given a questionnaire over a period of 6 months.[10] Thus, pet ownership not only helps an individual become more physically healthy and sculpts him/her into maintaining healthy behaviours, but also educates in public health. In addition, two studies performed with college students and elderly as subjects found that, in both age groups, the subjects with pets suffered from reduced stress as well as ameliorated psychological problems such as depression, troubled past, and other issues.[11] Dogs as pets have been

extremely helpful in assisting the blind, disabled as well as the elderly who are trained in Animal-Assisted Therapy.[12]

Pets may also have an effect on a person's health by affecting the immune system itself. In a study on children from ages five to seven conducted by Dr. Becker, it was found that "pet-owning households attend school three weeks more per year than those who don't have pets." This article also mentioned that more pets in early life can help build a better immune system, and cause fewer allergies will develop. He found that "Kids who grow up on farms and around animals don't have allergies," and the animal's dander is a "natural immunotherapy."[13]

Parts of the Immune System: Innate and acquired immunity (YL)

Immunity refers to all the mechanisms used by the body that protects against antigens, which are environmental agents that are foreign to the body; these include microorganisms or their products, foods, chemicals, drugs, pollen, and animal hair. Since pets are a great source of antigens, pet ownership may affect immunity levels. To understand how pet ownership can affect immunity, we need to understand how the immune system works. There are two types of immunity: innate and acquired.

Innate immunity is obtained by a diverse collection of cellular and subcellular components. An individual is born with innate immunity, and it is always present and available at very short notice to protect the individual from challenges by foreign invaders. Innate immunity is carried out by nonspecific physical and chemical barriers (e.g., the skin), cellular barriers (e.g., phagocytes), and molecular pattern-based reactions (e.g., the Toll-like receptors, or TLRs).

In contrast to innate immunity, which is a characteristic of almost every living organism in variable forms, acquired immunity is a more specialized form of immunity. It developed later in evolution and is found only in vertebrates. We are mainly focused on the effect on acquired immunity due to pet ownership, because the development of acquired immunity varies depending on the individual's environment. Acquired immunity is induced by immunization, which can be achieved in several ways: active immunization, passive immunization, and adoptive immunization. The acquired immune response also has several general features that distinguish it from other physiologic systems, such as circulation, respiration, and reproduction: specificity, adaptiveness, discrimination between self and nonself, and memory.

The innate immune system and acquired immune system are able to work together. The complex and ingenious communication among the various cytokines and cell adhesion molecules allows components of innate and acquired immunity to interact, send signals, activate one another, and work together toward the final goal of destroying and eliminating the invading microorganism and its products.[14]

Table 1 Major Properties of the Innate and Adaptive Immune System

Property	Innate	Adaptive (Acquired)

Characteristics	• Antigen nonspecific • Rapid response (Minutes-hours) • No memory	• Antigen specific • Slow response (days) • Memory
Immune components	• Natural barriers (e.g., skin, mucous membranes) • Phagocytes and Natural Killer cells • Soluble mediators (e.g., complement) • Pattern recognition molecules	• Lymphocytes • Antigen recognition molecules (B- and T- cell receptors) • Secreted molecules (e.g., antibody)

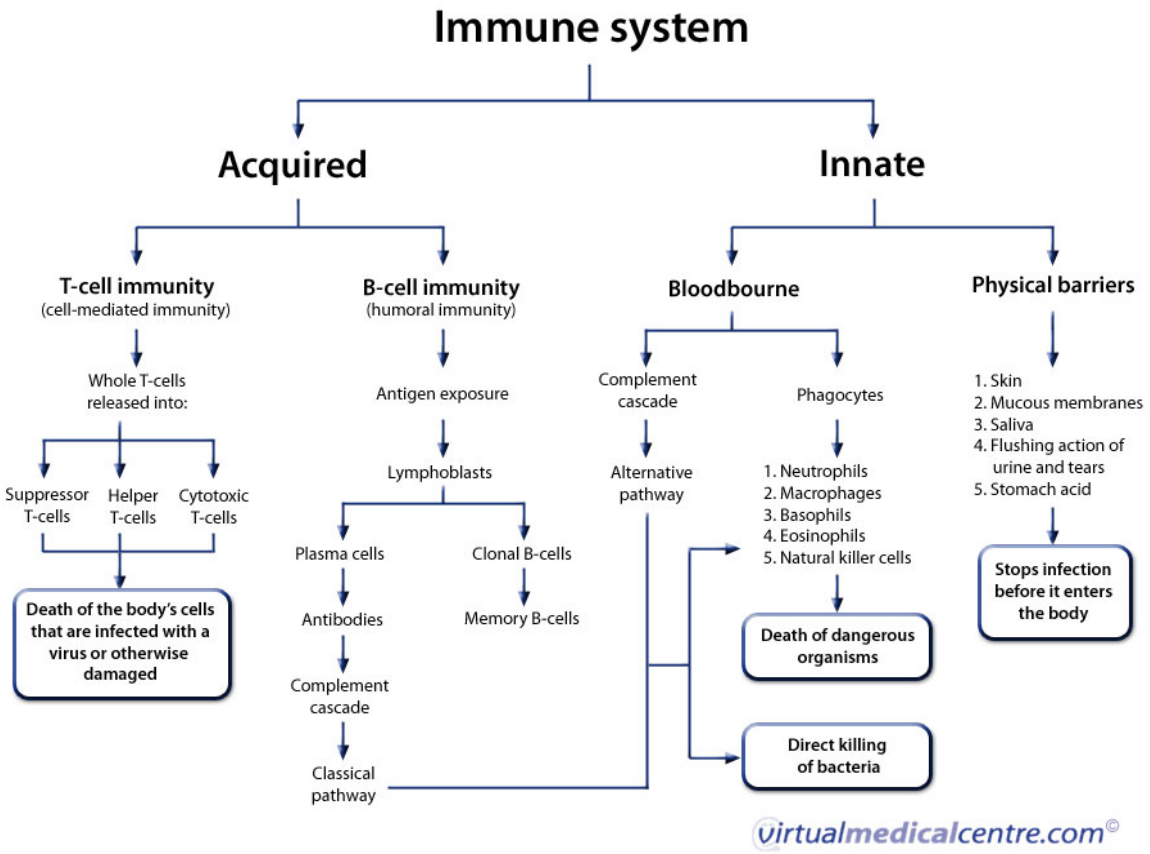


Figure 2. Parts of the Acquired and Innate Immunity[15]

Development of Antibodies (YL)

One of the major functions of the acquired immune system is the production of antibodies, which belong to the globulin class of protein. These soluble proteins circulate freely and exhibit properties that contribute specifically to immunity and protection against foreign material.

Initially, due to their migratory properties in an electrophoretic field, they were called γ-globulins (in relation to the more rapidly migrating albumin, α-globulin, and β-globulin); today they are known collectively as immunoglobulins. There are 5 types of immunoglobulin: IgG, IgM, IgA, IgD, and IgE.

IgG is capable of carrying out numerous biologic functions that range from neutralization of toxins to activation of complement and opsonization. IgG is the only class of immunoglobulin that passes through the placenta and gives maternal immunity on the fetus. The half-life of IgG (23 days) is the longest of all immunoglobulin classes. IgM is expressed on the surface of mature B cells; of all classes of immunoglobulin it functions as the best agglutinating and complement activating antibody. IgA antibody is present in monomeric and dimeric forms. The dimeric IgA is found in secretions and is referred to as secretory IgA. Secretory IgA is an important antiviral immunoglobulin. IgD is present on the surface of mature B cells and is co-expressed and shares antigen specificity with IgM. The functional properties of IgD have not been fully elucidated. IgE, also called reaginic antibody, takes major role in allergic reactions. It also protects body against parasitic infection. On contact with antigen, IgE triggers the degranulation of such cells, resulting in the release of pharmacologically active substances that mediate the hypersensitivity (allergic) reaction.[14]

Ethnicity and Immunity (YL)

Immunity varies across different ethnicities, and evidence for these differences has been observed with different infections. For example, in the U.S., the frequency of increases in the order of Asian, white, Native American, Hispanic, and then black. Data from South Africa display a similar sequence, white/Asian-Indian and then Colored or black. The intensity of that response is evidently modified by genes associated with the immune system. Polymorphisms among these genes are well known and have been correlated with racial disparities in a variety of diseases.[16]

The prevalence of infection by the Hepatitis C virus (HCV) also varies on the ethnicity. Some infected populations may develop chronic viremia, some may develop chronic liver disease, and some may able to clear the disease and remain free from disease. This is because the genes associated with HCV allele differ by the populations' ethnicity. The different association of genes and allele causes different immune reactions to the HCV.[17]

This difference can also be found with autoimmune disease. Patients with infectious conditions had an increased risk of developing non-Hodgkin's lymphoma (NHL), particularly for gastrohepatic, genital, and systemic infectious conditions. Patients with autoimmune disease were generally more likely to develop NHL than patients without autoimmune disease, especially for conditions that typically present with detectable autoantibodies with systemic involvement.[18]

Allergies were also associated with increased risk. Although the risk of NHL was lower for blacks than whites, blacks had a slightly higher risk of NHL associated infections than whites and a tendency toward higher risk associated with allergies. Risks associated with autoimmune conditions were similar by race. The observed difference in NHL risk by race supports a role for race-related differences in genes regulating immune/inflammatory response. There is also research data that shows African Americans are at higher risk than are Caucasians for systemic

lupus erythematosus and scleroderma, but at lower risk for type 1 diabetes and multiple sclerosis.[19]

Recent studies have focused primarily on genetic differences that may contribute to variations in disease risk, including genes affecting immune response and metabolism. Researchers at Chicago University examined over 9,000 genes from different ethnic groups to compare them. They found significant differences, particularly in immune system genes involved in producing antibodies to combat bacterial infection.[20] However, it was also reported that although different genes in different ethnicities play an important role in immunity, the environmental factors the population lives in can have a major effect on an individual's immunity.[21]

The Immune Response(CL)

If antigens are able to get past the physical barriers and enter the body, the initial priority of the immune system is to slow the antigen from spreading further into the body. This initial response, also known as the innate immune response, has various components from both the innate and adaptive arms of immunity working together, including: proteins involved in the classical, alternative, and lectin pathways of complement; naturally occurring antibodies circulating through the body; macrophages; and mast cells. Together, they focus on destroying these invaders. However, this typically is not enough to expel the invaders, which is where the adaptive arm of the immune system comes in.[22]

The adaptive response of the immune system is what allows the body to be able to more specifically target the antigens invading the body. The two key cell types involved in this phase are T lymphocytes and B lymphocytes. Activation of B lymphocytes allows production of antibodies more specifically tailored to the invading antigen. This process is done by presentation of parts of the antigen, which can bind to B cell receptors that have an affinity for the antigen. Only these B cells with a B cell receptor affinity for the antigen become activated, which then multiply in order to produce the amount of antibodies required to repel the antigen invasion. As these antibodies are being made, they are made even more specific for a particular antigen, due to mutations in the antibody binding site part of the gene. Two types of B lymphocytes are created, the plasma B cells that will provide the surge in antibodies needed to combat the immediate invasion and then die when the problem is dealt with, and memory B lymphocytes that live long after the antigen issue is solved, to defend against potential future encounters with that antigen.[23] Activation of T lymphocytes is similar to that of the B lymphocyte, but has a much wider array of effects. T helper cells assist in directing other cells, such as antibody class switching for B lymphocytes and maximizing bactericidal properties of macrophages. Cytotoxic T cells assist in dealing with cells infected with viruses and cancerous cells. Memory T cells remain after the initial problem is dealt with, for the same reasons as the memory B cells. These memory cells continue to improve specificity for the antigen upon future encounters, a fact that is utilized by doctors when administering booster shots.

The Allergic Response(CL)

The allergic response occurs when the immune system is dysregulated and has a much more

severe reaction to a specific antigen than expected. These antigens are typically common in the environment, and can include certain foods and This is due to B lymphocytes producing IgE antibodies, as opposed to the other classes of antibodies possible. These IgE antibodies then go out into the body and attach to the mast cells via the Fc site. When the antigen is encountered again, the antibody antigen binding site crosslinks with the antigen and triggers the release of histamine and other inflammatory mediators from mast cell granules.

These mediators have several effects: 1) blood vessel dilation, forming the red rash commonly associated with allergies; 2) nerve stimulation, leading to the sensation of itching and discomfort/pain; 3) capillaries becoming more permeable, leading to swelling; 4)constricting of bronchial pathways, causing difficulties breathing; 5) increase in mucus production causing congestion. In mild cases, the antigen remains localized to one small area, and only the first three symptoms may be observed. In more severe reactions, the antigen circulates throughout the body, and so the allergic reaction occurs throughout the body. If the antigen is circulated, all five of the symptoms are typically seen, often with dire consequences. Blood vessel dilation and increased capillary permeability throughout the body creates a sudden drop in blood pressure. The constriction of bronchial airways, combined with the stimulation of mucus production and swelling, can cause the person to potentially stop breathing. These symptoms, combined, can lead to anaphylactic shock and ultimately death.[24][25]

The Hygiene Hypothesis and Its Role in the Immune vs Allergic Response(CL)

With such an important role in defending the body from foreign invasion, it is of no surprise that being healthy involves having a strong immune system. However, the trends currently being seen have pointed to a weakening of the immune system. For instance, atopy rates in developed countries have become increasingly common, while rates in developing countries have remained fairly low. Also, the incidence rate of people who have experienced anaphylactic shock has doubled in recent decades, “from 21 per 100,000 person-years to 49.8 per 100,000 person years,” with the highest incidence rate in the 0-19 age group. These changes in frequency are believed to be largely due to the environment people are living in. With a lack of antigen exposure, the body is unable to become tolerant to the antigen, nor is it able to develop the memory B and T lymphocytes needed to defend against future encounters. Instead, the body remains sensitive to the antigen, and every encounter after the first results in a hypersensitivity reaction. This necessity for antigens is explained through the hygiene hypothesis, which states that because people are not coming into as much contact with antigens in the environment as before, fewer Th1 cells and more Th2 cells are being formed. Th2 cells cause the antibody class switching to IgE, which is required for atopy.

The hygiene hypothesis is one of the possible explanations for these recent increases in atopy. The hygiene hypothesis is the idea that in order for a strong immune system to develop, it must be exposed to the allergen so that it can react correctly in the future. Unfortunately, the trend over the last several decades was to create a clean and sterile environment, which did not allow the immune system to come into contact with common antigens in the environment and is ultimately weakened. Once an individual is removed from this bubble, trace amounts of antigen come into contact with the immune system for the first time. Since the immune system had not been primed to be fairly unreactive during critical development stages, there is a severe allergic reaction. Pets are believed to help alleviate some of the issues that can come with the clean environment, due to dander production, as well as acting as a potential carrier for some of the

more mild strains of bacteria that can be found in the everyday environment. This allows an individual's immune system to become used to dealing with antigens in the environment in an appropriate manner, which can potentially help reduce allergy rates.[26]

Hypoallergenic pets and their effects on allergic reaction (VD)

Hypoallergenic, a word invented in the efforts to campaign cosmetics in 1953, is nowadays widely used for a diminished potential for causing an allergic reaction.[27] Hypoallergenic pets are pets that produce a significantly lower amount of allergic symptoms in people who have feline and canine allergies, due to their coat type and genetic mutations in the production of certain proteins.[28] These breeds of pets are claimed to "produce lower allergenic quantities of dander through gene mutation." Hence, hypoallergenic pets are those breeds of pet that either produce less dander though gene mutation or have low production of saliva and fur. Dander, fur and saliva are the primary reservoirs of allergens in an animal and low production of these minimize allergic reactions.[29] There are few species or breeds of pets that are considered hypoallergenic. In dogs, breeds such as poodles, miniature schnauzers, malteses, Italian greyhounds and Chihuahua are possibly dogs that produce less dander. In cats, the Cornish Rex is considered hypoallergenic. For horses, Bashkir Curly horses are found to be a hypoallergenic breed of horse. Reptiles are also considered hypoallergenic as they lack fur and/or dander, which have made them popular with pet owners with allergies. Thus, individuals who have asthma or are medially allergic to cats and dogs can own pets because hypoallergenic pets will produce relatively less allergen which will in effect not aggravate allergic reactions.[2]

Other Studies Linking Animal Exposure to Immune System Function(CL)

There have been several studies that have begun to look into a possible connection between the presence of animals and the immune system. It has been fairly consistently shown that children living on rural farms were less likely to develop allergies than their urban counterparts, with a reduction of 42%. The study has also shown that pet ownership during childhood lowered atopy rates by 14%.[30] Clearly, there was a positive association between animal exposure and a better immune system.

Unfortunately, evidence for positive effects due to specific animals is still pointing to mixed conclusions. One study looking at pets owned during child infancy found little difference in asthma rates at school age among children who had no pets, owned a cat, or owned a cat and dog; however, there was some reduction of sensitivity to aerial antigens if furry pets were owned during the first two years of life.[31] On the other hand, a survey comparing Finnish and Russian children found that exposure cats made a person more at risk to develop asthma, while exposure to dogs made a person less at risk. This survey also found that intermittent contact with farm animals made urban children more susceptible to developing allergic asthma.[6]

Other cohort tests have also reached similar mixed conclusions. A pooled analysis of cohorts in Europe supposedly found no link between owning furred or feathered pets in altering risk of asthma in school age children.[32] However, in a study that looked at the link between pet exposure and allergic sensitization among 18 year olds, researchers found that pet exposure did lead to decreased levels of IgE being produced during the skin prick tests for atopic participants, meaning that allergic reactions were potentially less severe for individuals that had early pet

exposure, compared to individuals who did not have early pet exposure.[33] A different study observing wheezing babies found that the babies in environments that had higher endotoxin levels due to the presence of cats and/or dogs had fewer wheezing episodes than the babies living in an environment with lower endotoxin levels.[34] Finally, a cohort study of German babies found that the presence of dogs at time of birth was a protective factor.[35]

Among all animals that have been looked at, the dog has been the most consistent animal to have a positive effect on the immune system. Birds, cats, and other pets that have been looked at often have neutral or negative effects on the person's immune system. Further observation and testing will still need to be done in order to better elucidate the exact effect specific pets can have on the immune system.

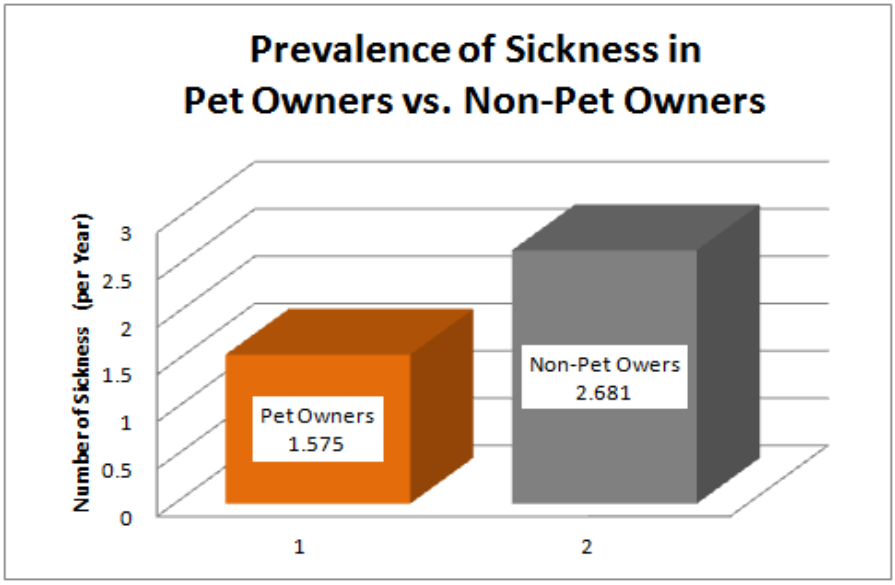
Community Outreach Response (CL & VD)

To analyze more in depth on the effects pets can have directly on the immune system, a survey using a questionnaire of sixteen questions was conducted. Survey participants were taken from pet events, such as the "Woofstock Halloween Parade" in Edgewater, New Jersey, as well as college students on the Rutgers University New Brunswick campus and their relatives. People surveyed varied in age, ranging from 18 years in college to over 65 years and retired. Responses to the survey were also obtained from individuals below the age of 18 but these data were not collected directly from these individuals, but rather from their parents or guardians. Participants were informed about the purpose of the survey, that it was anonymous and that there would be no compensation for taking the survey.

The questions in the survey covered the following variables: age, gender, ownership of a pet at any time, reason for not owning a pet (if applicable), types of pets, breeds of pets, years the pet was owned, presence of allergies, number of illnesses in the past year, and average length of sickness. Answers were then analyzed using averages and statistical tests to determine the effect pet ownership had, if any, on the immune system. A total of 136 surveys were collected, with 99 adult pet-owners, 22 adult non-pet owners and 15 children. Responses in variables such as time period of pet ownership, number of illnesses in the past year, and average length of sickness were adjusted to interpret results. For the time period of pet ownership, many participants answered in months, years, personal age, school grade of ownership. Due to the variation in answers, years of pet ownership was chosen to be the time unit for consistency in result interpretation. In the variable of number of sickness, participant's answers such as "never", "barely," and "hardly ever" were recorded as zero. Individuals who answered the number of sickness in just "yes" were recorded as 1. For individuals who answered "always," "constantly," and "a lot," we interpreted it as 12 with the assumption that the individual got sick once a month in a year at least. Lastly, for the length of sickness, answers of participants were modified to days for consistency and answers such as "whole year" and "5-6 days or months" were removed as outliers or the median of the range (5.5 days or months) were recorded. We analyzed the following variables in the following section: Pet ownership, presence of allergies, number of times the subject was ill, and average time required for the patient to recover from the illness.

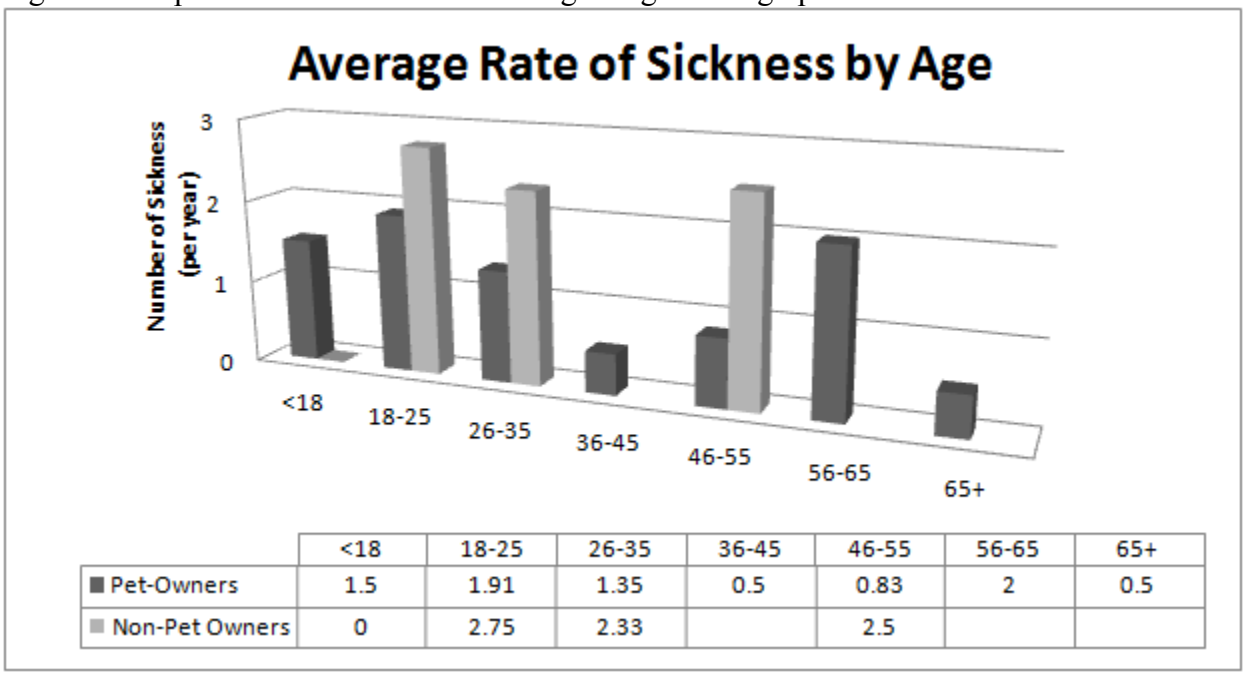
Service Project/ Survey Results (VD and CL):

Figure 3. Graph of Prevalence of Sickness in Pet Owners vs. Non-Pet Owners



To begin our survey analysis, we decided to first observe the relation of sickness frequency each year between pet owners and non-pet owners. In Figure 3, the survey results presented an average sickness frequency number of 1.575 per year for those individual owning a pet, in comparison to an average number of 2.681 per year for those individual who don't own pets. The data was statistically significant when a one-tailed t-test was run, yielding a p value of .031. This means that pet ownership was linked to a statistically significant decrease in the number of illnesses people had in a year. The evidence supports our original theory of pets' beneficial effects on human immune system and provides a foundation for further scientific investigation.

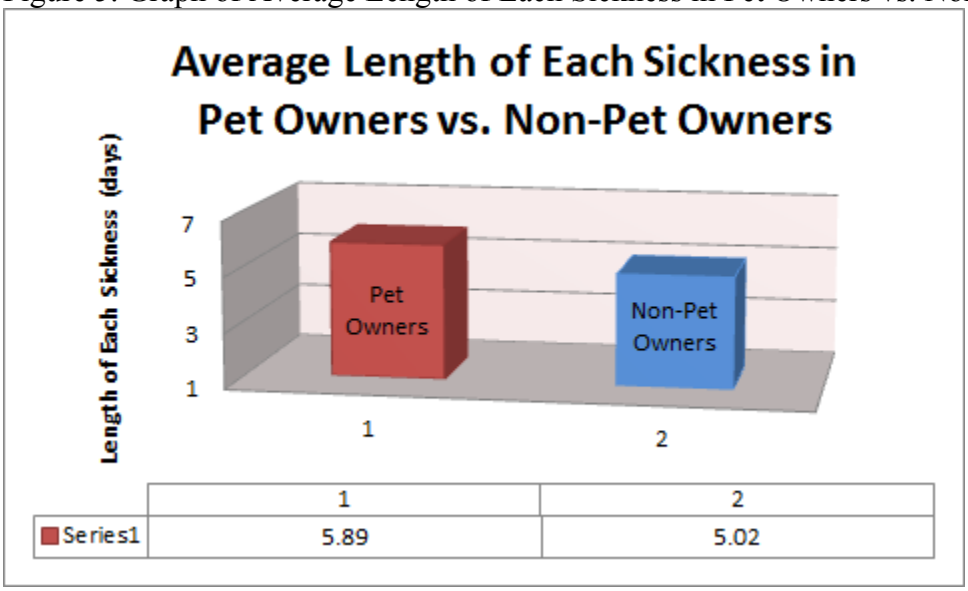
Figure 4: Graph of Rate of Illness According to Age Demographic



	<18	18-25	26-35	36-45	46-55	56-65	65+
Pet-Owners	1.5	1.91	1.35	0.5	0.83	2	0.5
Non-Pet Owners	0	2.75	2.33		2.5		

Figure 4 breaks down the data collected by age demographic to analyze if effects of pet ownership on frequency of sickness can be considerably different in different age groups. Starting with the age group of <18, the frequency of sickness in pet owners on average is 1.5 times per year while the non-pet owner was zero. The problem with this data set was that there were 14 child pet owners, while only 1 non-pet owner was surveyed. In the age group 18 to 25, the frequency of sickness in pet owners was generally lower than in non- pet owners. In the 26 to 35 and 46 to 55 age groups, we found a significant difference between pet owners and non-pet owners. Here, the average rate of illness per year was notably high in individuals with no pets, while individuals with pets were seen to have a lower average rate of illness of 1.35. This data indicates that pet ownership may strengthen one's immune system and reduce the occurrence of illness, and allergies. Not enough non-pet owners were surveyed in several of the age groups (<18, 36-45, 56-65, and 65+) to draw any conclusions. Overall, however, pet owners were sick less often in the age groups when comparisons could be made. More in-depth research needs to be conducted to provide more accurate results and demonstrate whether any correlation exists between frequency of illness and age in pet versus non-pet owners.

Figure 5. Graph of Average Length of Each Sickness in Pet Owners vs. Non-Pet Owners



The duration of illness was analyzed in pet versus non-pet owners. The mean was calculated after the removal of two outliers in the pet owner data, as two people had responded to the question regarding length of sickness as "always." which was interpreted as 365 days a year. The length of sickness in pet owners was found to be at 5.89 days, compared to people who did not own pets, at 5.02 days. Average calculation was made by taking out two outliers from the pet owner data, as two people had responded to the question regarding length of sickness as "always," which was interpreted as 365 days a year. The one-tailed t-test calculated a p-value of .232, so the difference between the two was not significant.

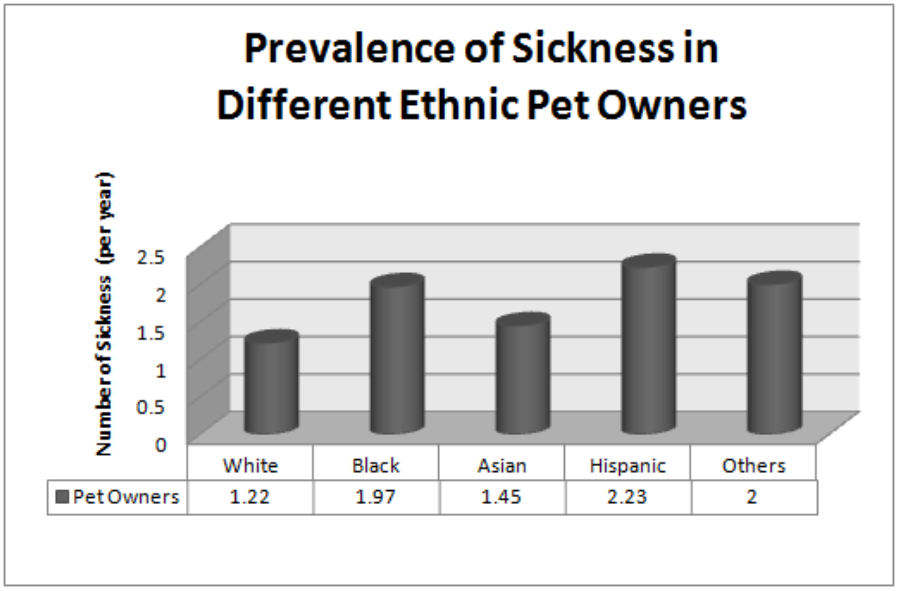
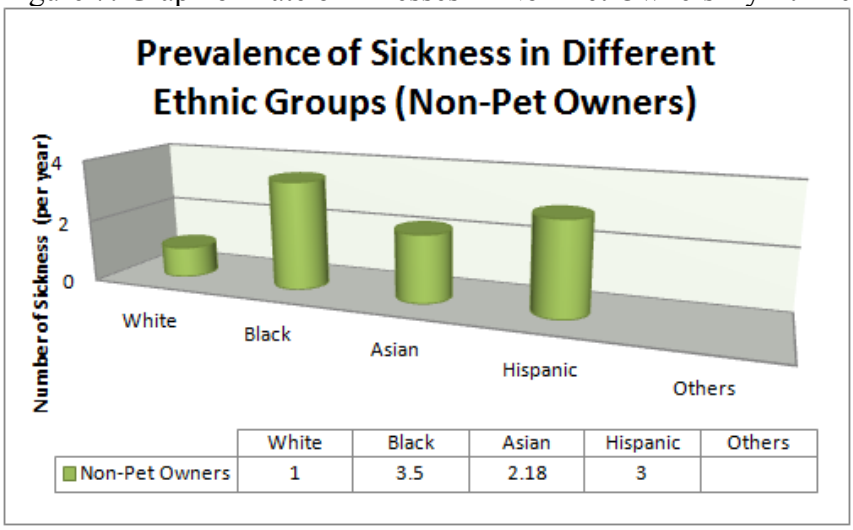


Figure 6: Graph of Rate of Sickness Among Pet Owners by Ethnicity

When we analyzed the number of illnesses per year in terms of ethnicity, Whites and Asians had the lowest average number of illnesses in a year, while Blacks, Hispanics and "Others" had a higher average number of illnesses in a year, as seen in the graph above. When we graphed ethnicity vs. number of illnesses for people who did not own pets, as seen in the graph below, Blacks and Hispanics were found to have the higher rate of sickness while a lack of data was found for the "others" group. However, our small sample number does not give this analysis enough power to definitively state any conclusion regarding the prevalence of illness in different ethnic groups in pets versus non-pet owners.

Figure 7: Graph of Rate of Illnesses in Non-Pet Owners By Ethnicity



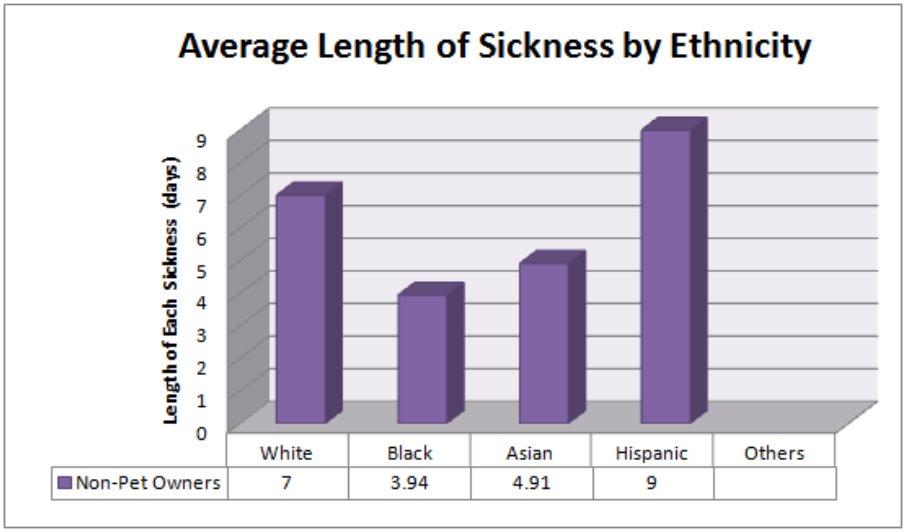
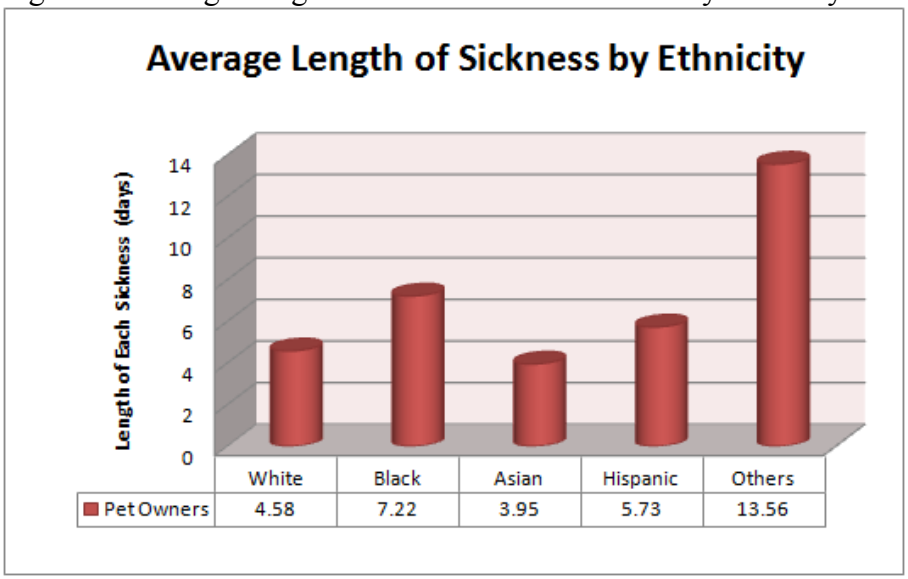


Figure 8: Average Length of Illness of Non-Pet Owners by Ethnicity

Next, we analyzed potential ethnic differences in the duration of illness between pet owners and non pet owners, based on diversity. For non pet owners, our results showed that blacks and Asians had the shortest sickness length, with whites having a slightly longer length and Hispanics much longer. Too small a sample size was surveyed in Whites and Hispanic non-pet owners, so the sickness length cannot be used as representative of the population. For pet owners, whites and Asians have the shortest sickness lengths, while blacks and Hispanics are slightly longer. There was a decrease in sickness length for Asians and whites, while there was an increase in sickness time in blacks due to pet ownership. These results can be seen in the Figures 8 and 9.

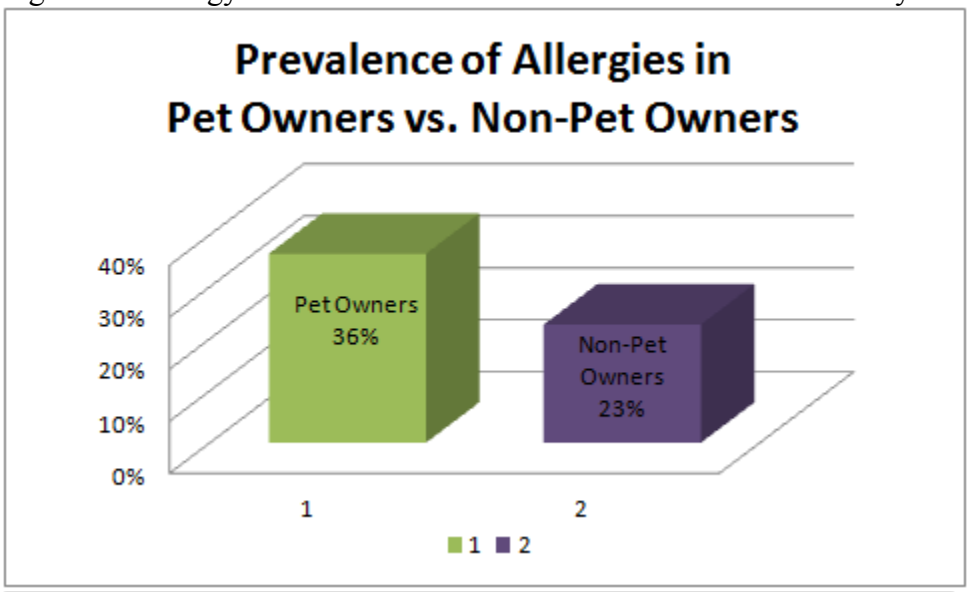
Figure 9. Average Length of Sickness of Pet Owners by Ethnicity

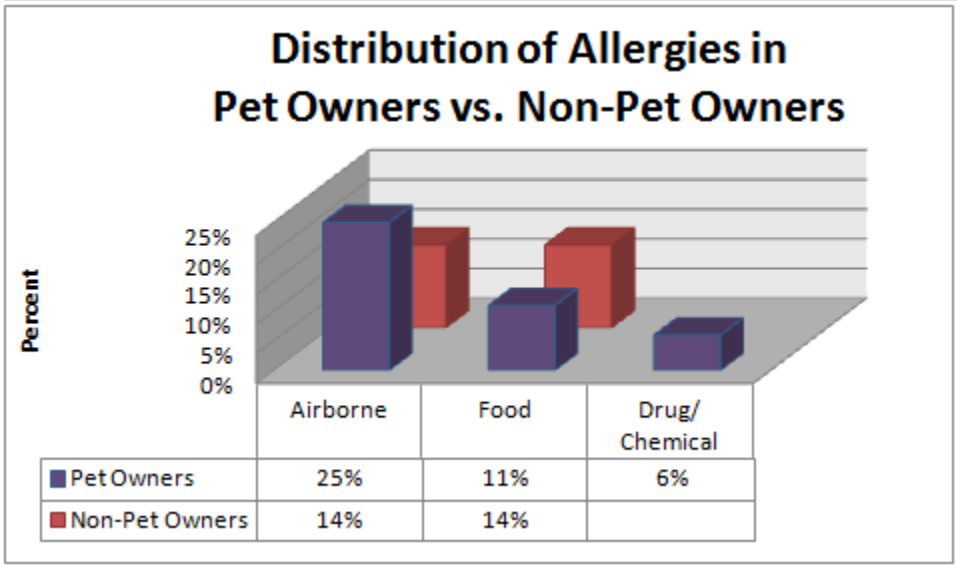


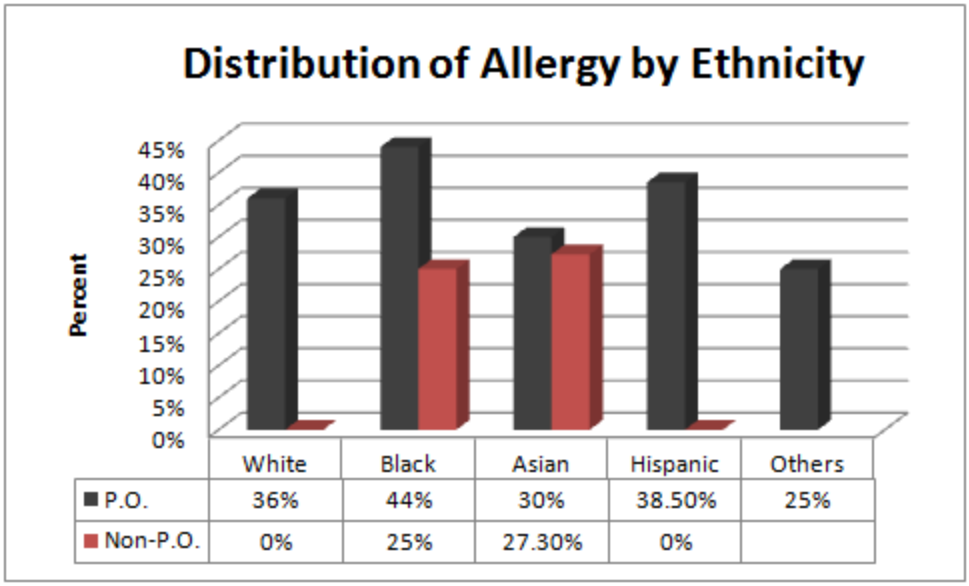
Finally, we analyzed allergy rates between pet owners and non pet owners. Surprisingly, our survey found that people who had owned pets had a much higher percentage of having allergies than those that did not have pets, over a twofold difference. The greatest difference in

allergy rates were those of airborne allergens, such as pollen. Rates of non-airborne allergens remained fairly unchanged between pet owners and non-pet owners. These results appear to contradict the literature. We then analyzed allergy rates by ethnicity for blacks and Asians, the two groups that had large enough sample sizes so that comparisons could be done with sufficient power. Blacks had an increase in allergy rates in the presence of pets, while Asians' allergy rates did not seem to be affected by the presence of pets.

Figure 10. Allergy Rates Between Pet Owners and Non-Pet Owners
Figure 11. Allergy Rates Between Pet Owners and Non-Pet Owners by Allergen Type







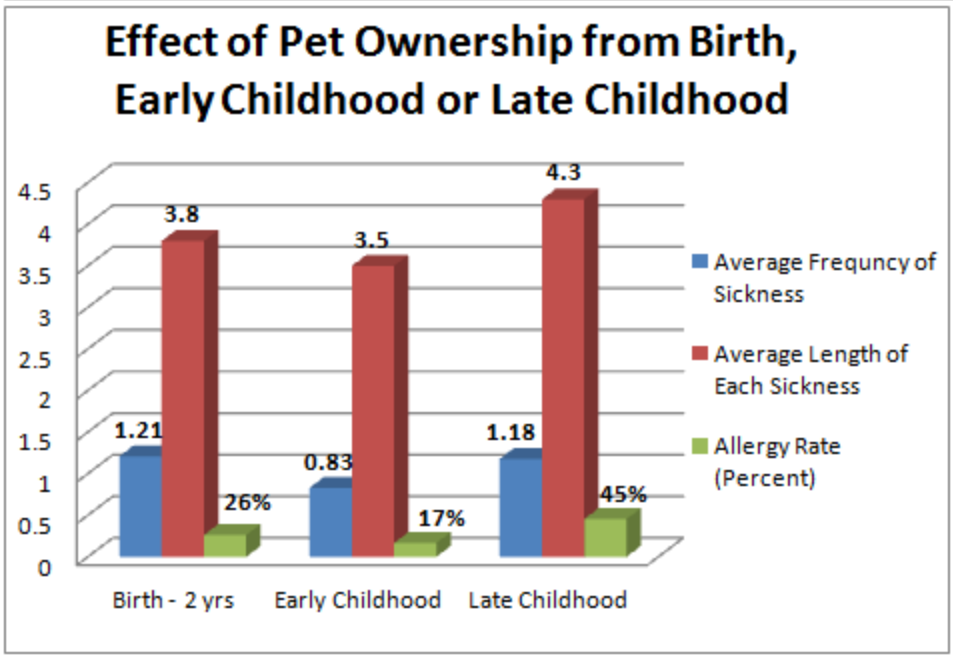


Figure 12. Allergy Rates of Pet Owners and Non-Pet Owners by Ethnicity
Figure 13. Comparison of Pet Ownership Period to Frequency of Illness, Length of Illness, and Allergy

Lastly, to support our theory of having pets during childhood or after birth for a development of a strong immune system, data from pet owner participants who had their first pet(s) between birth and age 2 were grouped in one category. Another set of data from pet owners who had pets between the age of 3 to 6 were categorized in the "early childhood" group while participants who had their first pets between ages 7 to 11 which grouped into the "late childhood" group. We found that participants in all three groups had a low frequency of illness. The frequencies were all below 1.25 times per year which is extremely low, making it significant. Here, we also found early childhood group to have the lowest frequency of 0.83. Next, the average length of illness was analyzed. The length of illness was highest in "late childhood" of 4.3 days while the "birth-2

yrs" and the "early childhood" group had a fairly similar lengths of 3.8 days and 3.5 days respectively. Lastly, we looked at the prevalence of "airborne" allergies in all three groups. The highest percent rate for airborne allergy was found in the "late childhood" group indicating that decreased chances to built a stronger immune system. The "early childhood" group had the lowest percent rate of airborne allergies indicating the individuals who were exposed to pets around age 3 to 6 that resulted in acquisition of a stronger immune system via acquired immunity in the specific age range. Thus, the above graph, demonstrating our findings, does provide supporting evidence to our theory that pet exposure in early childhood is beneficial as it results in a stronger acquired immune system to fight allergens and pathogens.

Discussion and Conclusions (CL, VD, YL)

Our results indicate that pet ownership may have a positive effects on the frequency of illness and prevalence of sickness in all ethnic groups. We also observed that the rate of frequency of illness, sickness length and airborne allergies were the lowest in the individuals who had their first pet between the age of 3 and 6. This particular age range shows the best age range of growth and development of immunity according to our survey sample. Hence, our findings does show evidence for our proposed hypothesis of the immunological benefits of pet ownership with a few discrepancies.

Any incongruent data may be due to several potential sources of error. The first is recall bias: as the questions we are asking rely on the subjects to remember correctly information over the potential span of many years, and the person may be unable to recall the information correctly. This includes the number of times the person was sick, how long the person was sick, and the time period when the person owned a particular pet. Another issue was sampling size: there were not enough samples for the older age brackets, which was potentially due to limitations in our data collection methods. Also, despite having surveyed a fairly large spread of ethnicities, a seemingly disproportionate majority had owned pets at some point in their lives, leaving us with a smaller than desired control group, with whites and Hispanics each only having one to three sample and therefore not having any power to do statistical analysis. Finally, some people answered the survey in vague terms, and our interpretation of these answers may have been incorrect.

Additional studies could address more specifically certain issues. For example, there is a potential that a specific type or category of allergy rate was decreased that was not looked at in this pilot study. Also, analyzing the time periods of owning a specific pet in terms of where an individual was in a developmental sense is also another area that can be studied; the immune system has a crucial window of development that could be potentially affected by the presence of pets. Finally, analysis of the parameters we have collected data for, such as by the variable of type of pet, may also prove to show some significance.

For the analysis of the effect of ethnicity on immunity, the survey has to be done differently since there is some indication from the literature that shows that immunity varies across different ethnicities and different diseases. For instance, the survey questions should ask the participants whether they have had specific diseases and how long they had suffered from them. Plus, since it was found that immunity could be affected by environmental factors more than the genetic factor, it would lead to clearer results if the survey is done in a wider variety of

areas; our survey was only done in New Jersey, and this could have worked as a source of error. Thus, the suggested survey should be carried out each ethnic group's own region. For example, having surveys for the Chinese population in China, the French population in France, and the Brazilian population in Brazil could potentially show an ethnic difference in immunity.

Finally, this survey, due to its sampling size, is only a pilot study. A larger pool of participants will be needed in order for this study to gain more power and be able to move forward. In order to access a larger participant pool, we would plan to extend the survey from the community level to nationwide. This survey can be distributed at universities across the country, to gather data from students and faculty/staff; this would give data for the majority of the age group range we had chosen to analyze. The larger pool of participants would allow for a more definitive conclusion about the specific effects that can be attributed to pets, based on ethnicity, age, and type of pet.

Linking Animal Exposure to Mortality Rates, Medical Cost and Pet Owning Cost (VD)

With urbanization and modernization, the importance of nature, animals and acquired immunity has highly decreased. We have grown so worried about our health that we are usually overly prescribed and get completely overwhelmed with the idea that everything we come in contact with must be sterile. This fact has made this generation the most pharmaceutically dependent, with the tendency to often forget that we need to be exposed to germs and certain bacteria in the early stages of the immunological development. Individuals who are not exposed to certain bacteria and viruses as babies will not be able to develop a strong immune system to fight common viruses and bacteria encountered day to day.

For instance, data has shown that people that are exposed to certain bacteria in their everyday environments tend to become immune to it. Take a look at the children mortality data from the UNICEF (Figure 1). The figure shows that developing countries like Colombia, Brazil and Nicaragua have the same mortality rates as European countries or the United States. Furthermore, it is known that living conditions and health care plans are in very precarious conditions in developing countries compared to the United States. Thus, from Figure 14, it can be inferred that the obsession with healthcare and pharmaceutical products in developed countries is not making

a great impact on the overall well being of individuals.

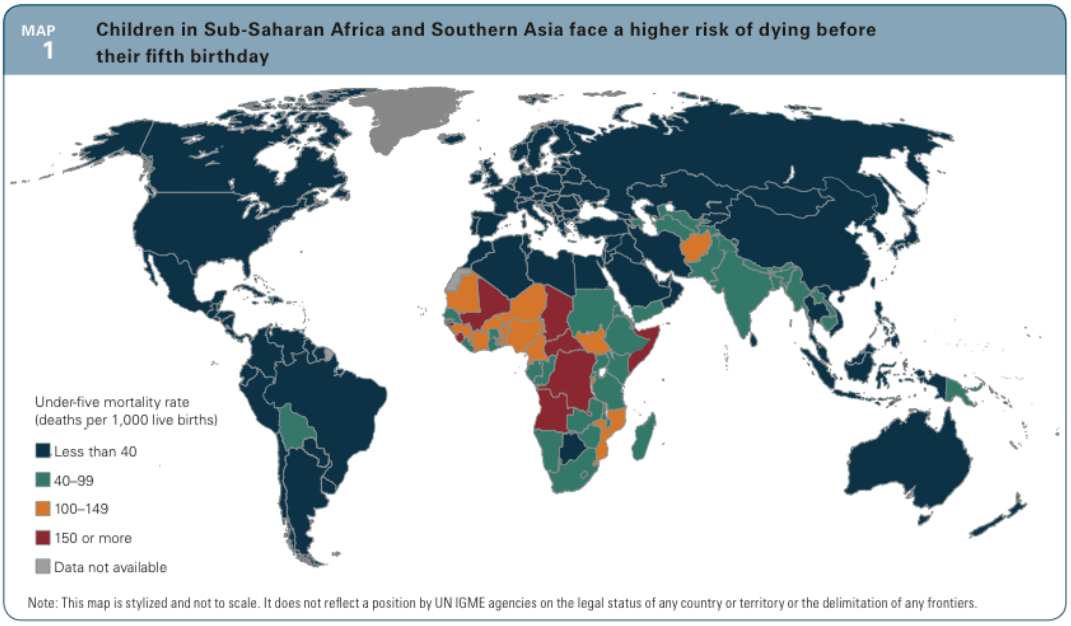


Figure 14. Children Mortality Rates
Source:
http://www.who.int/maternal_child_adolescent/documents/levels_trends_child_mortality_2012/en/index.html

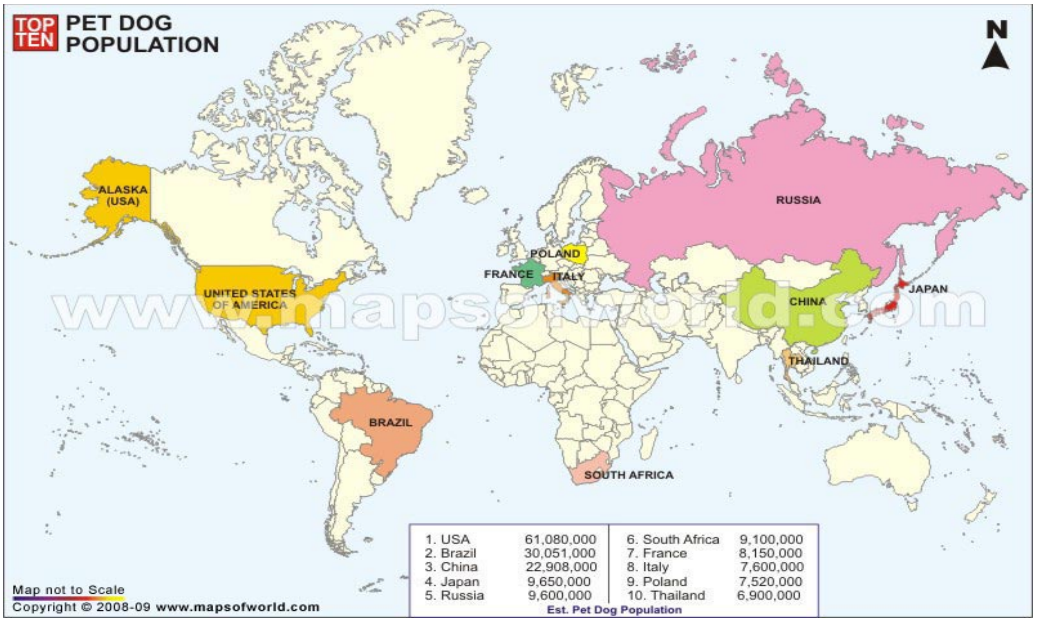


Figure 15: Top Ten Countries with the Most Pet Dog Populations
Source:
http://www.mapsofworld.com/world-top-ten/countries-with-most-pet-dog-population.html

Subsequently, Figure 15 shows that top ten countries who have the highest rate of pet dog ownership. Comparing the two graphs, we can observe a correlation that in countries like the US, Brazil (in Latin America), China, Japan, and Russia not only have the lowest rate of childhood

mortality but also have the highest numbers of dogs as pets. From these graphs, one can also infer that although a developing country, Brazil, is more in contact with nature and animals in comparison to Africa, another developing nation. Here, we can observe a correlation in the high rate of child mortality in african countries with low dog/animal population while the low rate of child mortality in Latin countries, specifically Brazil, with a high dog/animal population. This observation could be attributed being in contact with pets or animals which can possibly improve a persons well being. Thus, pet ownership or even higher presence of animal population around humans could potentially be a contributing factor in human mortality, specifically children. However, it is acknowledged that the difference in mortality rates cannot solely be attributed to being in contact with animals, as many other factors could play a major influential role. Moreover, the mortality rate data can be applied as a proxy to the fact that pets can enhance a person's immunity. At the end of the day, the health of a person is a strong indicator of the individual's immune system. With a strong focus on human health, the US healthcare has constantly been on the rise and could provide a good data for analysis. In the following reference, *The Lifetime Distribution of Health Care Costs* (Alemayehu and Warner), the impact of the cost of healthcare on an individual's life can be thoroughly evaluated. This article calculated an estimated lifetime expenditure on healthcare for any individual to be around $316,579. These values includes the cost of facility, hospital, nursing home, professional, prescription drug, dental, vision and hearing services.[36] On the other hand, the article *The Economics of Pet Ownership* evaluated the cost of owning a pet. With cost of surgical visits, food, grooming, kennel boarding, routine veterinary care, vitamins, treats and toys included, the cost of dog and cat pet ownership for ten-years is estimated to be around $15,710 and $9,190 respectively. With an average lifetime of dogs and cats to be around 10-15 years, the cost of owning a pet from birth to childhood is considerably cheaper than the cost of healthcare over lifetime.[37] Consequently, if owning a pet can develop a stronger immune system in addition to their general health benefits, pet ownership can not only provide one with the benefit of healthy life but also lower the cost of their health care. Thus, the costs associated with owning a pet are minimal compared to the amount saved due to the lower cost of healthcare.

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Appendices:

HUMAN SUBJECTS RESEARCH PROTOCOL – E12-342

I. TITLE: Pets: Are They Really Man's Best Friends?

II. OBJECTIVES
The main objective of this study is to examine effects of owning a pet on the human immune system.

III. BACKGROUND AND RATIONALE –
The immune system plays an important role in keeping people healthy during everyday life. In developed countries, there has been a growing percentage of people affected by allergies, compared to lower allergy rates found in third world countries(Tse). Due to lack of antigen exposure in developed countries, the immune system becomes hypersensitive to the antigen and causes an allergic reaction. This allergic reaction can eventually lead to the development of asthma, as "the development of allergic responses to inhaled allergens is the single biggest risk factor for asthma in the developed world"(Simpson).

One thing that can potentially help this problem is pet ownership. Many research studies have found a direct relation between ownership of pets especially dogs and improvement in health problems. One study saw a significant reduction in minor health problems such as common cold and flu, headaches, hay fever and even indigestion. There has also been major evidence that pet ownership decreased risk and slowed progression of coronary heart disease (http://www.ncbi.nlm.nih.gov/pubmed/21824172), as well as potential improvements in the health of obese individuals (http://www.ncbi.nlm.nih.gov/pubmed/1774745). Data from Finland and Russia showed that exposure to farm animals and certain animals like cats prenatally showed a higher risk for asthma while individual who had dogs as pets showed a protection against the asthma(http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2430194/?tool=pmcentrez).

However, environment is not the only determining factor; genetics also plays a major role in how the immune system functions. "Population differences in gene expression have only recently begun to be investigated...We believe they play a significant role in susceptibility to disease and in regulating drug response"(http://news.bbc.co.uk/2/hi/health/7270562.stm) For instance, racial ancestry influences the frequency of positive HIV-tests, F(HIV), as an independent variable. In every occupational, social, or other group tested in the United States, at all ages and for both sexes, F(HIV) increases in the order Asian→ white→ Native American→ Hispanic→ black. Data from South Africa display a similar sequence, white/Asian-Indian → Colored →black.(http://hivnotaids.homestead.com/HIViiiJSE255..288.pdf)

Some reports suggest differences in the rates of autoimmune disease among various racial groups, but the impact of racial background varies among individual autoimmune diseases. In the United

States, African Americans are at higher risk than are Caucasians for systemic lupus erythematosus and scleroderma, but at lower risk for type 1 diabetes and multiple sclerosis. High rates of certain autoimmune diseases have been reported in certain Native American groups...Studies on race and autoimmune disease have focused primarily on genetic differences that may contribute to variations in disease risk, including genes affecting immune response and metabolism (http://www.niaid.nih.gov/topics/autoimmune/Documents/adccreport.pdf). For instance, in one ethnic group an allele is associated with chronic viremia, while in another it is associated with spontaneous viral clearance(http://www.hcvadvocate.org/hcsp/articles/Azocar-2.html). Environmental factors that may be related to both race and risk of autoimmune disease include exposure to infectious agents, nutrition, individual and social stress (such as poverty and racism), and occupational and residential exposures related to residence in areas contaminated by industrial waste.
(http://www.niaid.nih.gov/topics/autoimmune/Documents/adccreport.pdf)
Therefore, we would like to further investigate the effects of pet ownership on the immune system.

IV. PROCEDURES
A. Design: Survey
B. Sample: Approximately 120 individuals of different age groups ranging from 18 to 65+ (Questions regarding childrens below age 18 will only be addressed to parents. Childrens/ Minors will not be approached.)
C. Measurement/Instrumentation: Statistical data recorded/analyzed
D. Location: College Campuses/ Pet Expo Events/ Day Care.

E. Detailed Study Procedures:
For this study, we have began by reading several research articles and have encountered findings that show a relationship between Pet ownership and possession of stronger immune system with a concentration on allergies, asthma and other conditions. In our research, we have also found a correlation between ethnicity and the response to diseases/ conditions. Thus, our procedure is based on examining these relationships. To analyze these relationships, we need to first find evidence. Hence, a brief survey of 15 questions will be conducted at different Rutgers' college campuses and at local grocery stores to collect data from different age and ethnic groups. These questions will be simple and mainly concerned about pet ownership. The survey will also specify age, ethnicity and yearly rate of sickness felt. For knowing more about the development of immunity due to pet ownership, we will also ask parents in the survey to briefly share their child's age and rate of sickness. Thus, all of these data collected from the survey will be divided down into different age groups as well as different ethnic groups and will be analyzed for three things. The first will be to find basis for our research study and actually confirm a protective effect of having pets. The second goal will be investigate the effects of having pets at an early age on immunity versus having pets later on in life like at age 20. And the third and final objective that will be analyzed from the survey is to examine if there truly does exist a correlation between ethnicity and being susceptible to diseases with regards to pet ownership.

F. Consent: The study will be explained to the subject by the student principal investigator, the consent form will be read to them and any of the subject's questions will be answered. Participants will be offered the informational sheet below. The student researcher will say: "This

research study is being conducted as part of a class project at Rutgers University which has been approved by the Human Subjects Institutional Review Board under protocol # E12-342. The study involves only a survey to be filled out that is both anonymous and confidential. Your participation in this study is strictly voluntary. The student researcher has been approved by the Rutgers Institutional Review Board to conduct the research. The consent will be read, and your questions answered. By giving verbal consent, you will be agreeing to participate in the study that you are over the age of 18."

G. Internal Validity: There is no true potential to study bias. Results of the surveys will be quantitatively analyzed by the company that produces the survey. The results will compare age/ gender/ ethnicity/ ownership of pet versus allergy/disease.

H. Data Analysis: statistics of data obtained from the survey in chart/table format

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Informational Sheet

Title: "Survey: Brief Analysis on Pet Ownership and Relation to Immunity"
Authors: Julie Fagan, Ph.D with students: Ye Rin Lim, Calvin Leung, and Vidhi Desai.

INTRODUCTION

You are invited to voluntarily participate in a research study that will measure the relationship between pet ownership and allergy/disease.

INFORMATION:

BENEFITS: You will not receive any direct benefit for participating in this research. However, it is expected that the research will provide scientists with a better understanding of immune system development.
RISKS: This study consists of only a survey and there are no risks involved.

CONFIDENTIALITY: This research is completely anonymous. No information will be recorded that could identify you.

COMPENSATION: You will receive no monetary compensation for participating in this study. The animal-assisted therapy sessions will be provided free of charge.

RESEARCH QUESTIONS: If you have any questions regarding the study, you may contact Dr. Julie Fagan at 848-932-8354 or email her at Fagan@rci.rutgers.edu

SUBJECT RIGHTS: If you have any questions about your rights as a research subject, you may contact the IRB Administrator at Rutgers University at: Rutgers University Institutional Review Board for the Protection of Human Subjects; Office of Research and Sponsored Programs; 3 Rutgers Plaza; New Brunswick, NJ 08901-8559; Tel: 848 932 4058; Email: humansubjects@orsp.rutgers.edu

The Survey

1. Sex Male Female
2. Age (18-25/ 26-35/ 36-45/ 46-55/ 56-65/ 65+)

3. Ethnicity (Asian/ White/ Black/ Hispanic/ N/A)
4. Have you ever owned a pet(s) Yes No
5. If Yes,
    a. How many? _____
    b. What type of pet(s) do you have/ had (please circle/specify)?

    Dog Cat Fish Bird Others _____

    c. What breed/species is your pet(s)?

    Pet #1: _____ Pet #2: _____
    Pet #3: _____ Pet #4: _____

    d. For how long?

    Pet #1: Since_____ until_____
    Pet #2: Since_____ until_____
    Pet #3: Since_____ until_____
    Pet #4: Since_____ until_____

6. If No, Why? _____
7. Are you allergic to anything? Please specify _____
8. How often have you been sick within the past year? _____
9. How long did each sickness lasted?_____
10. If you have children, how old? _____
11. Does your children have pets? Yes No
12. If yes,
    a. How many? _____
    b. What type of pet(s) do your children have/ had (please circle/specify)?

    Dog Cat Fish Bird Others_____

    c. What breed/species is your child's pet?

    Pet #1: _____ Pet #2:_____
    Pet #3: _____ Pet #4:_____

    d. For how long?

    Pet #1: Since_____ until _____
    Pet #2: Since_____ until _____

Pet #3: Since_____ until _____
Pet #4: Since_____ until _____

13. If no, Why? _____
14. Is your child allergic to anything? _____
15. How often has your child been sick within the past year? _____

16. How long has your child's sickness lasted? _____

RUTGERS UNIVERSITY
Office of Research and Sponsored Programs
ASB III, 3 Rutgers Plaza, Cook Campus
New Brunswick, NJ 08901

November 6, 2012

P.I. Name: Fagan
Protocol #: E13-214

Julie M. Fagan
Department of Animal Sciences
Bartlett Hall
84 Lipman Drive
Cook Campus

Dear Julie Fagan:

Notice of Exemption from IRB Review

Protocol Title: "A Survey to Determine Whether Household Pets Affect the Frequency and Duration of Illnesses"

The project identified above has been approved for exemption under one of the six categories noted in 45 CFR 46, and as noted below:

Exemption Date: 10/26/2012 **Exempt Category:** 2

This exemption is based on the following assumptions:

- **This Approval** - The research will be conducted according to the most recent version of the protocol that was submitted.
- **Reporting** – ORSP must be immediately informed of any injuries to subjects that occur and/or problems that arise, in the course of your research;
- **Modifications** – Any proposed changes MUST be submitted to the IRB as an amendment for review and approval prior to implementation;
- **Consent Form (s)** – Each person who signs a consent document will be given a copy of that document, if you are using such documents in your research. The Principal Investigator must retain all signed documents for at least three years after the conclusion of the research;

Additional Notes: **None**

Failure to comply with these conditions will result in withdrawal of this approval.

The Federalwide Assurance (FWA) number for Rutgers University IRB is FWA00003913; this number may be requested on funding applications or by collaborators.

Sincerely yours,
Margaret Cooper
Acting For

Sheryl Goldberg
Director of Office of Research and Sponsored Programs
gibel@grants.rutgers.edu

Vidhi's Human Subjects Research Certification Link:
http://acfc.rutgers.edu/sakai/printer_friendly.php?pi_full_name=Vidhi%20Desai&user=26895681-35ac-49e1-bbf6-721dffce6cb6&grade=95&recorded=2012-09-25%2013:16:04.0

Certification for Ye Rin Lim

http://acfc.rutgers.edu/sakai/printer_friendly.php?pi_full_name=Ye Rin Lim&user=ad6e0eb7-d4bb-4945-a1ae-ef27c5aa45ef&grade=87.5&recorded=2012-09-24 23:04:37.0

Certification for Calvin Leung:

http://acfc.rutgers.edu/sakai/printer_friendly.php?pi_full_name=Calvin Leung&user=ed6a6bdd-c254-4f1d-8a54-dcac086a70b4&grade=92.5&recorded=2012-09-26 03:05:17.0

(petspress@yahoo.com)

Letter to the Editor of Pets Press,

I am a student at Rutgers University in New Jersey, and I am currently working on a service project under the supervision of Professor Julie Fagan. For the research my partners and I are working on, we came up with a question "what may affect the immune system?" and we decided to connect this question to pet ownership, because pets have been with human beings for a long time, and the pet ownership is becoming more popular these days. There are many different types of pets and breeds which have different effect on human.

Nowadays, "well-being" is one of the important things that people care about. To become healthier, people try to have good diet, stay in good environment, use good product, and do exercise. Being healthy also includes obtaining healthy immune system, which is the primary barrier of our body. In this research, pet ownership is suggested as a factor that may affect human immune system in a beneficial way. Since many research articles have mentioned that exposure to moderate antigens can improve immunity, we suspected that pet could be a source of antigens that can train our immune system. Plus, we noticed that there are different rates of pet ownership by different ethnicity. Therefore, we decided to add information about relationship of immunity vs. ethnicity and pet ownership vs. ethnicity in our research.

We have looked at many research articles that can provide good support for our issue, and we also have randomly surveyed wide amount of people on college campus as well as the pet expo

to collect accurate data. Our research so far indicates that pet ownership has advantage on improving immunity even though the immunity differs by the ethnicity. The survey data also suggests hypoallergenic pet(s) for the individuals with special health issues such as allergy, so that more people can have pets for their health without any health concerns.

My partners and I would like to share the information we have worked on with many people, and found "Pet Press" to be the suitable place to submit. Since most of the reader of Pet Press are interested in pets, and I think our research can benefit the readers. Thus, I request you to publish our paper in Pet Press. It will be our honor to have our research published.

Thank you for your time and I hope my suggestion is taken into consideration.

Sincerely,
Ye Rin Lim

Daily Targum

To the Editor:

I am a student from Rutgers University, and am taking a colloquium course this semester. My partners and I are currently working on a service project under Dr. Julie Fagan, looking at the importance of pet ownership. We feel this is an important topic that should be more widely known about, and would greatly appreciate it if the editorial below were to be published.

Pet Ownership And Immunity

In the US alone, over 56% of households own at least one pet. This includes over 78 million dogs, 84 million cats, 16 million small mammals like hamsters and mice, as well as other pets like reptiles and birds. There are many reasons why a household may choose to get a pet: companionship; to teach responsibility; to add something colorful to the room decoration. Whatever the case may be, pets are currently a major part of Americans' lives, and can have an important role to play in our health.

Health is one of the top things Americans are concerned about in everyday life. For instance, we constantly hear about how bad the upcoming flu season is; or how an ethnicity is at increased risk for a certain disease, such as African Americans and heart disease; or how some food that has been found to lower high blood pressure. We worry about what we eat, how often we exercise, whether we are going to have a disease based on family history and ethnicity. One area of health we should be especially concerned about is the fact that allergy rates have been increasing in developed nations like the US in comparison to developing nations, where allergy rates have remained fairly low and consistent. This issue becomes an even greater problem when taking into account that it affects urban children at a much higher rate than those who live in rural areas. While allergy symptoms may not be as severe as with other diseases, they still take their toll in terms of productivity loss, through absences from school or work.

At the same time, healthcare costs are a major issue, and Americans are concerned about being able to afford the necessary treatments; we saw the arguments of how to control medical costs come to a head with the recent healthcare law that was passed and fought over in the Supreme

Court. Allergies are chronic, and only the symptoms can be treated. This means that a person diagnosed with an allergy must constantly buy medications that only relieve their symptoms, with prescription allergy medications costing anywhere between $70 and $160 each time. This is where pet ownership comes in- owning pets during childhood has been linked with a lowered allergy rate. A pet can cost, over its lifetime, from $5,000 to $12,500 for the more common types; while this may initially seem expensive, being able to avoid the whole hassle of constantly buying and taking a wide variety of medicines to treat allergy symptoms over a lifetime is an investment well worth the cost.

Sincerely,
Calvin Leung
School of Environmental and Biological Sciences Class of 2013

NJ Family Magazine
480 Morris Avenue
Summit, NJ 07901

To the Editor Judy Grover,

The main purpose of this letter is to promote the ownership of pets due to their beneficial contribution to the human health in a racially diverse population. We, the students of Rutgers University, are writing this letter as part of our service project under the supervision of Julie Fagan for our Ethics in Science Class. This course encourages us to address and investigate a specific, scientific topic which has recently become a subject of focus in the community. So, we decided to examine the link between pet ownership and the human immune system by age and ethnicity. My group members and I strongly feel that this is an important topic that can bring about a different outlook on pets and their role in the human immunity. Thus, we would greatly appreciate if the below editorial got published.

Thank you.

Sincerely,
Vidhi Desai

Editorial:

Advantage of Pet Ownership on the Human Immune System

Pet ownership has become highly prevalent around the globe. In the United States, there has been a significant rise in pet ownership from 1998 to 2006 according to the census. It is estimated that about 56% of the U.S households owns at least a single pet. Amongst the aquatic, avian, reptiles and other forms of pets, the most popular pets seen are cats and dogs which have their current population around 84 million and 78 million respectively. As of 2006, even China had more than 71 million bird pets. Aside from pet ownership being a trend, pets are kept for a wide variety of reasons that range from companionship, protection of household, enjoyment of the animal's attractive and playful nature to its' therapeutic effects on humans. Thus, ownership of pets is globally recognized and may have a potential benefit on the human health.

At the turn of the century, with the development of new chronic diseases, the focus on medicine and maintenance of a healthy human body has only intensified. People are constantly concerned with regulating a proper diet, performing exercise as well as monitoring their basic metabolites in the blood to ensure a strong defense against possible diseases. Research has found few general benefits such as reduction in common flu, decrease in risk and progression of coronary heart diseases, improvement in the health on obese individuals as well as reducing stress and ameliorating psychological problems in individuals with pets.

Conversely, recent studies have also found ethnicity to be a factor in affecting the immune system. African Americans are found to be at a higher risk than Caucasians for diseases such as systemic lupus erythematosus and scleroderma while being at a lower risk for type 1 diabetes and multiple sclerosis. It is suggested that rates of chronic immune stimulatory conditions and genes affecting the immune response and metabolism vary depending upon the race. As a result, different effects of pets are seen on the human immune system depending on the race.

With various factors affecting the immune system, the rise of allergy reactions in developed nations such as US has become a concern. Allergic responses, although not life-threatening, are chronic, incurable and occur when the body severely reacts to a foreign particle or antigen due to lack of exposure. In situations as such, the ownership of pets from a very young age can help reduce the chance of having allergies. The main idea is that exposure to antigens at a young age can make your adaptive immune system stronger and gain the ability to differentiate between toxic and non-toxic antigens. Acquisition of pets in older aged people might not be as effective as children since the body has already built the adaptive immune system. For older individuals and the ones who are allergic to pet dander, there is the option of having “hypoallergenic” pets which helps in reducing allergic responses as well. Hence, pet ownership can minimize an individual’s chance of having an allergic response, making pets a “man’s true best friend.”