

Persistent Aeroallergen Sensitization at Ages One and Two in the Cincinnati Childhood Allergy and Air Pollution Study

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Abstract

RATIONALE: Few studies have evaluated the longitudinal persistence of sensitization to a large number of aeroallergens in infants and young children.

METHODS: Children born to at least one atopic parent were skin prick tested (SPT) at ages one and two with the following categories of allergens: 1) pollen (fescue, timothy, white oak, maple, American elm, red cedar, and short ragweed), 2) mold (*Alternaria*, *Aspergillus fumigatus*, *Penicillium mix*, and *Cladosporium*), 3) dust mite or German cockroach, 4) animal (cat and dog), and 5) food (milk and egg).

RESULTS: A total of 752 children were tested prior to age two, with 700 before the age of 18 months and 672 between the ages of 18-30 months. Of the total tested, 82.4% (n = 620) were tested twice, once at age one and again at age two. The prevalence of aeroallergen sensitization in these increased from 18.3% at age one to 38.3% at age two. Although 67.6% of those sensitized to an aeroallergen at age one remained SPT+ to an aeroallergen at age two, the rate of persistent sensitization to pollen, mold, dust, and animal was 54.8%, 28.6%, 22.2%, and 30.4%, respectively. A positive SPT to pollen or animal antigens at age one was significantly associated with persistent sensitization at age two to the same category of allergen (p < 0.05). Sensitization to dust at age one is associated with mold sensitization at age two (p < 0.05). Dust sensitization at age two is not associated with prior sensitization at age one.

CONCLUSIONS: In general, infants sensitized to an aeroallergen at age one remain sensitized to at least one aeroallergen at age two. The rate of persistent sensitization to the same category of allergen, however, is much lower. The developing immune system, early-life environmental exposures, and genetics may all play a role in the patterns of aeroallergen sensitization which have been described. This ongoing study will determine the long-range consequence of infant aeroallergen sensitization and identify genetic and environmental factors which may be associated with very early development of persistent aeroallergen sensitization.

Objectives

- Describe the prevalence and persistence of sensitization to specific aeroallergens in children at ages one and two
- Determine aeroallergen sensitizations at age one which are predictive of other aeroallergen sensitizations at age two
- Determine if infant sensitization at age one is predictive of persistent sensitization to specific aeroallergens at age two

Methods

Subjects:

Children of atopic parents received a skin prick test to a panel of 15 aeroallergens and 2 foods at ages one (9-18 months of age) and two (18-30 months of age)

Sensitization and Symptom Definitions:

- Never sensitized:* SPT- at ages one and two
- Early sensitization:* SPT+ at age one and SPT- at age two
- Late sensitization:* SPT- at age one and SPT+ at age two
- Persistent sensitization:* SPT+ at age one and SPT+ at age two

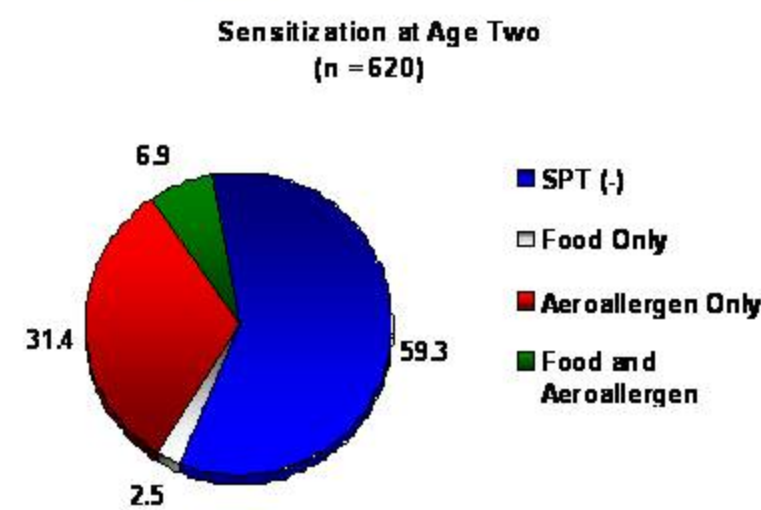
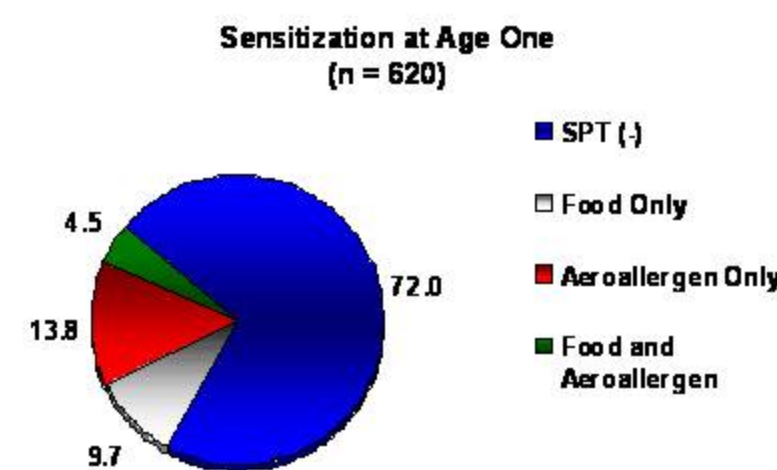
Analyses:

Logistic regression was utilized to determine what categories of sensitization and symptoms at age one were significantly associated with category sensitization at age two

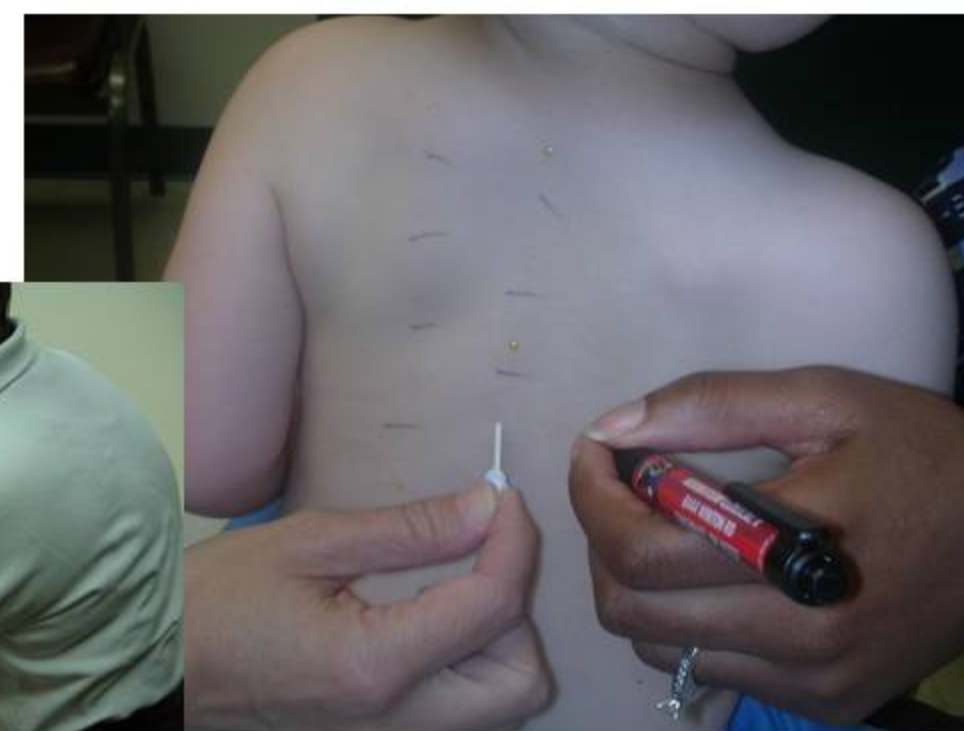
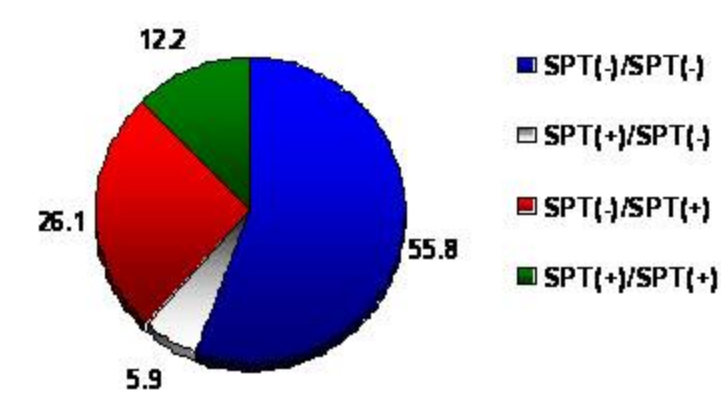
Descriptive characteristics of infants skin prick tested at ages one and two

Variable	Age One (<18 Months)	Age Two (18-30 Months)	Repeated SPT Prior to Age 30 Months
Children Tested	700	672	620
Mean Age (Months ± SD)	13.4 (± 2.2)	24.8 (± 1.8)	11.4 (± 2.7) [†]
% Male	55.1	53.6	54.4
% Caucasian	78.4	78.9	80.2
% Annual Income < \$20,000	18.2	19.1	17.3

[†] Mean number of months between SPTs

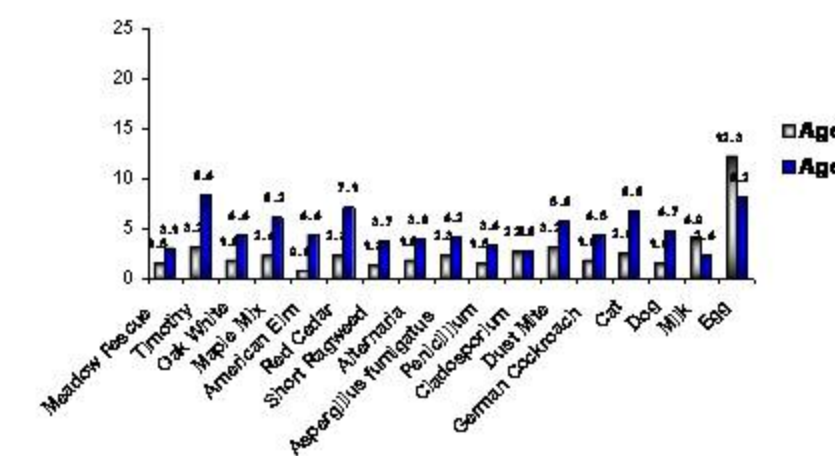


Type of Sensitization at Age Two (n = 620)

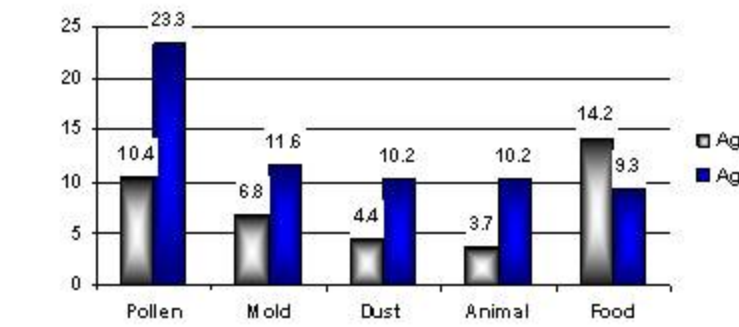


Results

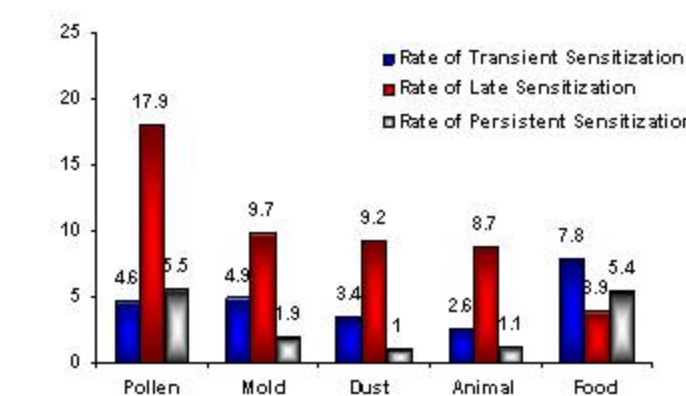
Allergen Sensitization at Ages One and Two (n = 620)



Sensitization at Ages 1 and 2 by Category (n = 620)



Category Sensitization Type at Age Two



Rates of Persistent Sensitization to Identical and Non-identical Aeroallergens At Age 2 Among Infants SPT+ at Age 1

Allergen	Rate of Specific Aeroallergen Persistent Sensitization	Rate of SPT+ at Age 1, SPT- to Identical Allergen at Age 2, SPT+ to Other Aeroallergen at Age 2
Meadow Fescue	0.11	0.75
Timothy	0.47	0.50
Oak White	0.25	0.89
Maple	0.29	0.50
American Elm	0.00	0.60
Red Cedar	0.43	0.63
Ragweed	0.25	0.83
Alternaria	0.09	0.80
Aspergillus	0.07	0.54
Penicillium	0.22	0.71
Cladosporium	0.24	0.46
Dust Mite	0.15	0.47
German	0.09	0.70
Cat	0.25	0.58
Dog	0.11	0.88

Unadjusted and adjusted odds ratios for the association between category sensitization at age one and two

Sensitization Age One	Unadjusted Odds Ratio	95% Confidence Interval	Adjusted Odds Ratio	95% Confidence Interval
POLLEN SPT(-) Age Two				
Pollen	4.9 [†]	2.85-8.43	4.55	2.57-8.04
Mold	2.14 [†]	1.12-4.12	1.26	0.59-2.66
Dust	1.4	0.60-3.27	0.89	0.34-2.26
Animal	1.79	0.74-4.32	1.28	0.48-3.32
Food	1.46	0.89-2.42	1.29	0.76-2.18
MOLD SPT(-) Age Two				
Pollen	2.72 [†]	1.43-5.17	1.99	0.99-4.00
Mold	3.43 [†]	1.67-7.06	2.05	0.91-4.61
Dust	4.18 [†]	1.80-9.71	2.72	1.10-6.74
Animal	2.82 [†]	1.08-7.41	1.95	0.70-5.48
Food	0.97	0.48-1.97	0.83	0.40-1.73
DUST SPT(-) Age Two				
Pollen	2.04 [†]	1.00-4.16	1.66	0.78-3.55
Mold	1.85	0.79-4.37	1.15	0.44-2.98
Dust	2.67 [†]	1.04-6.89	2.13	0.78-5.82
Animal	2.57	0.92-7.17	1.81	0.62-5.29
Food	2.07 [†]	1.10-3.88	1.89	0.99-3.60
ANIMAL SPT(-) Age Two				
Pollen	1.61	0.75-3.44	1.43	0.63-3.24
Mold	0.96	0.32-2.78	0.61	0.19-1.97
Dust	1.15	0.34-3.92	0.98	0.27-3.61
Animal	4.38 [†]	1.72-11.10	3.69	1.36-10.00
Food	3.05 [†]	1.68-5.52	2.9	1.57-5.35

Summary

- Children of atopic parents are sensitized as early as age one to multiple aeroallergens
- Infants sensitized to an aeroallergen at age one remain sensitized to at least one aeroallergen at age two
 - The rate of persistent sensitization to the same category of allergen is low
- The highest rate of persistent aeroallergen sensitization is to pollen
 - There are no prior aeroallergen or food sensitizations associated with dust or animal sensitization at age two
- Infants SPT+ to oak, dog, and ragweed at age one were most likely to test positive to a different aeroallergen at age two
- An infant's developing immune system may be reflected by their pattern of sensitization
- Environmental exposures in the first year of life coupled with genetic susceptibility may be associated with early persistent aeroallergen sensitization

Future Directions

- Early-life environmental exposures will be examined:
 - Endotoxin
 - Mold
 - β-glucan
 - Diesel exhaust particulates
- Gene-environment interactions will be analyzed
- Digitized wheal/flare measurements will be analyzed to determine the predictive value in young sensitized children