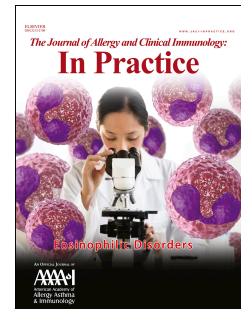


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Parent report of physician diagnosis in pediatric food allergy: An update

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Professor of Pediatrics at Northwestern University; and serves as a medical consultant/advisor for Before Brands, Pfizer, Kaléo Inc., and DBV Technologies. Ms. Isabel Galic, Dr. Christopher Warren, Ms. Jialing Jiang, and Dr. Mary Tobin do not have any conflicts of interest to report.

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Clinical Implications:

Of children with convincing FA in the “Top 9” (i.e. peanut, tree nut, egg, milk, shellfish, finfish, wheat, soy or sesame), about half reported no physician diagnosis. It is critical that we understand the barriers to FA diagnosis in order to reduce unnecessary food avoidance and ensure appropriate FA management and education, especially for underserved children.

An estimated 8% of children in the US have an IgE-mediated food allergy (FA). (1) Children with FA and their families experience substantial impairments in quality of life due to the constant vigilance required for food allergen avoidance. (2) Physician-diagnosis of suspected FAs is important to avoid unnecessarily restrictive diets, provide patient counseling, and ensure epinephrine prescriptions for emergency treatment. However, data from a nationally-representative survey in 2009 suggest that approximately one in three food-allergic US children had not received confirmatory allergy testing by a physician. (3)

In 2010, the National Institute of Allergy and Infectious Disease (NIAID) released guidelines aimed at standardizing clinical FA diagnostic practices. Since then, however, few studies have characterized national trends regarding the diagnosis of pediatric FAs. It is imperative to understand current practices in order to improve clinical management of children with FA. This study analyzes trends in the clinical diagnosis of childhood FAs since the publication of the 2010 guidelines and concomitant administration of a previous FA prevalence survey we administered in 2009-2010. (4)

In this study, physician practices in diagnosing pediatric FA were evaluated via a follow-up cross-sectional prevalence survey comprised of core 2009–2010 prevalence survey items, as well as additional questions designed to assess emerging questions in FA. The survey was administered October 2015–September 2016 to parents of another nationally-representative sample of 38,408 children. The Northwestern University Institutional Review Board approved all study activities.

The survey asked parents to provide a detailed history of all current suspected FAs for their child. Parent-reported FAs were considered convincingly IgE-mediated if the most severe reaction reported to that food included at least one symptom on the stringent symptom list developed by our expert panel (Table E1). (1, 4) Convincing FAs for which parents reported a physician diagnosis were considered physician-confirmed FAs. For all physician-diagnosed FAs, parents were asked which confirmatory diagnostic tests were conducted. The specific tests queried included allergen-specific IgE (blood test), skin prick test (SPT), and oral food challenges (OFC). Complex survey-weighted proportions were estimated to compare FA diagnosis characteristics by allergen. Detailed methodological information regarding survey design, sampling, weighting, and statistical analysis has been published previously. (1)

The overall estimated prevalence of IgE-mediated childhood FA was 7.6% (95%CI: 7.1-8.1), while the prevalence of physician-confirmed FA was 4.7% (95%CI: 4.3-5.0). An estimated 38.9% (95%CI: 35.6-42.4) of children with convincing FA had no physician diagnosis (Table 1). When the sample was restricted to those with convincing allergies to the “Top 9” (i.e. peanut, tree nut, egg, milk, shellfish, finfish, wheat, soy or sesame), 46.1% (95%CI: 42.7-49.5) of children with convincing FA reported no physician diagnosis. One in eight patients with physician-confirmed FA reported additional convincing FA in the “Top 9” which were not physician-diagnosed. Among children who received FA treatment in the emergency department, 73.2% (95%CI: 67.6-77.8) had at least one physician-diagnosed FA (Table 1).

Children from families earning less than \$50,000/year were less likely to have their convincing FAs diagnosed by a physician relative to families earning over \$50,000/year (Table 1). In

contrast to a previous prevalence survey administered in 2009-2010 (5), no significant racial differences in the relative frequency of physician-diagnosed FA (Table 1) were identified. Among children with physician-diagnosed FA, milk allergy patients reported the youngest median age of diagnosis (age 1, IQR 2.3), followed by peanut (age 2, IQR=4). Convincing FAs with the highest rates of physician-diagnosis were peanut (80.9%; 95%CI: 77.0-84.4), tree nuts (72.9%; 95%CI: 66.2-78.6), and egg (72.2%; 95%CI: 63.9-79.3). In contrast, convincing soy allergies were least likely to be physician-diagnosed [40.7% (95%CI: 28.6-54.1)]. Among children with physician-diagnosed FA, the majority were diagnosed by skin test [68.2% (95%CI: 63.6-72.4)] (Table 2). There were no significant differences in confirmatory diagnostic method by race or age (Table E2).

Our finding that 38.9% of children with convincing FA had no physician diagnosis is comparable to work in 2008 reporting that three in ten infants with convincing FA were not diagnosed by a physician. (6) Even among those with a physician-diagnosed FA, we found that the diagnosis is not often not complete and may exclude additional reported food allergies. A formal diagnosis is important to provide families with accurate management tools and avoid stress and malnutrition that may accompany unnecessary food avoidance or severe reactions.

Interestingly, four in five cases of convincing peanut allergy was diagnosed compared to two in five cases of soy allergy. This may be due to increased public awareness and perceived increased severity of peanut allergy compared to other allergens in the top nine. Peanut allergy is the one food that has guidelines for prevention (7), demonstrating that increasing public awareness can improve diagnoses especially in younger children.

In comparison to our previous study (6), the utilization of confirmatory SPT, allergen-specific IgE, and OFC testing increased by 20%, 10%, and 5% respectively, which may indicate that ongoing efforts (8) to educate pediatricians and promote diagnosis and quick referral to allergists have begun to bear fruit.

Beyond understanding clinical diagnostic patterns, these data help characterize the children less likely to receive a physician diagnosis. Families of lower socioeconomic status remain less likely receive a physician diagnosis and its corresponding food allergy management support. Previously, low income children were found to spend more on ED visits for food allergy and less on specialty care with allergists and less on special diets and medications. (9) Continued efforts to increase access to allergists for low income children is essential.

A limitation of our study is that convincingly IgE-mediated FAs were assessed via parent-reported questionnaires. However, stringent criteria were employed which exclude FAs with corresponding symptom-report inconsistent with IgE-mediated FA (1). While these criteria have been widely utilized (1, 4), some misclassification of IgE-mediated FA remains likely.

These data suggest over two million food-allergic children have undiagnosed FAs and even when FAs are diagnosed, inconsistency remains with respect to diagnostic practices. It is critical that we standardize physician evaluation of suspected FA to reduce unnecessary food avoidance and ensure appropriate FA management, especially for underserved children.

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TABLES

Table I: Independent factor distribution of diagnosed vs. undiagnosed FA among children with 1+ food allergy

Variable	Proportion of US children with each characteristic whose allergy is undiagnosed	Proportion of US children with each characteristic whose allergy is physician-diagnosed	P value
<i>Any Food Allergy</i>	38.9 (35.6-42.4)	61.1 (57.6-64.5)	<.01
<i>Any Top 9 Food Allergy</i>	46.1 (42.7-49.5)	53.9 (50.5-57.3)	0.03
<i>Specific Food Allergy</i>			
Peanut	19.1 (15.6-23.0)	80.9 (77.0-84.4)	<.01
Milk	47.9 (40.1-55.8)	52.1 (44.2-60.0)	0.6
Shellfish	40.8 (34.2-47.7)	59.3 (52.3-65.8)	<.01
Tree nuts	27.2 (21.4-33.8)	72.9 (66.2-78.6)	<.01
Egg	27.8 (20.8-36.1)	72.2 (63.9-79.3)	<.01
Wheat	45.1 (31.5-59.4)	54.9 (40.6-68.5)	0.5
Soy	59.3 (45.9-71.4)	40.7 (28.6-54.1)	0.16
Fin fish	46.8 (35.5-58.4)	53.2 (41.6-64.5)	0.59
Sesame	44.5 (31.4-58.4)	55.5 (41.6-68.6)	0.43
<i>Multiple Food Allergies?</i>			
Yes	27.0 (22.6-31.9)	73.1 (68.2-77.5)	<.01
No	46.9 (42.5-51.3)	53.1 (48.7-57.5)	0.17
<i>Severity</i>			
Mild/moderate	49.0 (44.3-53.8)	51.0 (46.2-55.7)	0.69
Severe	25.1 (21.1-29.6)	74.9 (70.4-79.0)	<.01
<i>Place of Birth</i>			
Born in the U.S.	38.65 (35.2-42.2)	61.4 (57.8-64.8)	<.01
Born outside of U.S.	50.3 (30.4-70.0)	49.7 (30.0-69.6)	0.98
<i>Reported 1 or more food-allergy-related ER visit (lifetime)</i>			
None	47.7 (43.3-52.1)	52.3 (47.9-56.7)	0.31
Any	26.8 (21.9-32.4)	73.2 (67.6-78.1)	<.01
<i>Epi Prescription</i>			
Yes	15.1 (12.4-18.3)	84.9 (81.8-87.6)	<.01
No	55.3 (50.7-59.8)	44.7 (40.2-49.3)	0.03

<i>Physician-diagnosed Comorbid Conditions</i>			
Asthma	26.8 (22.2-32.0)	73.2 (68.0-77.8)	<.01
EoE	16.2 (5.8-37.7)	83.8 (62.3-94.2)	<.01
Eczema	27.1 (19.1-36.9)	72.9 (63.1-80.9)	<.01
FPIES	26.1 (17.0-37.8)	73.9 (62.2-83.1)	<.01
Hay fever/Seasonal Allergies	26.4 (22.0-31.3)	73.6 (68.7-78.0)	<.01
Insect sting allergy	25.5 (16.5-37.2)	74.5 (62.8-83.5)	<.01
Latex allergy	19.6 (12.2-29.9)	80.4 (70.1-87.8)	<.01
Medication allergy	30.7 (22.0-41.0)	69.3 (59.0-78.0)	<.01
Urticaria/Chronic Hives	35.4 (20.5-53.82)	64.6 (46.2-79.5)	0.1
<i>Age</i>			
<1 year	2.5 (1.6-3.9)	1.6 (1.1-2.2)	0.09
1 year	6.4 (4.2-17.8)	5.1 (3.6-7.3)	0.44
2 years	10.7 (6.3-17.8)	5.5 (4.1-7.3)	0.03
3-5 years	21.0 (16.2-26.8)	15.7 (13.4-18.3)	0.06
6-10 years	23.9 (19.7-28.6)	32.5 (29.2-35.9)	<.01
11-13 years	13.9 (10.8-17.5)	18.2 (15.3-21.4)	0.07
14-17 years	21.7 (17.9-25.9)	21.6 (18.8-24.8)	0.99
<i>Race/ethnicity</i>			
Asian, non-Hispanic	2.8 (2.0-4.0)	2.7 (2.0-3.7)	0.85
Black, non-Hispanic	13.4 (10.4-17.1)	16.7 (13.5-20.5)	0.17
White, non-Hispanic	48.8 (42.8-54.9)	48.0 (44.1-51.9)	0.82
Hispanic	28.1 (22.1-35.1)	25.4 (22.0-29.2)	0.47
Multiple/other	6.9 (4.9-9.5)	7.2 (5.4-9.4)	0.85
<i>Sex</i>			
Female	50.3 (44.7-55.8)	46.9 (43.0-50.9)	0.34
Male	49.7 (41.2-55.3)	53.1 (49.1-57.0)	
<i>Household income, \$</i>			
<25,000	17.1 (13.0-22.3)	14.2 (11.6-17.3)	0.28
25,000-49,000	27.8 (22.7-33.5)	20.3 (17.6-23.4)	0.01
50,000-99,999	26.6 (22.6-31.1)	34.5 (20.9-38.4)	0.01
100,000-149,000	20.3 (14.8-27.2)	20.4 (17.4-23.9)	0.97
≥150,000	8.2 (5.4-12.2)	10.5 (8.1-13.5)	0.31

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Table 2. Distribution of physician-diagnosed food allergy characterized by positive confirmatory diagnostic test

Variable	Skin test	Blood test	OFC
1 or more of top 9 FA	68.2 (63.8-72.4)	50.4 (46.2-54.7)	25.0 (21.2-29.3)
<i>Type of allergy</i>			
Peanut	77.4 (72.0-82.0)	49.8 (43.4-56.2)	14.1 (10.9-18.1)
Milk	45.4 (36.4-54.6)	40.6 (32.2-49.6)	42.7 (32.7-53.3)
Shellfish	70.9 (63.0-77.6)	43.5 (35.7-51.7)	17.0 (11.6-24.2)
Tree nuts	81.9 (76.4-86.4)	48.1 (41.5-54.9)	16.9 (11.9-23.5)
Egg	61.7 (45.5-75.7)	46.7 (34.1-59.8)	20.9 (8.5-42.8)
Wheat	65.0 (52.1-76.1)	51.0 (36.7-65.1)	14.8 (8.9-23.5)
Soy	67.0 (52.3-79.0)	38.8 (27.1-51.8)	27.5 (16.1-43.0)
Fin fish	79.8 (71.2-86.3)	44.8 (32.9-57.3)	21.8 (13.9-32.5)
Sesame	80.9 (66.9-89.9)	45.3 (28.6-63.1)	6.5 (2.6-14.9)
<i>Multiple Food Allergies?</i>			
Yes	75.9 (69.1-81.7)***	49.3 (43.7-54.9)	26.7 (21.2-33.1)
No	55.8 (50.5-61.0)***	42.9 (37.6-48.5)	21.0 (17.2-25.2)
<i>Race/ethnicity</i>			
Asian, non-Hispanic	75.7 (61.9-85.7)	52.7 (38.5-66.4)	32.0 (19.5-47.8)
Black, non-Hispanic	65.1 (51.0-77.0)	44.1 (33.6-55.2)	31.0 (19.0-46.4)
White, non-Hispanic	63.0 (57.8-68.0)	48.8 (43.8-53.8)	20.2 (17.1-23.8)
Hispanic	70.7 (63.1-77.3)	43.0 (34.8-51.6)	24.7 (18.3-32.4)
Multiple/other	59.8 (46.3-72.0)	39.5 (28.5-51.8)	23.7 (14.7-35.8)
<i>Sex</i>			
Female	63.4 (56.7-69.7)	47.2 (41.0-53.4)	25.3 (19.6-32.1)
Male	67.2 (62.5-71.6)	44.9 (40.2-49.8)	22.3 (18.6-26.4)
<i>Age</i>			
<1 year	66.9 (50.4-80.1)	38.3 (23.7-55.3)	27.7 (15.2-44.9)
1 year	53.6 (35.0-71.3)	41.5 (24.2-61.2)	31.7 (18.0-49.4)
2 years	70.8 (57.2-81.6)	52.6 (38.2-66.5)	27.9 (16.2-43.8)
3-5 years	65.7 (56.6-73.9)	40.3 (32.8-48.4)	25.4 (17.9-34.6)
6-10 years	60.0 (53.0-66.7)	47.3 (40.7-54.0)	27.8 (21.6-35.1)
11-13 years	75.3 (68.6-81.0)	49.7 (40.3-59.1)	17.6 (13.2-23.2)
14-17 years	66.4 (58.4-73.5)	44.9 (37.5-52.5)	18.2 (13.9-23.4)
<i>Household income, \$</i>			
<25,000	59.9 (48.4-70.3)	40.2 (30.4-50.9)	29.7 (20.5-41.0)
25,000-49,000	60.1 (52.9-66.9)	40.1 (33.5-47.0)	27.9 (21.7-35.0)
50,000-99,999	63.6 (56.0-70.6)	46.0 (39.6-52.5)	25.6 (18.8-34.0)

100,000-149,000	74.1 (66.8-80.3)	57.9 (49.7-65.7)	18.2 (13.6-23.8)
≥150,000	72.6 (57.5-83.8)	42.0 (29.4-55.7)	12.0 (7.7-18.3)
<i>Region</i>			
New England	60.5 (42.6-76.0)	49.5 (34.0-65.1)	32.8 (18.1-51.9)
Middle Atlantic	63.7 (47.6-77.1)	40.8 (29.6-52.9)	27.6 (14.3-46.5)
East North Central	68.6 (58.6-77.2)	46.6 (37.6-55.8)	19.9 (14.0-27.4)
West North Central	59.4 (44.7-72.6)	53.3 (40.1-66.0)	22.6 (13.7-34.9)
South Atlantic	67.3 (60.3-73.6)	50.1 (42.1-58.1)	29.4 (23.1-36.5)
East South Central	64.1 (50.2-76.0)	42.7 (30.8-55.5)	15.5 (9.8-23.5)
West South Central	61.7 (49.9-72.2)	44.6 (33.7-56.1)	16.3 (11.0-23.4)
Mountain	67.4 (50.1-81.0)	36.2 (23.7-50.8)	22.9 (10.8-42.0)
Pacific	70.1 (62.3-77.0)	45.8 (38.1-53.6)	22.3 (16.2-29.9)