Published in final edited form as:

Clin Exp Allergy. 2011 July ; 41(7): 979–986. doi:10.1111/j.1365-2222.2011.03747.x.

Lifetime Dog and Cat Exposure and Dog and Cat Specific Sensitization at Age 18 Years

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Abstract

Background—Prior research about whether keeping a dog or cat in the home causes allergies to that pet has been limited to outcomes in early childhood.

Objective—Evaluate the association between lifetime dog and cat exposure and allergic sensitization to the specific animal at age 18 years.

Methods—Participants enrolled in the Detroit Childhood Allergy Study birth cohort in 1987–1989 were contacted at age 18 years. Sensitization to dog or cat was defined as animal-specific IgE ≥ 0.35 kU/L. Annual interview data from childhood and follow-up interviews at age 18 years were used to determine lifetime indoor dog and cat exposure (indoor defined as the animal spent >50% of their time in the home). Exposure was considered in various ways: first year, age groups and cumulative lifetime. Analyses were conducted separately for dogs and cats.

Results—Among males, those with an indoor dog in the first year of life had half the risk (RR=0.50, 95% confidence Interval=CI 0.27, 0.92) of being sensitized to dogs at age 18 compared to those who did not have an indoor dog in the first year. This was also true for males and females born via c-section (RR=0.33, 95% CI 0.07, 0.97). Overall, teens with an indoor cat in the first year of life had decreased risk (RR=0.52, 95% CI 0.31, 0.90) of being sensitized to cats. Neither cumulative exposure nor exposure at any other particular age was associated with either outcome.

Conclusions and clinical relevance—The first year of life is the critical period during childhood when indoor exposure to dogs or cats influences sensitization to these animals.

INTRODUCTION

The relationship between exposure to pets and allergic disease risk continues to be unsettled and may vary by age of exposure and outcome measurement, as well as the specific outcome measured.[1–23] In a recent publication, we reported no association between indoor dog and cat exposure (exposure in the first year, cumulative exposure, exposure at various ages) and overall allergic sensitization (positive allergen-specific IgE ≥ 0.35 kU/L) to at least one of seven common allergens at age 18–20 years.[2] However, we found that total IgE was lower in those young adults who had lived with pets during their infancy. Whether exposure specifically to dog(s) is associated with sensitization to dogs later in life and similarly,

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No author has any financial relationships with a biotechnology and/or pharmaceutical manufacturer that has an interest in the subject matter or materials discussed in the submitted manuscript.

whether prior exposure to cat(s) is associated with sensitization to cats remain as unresolved questions.

In our prior report, we hypothesized that indoor pets may increase microbial load and diversity in the home.[2,24] Furthermore, consistent with the hygiene hypothesis, we postulated that enhanced microbial exposure due to an increased richness, evenness and diversity of the home microbiome, could bias the immune system away from a Th2-like response, potentially through stimulation of innate immune receptors, resulting in lowered risk of allergic sensitization to common allergens. While data at age 6 have shown a lower risk of overall sensitization, the recent analysis did not support a persistent effect of pets to age 18–20 years. However, we did not focus on specific indoor cat or dog exposure and sensitization to the same animal. The mechanisms underlying a potential impact of animal-specific exposure and sensitization would likely differ from the effect of pet exposure on overall allergic sensitization.

In this report, we used a life course approach, similar to our examination of overall sensitization, to further investigate the relationships between exposure to indoor dogs and the risk of dog sensitization and exposure to indoor cats and cat sensitization^{25, 26}

The life course approach includes the examination of a critical period model (exposure to a factor or occurrence of an event during a specific time window of development leads to the disease) and a cumulative dose model (the cumulative exposure or lack of exposure to a factor over a period of time leads to the disease).

Using data from our study of birth cohort participants to age 18–20 years, we examined whether: 1) the presence of indoor dogs in the first year of life decreased the risk of sensitization (dog-specific IgE < 0.35 kU/L) at 18 years; and 2) high lifetime cumulative exposure to dogs in the home was associated with sensitization to dogs. Additionally, we examined whether exposure to dogs in any of the following age periods was associated with sensitization to dogs at age 18–20 years: 1st year of life, ages 1–5 years, ages 6–12 years and ages 13 and older. We then repeated the analyses separately for cats.

METHODS

Study Population

Recruitment methods for the Childhood Allergy Study (CAS), have been fully described elsewhere.[27] Briefly, without regard to allergic history, we recruited pregnant women 18 years and older from a geographically defined area of metropolitan Detroit, Michigan who belonged to a health maintenance organization. The women had to be seeing a Henry Ford Health System (HFHS) provider for their prenatal care and were to deliver between April 15, 1987 and August 31, 1989. A child was considered enrolled in the study after the mother provided a signed consent form, completed a prenatal interview and allowed us to collect the cord blood at delivery.

We obtained written consent from 953 women of the 1194 women who were eligible; 106 of their infants were never considered to be enrolled because their cord blood was not obtained for analysis. Six enrolled children were excluded because their cord blood was believed to be contaminated by maternal blood and six more were subsequently determined to be ineligible through review of eligibility criteria. Mothers of the remaining 835 children were asked to complete interviews annually to discuss the health of the child for the previous year until (and including) the child's sixth birthday. After their eighteenth birthday, the 835 teens were contacted to complete: (1) a telephone administered interview, and (2) a clinic visit with blood sample collection.

Of the 835 teens eligible at age 6 years, 15 withdrew from the study, died, or otherwise became ineligible prior to the follow-up at age 18 years; 40 were missing valid telephone numbers and were not contacted; 3 were enlisted in the military and unable to participate in the study; 3 had physical disabilities precluding them from completing interviews and 2 were incarcerated, leaving a total of 772 teens eligible for interviews and clinic visits. Of these 772 teens, 671 (86.9%) consented to study enrollment although blood was not collected from all participants. The HFHS Internal Review Board (IRB) and the Medical College of Georgia Human Assurance Committee approved this research.

Exposures

Families (usually the mother) reported current pet keeping at each annual interview through age 6 years. The question about pets in the house was: “Have you had any pets in your home for more than two weeks?” If yes, the type of animal (cat, dog, bird, etc.) and number of each type of animal were recorded as well as whether these animals were kept mostly indoors, outdoors or equally indoors and outdoors. Two weeks was chosen to differentiate household pets versus those being cared for on a temporary basis. The interviews also collected information on additional factors including family size and parental allergy history. Delivery type was collected from the mother’s medical record.

The telephone interview administered to teens at age 18 years solicited information on lifetime exposure to animals, family history of allergic disease and demographic questions. Teens were asked “Have you ever lived with any pets or outdoor animals?” Follow-up questions included the type of animals owned and whether or not these animals were indoor or outdoor animals. Animals were categorized as indoors if the teen reported that the animal stayed indoors for 12 or more hours per day. Teens were asked to list all indoor/outdoor pets that they ever lived with for at least one month. Pet type was also collected as were the ages they lived with the pet. We did not have data on dog or cat allergen levels across the teens’ life-spans.

Parental report of dogs or cats in the first 6 years of life and the teen’s report of dog or cat exposure from ages 6 years through 18 years were used to define the exposures. The exposure definitions are:

1. Critical periods:
 - a. Teens whose parents reported there was an indoor dog (cat) that was “in their home for at least 2 weeks” in the child’s first year of life.
 - b. Exposure to a dog (cat) during each of the following specific ages: 1st year of life, ages 1–5 years, ages 6–12 years and ages 13 and older adjusted for exposure in the other time periods. These groupings were chosen *a priori*. An indicator variable was created for each age period and teens were considered exposed during an age period if there was a dog (cat) kept indoors at least half the day during at least 1 of the years in that age period.
2. Cumulative exposure: Cumulative exposure was calculated as the total number of years in which a child lived in a home where a dog (cat) was kept indoors at least half the day. The years did not have to be contiguous.

We evaluated the following factors for effect modification and confounding: teen’s sex, parental allergy history (maternal and/or paternal history), firstborn status (parental interview data), and delivery type. Women were asked during their prenatal interview whether a physician had ever diagnosed them with “allergies” or told them that they had “hayfever” or if they ever had “immunotherapy (allergy shots)”. Mothers were classified as

having an allergic history if she had an affirmative response to any of these questions. A positive paternal allergic history was defined as the mother reporting the father being diagnosed with “hayfever” or “allergies” in the past.

Outcomes

Venous blood was collected for assessment of both total and allergen-specific IgE at age 18 years, and stored at -80°C until assayed. Levels of dog- and cat-specific IgE were measured according to the standard manufacturer’s protocols using the Pharmacia UniCAP system (Phadia, Portage, MI). Sensitization was defined as having the allergen-specific IgE ≥ 0.35 kU/L.

Pet Removal Due to Allergies

In the 18 year interview, teens and their parents were asked if pets were removed from the home for a reason other than death. If pets were removed, participants were asked the reason and responses were recorded as health related – not allergy (e.g.; animal bites, scratches); health related – allergy/asthma; and non-health reason.

Analytical Approach and Statistics

Odds ratios (OR) and relative risks (RR) with 95% confidence intervals (CI) were calculated. Kruskal-Wallis and Jonckheere-Terpstra tests were used to compare continuous variables across groups (group differences and trend tests, respectively). Associations between continuous variables were examined with Spearman correlations and linear regression models. Chi-square tests were used to calculate associations between categorical variables and atopy. Analyses were conducted for subgroups (sex, parental history of allergy, firstborn status, delivery type, presence of other animal) to address potential effect modification or confounding. Sample size constraints did not permit analyses by number of animals.

Final models were run excluding those who reported that they removed a dog (or cat) from the home because of health related-allergy reasons to see if the results changed. Analyses were first conducted for dog exposure and then separately for cat exposure.

RESULTS

The study population was comprised of 566 participants who provided blood samples and had information about their pet histories. Participants who completed the interview but provided no blood sample ($n=105$) did not differ from those who did provide blood samples ($n=566$) with respect to sex, pets in the first year of life, ever being exposed to pets, race, skin prick positive status at age 6 years, parental history of allergy, and whether or not they had a dog in the first year of life, had a cat in the first year of life or had a dog and cat in the first year of life (all Chi-square p values >0.05 , data not shown).

There were similar percentages of male and female participants (270 males, 296 females). Overall, 101 (17.8%) were sensitized to dogs and 116 (20.5%) were sensitized to cats. The rates of sensitization to dog and cat were similar in males and females (dog: $n=53$, 19.6%, and $n=48$, 16.2%, respectively; cat: $n=60$, 22.2%, and $n=56$, 18.9%, respectively). Of the teens, 297 (52.5%) had a parental history of allergy, 255 (45.1%) were firstborn and 426 (79.3%; 29 had missing delivery type) were born vaginally. Frequency of exposure patterns by dog and by cat are summarized in Table 1.

Critical Period - Exposure in the First Year

There were 184 (32.5%) teens with an indoor dog and 110 teens (19.4%) with an indoor cat in the first year of life. Among males but not females, those with an indoor dog in the first year of life had half the risk ($RR=0.50$, 95% confidence Interval=CI 0.27, 0.92) of being sensitized to dogs at age 18 compared to those who did not have an indoor dog in the first year (Table 2). A similar but not statistically significant association (relative risk) was found among firstborn teens ($RR=0.54$, 95% CI 0.27, 1.09). Also, teens born via c-section were far less likely than those born vaginally to be sensitized to dogs if they lived with at least one dog in the first year of life ($RR=0.33$, 95%CI 0.07, 0.97). There were no other statistically significant relative risks for sensitization to dog in any of the subgroups, including whether or not they had a parental history of allergy (Table 2).

Overall, teens with an indoor cat in the first year of life had half the risk ($RR=0.52$, 95% CI 0.31, 0.90) of being sensitized to cats at age 18 compared to those who did not have an indoor cat in the first year (Table 2). While the associations were only statistically significant among children who had a parental history of allergy ($RR=0.55$, 95% CI 0.30, 1.00), those who were not firstborn ($RR=0.33$, 95% CI 0.12, 0.85) and those born vaginally ($RR=0.50$, 95%CI 0.26, 0.95), the stratum specific estimates were not different from those who were not children of parents with allergic histories ($RR=0.41$, 95%CI 0.13, 1.27), firstborn ($RR=0.81$, 95%CI 0.41, 1.59), or those who were delivered via c-section ($RR=0.69$, 0.26, 1.83), respectively (Table 2). Thus, the overall effect did not depend on any individual subgroup.

Other Potential Critical Periods – Multiple Age Groups

In the examination of specific periods of exposure, adjusting for the other periods of exposure, only exposure to indoor dogs in the first year among males (adjusted OR= $aOR=0.38$, 95% CI 0.17, 0.85) and firstborn teens ($aOR=0.36$, 95% CI 0.14, 0.90) were associated with decreased risks of being sensitized to dogs at age 18 years (Table 3). Exposure in the first year also approached statistical significance in the children born via c-section ($aRR=0.28$, 95%CI 0.06, 1.19).

The importance of exposure in the first year also persisted for cats among all teens ($aOR=0.42$, 95%CI 0.21, 0.87). Again, although certain subgroups had significant associations, the stratum specific estimates were similar: those with a parent with a history of allergies ($aOR=0.30$, 95%CI 0.13, 0.74) and those without ($aOR=0.46$, 95%CI 0.11, 1.87); teens who were not firstborn ($aOR=0.27$, 95%CI 0.09, 0.86) and teens that were ($aOR=0.60$, 95%CI 0.22, 1.61); those delivered vaginally ($aOR=0.37$, 95%CI 0.16, 0.85) versus those delivered via c-section ($aOR=0.66$, 95%CI 0.14, 3.13); and those who ever had a dog ($RR=0.43$, 95%CI 0.20, 0.93) and those who never had a dog ($RR=0.42$, 95% CI 0.06, 2.75) (Table 4).

Cumulative Exposure

Cumulative exposure was not associated with risk of specific sensitization to the same animal allergen overall or for any subgroup (Table 5).

Analyses Excluding those who Removed a Dog or Cat

Only 11 families reported removing a pet from the home for health reasons related to allergy or asthma. The results were unchanged after removing these teens from our analyses.

DISCUSSION

While exposure to dogs and cats was not associated with overall sensitization in our study population [2], exposure to a dog or cat in the first year of life was associated with a decreased likelihood of sensitization to the allergens of that animal. However, an effect was seen for cats among all teens, while the effect of dog exposure was focused in a few subgroups (males, delivery via c-section).

While the mechanisms that mediate the role of pet exposure in allergy development are still unexplained, we hypothesized that pet ownership is associated with exposure to distinct, more broadly diverse bacterial populations (as assessed by increased richness, evenness and diversity) in household dust, and that these exposures influence bacterial colonization of the infant gastrointestinal tract, maturation of immune responsiveness, and development of allergen-specific sensitization, total IgE, allergy and atopic asthma.[24,28] While supporting the hypothesis with respect to total IgE, our results did not support this premise with respect to the outcome of overall sensitization at age 18 years.[2] However, there is likely a separate, but probably not completely independent, mechanism associated with sensitization to some specific allergen exposures. In our data, only exposure in the first year was associated with decreased risk of sensitization. Perhaps, a concomitant exposure to high levels of allergen and innate immune stimuli are necessary to confer a protective effect on sensitization. This argues for the importance of the timing of the exposure with respect to early life immune development and perhaps explains some of the discrepancies in the literature involving studies in which the timing of animal exposures was not precisely defined.

Based on their cross-sectional analyses of 226 children, Platts-Mills et al. suggest that a modified Th2 response could be responsible for exposure to cat allergen in which IgG and IgG4 antibodies are produced without IgE sensitization or risk of asthma.[8] We do not think that our current results are in opposition to this theory. We look forward to directly and thoroughly testing this hypothesis in the future as our analyses of IgG and IgG4 antibodies at ages 18–20 years reach completion.

The effects seen in the subgroups are interesting and not readily explained. Living with indoor dogs in the first year was only protective among males. In our earlier publication about the children at age 6 years, we reported that allergic sensitization was less frequent in boys exposed to two or more dogs in the first year of life.[1] Perhaps different gender-specific styles of interaction with the dog or gender differences in behaviors which, in turn, affect a child's exposure to dog allergen or other elements related to the dog that could affect subsequent risk of sensitization to dogs.

Most interesting are the differences seen for dog sensitization by delivery type. C-sections have recently come under scrutiny for their role in allergic disease causation. The mechanism is not known but has been hypothesized to be related to a critical exposure to the vaginal microbial environment during normal delivery resulting in microbial stimulation of the innate immune system or colonization of the respiratory and gastrointestinal tract with diverse bacteria being “protective” against subsequent development of allergies. Children born via c-section may have different gut microbes than children born vaginally. Ly et al. argue that children born vaginally swallow their mother's vaginal microbes during birth and through this process, acquire most of their own intestinal microbes.[29] Thus, children born via c-section would not have the same exposure to the mother's vaginal microbes and the children could have different immune responses in early life dependent on delivery type. Perhaps children born via c-section acquire a higher proportion of their microbes from

household (dust) exposures compared to children born vaginally, because vaginally born children have already been exposed to a broad array of microbes during birth.

Our methods are not quite comparable to those used in recent analyses of the longitudinal Dunedin cohort in which participants were followed to age 32 years.[3] The authors reported a lowered risk of atopy in childhood and young adulthood in those who had a dog and cat at some point in their youth (through age 9 years), however, their exposure history was not collected prospectively during early childhood.[3] We examined different time periods in our analyses and we observed protective effects of dogs and cats for animal specific sensitization without examining interactions between dogs and cats. In our study population, only 43 of the teens had both an indoor dog and indoor cat in their first year of life.

Other prior cohort studies have reported mixed results with some reporting that early life cat exposure is associated with the decreased frequency of sensitization to cat in school-aged children [30] and others reporting the opposite effect [16]. Perzanowski et al. reported that in a cohort of school-aged Swedish children, in a community where cat sensitization was strongly associated with asthma, owning a cat was protective against both prevalent and incident asthma. [12] The results have generally been more consistent in their demonstration of either no effect or a protective effect of dogs on allergic outcomes. [12,16,31,32] Overall, the evidence from prior studies is mixed and has been hampered by its inclusion of high risk participants (reducing ability to generalize and compare results), cross-sectional analyses and case-control studies.[31, 32] Our population based birth cohort maximizes use of our 18 years of longitudinal data.

Limitations for study of pets in this cohort persist from our earlier analyses of pets and overall sensitization. [2] These limitations include incomplete follow-up data on all participants enrolled in the original study; use of parental allergic history that was based on maternal report; no lifetime measurements of the participants' actual exposures to dog or cat allergen – through inhalation, ingestion or other routes; and, recall of pet exposure from ages 6–18 years. However, use of parental report of their allergic histories is not unique in cohort studies [3,6] and we reasonably assume that pet recall from ages 6–18 is fairly accurate given our prior demonstration of the CAS teens' very good recall of pets they had in their first 6 years of life.[33]

Additionally, while we controlled for parental history of allergy in the analyses, a parental history of allergy is not necessarily specific for dog or cat allergy. Individuals with severe pet allergy may be more likely to avoid pets at home. Conversely, parents with allergies to things other than pets would not benefit from pet avoidance. Thus, exposure to pets could be less common in homes of children who may be at an inherently higher risk of developing dog or cat allergy.

These analyses have multiple strengths. We used widely accepted analytical methods and our ability to consider exposures in multiple ways is novel. The approach of examining animal-specific exposure to animal-specific allergen sensitization over a long period of time is a great asset. We think that the results provide a unique and substantial contribution in understanding the role of pets in allergic disease development.

Dog and cat exposure has been reported to be associated with recurrent asthma exacerbation in sensitized individuals.[34] By preventing sensitization, hopefully exacerbations would be reduced or eliminated. In our cohort, early life exposure to dogs or cats was not associated with increased risk of sensitization to that animal but rather to a reduced risk of sensitization in many individuals. Additionally, the first year of life is the only time during childhood when indoor exposure to dogs or cats influences sensitization to these animals. An insightful and logical next step would be to further delineate the effects of pets on immune

development during smaller time windows (e.g.; the first month, the first three months) in the first year of life.

Acknowledgments

This work was funded by the Fund for Henry Ford Hospital and NIAID (R01AI051598).

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Table 1

Number of participants by combination of ages at pet exposure.

First Year	Age 1–5 years	Age 6–12 years	13+ Years	Dog Exposure N (% of all)	Cat Exposure N (% of all)
Yes	Yes	Yes	Yes	129 (22.8)	61 (10.8)
Yes	Yes	Yes	No	11 (1.9)	8 (1.4)
Yes	Yes	No	Yes	14 (2.5)	11 (1.9)
Yes	Yes	No	No	10 (1.8)	19 (3.3)
Yes	No	Yes	Yes	12 (2.1)	5 (0.9)
Yes	No	Yes	No	0	1 (0.2)
Yes	No	No	Yes	5 (0.9)	0
Yes	No	No	No	3 (0.5)	5 (0.9)
No	Yes	Yes	Yes	89 (15.7)	56 (9.9)
No	Yes	Yes	No	5 (0.9)	7 (1.2)
No	Yes	No	Yes	16 (2.8)	11 (1.9)
No	Yes	No	No	10 (1.8)	17 (3.0)
No	No	Yes	Yes	83 (14.7)	48 (8.5)
No	No	Yes	No	2 (0.3)	18 (3.2)
No	No	No	Yes	39 (6.9)	28 (5.0)
No	No	No	No	138 (24.4)	271 (47.9)

Table 2

Relative risks (95% confidence intervals) of sensitization to the specific animal at 18 years associated with exposure to that animal in the first year. *

	Sensitized to dog RR (95% CI)	Sensitized to cat RR (95% CI)
N	566	566
All Teens	0.88 (0.59–1.29)	0.52 (0.31–0.90)
Male n=270	0.50 (0.27–0.92)	0.45 (0.19–1.07)
Female n=296	1.48 (0.87–2.49)	0.59 (0.30–1.19)
No Parental History of Allergy n=269	0.59 (0.28–1.25)	0.41 (0.13–1.27)
Parental History of Allergy n=297	1.09 (0.70–1.70)	0.55 (0.30–1.00)
Not Firstborn n=311	1.19 (0.75–1.91)	0.33 (0.12–0.85)
Firstborn n=255	0.54 (0.27–1.09)	0.81 (0.41–1.59)
Vaginal birth n=426	1.01 (0.66–1.56)	0.50 (0.26–0.95)
C-section n=111	0.33 (0.07–0.97)	0.69 (0.26–1.83)
Had other kind of animal in home (cat and dog) n=110 and n=184, respectively	0.62 (0.21–1.86)	0.63 (0.28–1.42)
Had no other kind of animal in home (cat and dog) n=456 and n=382, respectively	0.95 (0.63–1.44)	0.46 (0.22–0.95)

* Sensitization is defined as dog- or cat-specific IgE ≥ 0.35 kU/L;

Table 3

Logistic regression models of sensitization to dog at 18 years and timing of dog exposure.*

	Number sensitized to dog	Odds ratio	95% CI	p
All teens	101			
1 st year	30	0.79	0.45 – 1.36	0.39
1–5	52	1.36	0.78 – 2.37	0.28
6–12	55	0.71	0.39 – 1.29	0.26
13+	68	1.12	0.60 – 2.07	0.72
Male teens	53			
1 st year	11	0.38	0.17 – 0.85	0.019
1–5	25	1.13	0.53 – 2.41	0.76
6–12	27	0.70	0.32 – 1.55	0.38
13+	38	1.86	0.78 – 4.43	0.16
Female teens	48			
1 st year	19	1.54	0.70 – 3.36	0.28
1–5	27	1.55	0.67 – 3.61	0.31
6–12	28	0.71	0.27 – 1.86	0.48
13+	30	0.73	0.30 – 1.78	0.49
No parental history of allergy	34			
1 st year	8	0.47	0.19 – 1.18	0.11
1–5	19	1.90	0.80 – 4.55	0.15
6–12	16	0.70	0.26 – 1.89	0.48
13+	21	0.85	0.31 – 2.36	0.76
Parental history of allergy	67			
1 st year	22	1.12	0.53 – 2.35	0.76
1–5	33	1.19	0.55 – 2.59	0.66
6–12	39	0.60	0.27 – 1.33	0.21
13+	47	1.38	0.63 – 3.05	0.42
Not firstborn teens	61			
1 st year	21	1.34	0.66 – 2.71	0.42
1–5	33	1.25	0.59 – 2.67	0.56
6–12	34	0.64	0.27 – 1.54	0.32
13+	39	0.92	0.40 – 2.10	0.84
Firstborn teens	40			
1 st year	9	0.36	0.14 – 0.90	0.029
1–5	19	1.57	0.68 – 3.64	0.29
6–12	21	0.74	0.31 – 1.74	0.49
13+	29	1.68	0.65 – 4.32	0.28
Vaginal birth	76			
1 st year	25	0.86	0.46 – 1.61	0.64
1–5	42	1.45	0.76 – 2.75	0.26
6–12	44	0.76	0.37 – 1.56	0.46

	Number sensitized to dog	Odds ratio	95% CI	p
13+	52	1.22	0.59 – 2.53	0.58
C-section birth	22			
1 st year	3	0.28	0.06 – 1.19	0.08
1–5	8	1.20	0.34 – 4.23	0.77
6–12	9	0.56	0.16 – 1.91	0.35
13+	14	1.10	0.32 – 3.78	0.88
Ever had a cat	42			
1 st year	17	0.77	0.36–1.63	0.49
1–5	30	2.09	0.92–4.85	0.09
6–12	30	1.04	0.44–2.47	0.92
13+	35	1.63	0.61–4.38	0.33
Never had a cat	59			
1 st year	13	0.84	0.37–1.94	0.69
1–5	22	1.11	0.50–2.48	0.79
6–12	25	0.47	0.19–1.18	0.11
13+	33	1.19	0.48–2.94	0.71

* Dog sensitization is defined as ≥ 1 allergen-specific IgE ≥ 0.35 kU/L (Dog); Each odds ratio indicates the odds of being sensitized among those exposed at that age versus those not exposed at that age controlling for exposure during the other age groups.

Table 4

Logistic regression models of sensitization to cat at 18 years and cat exposure.

	Number sensitized to cat	Odds ratio	95% CI	p
All teens	116			
1 st year	13	0.42	0.21 – 0.87	0.019
1–5	34	1.23	0.68 – 2.23	0.49
6–12	37	0.95	0.51 – 1.75	0.86
13+	40	0.89	0.49 – 1.63	0.71
Male teens	60			
1 st year	5	0.35	0.11 – 1.13	0.080
1–5	12	1.09	0.43 – 2.74	0.86
6–12	18	1.22	0.53 – 2.82	0.64
13+	18	0.85	0.38 – 1.91	0.70
Female teens	56			
1 st year	8	0.47	0.19 – 1.18	0.11
1–5	22	1.47	0.66 – 3.28	0.35
6–12	19	0.73	0.30 – 1.79	0.49
13+	22	0.97	0.39 – 2.39	0.94
No parental history of allergy	37			
1 st year	3	0.46	0.11 – 1.87	0.28
1–5	9	0.70	0.26 – 1.90	0.48
6–12	12	0.86	0.32 – 2.29	0.76
13+	14	1.23	0.47 – 3.19	0.67
Parental history of allergy	79			
1 st year	10	0.30	0.13 – 0.74	0.009
1–5	25	2.03	0.92 – 4.50	0.079
6–12	25	1.10	0.47 – 2.57	0.82
13+	26	0.70	0.30 – 1.63	0.41
Not firstborn teens	73			
1 st year	4	0.27	0.09 – 0.86	0.026
1–5	17	0.96	0.45 – 2.04	0.92
6–12	22	1.08	0.48 – 2.44	0.85
13+	24	0.92	0.42 – 2.03	0.84
Firstborn teens	43			
1 st year	9	0.60	0.22 – 1.61	0.31
1–5	17	1.86	0.70 – 4.94	0.21
6–12	15	0.77	0.29 – 2.05	0.60
13+	16	0.82	0.31 – 2.17	0.69
Vaginal birth	86			
1 st year	9	0.37	0.16 – 0.85	0.019
1–5	27	1.30	0.67 – 2.51	0.43
6–12	31	1.27	0.62 – 2.61	0.51

	Number sensitized to cat	Odds ratio	95% CI	p
13+	32	0.74	0.36 – 1.51	0.41
C-section	24			
1 st year	4	0.66	0.14 – 3.13	0.60
1–5	7	1.26	0.30 – 5.30	0.75
6–12	6	0.53	0.12 – 2.38	0.40
13+	7	1.27	0.31 – 5.28	0.74
Also had a dog with the cat	85			
1 st year	11	0.43	0.20–0.93	0.033
1–5	29	1.28	0.66–2.46	0.47
6–12	31	0.96	0.49–1.88	0.91
13+	34	0.96	0.49–1.85	0.90
Had no dog with the cat	31			
1 st year	2	0.42	0.06–2.75	0.36
1–5	5	1.06	0.26–4.38	0.93
6–12	6	1.01	0.19–5.25	0.99
13+	6	0.67	0.13–3.44	0.63

* Cat sensitization is defined as ≥ 1 allergen-specific IgE ≥ 0.35 kU/L (cat); Each odds ratio indicates the odds of being sensitized among those exposed at that age versus those not exposed at that age controlling for exposure during the other age groups.

Table 5

Odds ratios of animal sensitization at 18 years associated with exposure to cumulative number years ever lived with a dog or cat (N=566: All teens)

	Sensitized to dog RR (95% CI)	Sensitized to cat RR (95% CI)
N	566	566
All Teens	0.99 (0.96–1.02)	0.98 (0.95–1.01)
Male	0.98 (0.94–1.02)	0.98 (0.94–1.03)
Female	1.00 (0.96–1.05)	0.97 (0.93–1.02)
No Parental History of Allergy	0.97 (0.92–1.02)	0.97 (0.91–1.02)
Parental History of Allergy	1.00 (0.96–1.03)	0.98 (0.95–1.02)
Not Firstborn	0.98 (0.95–1.02)	0.97 (0.94–1.01)
Firstborn	1.00 (0.95–1.05)	0.98 (0.94–1.03)
Vaginal birth	1.00 (0.97–1.04)	0.98 (0.95–1.02)
C-section	0.95 (0.89–1.01)	0.98 (0.92–1.04)
Had other kind of animal in home (cat and dog)	1.03 (0.98–1.08)	0.98 (0.95–1.02)
Had no other kind of animal in home (cat and dog)	0.97 (0.93–1.00)	0.95 (0.89–1.02)

* Sensitization to dog is defined as dog-specific IgE ≥ 0.35 kU/L; sensitization to cat is defined as cat-specific IgE ≥ 0.35 kU/L.