

Racial differences in pet ownership in families of children with asthma

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Background: Exposure to household domestic animals such as cats and dogs in early life may have some role in pathogenesis of asthma. Racial differences exist in the prevalence of asthma. We hypothesized that there may also be racial differences in pet ownership in families with asthma.

Methods: A cross sectional study was conducted from June 2011 to December 2014 on 823 of 850 (97%) families of children with asthma for pet ownership. Comparisons among racial groups were done using chi square analysis and one-way analysis of variance.

Results: The mean age of the cohort was 6.9 ± 4.4 years. A total of 540 (65.62%) patients were Caucasian, 195 (23.7%) African American, 42 (5.1%) hispanics, and 26 (3.2%) biracial with one Caucasian parent. Pets in the home were reported by 470 (58.5%) households. Significantly fewer African American and hispanic families had pets in the home (26.9% and 44.7%) than biracial and Caucasian families (72% and 69.9%, $P < 0.001$). Likewise, significantly more biracial and Caucasian families were noted to have dogs (52% and 54.4%) or cats (25.4% and 40%) or both cats and dogs (28% and 18%) than African Americans families (20.3%, $P < 0.001$; 7.1%, $P < 0.001$) and (4.6%, $P < 0.001$), respectively.

Conclusion: Among families with asthmatic children, pet ownership is significantly more likely in Caucasian families compared with African-American and Hispanic families, thus there is a racial diversity in pet ownership among families of children with asthma.

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Introduction

Asthma is a common chronic disease affecting children and adolescents. Exposure or ownership of pets such as cat or dog as a risk factor for subsequent asthma is challenged as studies have revealed contradictory effects. Two recent meta-analyses concluded that most birth cohort studies suggest no increased risk of wheezing or asthma due to exposure to a cat or dog during infancy.^[1,2] Similarly, in school age children, the majority of published data suggested the lack of an association between exposure to animals and subsequent development of wheezing or asthma.^[1,2] Some experts have shown an inverse association between cat exposure and asthma,^[3] while others suggest a positive association between cat exposure and increased risk for wheezing or asthma later in life.^[4,5]

The prevalence of asthma differs among racial and ethnic populations. Epidemiologic data from the Centers for Disease Control and Prevention in 2010 reported that the prevalence of asthma in the general population was 8% with the most common afflicted population being African Americans (11.2%) and the least being Caucasians (7.7%).^[6] Current medical literature is limited regarding data on racial differences in pet ownership. An online database reported that in United States in 2011, 61% of Caucasian households had pet at home compared to 40% Hispanics and 22% of African American households, suggesting racial differences in pet ownership.^[7] Thus, data in the general population suggest that the prevalence of both asthma and having a pet at home is different in different racial groups. We conducted this study to observe racial differences, if any, in pet ownership in families with children with asthma.

Methods

Study cohort

After Institutional Review Board (IRB) approval (IRB11-00174) by local Children's Hospital, 850 children with asthma referred to the Pediatric Asthma Center between June 2011 and December 2014 were enrolled into the study. These patients were referred by local pediatric offices for asthma management. Inclusion criteria were all children with physician diagnosed asthma referred to pediatric asthma center. Written consent was waived by IRB. Families or patients were not compensated for study participation. Study design was cross-sectional observational and a survey (questionnaire) was completed by parents at the initial clinic visit. Information collected from parents included demographics such as age, gender, race and presence of a pet at home. Eight hundred and twenty three families completed the questionnaire (823/850, 97%). Comparisons were made between Caucasian, African-American, Hispanic and Biracial families with one Caucasian parent. Asian children ($n=14$) were removed from analysis as number of children in this group were very small. Asthma severity was classified according to guidelines for the diagnosis and management of asthma (EPR-3).^[8]

Statistical analysis

Demographic, clinical, and asthma risk factors are reported as frequencies, percentages, means, and standard deviations as appropriate. Comparison of factors between the four racial groups (Caucasian, African American, Hispanic and biracial with one Caucasian parent) was conducted with chi square analyses and z-tests with Bonferroni adjustments of P value, and one-way analysis of variance (ANOVA) depending upon the level of measurement. Alpha level of significance was set at <0.05 .

Results

The sample of 823 children with asthma enrolled into the study. Demographics are explained in Table 1. Caucasian was the most prevalent race followed

by African Americans. The majority of the subjects had asthma categorized as moderate severity. More than half of the families had at least one pet in the home ($n=470$, 58.5%). Dogs were in 366 (45.5%) households, cats in 167 (20.8%) homes and both dog and cat in 118 (14.7%), while other pets were present in 51 (6.3%) households (Table 1). Significantly more Caucasian ($n=376$, 69.6%) and biracial families ($n=18$, 72%) had pets within the household compared to African American and Hispanic families ($n=53$, 26.9% and $n=21$, 44.7%, respectively, $P<0.001$). Dogs were the most common pet in all four ethnic groups, with significantly more Caucasian ($n=294$, 54.4%) and biracial families ($n=13$, 52%) having a dog in the household compared to African American and Hispanic families ($n=40$, 20.3% and $n=17$, 36.2%, respectively, $P<0.001$). Significantly more Caucasian ($n=137$, 25.4%) and biracial households ($n=10$, 40%) had cats compared to African American families ($n=14$, 7.1%, $P<0.001$). Significantly more Caucasian ($n=97$, 18%) and biracial households ($n=7$, 28%) had both pets (cats and dogs) compared to African American families ($n=9$, 4.6%, $P<0.001$). There was no significant difference between African American and Hispanics in regards to prevalence of having a pet at home (Table 2).

Table 1. Demographic and asthma risk factors for the total group of children diagnosed with asthma ($n=823$)

Variables	Total sample	
	<i>n</i>	%
Gender		
Male	477	58.0
Female	346	42.0
Ethnicity		
White	540	65.6
Black	195	23.7
Hispanic	42	5.1
Biracial	26	3.2
Asthma severity		
Mild intermittent	11	1.6
Mild persistent	187	26.4
Moderate	490	69.2
Severe	20	2.5
Pets	470	58.5
Dog	366	45.5
Cat	167	20.8
Both dog and cat	118	14.7
Other pets	51	6.3

Table 2. Race and pet at home

Pets	Black ($n=197$)		Biracial ($n=25$)		White ($n=540$)		Hispanic ($n=47$)		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Pets in the home	53	26.9	18	72	376	69.6	21	44.7	<0.001
Cat in the home	14	7.1	10	40	137	25.4	4	8.5	<0.001
Dog in the home	40	20.3	13	52	294	54.4	17	36.2	<0.001
Both dog and cat in the home	9	4.6	7	28	97	18.0	3	6.4	<0.001

Black and Hispanic children had fewer pets in the home (26.9% and 44.7%) than biracial children and white children (72% and 69.6%, $P<0.001$). Biracial children had more cats in the home (40%) than black and hispanic children (7.1% and 8.5%, $P<0.001$). Biracial and white children had significantly more dogs in the home (52% and 54.4%) than black children (20.3%, $P<0.001$). Biracial and white children had significantly more both dogs and cats in the home (28% and 18%) than black children (4.6%, $P<0.001$).

Discussion

The current study reports that among families with asthmatic children, more than half (58.5%) have a pet at home. It also showed that significantly fewer African American and Hispanic families had pets in the home (26.9% and 44.7%) compared to biracial and Caucasian families (72% and 69.6%, $P < 0.001$). This difference was noted with dog or cat or both dog and cat at home.

It is well known that racial differences exist in the United States regarding asthma prevalence with the lowest rate being in Caucasians and the highest in African Americans.^[6] The present study suggests that Caucasian families with asthmatic children are significantly more likely to own a pet compared to African-American or Hispanic families with asthmatic children suggesting racial differences in pet ownership among asthmatic families. Caucasians have the lowest prevalence of asthma but have the highest percentages of households with pets and African Americans have the highest prevalence of asthma but the lowest percentages of households with pets.

It is possible that presence of pet at home may have some role in improving respiratory symptoms in some children over time. A number of factors attribute to racial disparity in asthma prevalence including variations in genes and their interaction with environment, urban vs. rural living, socioeconomic status, adherence with medication and health care access and greater exposure to environmental triggers such as tobacco smoke and indoor allergens,^[9] but our study was not designed to address them.

Role of exposure to pet (cat or dog) and subsequent development of wheezing or asthma is not clear.^[1,2] Some have suggested that exposure to cat may be a risk factor for subsequent development of wheezing or asthma later in life^[4,5] while others have shown an inverse association between cat exposure and asthma.^[3] Some studies have even suggested that the exposure to dog during infancy may have protective effects against developing the sensitization to aeroallergens.^[10-13] It was proposed, though not well established, that pet keeping especially dogs may increase the exposure to bacterial endotoxins, which may alter immune responses by favoring T helper-1 lymphocytes, thus protecting these particular children from allergic phenotypes including asthma.^[14-16] It is also suggested that exposure to dogs in infancy may be associated with changes in immune development leading to reduction in wheezing and atopy.^[11] Some studies^[17,18] have suggested that keeping pets during early lifetime (in infancy), but not in the current residence, could be a risk factor for childhood asthma, allergies, and airway diseases. It is postulated that families with sick children/members, as well as

family history of atopy, probably would avoid keeping furred pets (pet avoidance behavior) while families with pets in the current residence probably can stay with pets (less disease). Therefore, there may be negative associations of current pet-keeping with asthma or other diseases. In our cohort, families with pet ownership had pet at home at the time of questionnaire. Our questionnaire was not designed to gather information on lifetime pet exposure or exposure to pets in infancy. It is possible that families in different races may have different consideration of pet avoidance behavior and/or have different response when exposure to furred pets (due to heredity difference).

Data on ethnic or racial differences on pet ownership in the US is very limited. One online database in 2011 mentioned 61% of white households owned pets (dog or cat) compared to 40% Hispanics and 22% of black households.^[7] A study by Marx and colleagues in 1987,^[19] based on phone conversations, reported in a cohort of 1300 households that 816 (63%) owned a pet and among them 34% owned a dog and 12% owned a cat. Our study found that 65% of white households had a pet compared to 46% of non-whites. Both studies suggest that Caucasians are more likely to have a pet at home compared to African American or Hispanic families. Our data on families with asthmatic children revealed similar trends even though asthma prevalence varies in different races.

If presence of a pet (cat or dog) at home is associated with increased risk of asthma then African American households should have had the highest rate of pet ownership as asthma prevalence is the highest in this ethnic group. On the contrary, it is noted that the pet ownership in both the general population in the US^[7,19] and among families with asthmatic children in our study, is the highest in the racial group with the least prevalence of asthma (Caucasians) and is the lowest in the group with highest prevalence of asthma (African Americans). In our study, there was no significant difference between African American and Hispanic families in pet ownership. According to the current medical literature, prevalence of asthma in hispanics in the US varies based on ethnic subgroups with an overall prevalence of 6.5% but ranging from 5.4% in Mexican Americans to 16.1% in Puerto Rican Americans.^[6] In the present study, the Hispanic group was diverse but small ($n=42$, 5.1%), thus sub-group analysis was not possible.

There are several limitations of the current study. The reliance on information provided by the family is a concern. More importantly, there is no control group (families with no asthmatic children) for comparison. The data of socio-economic and household income data were not collected. And a single institutional study

can introduce bias. Another limitation is that it is not a general population study and subjects were selected starting from the outcome (asthmatic). These issues may limit generalization of the results. Despite these deficiencies, the current study has a large cohort with the majority of the cohort completing the questionnaire.

In conclusion, there are significant racial differences in pet ownership among families with children with asthma. Further research with larger cohorts is needed to better understand pet ownership at home and its relationship with asthma prevalence in different racial groups.

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Competing interest: The authors report no conflicts of interests and have no relevant disclosures.

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References

- Chen CM, Tischer C, Schnappinger M, Heinrich J. The role of cats and dogs in asthma and allergy--a systematic review. *Int J Hyg Environ Health* 2010;213:1-31.
- Lødrup Carlsen KC, Roll S, Carlsen KH, Mowinckel P, Wijga AH, Brunekreef B, et al. Does pet ownership in infancy lead to asthma or allergy at school age? Pooled analysis of individual participant data from 11 European birth cohorts. *PLoS One* 2012;7:e43214.
- Remes ST, Castro-Rodriguez JA, Holberg CJ, Martinez FD, Wright AL. Dog exposure in infancy decreases the subsequent risk of frequent wheeze but not atopy. *J Allergy Clin Immunol* 2001;108:509-515.
- Linneberg A, Nielsen NH, Madsen F, Frølund L, Dirksen A, Jørgensen T. Pets in the home and the development of pet allergy in adulthood. The Copenhagen Allergy Study. *Allergy* 2003;58:21-26.
- Torrent M, Sunyer J, Garcia R, Harris J, Iturriaga MV, Puig C, et al. Early-life allergen exposure and atopy, asthma, and wheeze up to 6 years of age. *Am J Respir Crit Care Med* 2007;176:446-453.
- Centers for Disease Control and Prevention. Vital signs: asthma prevalence, disease characteristics, and self-management education: United States, 2001--2009. *MMWR Morb Mortal Wkly Rep* 2011;60:547-552.
- Dog or cat ownership rates in households by race/ethnicity in the United States in 2011. <http://www.statista.com/statistics/250858/dog-or-cat-ownership-rates-of-us-households-by-race-ethnicity/> (accessed January 18, 2016).
- Guidelines for the Diagnosis and Management of Asthma (EPR-3). Expert panel report 3: (EPR-3 2007). NIH Publication No. 08-4051. Bethesda, MD: U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute; National Asthma Education and Prevention Program, 2007.
- Hill TD, Graham LM, Divgi V. Racial disparities in pediatric asthma: a review of the literature. *Curr Allergy Asthma Rep* 2011;11:85-90.
- Chen CM, Morgenstern V, Bischof W, Herbarth O, Borte M, Behrendt H, et al. Dog ownership and contact during childhood and later allergy development. *Eur Respir J* 2008;31:963-973.
- Bufford JD, Reardon CL, Li Z, Roberg KA, DaSilva D, Eggleston PA, et al. Effects of dog ownership in early childhood on immune development and atopic diseases. *Clin Exp Allergy* 2008;38:1635-1643.
- Lodge CJ, Lowe AJ, Gurrin LC, Matheson MC, Balloch A, Axelrad C, et al. Pets at birth do not increase allergic disease in at-risk children. *Clin Exp Allergy* 2012;42:1377-1385.
- Nafstad P, Magnus P, Gaarder PI, Jaakkola JJ. Exposure to pets and atopy-related diseases in the first 4 years of life. *Allergy* 2001;56:307-312.
- Campo P, Kalra HK, Levin L, Reponen T, Olds R, Lummus ZL, et al. Influence of dog ownership and high endotoxin on wheezing and atopy during infancy. *J Allergy Clin Immunol* 2006;118:1271-1278.
- Gern JE, Reardon CL, Hoffjan S, Nicolae D, Li Z, Roberg KA, et al. Effects of dog ownership and genotype on immune development and atopy in infancy. *J Allergy Clin Immunol* 2004;113:307-314.
- Lau S, Illi S, Platts-Mills TA, Riposo D, Nickel R, Grüber C, et al. Longitudinal study on the relationship between cat allergen and endotoxin exposure, sensitization, cat-specific IgG and development of asthma in childhood--report of the German Multicentre Allergy Study (MAS 90). *Allergy* 2005;60:766-773.
- Bornehag CG, Sundell J, Hagerhed L, Janson S; DBH Study Group. Pet-keeping in early childhood and airway, nose and skin symptoms later in life. *Allergy* 2003;58:939-944.
- Naydenov K, Popov T, Mustakov T, Melikov A, Bornehag CG, Sundell J. The association of pet keeping at home with symptoms in airways, nose and skin among Bulgarian children. *Pediatr Allergy Immunol* 2008;19:702-708.
- Marx MB, Stallones L, Garrity TF, Johnson JP. Demographics of pet ownership among U.S. adults 21-64 years of age. *Anthrozoos* 1988;2:33-37.

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