

Four-year incidence of allergic sensitization among schoolchildren in a community where allergy to cat and dog dominates sensitization: Report from the Obstructive Lung Disease in Northern Sweden Study Group

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Background: Exposure to high levels of cat allergen might prevent sensitization.

Objective: We sought to measure the incidence of allergic sensitization among schoolchildren living in a dust mite- and cockroach-free environment and the associated risk factors.

Methods: In 1996, a longitudinal cohort was established in northern Sweden, including 2454 children aged 7 to 8 years. Children were skin tested, and the testing was repeated 4 years later. Questionnaires were completed yearly. Participation was 88% both in 1996 and 2000.

Results: The prevalence of positive skin test results increased from 20.6% at age 7 and 8 years to 30.4% at age 11 and 12 years, a cumulative incidence of 13.8%, and was significantly higher among boys. The incidence was highest for cat (6.0%), timothy grass (5.9%), dog (4.9%), and birch (3.6%). A family history of allergy was the major risk factor for both a positive skin test response at age 7 and 8 years (odds ratio [OR], 1.69; 95% CI, 1.36-2.10) and for development of a positive skin test response over the next 4 years (OR, 1.67; 95% CI, 1.23-2.28). A significant inverse association between cat and dog ownership and the prevalence of type 1 allergy was found, particularly for those children who had lived with a cat both before age 7 and 8 years and during the next 4 years (OR, 0.44; 95% CI, 0.31-0.61). A similar pattern, although not significant, was found for incident cases.

Conclusion: The high incidence of type 1 allergy at this age

was similar to reports from communities with mite and cockroach allergen. Despite cat and dog being the most common allergens of sensitization, keeping these animals at home was not associated with an increased risk for sensitization. (*J Allergy Clin Immunol* 2003;112:747-54.)

Key words: Allergic sensitization, prevalence, incidence, risk factors, schoolchildren

Quantifying the hypothesized increase in the prevalence of type 1 allergy has been difficult because both the methods and the allergen extracts used for assessing immediate hypersensitivity have altered. Nevertheless, several studies point to a recent increase in the prevalence of allergy.^{1,2}

The prevalence of type 1 allergy increases with increasing age and becomes highest among young adults.^{3,4} The preteenage years are thought to be an important time for the onset of allergy, and a report from Australia showed a 4-year cumulative incidence of a positive skin test response of 15% from age 8 to 12 years.⁵ However, studies have examined the incidence of allergic diseases mostly among young children.⁶

Much of the current literature concerning risk factors for allergic sensitization has been derived from cross-sectional studies, which are less informative than prospective studies. The strongest identified risk factor is a history of allergy in the family.^{7,8} Urban living has been reported to be a risk factor,^{7,9} even though a lower prevalence of positive skin test responses was found in a more polluted area.¹⁰ The number of older siblings^{11,12} has been reported to be inversely related to having a positive skin test response. The hygiene hypothesis has been extended to include other lifestyle factors that have been associated with a decreased prevalence of allergy: living on a farm,^{13,14} an anthroposophical lifestyle,¹⁵ and exposure to bacteria.¹⁶

Recent studies have suggested that living in a home with cats or dogs might protect against the development of type 1 allergy.^{6,17-20} Studies from the current cohort in Northern Sweden found an inverse association between pet ownership and type 1 allergy at age 7 and 8 years.⁷ Prospective follow-up over the next 3 years showed a decreased risk for incidence of asthma among cat owners.²⁰

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Abbreviations used

OR: Odds ratio
RR: Relative risk
SPT: Skin prick test

The cold, dry climate in the northernmost province of Sweden offers a unique allergen environment. Despite the lack of mite and cockroach allergen,²¹ the prevalence of asthma is similar to that in other areas in Europe and higher than that in southern Sweden.^{2,17} In 1996, the prevalence of allergic sensitization was 21% in the cohort of 7- and 8-year-old children.^{7,17} The aim of the present study was to evaluate the incidence of type 1 sensitization over 4 years and to examine the risk factors for sensitization, including cat and dog ownership.

METHODS

We used questionnaires and skin prick tests (SPTs). SPTs were performed at the beginning of the study and 4 years later. A questionnaire was completed yearly. Consent for SPTs was obtained from parents. The ethical committee at the University Hospital of Northern Sweden in Umeå approved the study.

Study population

In 1996, all children enrolled in the first and second grades (n = 2454) in schools in the municipalities of Kiruna and Luleå, Sweden, were invited to participate (ages 7 and 8 years). Four years later, all children, now in the fifth and sixth grades, were invited. The participation rate was 88% in both 1996 (n = 2149) and 2000 (n = 2155) and did not differ by sex and area. Studies of incidence were performed among the 1870 children who were tested both times.

SPTs

SPTs were carried out between February and April. The same nurse tested the children in Kiruna both times, whereas 2 nurses performed the tests in Luleå in 1996 and 2000, respectively. The nurses were trained together before the studies. SPTs were performed on the volar aspects of one forearm by using lancets. The allergens were birch, timothy grass, mugwort, dog, cat, horse, *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, *Cladosporium* species, and *Alternaria* species (Soluprick; ALK, Hørsholm, Denmark). The potency of the extracts was 10 HEP, except for the 2 molds, which were 1:20 wt/vol. Histamine, 10 mg/mL, and glycerol were used as positive and negative controls, respectively. A positive reaction was recorded if the wheal was 3 mm or larger after 15 minutes.²²

Serum collection

The SPT results from the children at age 7 and 8 years have been validated previously.²¹ In 2000-2001, sera were collected from a total of 923 children, all of the children in Kiruna and a random sample in Luleå. Specific IgE antibodies to cat, dog, birch, and timothy grass were measured by using the CAP system (Pharmacia Upjohn) at the University of Virginia, Charlottesville.

Questionnaire

The parental questionnaire included questions for screening of possible risk factors and was completed yearly. In 1996, we asked about current or earlier cat or dog ownership. After 1996, data about keeping cats or dogs were collected annually.

Definitions

A positive SPT response was defined as a wheal of 3 mm or larger to any of the tested allergens. Any positive SPT response was defined as a positive SPT response to at least one of the tested allergens. Incidence of sensitization was defined as a negative SPT response in 1996 but a positive SPT response in 2000. A respiratory infection was defined as a report of whooping cough, croup, pneumonia, or severe respiratory infection, including respiratory syncytial virus. Rural living was defined as living in the countryside or in villages with fewer than 500 inhabitants. A family history of allergy was defined as a report of allergy in the mother, father, or any sibling. Cat and dog ownership at different periods is shown in Fig 1.

Analysis

The incidence of any positive SPT response was expressed as the proportion of children with no positive SPT responses in 1996 but any positive SPT responses in 2000. The incidence of sensitization to a specific allergen was evaluated separately for each allergen.

Statistical analyses were performed by using SPSS and Epi-info. χ^2 tests were used for bivariate comparisons. Risk ratios (RRs) with 95% CIs were calculated for determinants of positive SPT responses. Multiple logistic regression analysis was performed by using the independent variables that were significantly associated with positive SPT responses in the bivariate analyses. The effect of having a cat or dog was compared with results in those who never had a cat or dog at home. In the analysis of the effect of cat or dog ownership, the children who had answered the specific questions about having a cat or dog at home every year were included. Nonresponse to specific questions was 0% to 7%. The dependent variables were prevalent and incident cases of positive SPT responses.

RESULTS**Prevalence and incidence**

The prevalence of a positive SPT response to any of the tested allergens was 20.6% at age 7 and 8 years and had increased to 30.4% by age 11 and 12 years. At both ages, the most common allergen was cat, followed by dog, birch, and timothy grass (Fig 2). The prevalence of any positive SPT response at age 11 and 12 years among the 1870 children who were tested twice was 30.8%.

The cumulative incidence of any positive SPT response during the 4-year period was 13.8% among the 1478 children with a negative SPT response to all tested allergens in 1996. Examining the specific allergens, the incidence was highest for cat (6.0%) and timothy grass (5.9%), followed by dog (4.9%) and birch (3.6%; Table I).

The incidence of sensitization to specific allergens was higher when calculated independently of the child's status to other allergens at age 7 and 8 years and was highest for dog (10.4%), followed by timothy grass (9.7%), cat (8.8%), and birch (7.5%), whereas it was low for mite and mold (Table II).

Validation of the skin tests

The correlations between positive SPT responses and specific IgE levels were high. By using the serum assay as the true value (positive = >0.35 IU IgE/mL), the sensitivity and specificity of the SPTs for cat were 95.3% and 90.1%, respectively. The corresponding values for dog were 88.9% and 88.3%, values for birch were 84.8%

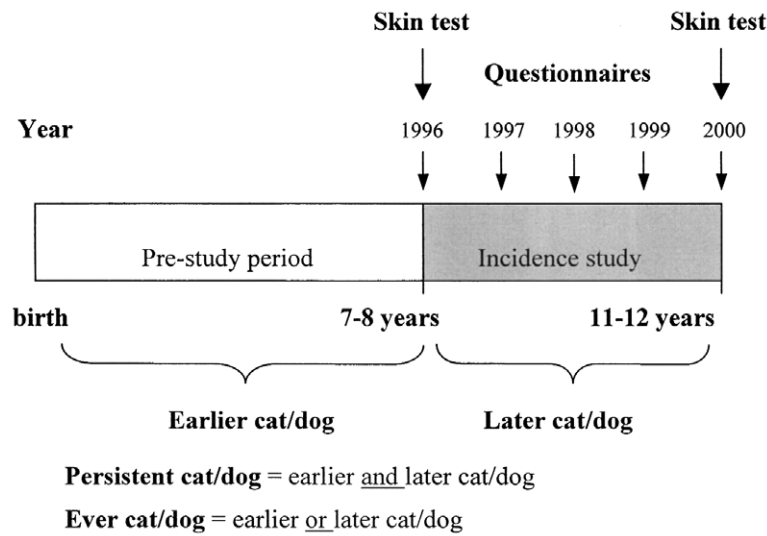


FIG 1. Prospective incidence study of positive skin test responses over 4 years beginning at age 7 to 8 years. Data on furred pets at home during the first 2 years of life were obtained by recall when the child was 7 to 8 years old. Ever cat in 1996: rural 41%, urban 35%; Luleå 39%, Kiruna 27%. Ever dog in 1996: rural 60%, urban 47%; Luleå 43%, Kiruna 62%.

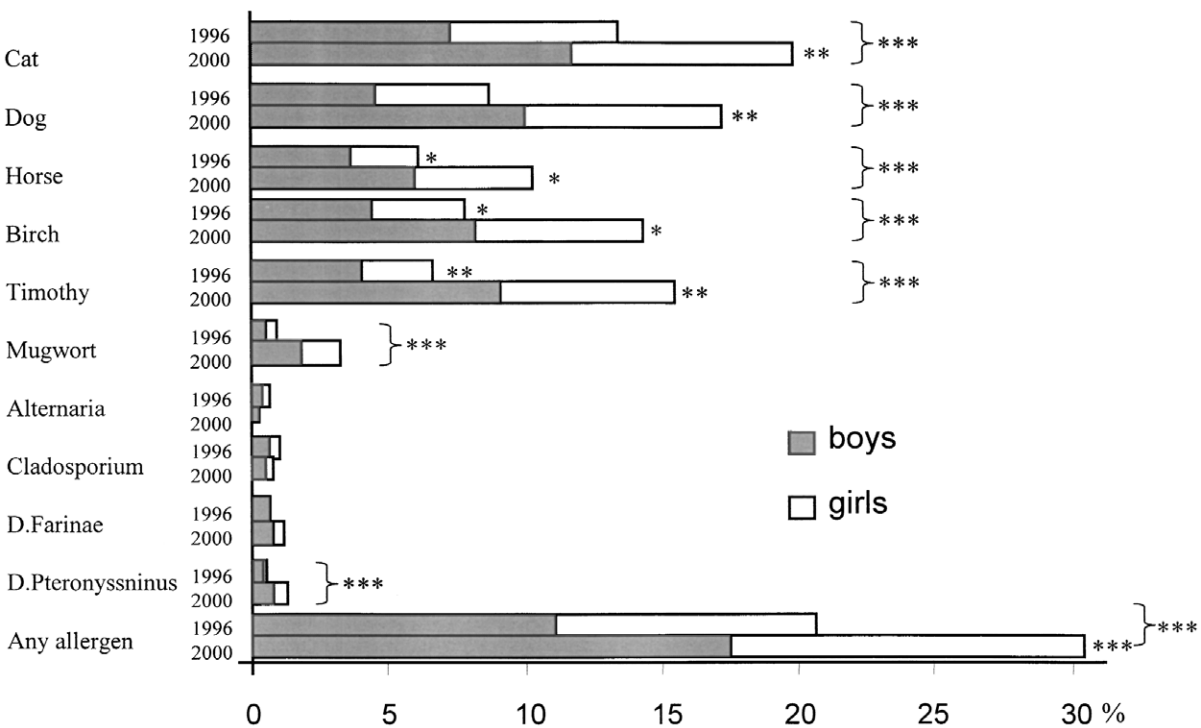


FIG 2. Prevalence (percentage) of positive skin test responses in 1996 (age 7-8 years) and in 2000 (age 11-12 years): difference by sex and study year. Significant differences: * $P < .05$; ** $P < .01$; *** $P < .001$.

TABLE I. Four-year cumulative incidence and number of positive SPT responses from age 7 and 8 to age 11 and 12 years

Allergen	Incidence with the population at risk: children with no positive SPT responses at age 7-8 y				Incidence with the population at risk: children with a negative SPT response to the specific allergen at age 7-8 y			
	Boys, % (n)	Girls, % (n)	All, % (n)	Difference by sex, <i>P</i> value	Boys, % (n)	Girls, % (n)	All, % (n)	Difference by sex, <i>P</i> value
Cat	7.5 (55)	4.6 (34)	6.0 (89)	.018	10.7 (86)	7.0 (56)	8.8 (142)	.009
Dog	6.1 (45)	3.6 (27)	4.9 (72)	.051	12.9 (111)	8.6 (73)	10.4 (184)	.011
Horse	2.0 (15)	1.3 (10)	1.7 (25)	.297	5.8 (51)	5.0 (44)	5.4 (95)	.471
Any animal	9.8 (72)	6.2 (46)	8.0 (118)	.010	12.5 (98)	7.5 (58)	10.0 (156)	.001
Birch	3.8 (28)	3.4 (25)	3.6 (53)	.638	8.2 (71)	6.8 (58)	7.5 (129)	.251
Timothy	7.2 (53)	4.6 (34)	5.9 (87)	.030	11.1 (96)	8.4 (73)	9.7 (169)	.056
Mugwort	1.0 (7)	0.7 (5)	0.8 (12)	.546	3.0 (28)	2.4 (22)	2.7 (50)	.441
Any pollen	10.1 (74)	7.1 (53)	8.6 (127)	.042	13.8 (112)	10.1 (83)	11.9 (195)	.021
Any allergen	16.2 (119)	11.4 (85)	13.8 (204)	.008	16.2	11.4	13.8	.008

The incidence was calculated both with children who had negative SPT responses to all allergens tested at age 7 and 8 years as the population at risk and with the children who had negative SPT responses to the specific allergen as the population at risk.

TABLE II. Risk factors for prevalent cases of positive SPT responses at age 7 and 8 years, incident cases over the next 4 years of life, and prevalent cases at age 11 and 12 years

Risk factors	Children with risk (%)	Any positive skin test response		
		Prevalent cases at age 7-8 y, RR (95% CI)	Prevalent cases at age 11-12 y, RR (95%)	4-y incident cases, RR (95% CI)
Male sex	50.0	1.17 (0.99-1.39)	1.28 (1.12-1.46)	1.42 (1.10-1.84)
Family history of allergy	45.4	1.57 (1.33-1.86)	1.61 (1.41-1.84)	1.53 (1.18-1.97)
Birth order				
No. 2	35.6	0.89 (0.73-1.08)	0.92 (0.79-1.07)	0.99 (0.73-1.34)
No. 3 or more	26.1	0.86 (0.69-1.07)	0.92 (0.78-1.10)	1.01 (0.72-1.39)
Breast-fed <3 mo	22.5	0.87 (0.70-1.07)	0.94 (0.80-1.11)	1.02 (0.75-1.39)
Mother smokes	31.8	0.91 (0.76-1.08)	0.92 (0.80-1.06)	1.03 (0.79-1.34)
House dampness	22.7	1.10 (0.91-1.33)	1.11 (0.96-1.28)	0.99 (0.72-1.35)
Rural living	12.4	0.63 (0.46-0.86)	0.86 (0.70-1.06)	1.17 (0.83-1.64)
Residence in Kiruna (vs Luleå)	28.7	1.02 (0.85-1.22)	1.35 (1.18-1.55)	1.97 (1.53-2.53)
Any pet ever at home	69.4	0.80 (0.67-0.95)	0.74 (0.65-0.85)	0.89 (0.68-1.15)
Cat ever at home	26.5	0.65 (0.52-0.80)	0.61 (0.52-0.71)	0.69 (0.50-0.95)
Dog ever at home	33.8	0.74 (0.66-0.90)	0.83 (0.73-0.95)	0.94 (0.73-1.22)
Furred pets at home first 2 y of life	34.4	0.81 (0.67-0.97)	0.85 (0.73-0.98)	1.02 (0.78-1.33)
Ever lived at a farm	2.8	0.33 (0.13-0.85)	0.52 (0.28-0.94)	0.62 (0.24-1.59)

and 96.4%, and values for timothy grass were 90.8% and 92.3%. The prevalence of increased IgE levels to cat, dog, birch, or timothy grass was 30.9% in Kiruna versus 24.6% in Luleå (*P* = .03).

Risk factors for prevalent and incident SPT response positivity

The strongest risk factor for a positive SPT response to any allergen in all bivariate analyses was a family history of allergy (RR, 1.5-1.6). Male sex was a significant risk factor for the prevalent cases at age 11 and 12

years and the incident cases as well. Rural living decreased the risk significantly at age 7 and 8 years but not at age 11 and 12 years or the incident cases. Of the children tested, 2.8% had lived on a farm, and they were at significantly lower risk of having a positive SPT response to any allergen both at age 7 and 8 years (RR, 0.33; 95% CI, 0.13-0.85) and 4 years later (RR, 0.52; 95% CI, 0.28-0.94; [Table II](#)).

The variables of having a cat or dog ever at home and having furred pets at home during the first 2 years of life were both significantly associated with a decreased risk

TABLE III. Frequency of positive SPT responses in 1996 (age 7-8 years) and 2000 (age 11-12 years) and the incident cases between 1996 and 2000 in relationship to cat and dog ownership

	Prevalent cases at age 7-8 y (n), RR (95% CI)		Prevalent cases at age 11-12 y (n), RR (95% CI)		4-y incident cases (n), RR (95% CI)	
	Any positive SPT response	Positive response to cat-dog*	Any positive SPT response	Positive response to cat-dog*	Any positive SPT response	Positive response to cat-dog*
Never cat	22.8% (357), reference	15.1% (237), reference	35.4% (454), reference	23.7% (303), reference	15.7% (141), reference	9.8% (98), reference
Cat earlier	18.4% (61), 0.81 (0.63-1.03)	11.5% (38), 0.76 (0.55-1.05)	26.2% (50), 0.74 (0.55-0.95)	17.8% (34), 0.75 (0.55-1.04)	11.2% (16), 0.71 (0.44-1.16)	6.5% (10), 0.66 (0.35-1.24)
Cat later	—	—	23.3% (35), 0.66 (0.49-0.89)	15.3% (23), 0.65 (0.44-0.96)	12.2% (14), 0.78 (0.46-1.30)	9.9% (12), 1.01 (0.57-1.78)
Cat persistent- current in 1996†	9.4% (22),† 0.41 (0.27-0.62)	5.1% (12),† 0.34 (0.19-0.60)	16.4% (50), 0.46 (0.36-0.60)	8.9% (27), 0.38 (0.26-0.55)	9.9% (25), 0.63 (0.42-0.94)	6.4% (17), 0.65 (0.40-1.07)
Never dog	22.6% (319), reference	9.3% (131), reference	33.1% (345), reference	19.8% (206), reference	14.3% (105), reference	12.5% (108), reference
Dog earlier	21.5% (78), 0.95 (0.77-1.19)	11.1% (40), 1.19 (0.85-1.66)	35.0% (64), 1.06 (0.85-1.31)	21.9% (40), 1.11 (0.82-1.49)	13.1% (16), 0.92 (0.56-1.50)	10.6% (15), 0.85 (0.51-1.41)
Dog later	—	—	26.2% (64), 0.79 (0.63-0.99)	13.9% (34), 0.70 (0.50-0.99)	11.2% (21), 0.79 (0.51-1.22)	9.4% (20), 0.76 (0.48-1.19)
Dog persistent- current in 1996†	11.9% (43),† 0.53 (0.39-0.71)	3.9% (14),† 0.42 (0.24-0.72)	25.2% (121), 0.76 (0.64-0.91)	12.1% (58), 0.61 (0.47-0.80)	15.1% (58), 1.05 (0.78-1.42)	8.6% (36), 0.69 (0.48-0.98)

*Positive SPT response to cat in relation to cat exposure and positive SPT to dog in relation to dog exposure.
†Having cat, respectively dog, currently at home at the start of the study in 1996, when the children were 7-8 years old.

for prevalent cases of any positive SPT response both at age 7 and 8 years and age 11 and 12 years. Furthermore, ever having a cat at home was significantly associated with a decreased risk for incident cases (RR, 0.69; 95% CI, 0.50-0.95; Table II) and most pronounced among those children who persistently had a cat at home, both for prevalent cases at age 11 and 12 years (RR, 0.46; 95% CI, 0.36-0.60) and for incident cases (RR, 0.63; 95% CI, 0.42-0.94). The pattern was similar for persistently having had a dog at home (Table III).

Having furred pets at home during the child's first 2 years of life was more prevalent among those without a history of allergy in the family compared with those with a family history of allergy (62.4% vs 37.6%, $P < .001$). The prevalence of any positive SPT response in 1996 among the children with a family history of allergy was 20.3% among those who had furred pets during the first 2 years of life, whereas it was 28.2% among those who did not have a pet ($P = .011$). Among the children without a history of allergy in the family, the corresponding prevalence was 17% both among the children who had a furred pet at home in the first 2 years of life and those who did not.

Multivariate analysis

The pattern remained similar in the multiple logistic regression analyses, and the highest risks for any positive SPT response at age 11 and 12 years were a family history of allergic disease (OR, 1.88; 95% CI, 1.54-2.30), male sex (OR, 1.50; 95% CI, 1.23-1.84), and living in

Kiruna versus Luleå (OR, 1.51; 95% CI, 1.21-1.88). Living in a rural area significantly decreased the risk for sensitization to cat (OR, 0.59; 95% CI, 0.40-0.87) and to dog (OR, 0.63; 95% CI, 0.43-0.95). When the variable of ever having lived on a farm was used in the analyses instead of the variables about cat or dog ownership, a significantly decreased risk for any positive SPT response was found (OR, 0.33; 95% CI, 0.12-0.92). However, it did not reach significance if cat or dog ownership was included in the model.

The inverse associations between living in a house with a cat or dog and sensitization remained significant in the multivariate analyses. A decreased risk for any positive SPT response at age 11 and 12 years was found among all 3 pet ownership temporal groups and was most pronounced among the children who persistently had lived in a house with a cat. The effect of dog ownership showed a similar but less distinct pattern (Table IV). Separate analyses among boys and girls showed persistent exposure to cat to be significantly associated with a decreased risk of sensitization both among boys (OR, 0.31; 95% CI, 0.19-0.51) and girls (OR, 0.60; 95% CI, 0.38-0.94).

Significant risk factors for incident cases of any positive SPT response were a family history of allergy (OR, 1.67; 95% CI, 1.23-2.28), male sex (OR, 1.69; 95% CI, 1.24-2.31), and living in Kiruna (OR, 2.17; 95% CI, 1.58-2.99). Cat or dog ownership at any time period indicated a decreased risk for sensitization; however, these associations were not significant (Table IV).

TABLE IV. Multivariate analysis (logistic regression) of the association between pet ownership at different times in a child's life and positive SPT responses to any allergen at age 7 to 8 and 11 to 12 years, cat or dog at age 11 to 12 years, and incident cases of any allergen in the 4 years before age 11 to 12 years

Independent variables	Dependent variable			
	Any positive SPT response at age 7-8 y, OR (95% CI)	Any positive SPT response at age 11- 12 y, OR (95% CI)	Cat-dog* positive SPT response at age 11-12 y, OR (95% CI)	4-y incidence of any positive SPT response, OR (95% CI)
Cat earlier	0.83 (0.61-1.13)	0.70 (0.50-0.99)	0.77 (0.51-1.14)	0.73 (0.42-1.27)
Cat later	—	0.62 (0.41-0.92)	0.65 (0.41-1.04)	0.88 (0.48-1.61)
Cat persistent-current in 1996†	0.41 (0.26-0.65)†	0.44 (0.31-0.61)	0.39 (0.26-0.60)	0.72 (0.45-1.14)
Dog earlier	0.99 (0.75-1.32)	1.15 (0.82-1.62)	0.70 (0.46-1.08)	0.94 (0.53-1.66)
Dog later	—	0.72 (0.52-0.99)	0.58 (0.35-0.97)	0.74 (0.44-1.23)
Dog persistent-current in 1996†	0.50 (0.35-0.71)†	0.66 (0.51-0.85)	0.37 (0.23-0.59)	0.91 (0.63-1.31)

Other variables included in the models were sex, family history of allergy, rural living, and area of domicile.
*Positive STP response to cat in relation to cat exposure and positive STP to dog in relation to dog exposure.
†Having cat, respectively dog, currently at home at the start of the study in 1996, when the children were 7-8 years old.

DISCUSSION

The incidence of sensitization to inhalant allergens over 4 years was high (13.8%) and resulted in an increase in prevalence from 20.6% at age 7 and 8 years to 30.4% 4 years later. The high incidence combined with the prospective nature of the study design and the size of the cohort allowed for an in-depth analysis of the risk factors for the onset of sensitization. The high participation rate, standardized methods, and close correlation between SPT results and in vitro IgE assays at age 7 and 8 years²¹ and at age 11 and 12 years support the validity of the results.

The results are in keeping with 2 previous cross-sectional studies conducted in northern Sweden, one² in which 27% of 7- to 9-year-old children and another⁸ in which 43% of 14-year-old children were allergic. In a prospective study of similar age groups conducted in Australia, where dust mites are common, the 4-year cumulative incidence of positive SPT responses was 15%.⁵ In the absence of both dust mites and cockroaches, development of allergic sensitization in the pre-teenage years was surprisingly similar in northern Sweden to that found in a mite-endemic environment.

The risk factors for incident cases of positive SPT responses were similar to those of subjects who already had immediate hypersensitivity by age 7 and 8 years.⁷ The strongest risk factor was a family history of allergy. Although no sex difference in the prevalence of allergy was found at age 7 and 8 years, the incidence of allergic sensitization was higher among boys. This sex difference had been previously observed.^{2,4} The higher prevalence of allergy in Kiruna compared with that in the rest of Sweden has also been reported previously.² In contrast to previous reports,^{11,12} no association between the number of siblings or birth order was found for allergic sensitization in this population.

The absence of a cat at home does not mean that a child is not exposed to cat allergens. Cat allergen is transferred on clothing to schools and public buildings, and significant levels of cat and dog allergens have been measured in the schools that these children attend, although the levels of cat allergen in homes with a cat are approximately 100 times higher.^{21,23-25} The relationship between allergy and high exposure of allergens is not consistent. High exposure to pollen might increase the risk for allergy,²⁶ although our study did not find any association between sensitization and having been born during the pollen season.

Recently, several studies have shown a protective effect of having a cat or dog at home on development of sensitization and asthma.^{6,17-19,27} In our cohort, cat ownership was not only associated with a lower prevalence of sensitization but was also associated with a lower prevalence of asthma, as well as a lower incidence of asthma during the same lifetime period examined in this study.^{7,20} Secondary prevention (ie, cats being removed when children become allergic) has been suggested as the cause of the pet protective effect.²⁸ However, this type of selection bias has been corrected for in our studies by using the pet ownership variable of ever having had a cat in the home, thereby including any children who became allergic with a cat in the cat ownership group.^{7,20} Primary prevention has also been suggested, and children of allergic parents are less likely to live in a house with a cat in this community. However, when the data are stratified into those children who have a family history of allergy or asthma, the protective effect against sensitization and asthma is more pronounced among those children with a hereditary risk for allergic disease.²⁰ In addition, an inverse association between pet ownership and allergy has been observed in communities in which there is equal pet ownership between children with and without an allergic parent.⁶

Several steps were taken in our study to avoid the potential bias of pet ownership selection. First, the results have been corrected for a history of allergy in the family. Furthermore, in the longitudinal study cat and dog ownership were known before sensitization had occurred. Those children who owned a cat had a lower incidence of allergic sensitization. The relationship was not significant for new cat owners (cat later) or children who had only been exposed earlier in life (cat earlier), although the trend was still toward a negative association. In addition, exposure to furred pets at home during the first 2 years of life was associated with a decreased risk of sensitization, particularly among those with a history of allergy in the family. Therefore we have not identified any period in preteenage life when exposure to a cat in the home was associated with increased allergy. In fact, persistent exposure to high levels of cat allergen appears to be protective against the development of sensitization among both boys and girls.

As seen with other studies, the children at age 7 and 8 years were less likely to be allergic if they were living in a rural area^{7,9} or living on a farm.^{13,14} Interestingly, however, there was no protective effect of rural living seen for the incident cases. A similar protective effect in early life, but not later, has been reported.²⁹ Understanding the protective effect seen with rural living is difficult because it could encompass several factors, such as lifestyle, diet, housing, bacterial exposure, and animal exposure. There is some evidence for a role of increased bacterial exposure in reductions in the risk of allergy.^{16,30,31} However, our preliminary results do not indicate higher levels of airborne endotoxin in homes with animals. A modified immune response has been proposed, whereby exposure to high quantities of cat allergen causes a specific switch from IgE to IgG production.¹⁹

In conclusion, the incidence of allergic sensitization between ages 7 to 8 and 11 to 12 years was high in this community, despite a lack of dust mites or cockroaches. The major risk factor for incident and prevalent cases of positive skin test response was a history of allergy in the family. Even though cat was the most common allergen of sensitization, keeping a cat or dog at home was not related to an increased risk for development of sensitization to allergens from these animals. Thus, in contrast to traditional thinking, avoiding cats and dogs at home does not protect against sensitization.

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