

ORIGINAL ARTICLE

Knowledge of Skin Test Results Among Parents of Asthmatic Children

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ABSTRACT

Background. The control of asthma in children depends upon several factors, among which is the ability of parents to minimize the exposure of their children to specific allergens. If parents are ill-informed of the specific allergen sensitivity of their children, they may be unable to take the necessary steps to minimize exposure. *Objectives.* This study seeks to determine the ability of parents to recall accurately the skin test results for their children. Parents were low income, multicultural, urban residents. *Methods.* One hundred eligible children with persistent asthma, between 6 and 14 years old, who were skin test positive to dust mite or cockroach allergen, were recruited from a mobile asthma clinic in Los Angeles. Caretakers were interviewed in English or Spanish. From skin test results, sensitivity and specificity of parental recall of test results were computed. The sensitivity and specificity were further stratified on demographic and exposure characteristics. *Results.* The sensitivity was lowest for dogs (65%), but higher for all other allergens: cat 93%, roach 91%; dust mites 88%, and mold 81%. The range of specificity was from 40% to 83%. Thus, parents were more aware of positive than of negative test results. Stratification did not appreciably change the sensitivity or specificity results. *Conclusions.* We conclude that the sensitivity and specificity of parental response concerning skin test results is high regardless of cultural, demographic, or exposure levels of the child.

Key Words: Asthma; Skin test; Allergens; Heath education; Youth knowledge.

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INTRODUCTION

The control of asthma in children depends upon several factors, among which is the ability of parents to minimize the exposure of their children to specific allergens. In order to determine which allergens are of concern, children can be skin tested for atopy (defined as skin prick test positivity). However, even after skin testing, parents may be ill informed of specific allergies of their children and thus may be unable to take the necessary steps to minimize exposure. Further, the ability of parents in a multicultural inner-city setting to recall this information may be highly influenced by cultural, educational, and language characteristics. The severity of the asthma itself, the history of asthma in the family, and the interaction with health care providers may also influence parental knowledge and recall. Finally, skin test sensitivity may be related to the presence in the home of cockroaches, dust mites, mold, dogs, and cats.

Few studies have examined the relationship between patient perceptions of what their sensitivity is for specific allergens and results of skin testing (1–3). Carter et al. (3) found that parent report of allergy was no better than chance in predicting skin test reactivity for their children to three common allergens: cat, dust mite, and grass. Li et al. (1) found sensitivities of only 10% to 63% of patients able to correctly predict for which allergens they would be skin test positive, and Kauppi et al. (2) found a low specificity (31%) but relatively high sensitivity (90%). Thus, the ability to predict prior to testing is somewhat low. This study seeks to determine the ability of parents to accurately recall test results for their children at a later time and to state what allergens stimulate an asthma attack in their children.

METHODS

Subjects

Families were recruited through the Breathmobile, a school based mobile asthma clinic, and through the pediatric allergy program at the Los Angeles County–USC Medical Center. One hundred eligible children had persistent asthma, were between 6 and 14 years old, and were skin test positive to dust mite or cockroach allergen. Skin test results were provided to parents verbally by the Breathmobile health care provider with a language translator present. They had visited the Breathmobile at least three times. We interviewed caretakers who spoke English or Spanish and consented to the study procedures.

Measurement

Skin test results in terms of maximum diameter of wheal were abstracted from the medical record maintained at the Breathmobile. Not all children were tested for each of the allergens. Percutaneous skin testing for immediate hypersensitivity was performed using the Multi-Test™ (Lincoln Diagnostics, Decatur, IL) and included both histamine and diluent controls. The criterion used for a positive skin test was a wheal size that was 3 mm or greater than the control skin test site (4). The skin test reagents used were manufactured by Hollister–Stier Laboratories, Spokane, WA. The reagents used were: D.F. mite 30,000 AU/mL, DP mite 30,000 AU/mL, Cockroach Mix (American, German) 1:10 wt/vol, Hormodendrum 1:10 wt/vol, Alternaria Tenuis 1:10 wt/vol, Aspergillus Niger 1:10 wt/vol, Aspergillus Fumigatus 1:10 wt/vol, Cat Pelt (standardized 10,000 BAU/mL), Acetone Precipitated Dog Dander 1:50 wt/vol.

Parental reports of knowledge of skin test positivity were determined from an interviewer-administered questionnaire. Interviews were conducted in English or in Spanish. The following questions were asked: “Has (child) been skin tested to see if she/he has allergies?” “Was the skin test positive for any of the following: dogs, cats, molds, house dust mites, cockroaches?” In our analysis, we categorized “no” and “don’t know” as “no” responses. A later question in the questionnaire asked parents to report “What do you think causes your child to have asthma attacks?” The parental answer to this open-ended question was categorized to indicate dust, dust mites, cockroaches, mold, or pets or other animals (as well as other possible answers not tabulated here).

Cockroach counts were determined by counting the numbers of roaches caught on five sticky traps (JT Eaton Stick-a-Roach) over a one- to two-week period. These traps were placed by the home data collectors (three in the kitchen and two in the bathroom) and were mailed back to the data collectors by the parents one to two weeks later.

Several covariates were also assessed from the caretaker report in order to determine whether any of these acted as barriers to the recall of skin test results. These included the language, education and employment of the caretaker, the severity of the child’s asthma, the length of time seen at the Breathmobile, the family history of asthma, and the caretaker perception of cockroach infestation in the house. A scale to assess the child’s health in terms of seven symptoms of asthma and eight symptoms of medication side effects was used as a covariate dichotomized at the median (5).



Table 1. Demographic characteristics of children (n = 100).

<i>Age of child</i>	
6–8	25
9–10	34
11–12	24
13–14	17
<i>Caregiver relationship</i>	
Mother	87
Father	9
Adoptive mother	2
Grandmother/grandfather	2
<i>Questionnaire language</i>	
Spanish	92
English	8
<i>How well caretaker speaks/understands English</i>	
Very well	10
Moderately well	17
Only a little	64
<i>Birthplace of caretaker</i>	
United States	4
Mexico	68
Central/South America	26
Asia	2
<i>Child gender</i>	
Male	70
Female	30
<i>Health insurance</i>	
Public (Medi-Cal)	68
Private insurance	16
Self pay	4
No insurance but don't pay	7
Other	4

Statistical analyses were conducted with the SAS program and were based primarily on dichotomous associations. From these we computed sensitivity (parent reports of a positive skin test/Breathmobile reports positive skin test) and specificity levels (parent reports of a negative skin test/Breathmobile reports negative skin test). The sensitivity and specificity levels were also computed stratifying on each of the covariates listed above.

RESULTS

Participants

The sample consisted of 100 children between the ages of 6 and 14; 70% were male and 30% were female. The caretaker responses were primarily from the mother (87%), with 9% from the father, 2% from an adoptive mother, and 2% from a grandparent. Ninety-two percent of the questionnaires were administered in Spanish with the remainder in English. In 64%, the caretaker spoke only a little English. Only 4% of the caretakers were born in the United States. The majority were from Mexico and Central or South America. Most of the children were covered under public health insurance (Medi-Cal) (see Table 1).

Of the first 100 subjects recruited, 95 of the caretakers said the child had been skin tested for allergies and 92 of the caretakers reported that the child had allergies. In fact all of the children had been skin tested and all of them had a positive skin test for cockroaches or dust mites. In terms of specific allergens, 89% were allergic to dust mites (Der f 1 or

Table 2. Parental knowledge of skin test results as compared to breathmobile abstract data based on wheal response.

		Sensitivity true positive		Specificity true negative	
		Parent +/Abstract +		Parent – or don't know ^a / Abstract –	
Wheal +3	+ tests/# tested (percent +)				
Dog	17/67 (25%)	11/17	65%	30/48	63%
Cat	28/72 (39%)	26/28	93%	26/42	62%
Roach	46/92 (50%)	41/45	91%	37/45	82%
Dust mites	85/96 (89%)	74/84	88%	4/10	40%
Mold	32/77 (42%)	26/32	81%	31/43	72%

^aThe percent of parents responding “don't know” for each allergen are as follows: Dog—20%, Cat—13%, Roach—14%, Dust mites—10%, and Mold—20%.

Table 3. Parental indication of exposures that they believe cause asthma attacks in their children.

	Of abstract wheal positive	Of abstract wheal negative
Dog	7/17 (41%)	6/48 (13%)
Cat	8/28 (29%)	6/42 (14%)
Roach	9/45 (20%)	0/45 (0%)
Dust	41/84 (49%)	4/10 (40%)
Dust mites	13/84 (15%)	1/10 (10%)
Mold	3/32 (9%)	1/43 (2%)

Der p 1), 42% to mold, 39% to cats, 25% to dogs, and 50% to cockroaches (see Table 2).

In order to determine whether parents were aware of the allergens to which their child was skin test positive, we compared their responses on the questionnaire with data abstracted from the Breathmobile records and we expressed these as sensitivity (parent and abstract both indicated atopy) and specificity (parent and abstract both indicated no atopy). The Breathmobile health care provider provides skin test results to parents, with a language translator present. We found that 65% of those with a child allergic to dogs on the basis of the measured wheal response indicated that they believed their child was allergic. The sensitivity was higher for all other allergens: cat 93%, roach 91%; dust mites 88%, and mold 81% (see Table 2). The range of specificity was from 82% to 40%. Thus, parents were more aware of positive than of negative test results. Our results also indicated that the sensitivity and specificity did not differ by whether the analysis was done on the basis of wheal or flare response. In fact there was 89% to 97% agreement between these two criteria (depend-

ing upon the allergen) and therefore no difference would be expected.

We then stratified the analysis based on other characteristics including language (understood English very well, moderately well, or only a little), education (less than high school or more than high school), employment (not employed, employed), any history of severe asthma from the Breathmobile records, family history of asthma, number of prior visits to the Breathmobile, and symptom scale. For each variable, the stratification did not appreciably change the sensitivity or specificity results.

Parental responses to the open-ended question asking about what exposures they believed cause their child to have an asthma attack are presented in Table 3. Of those who were wheal positive, the following proportions reported that the allergen could provoke an asthma attack in their children: 9% (mold), 15% (dust mites), 20% (roach), 29% (cat) 41% (dog), and 49% (dust). Of those who were wheal negative, the following percents believed the allergen could provoke an asthma attack in their children: 2% (mold), 10% (dust mites), 0% (roach), 14% (cat), 13% (dog), and 40% (dust).

We then examined skin test results for whether those who had exposures (e.g., had a cat) were different from those without an exposure (e.g., did not have a cat), in terms of skin test results (see Table 4). Although few people had cats—it appears that neither the presence of cats or dogs was associated with the child's skin test result. Caretaker reports of cockroaches also were moderately associated ($p = 0.06$) with observed skin test sensitivity to cockroaches. However, when cockroach exposure was based on counts from traps, 37% of those with no cockroaches were skin test positive, 37% of those with 1–16, and 72% of those

Table 4. Skin test results as related to specific exposures.

	Skin test positive	Skin test negative	Total
Dog present	6 (26%)	17 (74%)	23
No dog present	11 (25%)	33 (75%)	44
		$X^2 = 0.01, p = 0.92$	
Cat present	2 (50%)	2 (50%)	4
No cat present	26 (39%)	41 (61%)	67
		$X^2 = 0.20, p = 0.66$	
Roach reported	24 (62%)	15 (38%)	39
No roach/reported	22 (42%)	31 (58%)	53
		$X^2 = 3.61, p = 0.06$	
17–287 roaches on traps	23 (71.9%)	9 (28.1%)	32
1–16 roaches on traps	12 (37.5%)	20 (62.5%)	32
No roaches on traps	10 (37.0%)	17 (63.0%)	27
		$X^2 = 9.93, p = 0.007$	



with 17–287 cockroaches were skin test positive ($X^2 = 9.93$, $p = 0.007$).

DISCUSSION

Parental reports are an important source of information about history, severity, and response to therapy of pediatric asthma. Further, parental knowledge of the child's specific allergens may provide a basis for interventions to limit allergen exposure. This study finds parental reports of child skin test results to be accurate.

One similar study (1) found that asthma and allergy patients were limited in their ability to predict specific allergens. For positive skin tests, 10% to 63% of predictions were correct vs. 67% to 89% correct for negative test results. The investigators concluded that patients were better at predicting negative skin test results than positive. While this appears to be true for those who are being newly tested and are trying to anticipate the results, it was not true for this study. In this study the patient had been previously tested and the parent reported retrospectively on the outcome of that test. Accuracy was greater for positive tests than for negative despite the fact that clinicians explained the test results whether positive or negative. This suggests that the parental focus on "what is a problem," i.e., the positive test, is more accurate than a focus on "what problem is not present," i.e., a negative test.

While it makes sense that the sensitivity would be higher than among populations who are prospectively reporting expectations of skin test results as compared to those who are recalling skin test results retrospectively, it is not clear why specificity would be lower. Our criteria were such that those who responded "don't know" were included as a "no" response. Including only the "no" responses resulted in lower specificity (dog, 40%; cat, 56%; roach, 56%; dust mites, 40%; and mold, 47%). This may also reflect some "yes saying" bias on the part of Hispanic respondents that has been previously noted as a methodological issue in this population (6). If this is the case, then true sensitivity may be lower than we report—it may be some combination of those who actually know and recall the test result and those who feel obligated to say "yes" in response to interviewer questions. Further, "yes saying" may also explain the low specificity. A wheal size 3 mm greater than control is generally used by the Breathmobile clinicians as the criterion for clinical atopy and is consistent with published recommendations (4). This wheal size may appear small to a parent. This may contribute to lower sensitivity as well.

This study was conducted among parents and children who were predominantly of Hispanic heritage, who were primarily Spanish speaking, and who were on public pay health coverage (Medicaid/Medi-Cal). The fact that the accuracy of parental response did not differ when stratified by language, education, employment of the caretaker, severity of the child's asthma, length of time seen at the Breathmobile, family history of asthma, and the caretaker perception of cockroach infestation in the house, suggests that none of these acted as a barrier to accurate recall of test results. The Breathmobile clinic was able to overcome these barriers to provide information to parents regardless of their background. This suggests that other inner city clinics could do likewise. Information on control of relevant environmental allergens is provided as part of routine clinical care, and this may further help to reinforce patient recall of allergy testing results.

However, when using an open-ended question that asked parents to report what causes their child to have asthma attacks, very few parents correctly volunteered the allergen for which their child was skin test positive. This may indicate that the level of knowledge is lower than the sensitivity data would suggest. Alternatively, this low level of reporting among those whose child was allergic may indicate that while parents knew what their child's skin test results were, they did not link that result with an actual symptom—i.e., with an asthma attack. It may have been that the allergenic extract dose is not biologically relevant in terms of an asthma attack despite atopy (7). The exposure may not have had the biological effect of triggering an attack. Alternatively, the exposure may have been such that parents did not bring it readily to mind, for example exposure to dust mites is not readily visible. Other exposures such as exercise, upper respiratory infections, and changes in the weather may be more readily apparent to parents and may in fact be the immediate triggers.

With regard to actual exposures, we note that skin test results were not highly related to current exposures to cats or dogs. That is to say, those who were allergic were no more likely to have a dog or cat than those who were not allergic. However, it is also true that only 23 of the families had a dog and only four had a cat. As reported in other studies (8), it is unclear whether parents reduce exposure to allergens on the basis of clinical symptoms or skin tests. Cats are generally not a pet of choice in the Hispanic community and the lack of cats was more likely due to pet preference than to an asthma intervention by parents of these children.

On the other hand, the presence of cockroaches, either by self report or by roach trap counts was highly related to atopy for roach allergen. This relationship



may suggest that those children who are more exposed are more likely to develop atopy. This relationship was most apparent for those children who lived in a dwelling with many cockroaches, although previous research has been inconsistent in this regard (9–12).

These data were collected as part of a large-scale study of asthma in Hispanic children in Los Angeles County. Our results are encouraging to the extent that they demonstrate that knowledge of skin test results were communicated to parents despite differences in education and language fluency in English. It is not clear from the results whether parents connected the skin test results with the actual asthma attacks suffered by their children.

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