Do asthma and allergy influence subsequent pet keeping? An analysis of childhood and adulthood

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Background: Asthma and allergy might influence the choice of keeping pets, leading to apparent protective effects of pets on allergic disease.
Objective: We investigated the effects of asthma and allergy on subsequent pet keeping in childhood and adulthood.
Methods: Information about asthma and pet keeping at ages 0 to 4, 5 to 15, 20 to 44, and 26 to 56 years was provided by 9812 subjects participating in the 9-year follow-up of the European Community Respiratory Health Survey.
Results: In childhood asthma debut at younger than 5 years was associated with less cat keeping at 5 to 15 years (odds ratio [OR], 0.60; 95% CI, 0.44-0.82), an effect only observed when the parents did not have asthma or allergy ($P_{interaction}$ = .045). Childhood asthma did not influence adult pet ownership, unless there were adult symptoms. Adults less often acquired cats at follow-up if they had 3 or more asthma symptoms (OR, 0.78; 95% CI, 0.64-0.95), were taking asthma medication (OR, 0.48; 95% CI, 0.31-0.74), had hay fever (OR, 0.75; 95% CI, 0.62-0.91), had atopy (OR, 0.75; 95% CI, 0.61-0.91), or had specific IgE to cat (OR, 0.57; 95% CI, 0.39-0.82) at baseline. Adults who already had pets usually continued keeping the same type of pet, except that the presence of 3 or more asthma symptoms was associated with less subsequent dog keeping (OR, 0.69; 95% CI, 0.53-0.89). Pet removal between surveys to reduce allergen was reported by 4.7%.
Conclusion: Selective avoidance subsequent to asthma or allergy was observed for childhood cat keeping and adult cat acquisition. Avoidance would produce an apparent protective effect of cats on childhood asthma (large OR, 0.83). Avoidance was generally not observed for dogs or birds.
Clinical implications: A part of the protective effects of childhood cats on asthma and allergy can be attributed to selective avoidance. (J Allergy Clin Immunol 2006;118:691-8.)

Key words: *Selective avoidance, pets, cats, dogs, birds, asthma, allergy, atopy, ECRHS*

Several epidemiologic studies have reported that asthma or allergy is less common among subjects who kept a pet in childhood.[1-19] This finding could be explained by true protective effects of pets because it is biologically plausible that exposure to pets under certain conditions might contribute to a nonallergic immunologic development by inducing tolerance[3,20,21] or through microbial stimulation.[2,22,23] On the other hand, this finding could be explained by selective avoidance because subjects at risk for asthma or allergy might tend to avoid keeping pets because of allergic symptoms or because of counseling from physicians and the media. Avoidance or removal of a pet because of allergy was reported by 1.7% and 12%, respectively, of parents in a Dutch children's study[24] and by 27% and 10%, respectively, of parents in a Swedish children's study.[17] Indirect signs of selective avoidance are reported in several studies.[2,5,6,18,19,25]

Correct counseling concerning pet keeping is essential for the primary prevention of asthma and allergy; however, good intervention studies of long-term effects of pets are difficult, if not impossible, to perform. Decisions are currently made based on findings from suboptimal studies, and further knowledge about selective avoidance would be most useful.

Abbreviations used
ECRHS: European Community Respiratory Health Survey
OR: Odds ratio

The European Community Respiratory Health Survey (ECRHS) collected information on pet keeping, asthma, and allergy during childhood, as well as adulthood. We used this opportunity to investigate whether asthma and allergy influenced subsequent pet keeping. Thus this analysis does not address the commonly investigated effects of pets on asthma but rather the contrary: the effects of asthma on later pet keeping. First, we investigated whether asthma debut in early childhood was of importance for pet keeping later in childhood and whether asthma and allergy in family members was of importance for avoidance behavior. Second, we studied whether childhood asthma influenced adult pet keeping. Third, we investigated whether symptoms of asthma and allergy, bronchial hyperreactivity, or sensitization to common allergens in adults predicted pet keeping after a 9-year follow-up period.

METHODS

In the ECRHS I[26] representative samples of adults aged 20 to 44 years were selected in 48 centers in 22 countries during the period from 1991 through 1993. A total of 137,619 subjects (median response rate, 78%) completed a brief questionnaire concerning respiratory health (stage 1). In 38 centers a random sample of the responders was invited to further investigation (stage 2), including an interviewer-administered questionnaire, bronchial reactivity, and serum IgE measurements. Most centers included an additional symptomatic sample in stage 2. Altogether, 21,809 subjects (median response rate, 65%) participated.

The ECRHS II is the follow-up of the participants in stage 2 of the ECRHS I, taking place from 1998 through 2002.[27] Twenty-nine centers took part in the ECRHS II, which used data collection methods similar to those in the ECRHS I stage 2. Of 14,681 invited subjects, 11,168 (76%) participated. The mean follow-up time was 8.9 years (interquartile range, 8.3-9.5 years). Informed consent was obtained from all participants, and all the involved ethics committees approved the study. The full protocol can be found at www.ecrhs.org.

Subjects who participated in both surveys were the target population for our analysis. Three centers (Geleen, Caerphilly, and Melbourne) did not obtain information on childhood pet keeping in the second survey and were therefore excluded. Thus 9812 subjects from 26 centers, including 8287 subjects from the random sample and 1525 from the symptomatic sample, were analyzed.

Study design

Information was available for 4 age periods, 2 in childhood (information collected retrospectively from adults) and 2 in adulthood. The effects of asthma and allergy on subsequent pet keeping were analyzed for 3 age spans:

1. within childhood: effects of asthma debut at age 0 to 4 years on pet keeping at age 5 to 15 years;
2. transition from childhood to adulthood: effects of asthma debut in childhood (age 0-15 years) on pet keeping in adulthood (age 20-44 years, ECRHS I);
3. within adulthood: effects of symptoms of asthma and allergy, bronchial hyperreactivity, and atopy at baseline (ECRHS I,

age 20-44 years) on pet keeping at follow-up (ECRHS II, age 26-56 years) and on pet removal during follow-up.

Although the analyses of adulthood were based on a true longitudinal study design, the analyses of childhood were based on retrospective data. All periods were longitudinally analyzed in the sense that the effects of asthma at t_0 on pet keeping at a later age, t_1, were investigated.

Exposure: Asthma and allergy

In a face-to-face interview the subjects were asked whether they had ever had asthma and at what age they had their first asthma attack. Asthma debut at age 0 to 4 years was defined as having had a first asthma attack before the age of 5 years and childhood asthma as having had a first asthma attack before 15 years.

Wheeze was defined as having had wheezing or whistling in the chest during the last 12 months, *asthma medication* as currently using asthma medication, and *3 or more asthma symptoms* as responding positively to 3 or more of the 8 available questions concerning asthma symptoms during the last 12 months[28]: wheeze, wheeze with shortness of breath, wheeze without a cold, waking with tightness in the chest, shortness of breath at rest during daytime, shortness of breath after strenuous activity, waking with shortness of breath, and waking with a cough.[28] *Hay fever* was defined as having hay fever or nasal allergies.

Methacholine challenge was conducted with a dosimeter (Mefar, Brescia, Italy). The degree of bronchial responsiveness was expressed as ECRHS slope,[29] and the 25% most reactive subjects were defined as bronchially hyperresponsive (ECRHS slope <6.34).

Specific IgEs were measured with the Pharmacia CAP system.[30] Assay results for specific IgE were considered positive when in excess of 0.35 kU/L of the specific allergen. Atopy was defined as specific IgE to cat dander, house dust mite (*Dermatophagoides pteronyssinus*), timothy grass, and/or *Cladosporium herbarum*.

Outcome: Pet keeping

Information on the cumulative prevalence of childhood pet keeping was obtained retrospectively through a face-to-face interview in the ECRHS II. The subjects were asked the following questions: "Was there a cat in your home during your first year of life? When you were aged 1 to 4 years? When you were aged 5-15 years?" (and likewise for dog and bird).

Information on point prevalence of current adult pet keeping was obtained from interview data in the ECRHS I and II. At both surveys, the subjects were asked, "Do you keep a cat?," and likewise for dog and bird. A question about pet removal between surveys was included in the ECRHS II (except the Spanish and Swedish centers): "Have you taken any of the following measures to reduce allergen or exposure to allergen in your home since last survey? Sold, given away or destroyed a pet dog or cat?"

Covariates

Childhood factors. Sibship size, maternal and paternal asthma/allergy, and maternal and paternal smoking was reported in the ECRHS I and moving house at less than 5 years of age ("How many times did you move house during the first five years of your life?") and area of growing up (inner city, suburb, small town, rural village, or farm) was reported in the ECRHS II.

Adult characteristics. Adult socioeconomic status was defined based on the longest-held occupation between surveys and classified into 6 categories: managers and professionals–nonmanual; technicians and associate professionals; other nonmanual; skilled manual; semiskilled or unskilled manual; and unclassifiable. Smoking as reported in the ECRHS II was categorized as current smoking, exsmoking, and never smoked. Information on moving house between surveys was available in the ECRHS II.

Statistical analysis

Continuation (keeping a pet at follow-up in subjects who kept the same type of pet at baseline) and *acquisition* (pet keeping at follow-up in a subject who did not have a cat, dog, or bird at baseline) of a pet were assumed to be subject to different behavioral patterns and were investigated separately.

The effects of asthma/allergy at t_0 on pet keeping at t_1 were analyzed by using multiple logistic regressions. Analyses of determinants for pet keeping in childhood were adjusted for related childhood factors.[3,31] Adult characteristics were not related to childhood pet keeping and therefore not included in final models. Analyses of determinants for adult pet keeping were adjusted for age, sex, social class, moving house between surveys, and center. Childhood factors were not associated with adult pet keeping and therefore not included in final models. Center-unadjusted analyses are not presented because both exposure and outcome varied substantially by center. Meta-analyses according to Dersimonian and Laird[32] were used to investigate potential heterogeneity between countries in the associations between asthma/allergy and subsequent pet keeping.

RESULTS

The prevalence of asthma, allergy, and pet keeping by age is presented in Table I.

Within childhood

Subjects who kept a pet early in childhood usually continued keeping the same type of pet when 5 to 15 years of age, whereas acquisition of a pet was less common (Table II; ie, 84% continued keeping a cat, whereas only 23% of those with no cat acquired one). Cat keeping at age 5 to 15 years (both continuation and acquisition) was significantly less common in subjects with asthma debut at age 0 to 4 years compared with those without childhood asthma. Continuation of a dog also appeared to be less common in those with early asthma, but this effect did not reach statistical significance. The associations of childhood cats and dogs with early childhood asthma did not differ significantly between countries (cats: $P_{\text{heterogeneity}} = .5$; dogs: $P_{\text{heterogeneity}} = .2$).

Maternal or paternal asthma/allergy was not associated with less cat keeping in childhood (data not given) but modified the effect of early asthma debut on cat keeping in childhood: continuation of a cat was less common subsequent to early asthma in those with no family history (odds ratio [OR], 0.24; 95% CI, 0.10-0.56), whereas no avoidance was observed among those with parental asthma/allergy (OR, 1.16; 95% CI, 0.33-4.06; $P_{\text{interaction}} = .045$). The patterns were similar for cat acquisition, but the interaction term was not significant.

Childhood pet keeping was determined by childhood factors and not by adult characteristics (data not given). Childhood cats were significantly more common in subjects from large families or growing up in rural areas, whereas subjects who moved house before 5 years more often acquired and less often continued keeping a cat; similar patterns were observed for dog keeping.

A crude OR of 0.66 was calculated for the association between cat keeping at age 0 to 4 years and asthma debut at

TABLE I. Prevalence of exposure and outcome variables by age: age of asthma debut as reported retrospectively in the ECRHS II, cumulative pet keeping in childhood age 0 to 4 years and age 5 to 15 years as reported retrospectively in the ECRHS II, and current pet keeping in adulthood as reported in the ECRHS I and ECRHS II

		Childhood		Adulthood	
		0-4 y	5-15 y	20-44 y ECRHS I	26-56 y ECRHS II
	No. with data	N (%)	N (%)	N (%)	N (%)
Asthma and allergy					
Asthma debut	9786	239 (2.4%)	391 (3.9%)		
Wheeze	9801			2637 (27%)	
≥3 Asthma symptoms*	9693			2345 (24%)	
Asthma symptoms near pets	9488			952 (10%)	
Asthma medication	9769			576 (5.9%)	
BHR >75th percentile	7458			1786 (24%)	
Hay fever	9759			2770 (28%)	
Nose/eye symptoms near pets	9490			1576 (17%)	
Atopy†	8128			2602 (32%)	
Specific IgE to cat	8128			861 (11%)	
Pets					
Cat	9569-9784‡	2432 (27%)	3777 (39%)	1773 (18%)	1963 (21%)
Dog	9564-9786‡	2178 (24%)	3670 (38%)	1461 (15%)	1722 (18%)
Bird	9555-9785‡	1392 (15%)	3522 (37%)	1100 (11%)	739 (7.7%)
Removed pet to reduce allergen between surveys	5507				260 (4.7%)

BHR, Bronchial hyperreactivity.
*Three or more of the following asthma symptoms: wheeze, wheeze with shortness of breath, wheeze without a cold, waking with tightness in the chest, shortness of breath at rest during daytime, shortness of breath after strenuous activity, waking with shortness of breath, and waking with a cough.
†Specific IgE to cat, timothy grass, house dust mite, and/or *Cladosporium* species.
‡Varying number of missing for each age group.

TABLE II. Effect of asthma debut in early childhood on subsequent childhood pet keeping: cumulative prevalence of pet keeping at age 5 to 15 years in relation to asthma debut at age 0 to 4 years according to pet keeping at age 1 to 4 years

Asthma debut 0-4 y	No.	Pet keeping	OR (95% CI)*
		Cat age 5-15 y	
Cat age 1-4 y–continuation			
No	2117	84%	1
Yes	34	69%	0.43 (0.22-0.84)
No pet age 1-4 y–acquisition			
No	5266	23%	1
Yes	128	16%	0.54 (0.33-0.90)
		Dog age 5-15 y	
Dog age 1-4 y–continuation			
No	2137	86%	1
Yes	56	75%	0.58 (0.30-1.13)
No pet age 1-4 y–acquisition			
No	5230	23%	1
Yes	128	24%	0.98 (0.63-1.52)
		Bird age 5-15 y	
Bird age 1-4 y–continuation			
No	1453	88%	1
Yes	40	78%	1.03 (0.41-2.60)
No pet age 1-4 y–acquisition			
No	5209	29%	1
Yes	129	22%	0.70 (0.46-1.09)

*Multivariable logistic regression analysis with adjustment for moving house before age 5 years, sibship size, area of growing up, parental smoking, and center.

age 0 to 4 years (numbers from Table II). By applying an extent of avoidance as described in Table II, an OR of 0.55 was calculated. Given a true association between cat keeping and asthma of 1.00, an OR of 0.83 would be measured because of selective avoidance (calculations are given in Appendix E1 in the Online Repository at www.jacionline.org).

Transition from childhood to adulthood

During the transition from childhood to adulthood, continuation of a pet was much less common, and acquisition of a pet was less common than within childhood or within adulthood (Table III). There was no indication that asthma debut in childhood influenced the choice of keeping a pet in adulthood in the overall study population (Table III).

Within adulthood

Almost 60% of adults with a cat at baseline kept a cat 9 years later, whereas about 12% had acquired one at follow-up (Table IV). Subjects with symptoms of asthma and allergy, atopy, or specific IgE toward cat at age 20 to 44 years less often acquired a cat during follow-up. Disease status did not significantly influence continuation of cat keeping (Table IV).

Stratification by childhood asthma showed that acquisition of cats subsequent to adult symptoms was avoided among subjects with a history of childhood asthma (wheeze: OR of 0.30, 95% CI of 0.12-0.78; asthma symptoms: OR of 0.40, 95% CI of 0.16-1.01) but less so among those without childhood asthma (wheeze: OR of

0.97, 95% CI of 0.80-1.18; asthma symptoms: OR of 0.88, 95% CI of 0.71-1.09). The interaction of childhood asthma with adult symptoms was significant (wheeze: $P_{interaction} = .006$; asthma symptoms: $P_{interaction} = .063$).

People tended to continue keeping dogs (55%), whereas acquisition of a new dog was less common (10%). Disease status at baseline was not significantly associated with dog keeping at follow-up, with the exception that subjects with 3 or more asthma symptoms would less often continue keeping dogs (OR, 0.69; 95% CI, 0.53-0.89; see Table E1 in the Online Repository at www.jacionline.org).

Continuation of bird keeping (27%) was much less common than continuation of cats and dogs. Disease status at baseline was not significantly associated with bird keeping at follow-up; continuation of birds appeared to be slightly more common subsequent to asthma and allergy, but this was not statistically significant (see Table E1 in Online Repository at www.jacionline.org).

Adult cat and dog keeping was more common in subjects who had not moved house between surveys, in current smokers, and in the older groups of our study population. Women more often acquired or continued keeping cats (data not given).

Two hundred sixty (4.7%) subjects reported that they had removed a cat or dog between surveys to reduce allergen in the home, including 8.5% of baseline dog keepers and 7.1% of baseline cat keepers. Several measures of disease status were significantly associated with subsequent pet removal, and the strongest association was observed for symptoms of asthma or allergy when near pets (Table V).

The associations of disease status with subsequent pet keeping were consistent between centers for most exposures; consistent differences in avoidance behavior between centers were not observed. Analyses including only the random sample were performed for adult wheeze, asthma symptoms, and atopy and gave the same results as when all subjects were included.

TABLE III. Effect of asthma debut in childhood on adult pet keeping: point prevalence of pet keeping at the ECRHS I (age 20-44 years) in relation to asthma debut at age 0 to 14 years according to pet keeping at age 0-14 years

Childhood asthma	No.	Pet keeping	OR (95% CI)*
		Cat 20-44 y	
Childhood cat–continuation			
No	3967	25.2%	1
Yes	252	26.6%	0.86 (0.63-1.17)
No childhood pet–acquisition			
No	2502	13.1%	1
Yes	167	12.0%	0.96 (0.58-1.58)
		Dog 20-44 y	
Childhood dog–continuation			
No	3778	21.9%	1
Yes	257	24.9%	1.13 (0.83-1.53)
No childhood pet–acquisition			
No	2504	9.5%	1
Yes	167	7.8%	0.87 (0.48-1.59)
		Bird 20-44 y	
Childhood bird–continuation			
No	3472	16.2%	1
Yes	240	14.2%	1.01 (0.68-1.49)
No childhood pet–acquisition			
No	2503	8.1%	1
Yes	167	7.2%	1.09 (0.58-2.04)

*Multivariable logistic regression analysis with adjustment for moving house between surveys, age, sex, smoking, social class, and center.

DISCUSSION

In this longitudinal analysis of a multicultural population, selective avoidance of pets subsequent to asthma and allergy was observed both in childhood and adulthood. Although this was very consistent for cat in childhood and cat acquisition in adulthood, avoidance was generally not observed with regard to dogs and birds. Parental asthma or allergy did not influence childhood cat keeping directly but rather by modifying the effect of early-onset asthma in the direction opposite of what might have been suspected; avoidance in childhood was stronger in subjects with no family history. Childhood asthma did not influence adult cat keeping directly but rather by modifying the effect of adult symptoms; selective avoidance in adults was more pronounced among those with a history of childhood asthma. On the other hand, parents who kept cats in spite of their own asthma or allergy did so even if their child got asthma, and adults who already kept a cat continued to do so in spite of allergic disease.

Does selective avoidance account for the entire ''protective'' effects of pets early in life on asthma and allergy? In this study a crude OR of 0.66 was calculated for the association of asthma with pets in early childhood, whereas selective avoidance alone would only produce an effect of 0.83. Perzanowski et al[8] reported a negative association of cat keeping with asthma among Swedish children (relative risk, 0.49); if accounting for selective avoidance as presented above, a true protective effect of 0.59 can still be calculated ($0.49 * 1/0.83$). Thus although selective avoidance is certainly present, it appears to account for only a part of the protective effects of pets presented in the literature.

Adult reporting of asthma onset and childhood pets is likely to be subject to error. However, an analysis of the ECRHS showed that adult reporting of childhood pets was relatively reliable, and the observed misclassification was not differential with regard to asthma or allergy (unpublished data). Furthermore, it seems unlikely that error in reporting of age of asthma onset (Q14) should vary systematically with error in reporting of age of pet keeping (Q64-Q66), creating the observed patterns with differences between acquisition/continuation and among cats, dogs, and birds. Nondifferential misclassification, however, might have attenuated the effects toward the null. In the present study the OR of 0.66 for the association of cat with asthma in early childhood, attenuated to 0.79 on accounting for selective avoidance, represents an effect of

TABLE IV. Effect of adult asthma and allergy on subsequent adult pet keeping: prevalence of pet keeping at follow-up (ECRHS II, age 26-56 years) and association with disease status at baseline (ECRHS I, age 20-44 years) according to pet keeping at baseline (ECRHS I, age 20-44 years)

	Cat at baseline–continuation (n = 1725)§		No pet at baseline–acquisition (n = 6107)§	
Disease status at baseline	**Cat at follow-up (%)**	**OR (95% CI)***	**Cat at follow-up (%)**	**OR (95% CI)***
Wheeze				
No	58	1	12	1
Yes	54	0.85 (0.67-1.07)	11	0.85 (0.71-1.03)
≥3 asthma symptoms†				
No	58	1	12	**1**
Yes	54	0.82 (0.64-1.04)	10	**0.78 (0.64-0.95)**
Asthma symptoms near pets				
No	57	1	12	**1**
Yes	57	0.93 (0.64-1.35)	6.1	**0.34 (0.24-0.49)**
Asthma medication				
No	57	1	12	**1**
Yes	65	1.42 (0.92-2.20)	7.3	**0.48 (0.31-0.74)**
BHR >75th percentile				
No	56	1	12	1
Yes	57	0.94 (0.70-1.26)	11	0.85 (0.67-1.08)
Hay fever				
No	59	1	12	**1**
Yes	60	0.92 (0.74-1.16)	10	**0.75 (0.62-0.91)**
Nose/eye symptoms near pets				
No	58	1	12	**1**
Yes	51	0.76 (0.58-1.00)	8.5	**0.51 (0.39-0.65)**
Atopy‡				
No	58	1	12	**1**
Yes	55	0.87 (0.68-1.11)	10	**0.75 (0.61-0.91)**
IgE cat				
No	57	1	12	**1**
Yes	57	1.19 (0.82-1.73)	7.9	**0.57 (0.39-0.82)**

ORs with 95% CIs for associations with a *P* value of less than .05 are shown in bold.
BHR, Bronchial hyperreactivity.
*OR from multiple logistic regression with adjustment for moving house between surveys, age, sex, smoking, social class, and center.
†Three or more of the following asthma symptoms: wheeze, wheeze with shortness of breath, wheeze without a cold, waking with tightness in the chest, shortness of breath at rest during daytime, shortness of breath after strenuous activity, waking with shortness of breath, and waking with a cough.
‡Specific IgE to cat, timothy grass, house dust mite, and/or *Cladosporium* species.
§Number with information on the respective pet: numbers for each exposure and in multivariate analyses are lower because of a varying number of missing data for exposure or confounding variables.

0.70 when also taking into account nondifferential misclassification.

Several factors determined the occurrence of selective avoidance. *Type of pet* was most important because avoidance patterns were convincing for cats, indicated for dogs under certain conditions, and not observed for birds. *Previous pet keeping* was another important determinant. A previous pet was a much stronger predictor for subsequent pet keeping than disease status, both in childhood and adulthood. People appear to prefer taking asthma medication rather than getting rid of a beloved pet, which seems reasonable. When it comes to acquiring a new cat, however, asthma influences the choice. *The type of symptoms* was also of importance; that is, avoidance patterns with regard to adult acquisition of a cat were significantly more pronounced for asthma symptoms near pets than for just wheeze. *Parental asthma or allergy* played a modifying role for avoidance of pets in childhood. Although families with parental asthma or allergy did not keep less pets (as also observed in other studies[14]), the family history contributed to determining the consequences of a child's asthma, with the asthmatic parent less often avoiding pets subsequent to a child's asthma. Thus the stronger protective effects of cats on allergy often observed among those with allergic predisposition[2,5,8] is less likely to be explained by selective avoidance than protective effects among those not predisposed. This is contrary to the general belief, illustrating the importance of proper investigation of selective avoidance. *Childhood asthma* did not determine adult pet keeping in general but contributed to determine the consequences of adult symptoms, with childhood asthma favoring less cat acquisition subsequent to adult symptoms. Because childhood asthma played a limited role for adult pet keeping, transmission of selective avoidance from childhood to adulthood appears to be a small, although complex, problem.

TABLE V. Association of disease status in the ECRHS I with pet removal between the ECRHS I and ECRHS II (Note: the Spanish and Swedish centers did not have this information and were not included [n = 5507].)

Baseline disease status	Pet removal	Adjusted OR (95% CI)*
Wheeze		
No	4.4	1
Yes	5.8	1.30 (0.97-1.74)
≥3 Asthma symptoms		
No	4.5	1
Yes	6.1	1.44 (1.07-1.94)
Asthma symptoms near pets		
No	4.4	1
Yes	9.2	2.37 (1.64-3.43)
Asthma medication		
No	4.7	1
Yes	6.0	1.78 (1.06-3.29)
Ever asthma		
No	4.6	1
Yes	6.0	1.54 (1.07-2.23)
Childhood asthma (debut <15 years)		
No	4.7	1
Yes	5.1	1.24 (0.73-2.09)
BHR (>75th percentile)		
No	4.6	1
Yes	5.2	1.34 (0.95-1.89)
Hay fever		
No	4.4	1
Yes	5.8	1.57 (1.18-2.07)
Nose/eye symptoms near pets		
No	4.0	1
Yes	9.3	2.78 (2.04-3.78)
Atopy		
No	5.0	1
Yes	5.0	1.26 (0.94-1.70)
IgE, cat		
No	4.8	1
Yes	6.7	1.68 (1.03-2.73)

BHR, Bronchial hyperreactivity.
*OR from logistic regression with adjustment for moving house between surveys, age, sex, smoking, social class, and center.

Avoidance patterns were generally not observed for dogs or birds, which could reflect less symptoms related to these pets compared with cats, less awareness of potential symptoms, or emotional factors being stronger than the concern for asthma and allergy. Exposure to dogs appear to be associated with respiratory symptoms, although mostly nonallergic.[3,10] Patients might not be aware of this; alternatively, emotional factors or other health concerns might be more important for the choice of keeping a dog.

One might expect stronger avoidance patterns in more recent generations because of higher focus on asthma, allergy, and pets during the last decades. Such generational difference were not consistent and not significant: although there was a tendency that subjects born after 1960 less often acquired a cat subsequent to adult symptoms ($P_{interaction} = .052$), the same generation appeared to more often continue keeping a cat subsequent to their child's asthma ($P_{interaction} = .17$). There were no indicated differences with regard to cat continuation in adulthood or cat acquisition in childhood. Thus this study gives no evidence that selective avoidance is more pronounced in younger generations.

In conclusion, this study shows that under certain circumstances, persons avoid pets because of asthma and allergy. The clinician should know that this is relatively uncommon; asthma and allergy is often of limited importance for the choice of keeping a pet, and those who already keep pets usually continue to do so, particularly those who have decided to keep a pet in spite of their own or a family member's allergy. From a scientific point of view, however, the message is that selective avoidance is clearly present and must be taken into account when analyzing associations of pets with asthma and allergy. Selective avoidance appears to be of limited magnitude and most likely accounts for only a part of the described protective effects of pets on asthma and allergy.

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