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OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

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Pediatrics published online Dec 7, 2009;

DOI: 10.1542/peds.2009-1116

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American Academy of Pediatrics

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Food Allergy Knowledge, Attitudes, and Beliefs of Primary Care Physicians

AUTHORS: Ruchi S. Gupta, MD, MPH,^{a,b} Elizabeth E. Springston, BA,^a Jennifer S. Kim, MD,^c Bridget Smith, PhD,^{b,d} Jacqueline A. Pongracic, MD,^c Xiaobin Wang, MD, MPH, ScD,^a and Jane Holl, MD, MPH^b

^aSmith Child Health Research Program and ^cDivision of Allergy and Immunology, Children's Memorial Hospital, Chicago, Illinois;

^bInstitute for Healthcare Studies, Northwestern Feinberg School of Medicine; Chicago, Illinois; and ^dCenter for Management of Complex Chronic Care, Edward Hines Jr VA Hospital, Hines, Illinois

KEY WORDS

food allergy, pediatricians, family physicians, anaphylaxis, diagnosis, treatment, knowledge

ABBREVIATION

CFARS-PHYS—Chicago Food Allergy Research Survey for Primary Care Physicians

www.pediatrics.org/cgi/doi/10.1542/peds.2009-1116

doi:10.1542/peds.2009-1116

Accepted for publication Jul 14, 2009

Address correspondence to Ruchi S. Gupta, MD, MPH, Children's Memorial Hospital, 2300 Children's Ave, Box 157, Chicago, IL 60614. E-mail: rugupta@childrensmemorial.org

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*



WHAT'S KNOWN ON THIS SUBJECT: Few data exist detailing the generalist's knowledge and perceptions of food allergy. A comprehensive evaluation of food allergy knowledge, attitudes, and beliefs among pediatricians and family physicians in the United States is needed.



WHAT THIS STUDY ADDS: We surveyed more than 400 primary care physicians and found that knowledge of food allergy was fair, with several important opportunities for improvement identified. Of particular interest, respondents expressed concern regarding their ability to care for affected children.

abstract

OBJECTIVE: To provide insight into food allergy knowledge and perceptions among pediatricians and family physicians in the United States.

METHODS: A national sample of pediatricians and family physicians was recruited between April and July 2008 to complete the validated, Web-based Chicago Food Allergy Research Survey for Primary Care Physicians. Findings were analyzed to provide composite/itemized knowledge scores, describe attitudes and beliefs, and examine the effects of participant characteristics on response.

RESULTS: The sample included 407 primary care physicians; 99% of the respondents reported providing care for food-allergic patients. Participants answered 61% of knowledge-based items correctly. Strengths and weaknesses were identified in each content domain evaluated by the survey. For example, 80% of physicians surveyed knew that the flu vaccine is unsafe for egg-allergic children, 90% recognized that the number of food-allergic children is increasing in the United States, and 80% were aware that there is no cure for food allergy. However, only 24% knew that oral food challenges may be used in the diagnosis of food allergy, 12% correctly rejected that chronic nasal problems are not symptom of food allergy, and 23% recognized that yogurts/cheeses from milk are unsafe for children with immunoglobulin E-mediated milk allergies. Fewer than 30% of the participants felt comfortable interpreting laboratory tests to diagnose food allergy or felt adequately prepared by their medical training to care for food-allergic children.

CONCLUSIONS: Knowledge of food allergy among primary care physicians was fair. Opportunities for improvement exist, as acknowledged by participants' own perceptions of their clinical abilities in the management of food allergy. *Pediatrics* 2010;125:123–129

Food allergy is a growing concern in the United States, affecting an estimated 4% to 6% of children.^{1,2} For these children, the standard of care is limited to avoidance of allergenic foods and prompt response after accidental ingestion.³ Management is further complicated by the unpredictable nature of the disease. Case studies have shown that food allergy may be fatal at a time and place that cannot be predicted and may occur despite perceived allergen avoidance, self-treatment, and medical attention.⁴ Although such anaphylactic occurrences are rare, food-induced anaphylaxis is the most common type of anaphylaxis in children⁵ and is responsible for an estimated 150 deaths annually in the United States.⁶

Given the uncertainty of predicting future risk for food-allergic children, prevention is of utmost importance. Accordingly, the primary care physician plays a critical role in the protection of food-allergic children. Pediatricians and family physicians are often the first and sometimes the only line of defense against childhood food allergy. They are frequently relied on by families for an initial diagnosis of food allergy, instruction in the management of food allergy, and evaluation of the allergy over time. At the very least, the primary care physician is expected to recognize the signs of food allergy to make an appropriate referral to an allergist.

Few data exist detailing food allergy knowledge and perceptions among primary care physicians. However, it has been suggested that uncertainty among families regarding their child's food allergy is compounded by divergent medical opinions.⁷ Differing diagnostic approaches^{8,9} and perceived clinical manifestations of food allergy¹⁰ among providers have been documented. In addition, knowledge gaps regarding the identification and treat-

ment of food-induced anaphylaxis have been reported.^{11,12} To date, research regarding knowledge and perceptions of food allergy among physicians has tended to focus on a specific aspect of the disease (eg, food-induced anaphylaxis) or has included primary care physicians only as a small subset of the total study sample. A comprehensive evaluation of food allergy knowledge, attitudes, and beliefs among pediatricians and family physicians in the United States is needed.

Given the growing burden of childhood food allergy among children and the significant role of the primary care physician in its diagnosis and treatment, we developed and administered the Chicago Food Allergy Research Survey for Pediatricians and Primary Care Physicians (CFARS-PHYS). The goal of this survey was to characterize food allergy knowledge, attitudes, and beliefs among primary care physicians and family physicians in the United States.

METHODS

Survey Instrument

The CFARS-PHYS was developed by using well-established survey methodology.^{13,14} Focus groups ($n = 3$), cognitive interviews ($n = 10$), reliability testing ($n = 12$), and item reduction ($n = 62$) were used to develop and validate the survey instrument. An expert panel of pediatricians, pediatric allergists, survey researchers, and food allergy awareness advocates oversaw development and validation. For additional details on survey methodology, refer to the article by Gupta et al (2009).¹⁵

The final, validated survey instrument consisted of 46 items and may be obtained from Gupta et al.¹⁵ Thirty-nine items tested food allergy knowledge (13 true/false, 22 multiple-choice); the remainder assessed food allergy attitudes and beliefs (10 5-point Likert scale items, 1 multiple-choice). Each

item corresponded to 1 of 8 identified food allergy content domains: (1) definition and diagnosis; (2) symptoms and severity; (3) triggers and environmental risk; (4) perceptions of susceptibility and prevalence; (5) stigma and acceptability; (6) perceptions of quality of life; (7) treatment and use of health care; and (8) policy issues.

Study Design

Practicing pediatricians and family physicians were recruited anonymously from April to July 2008. Primary care physicians were initially recruited by a commercial vendor specializing in survey administration (Redi-Data, Fairfield, NJ). A portion of the American Medical Association master file, which contains contact information for 4500 pediatricians and 1500 family physicians in the United States, was purchased. A targeted e-broadcast was then deployed with a direct link to the survey. Additional respondents were recruited at the Pediatric Academic Society Annual Meeting in May 2008 (Honolulu, HI). Attendees were able to complete the survey electronically at an exhibition booth or to sign up to receive a direct link to the survey via e-mail. An honorarium was provided to the first 400 respondents. Incomplete surveys ($n = 68$) were not included in analysis. The development and launch of the CFARS-PHYS was approved by the institutional review boards of both Children's Memorial Hospital and Northwestern University.

Statistical Analyses

A summary score of food allergy knowledge was created by calculating the percentage of knowledge items that each respondent answered correctly. Descriptive analyses included presentation of overall score, percentage of respondents who answered each item correctly, and scores according to respondent characteristics. Analysis of variance and multiple lin-

ear regression were used to measure the association between knowledge score and physician type. χ^2 tests were used to examine the relationship between itemized knowledge and physician type. To assess the association between respondent characteristics and the probability of answering a particular question or combination of questions correctly, Poisson regression models with robust error variances were used to obtain relative risk ratios.¹⁶

To describe perceptions of quality of life and policy considerations, response categories were collapsed into strongly disagree/disagree, neither agree/disagree, and strongly agree/agree. Frequencies were calculated for each category. χ^2 tests were used to test the association between physician type and agreement with each quality-of-life/policy item. All statistical analyses were performed by using Stata 10 (Stata Corp LP, College Station, TX).

RESULTS

Participant Characteristics

A total of 407 physicians completed the survey (Table 1); 68 respondents (17%) were family physicians, and 339 (83%) were pediatricians. All participants were practicing medicine, although the time in practice varied from <5 years to >20 years. Forty-one percent of the respondents were in private practice, 31% were affiliated with an academic institution, and 28% were hospital-based clinicians. Practices were located in 48 states and were well distributed across all census regions. Ninety-nine percent of respondents reported caring for food-allergic children; these children tended to comprise <5% of the provider's overall patient population. Respondents reported caring for 60 to 70 children per week. On average, 41% of these patients were white, 25% were Hispanic,

TABLE 1 Demographic Characteristics of Primary Care Participants (N = 407)

Variable	Sample Population, n (%)
Medical specialty	
Family physician	68 (17)
Pediatrician	339 (83)
Years in practice	
<5	98 (24)
5–10	99 (24)
11–15	65 (16)
16–20	46 (11)
>20	99 (24)
Practice type	
Academic clinician	125 (31)
Hospital-based clinician	116 (28)
Private practice/community clinician	166 (41)
Practice region	
Northeast	73 (18)
Midwest	85 (21)
South	99 (24)
West	150 (37)
Food-allergic patient population	
0%	4 (1)
<5%	235 (58)
6%–10%	143 (35)
>10%	25 (6)
Food-allergic acquaintance ^a	
Yes	241 (59)
No	166 (41)

^a Participant was acquainted with ≥ 1 of the following food-allergic individuals: himself/herself, a spouse/partner or child, or a relative or close friend.

22% were black, and 8% were Asian. Forty-six percent of the patients were insured by an employer, 41% received Medicaid, and 9% were uninsured.

Knowledge of Food Allergy

Participants answered 61% of knowledge-based items correctly, ranging from 23% to 87% correct. The overall score was significantly higher for pediatricians (62%) than for family physicians (54%). However, multiple linear regression analysis found very little variation in clinical knowledge of food allergy according to medical specialty, years in practice, practice type, practice location, or percentage of food-allergic patients (Table 2). Strengths and weaknesses in food allergy knowledge were observed in each content domain. Itemized knowledge scores are listed in Table 3.

Perceptions of Food Allergy

Respondents' food allergy attitudes and beliefs were well distributed across a 5-point Likert scale, ranging from strongly disagree to strongly agree (Table 4). In addition to questions that assessed perceptions of food allergy, all participants were asked to identify the single most important step for improving the lives of those with food allergy. Responses were widely distributed, with promoting public awareness campaigns (33%) and identifying the cause of food allergy (30%) selected most frequently. Other options included developing a cure (19%), improving treatments (13%), and promoting school education programs (5%).

DISCUSSION

To our knowledge, this study is the first to provide a comprehensive review of food allergy knowledge and perceptions among primary care physicians in the United States. It should be noted that 99% of participants reported providing care for food-allergic patients. Respondents' knowledge of food allergy was fair, with strengths and weaknesses identified in each content domain. Of particular interest, participants correctly answered a number of items pertaining to triggers/environmental risks, susceptibility/prevalence, and treatment/utilization of health care. However, significant knowledge gaps were also identified in areas relating to triggers/environmental risks, as well as on several items regarding the definition/diagnosis and symptoms/severity of food allergy. Perceptions regarding food allergy were generally well distributed, although respondents consistently expressed concern regarding their ability to care for affected children.

Pediatricians and family physicians acknowledged that an increasing num-

TABLE 2 Multivariable Regression: Relationship of Respondent Characteristics and Clinical Knowledge of Food Allergy

Variable	Relative Risk Ratio (95% CI)		
	Aware of Skin-Prick Test or RAST Insufficient for Food Allergy Diagnosis	Aware of Influenza Vaccine Unsafe For Children With Egg Allergy	Able to Appropriately Prescribe Epinephrine for Food Allergy Reaction
Medical specialty: family physicians vs pediatricians	0.75 (0.59–0.97) ^a	0.95 (0.84–1.08)	0.46 (0.21–0.98) ^a
Years in practice: >10 vs <10 y	1.04 (0.91–1.19)	0.87 (0.78–0.95) ^a	0.84 (0.59–1.19)
Practice type			
Academic vs community-based physician	0.96 (0.81–1.14)	0.75 (0.65–0.85) ^a	0.96 (0.60–1.52)
Hospital vs community-based physician	0.92 (0.78–1.09)	0.82 (0.73–0.92) ^a	1.15 (0.76–1.73)
Practice region			
Midwest vs West	0.85 (0.70–1.03)	1.10 (0.97–1.25)	1.16 (0.75–1.80)
South vs West	0.90 (0.75–1.10)	1.17 (1.03–1.32)	0.81 (0.48–1.38)
Northeast vs West	0.92 (0.77–1.11)	1.04 (0.89–1.21)	0.96 (0.59–1.56)
Food-allergic patient population: >5% vs <5% patients with food allergy	0.98 (0.86–1.12)	0.95 (0.86–1.05)	1.07 (0.75–1.52)
Food-allergic acquaintance: with vs without food-allergic acquaintance ^b	1.03 (0.90–1.17)	1.04 (0.95–1.14)	1.26 (0.89–1.77)

CI indicates confidence interval; RAST, radioallergosorbent test.

^a $P < .05$

^b Participant was acquainted with ≥ 1 of the following food-allergic individuals: himself/herself, a spouse/partner or child, a relative, or a close friend.

ber of children are affected by food allergy. They also identified children ≤ 5 years old as the group most commonly affected by food allergy. To this end, a report recently released from the Centers for Disease Control and Prevention highlighted the growing commonality of perceived childhood food allergy and digestive disorders as well as an increase in the number of children discharged from the hospital with a diagnosis of food allergy or a related disorder.¹⁷ Epidemiological data indicate that food allergy is most common in the first 3 years of life and is less frequently observed in the years that follow.²

There was some confusion among participants regarding signs and symptoms suggestive of an underlying food allergy. Although the majority of respondents recognized hives and eczema as food allergy symptoms, many participants also associated chronic nasal problems with childhood food allergy. Symptoms of a food allergy reaction commonly involve localized hives and worsening eczema,¹⁸ with moderate-to-severe atopic dermatitis a frequent comorbid condition of food allergy.¹⁹ Although there is currently

no evidence to suggest that chronic nasal congestion is a sign of food allergy, acute rhinitis may be a symptom of a food-induced allergic reaction.¹⁸ This distinction may cause confusion, explaining the frequency with which participants incorrectly selected chronic nasal problems as a sign of food allergy.

Previous research has suggested that varied approaches to the diagnosis of food allergy exist among primary care physicians.⁸ When making a diagnosis of food allergy, participants in our study tended to prefer food-specific immunoglobulin E levels and, to a lesser extent, skin-prick testing. Few respondents reported using oral food challenges as a diagnostic tool. Consistent with these findings, a study that included a small sample of nonallergists revealed that this group favored food-specific immunoglobulin E levels to diagnose food allergy more frequently than percutaneous skin testing.⁹ Nonallergists in this study were also much less likely than allergists to use oral food challenges to confirm a food allergy diagnosis.⁹

The majority of respondents correctly identified peanut, milk, and egg as the

top 3 food allergens in children.² However, shellfish was also frequently selected, which, although the most common allergen among US adults, is less likely to be a food allergen in children.²⁰ In addition, most participants were unaware of the relative frequency with which children outgrow common food allergies. Respondents were expected to recognize that >75% of milk-allergic children and <25% of peanut-allergic children develop tolerance. These ranges are well documented in the literature. At the upper limit, it has been reported that 79% to 87% of milk-allergic children will outgrow their allergy.^{21,22} Conversely, peanut-allergic children tend to carry their allergy into adulthood; at most, tolerance has been shown to occur in 22% of cases.²³

Providers were aware of many triggers of food-induced reactions. They aptly identified certain medications as containing allergenic food ingredients and knew that the influenza vaccine may be unsafe for children with an egg allergy. Because the influenza virus is grown in chick embryos, the vaccine may contain measurable amounts of egg protein. Therefore, the American

TABLE 3 Itemized Food Allergy Knowledge of Primary Care Participants According to Medical Specialty: Unadjusted (*n* = 407), Pediatricians (*n* = 339), and Family Physicians (*n* = 68)

Item	Knowledge Score, % Correct		
	Unadjusted	Pediatricians	Family Physicians
Overall mean score	61	62 ^a	54 ^a
Definition and diagnosis			
Tests to diagnose food allergy (food-specific IgE levels)	64	68 ^a	43 ^a
Tests to diagnose food allergy (oral food challenges)	24	25	22
Tests to diagnose food allergy (skin-prick test)	57	59	49
Positive skin prick test or RAST is sufficient food allergy diagnosis (F)	68	71 ^a	53 ^a
Symptoms and severity			
Chronic nasal problems are symptom of food allergy (F)	12	13	6
Child can die from milk allergy reaction (T)	72	77 ^a	50 ^a
Mechanism of "milk protein allergy" symptom: blood in stool (T-cell mediated)	21	21	22
Mechanism of "milk protein allergy" symptom: colic (non-immune-mediated)	57	60 ^a	38 ^a
Isolated symptom of food allergy in infant (hives)	79	82 ^a	63 ^a
Isolated symptom of food allergy in infant (eczema)	75	78 ^a	63 ^a
Sign of IgE-mediated milk allergy (flushing)	43	46 ^a	28 ^a
Triggers and environmental risk			
Asthma is important risk factor for severe anaphylaxis (T)	68	65 ^a	79 ^a
Moderate/severe atopic dermatitis is associated with food allergy (25%–50%)	36	37	32
Children with IgE-mediated milk allergies tolerate some yogurts/cheese with milk (F)	23	26 ^a	10 ^a
Food allergens are passed from maternal diet into breast milk (T)	83	88 ^a	59 ^a
Okay for children with egg allergies to eat egg yolks (F)	65	65	63
Food additives are common food allergens (F)	39	40	34
3 most common childhood food allergies (egg)	66	66	63
3 most common childhood food allergies (milk)	73	73	72
3 most common childhood food allergies (peanut)	77	76	84
Contains food ingredients that could cause allergic reaction (Play-doh)	57	56	63
Contains food ingredients that could cause allergic reaction (medicines)	82	81	82
Contains food ingredients that could cause allergic reaction (toothpaste)	48	47	53
Contains food ingredients that could cause allergic reaction (lotions/creams)	70	71	61
Food component that causes allergic reaction (protein)	90	91	90
Vaccines are unsafe for children with egg allergy (influenza)	80	82	80
Perceptions of susceptibility and prevalence			
No. of children in US with food allergy is increasing (T)	90	90	91
Teenagers are at higher risk for fatal food allergy vs younger children (T)	34	37 ^a	22 ^a
Age group most likely to have food allergies (0–5 y)	79	83 ^a	60 ^a
Children with milk allergy develop tolerance (>75%)	35	57 ^a	22 ^a
Children with peanut allergy develop tolerance (1%–25%)	44	44	43
Treatment and utilization of health care			
Daily antihistamine prevents food allergy reaction (F)	86	87	85
There is a cure for food allergy (F)	80	80	81
No contraindication to prescribing self-injectable epinephrine (T)	63	65 ^a	49 ^a
Timely administration of epinephrine prevents fatal anaphylaxis (most of the time)	75	75	75
Dose of epinephrine, 60-lb child (EpiPen/Twinject, 0.3 mg epinephrine)	51	56 ^a	25 ^a
Epinephrine injection location (lateral thigh)	91	92 ^a	82 ^a
Treatment for child after peanut ingestion (epinephrine 1:1000 IM)	50	52	41
Policy issues			
Mandates of FALPCA (plain-language ID of common allergens on ingredient list)	71	72	65

F indicates false; FALPCA, Food Allergen Labeling and Consumer Protection Act; ID, identification; IgE, immunoglobulin E; IM, intramuscular; RAST, radioallergen sorbent test; T, true.

^a Score is significantly different from unadjusted score (*P* < .05).

Academy of Pediatrics does not generally recommend the influenza vaccine for children with a history of egg-induced anaphylaxis.²³

Most participants recognized that no cure exists for food allergy and also acknowledged the importance of timely administration of epinephrine

to prevent fatal anaphylaxis. However, the majority of participants believed that anaphylaxis posed the greatest threat to young children rather than teenagers. Although food-induced anaphylaxis can occur at any age, epidemiological studies have shown that adolescents, particularly those with peanut and tree nut allergies, are disproportionately affected.²⁵

Difficulty also arose when participants were asked specific questions regarding the treatment of anaphylaxis. Although respondents knew the recommended injection site for epinephrine, only half were able to identify the correct dosage based on a child's weight. Likewise, only half chose the correct concentration and route of administration for epinephrine in the event of food-induced anaphylaxis. This finding is consistent with other studies of anaphylactic care among primary care physicians. A previous study revealed that only 56% of pediatricians were able to identify and address anaphylactic reactions in children.¹¹ Similarly, survey (including pediatricians and internists) reported that half of the respondents selected the incorrect concentration of epinephrine and route of administration for food-induced anaphylaxis.¹²

There was no clear consensus among the participants in our study regarding the need for nut-free classrooms. Previous research has indicated that 68% of parents with nonfood-allergic children oppose such policies,¹⁵ whereas our preliminary, unpublished data suggested that parents with food-allergic children tended to support nut-free classrooms (49% supported, 28% opposed, and 23% were neutral). Several private and public schools in the United States have banned peanuts, although the viability and efficacy of such policies remain a point of contention. It is worth noting, however, that 18% of preschool- and school-

TABLE 4 Perceptions of Food Allergy Considerations Among Primary Care Physicians According to Medical Specialty: Unadjusted ($n = 407$), Pediatricians ($n = 339$), and Family Physicians ($n = 68$)

Item	Disagree, %	Neutral, %	Agree, %		
			Unadjusted	Pediatricians	Family Physicians
Clinical ability					
Comfortable interpreting laboratory tests to diagnose food allergy	47	25	28	29	26
Medical training adequately prepared me to care for food allergy patients	54	24	22	22	19
Confident in ability to care for food allergy patients	32	30	38	40	28
Confident ED will discharge patients with food allergy reaction with epinephrine autoinjector	11	15	74	75	71
Partners knowledgeable about food allergy ($n = 374$; group practice only)	16	31	53 ^a	56 ^a	34 ^a
Policy considerations					
Classrooms should be nut free	23	25	52 ^a	55 ^a	37 ^a
EpiPen/Twinject kept only in nurse's/principal's/counselor's office in school	61	15	24	23	28
\$10 million/y for food allergy research vs \$400/y for asthma is sufficient	58	32	10	9	15
Perceptions of quality of life					
Most people take food allergy seriously	27	15	58 ^a	62 ^a	43 ^a
Parents of children with food allergy are hypervigilant	14	19	67	67	65

ED indicates emergency department.

^a $P < .05$.

aged children with food allergy have been reported to experience at least 1 reaction over a 2-year period while at school, with peanut the most common cause among school-aged children.²⁵

Participants in our study acknowledged limitations in their knowledge of food allergy. Few felt comfortable interpreting laboratory test results to diagnose food allergy or felt adequately prepared by their medical training to care for food-allergic children. Most pediatric and family medicine training programs do not offer formal training in food allergy, although experience likely varies by program. With the recent increase in childhood food allergy and the threat posed by food-induced anaphylaxis, it is important for generalists to be educated about the diagnosis and treatment of this condition. It is encouraging that medical residents who select an allergy rotation have been shown to be more comfortable with common allergic disorders and were more likely to refer patients to allergists.²⁶

Several resources exist to assist physicians in the diagnosis and management of food allergy. A food allergy practice parameter, outlining risk factors, diagnostic techniques, and treat-

ment plans, was developed and published in 2006 by the American Academy of Allergy Asthma & Immunology and the American College of Allergy, Asthma, and Immunology.²⁷ A practice parameter for the diagnosis and management of anaphylaxis was also published in 2005.³ Additional review articles in both the *New England Journal of Medicine* and *Pediatrics* are useful tools for an overview of food allergy management and provide decision trees that can be used as a quick reference when evaluating a child with suspected food allergy.^{18,28} Finally, educational resources have been specifically developed and validated to meet the needs of the primary care physician.²⁹ However, efforts are needed to encourage the dissemination and use of these materials to better prepare generalists to address the needs of their food-allergic patients. Familiarity with current resources is a first step toward improving physicians' confidence and clinical ability when dealing with childhood food allergy.

This study has several limitations. Although more than 400 participants completed our survey, only those able to complete the survey in English, those

with access to the Internet, and those listed in the commercial vendor's sampling database or in attendance at the annual meeting of the Pediatric Academic Society were recruited. In addition, there is some selection bias inherent in the recruitment process; those with an interest in food allergy may have been more inclined to complete the survey. Intuitively, one might expect this to result in higher knowledge scores among participants in our study; even so, significant knowledge gaps were identified. Although Web-based surveys have been shown to be valid and reliable means of data collection, potential difficulties have been highlighted, such as multiple entries for a given individual and poor sample representation that result from limited Internet access.³⁰⁻³² Responses were carefully monitored to avoid duplicate entries, and the survey was deployed in a controlled and secure online environment with particular attention paid to the demographic characteristics of respondents.

CONCLUSIONS

Knowledge of food allergy among primary care physicians was fair. Opportunities for improvement exist as

acknowledged by the respondents' own perceptions of their clinical abilities in the management of food allergy. Given the recent increase in childhood food allergy, the threat posed by food-induced anaphylaxis, and the frequency with which the primary care physician encounters these patients, it is imperative that

efforts be made to better equip generalists in the provision of care for food-allergic children.

ACKNOWLEDGMENTS

We thank the members of our expert panel, Denise Bunning, Anne Munoz-Furlong, Corrie Harris, MD, Karen Wilson, MD, Barry Zuckerman, MD, and Scott Sicherer, MD, for invaluable

guidance in the survey-development process and Laura Amsden, Julia Barnathan, and Emily Collins for assistance during the preliminary stages of survey development. We would also like to thank our funders, Dave and Denise Bunning and the Food Allergy Initiative, for their generous support of our research.

REFERENCES

- Bangash SA, Bahna SL. Pediatric food allergy update. *Curr Allergy Asthma Rep*. 2005;5(6):437–444
- Sampson HA. Update on food allergy. *J Allergy Clin Immunol*. 2004;113(5):805–820
- Joint Task Force on Practice Parameters; American Academy of Allergy, Asthma and Immunology; American College of Allergy, Asthma and Immunology; Joint Council of Allergy, Asthma and Immunology. The diagnosis and management of anaphylaxis: an updated practice parameter. *J Allergy Clin Immunol*. 2005;115(3 suppl 2):S483–S523
- Pumphrey RS. Lessons for management of anaphylaxis from a study of fatal reactions. *Clin Exp Allergy*. 2000;30(8):1144–1150
- Bohlke K, Davis RL, DeStefano F, Marcy SM, Braun MM, Thompson RS. Epidemiology of anaphylaxis among children and adolescents enrolled in a health maintenance organization. *J Allergy Clin Immunol*. 2004;113(3):536–542
- Yocum MW, Butterfield JH, Klein JS, Volcheck GW, Schroeder DR, Silverstein MD. Epidemiology of anaphylaxis in Olmsted County: a population-based study. *J Allergy Clin Immunol*. 1999;104(2 pt 1):452–456
- Hu W, Grbich C, Kemp A. When doctors disagree: a qualitative study of doctors' and parents' views on the risks of childhood food allergy. *Health Expect*. 2008;11(3):208–219
- Kaila M, Vanto T, Valovirta E, Koivikko A, Juntunen-Backman K. Diagnosis of food allergy in Finland: survey of pediatric practices. *Pediatr Allergy Immunol*. 2000;11(4):246–249
- Wilson BG, Cruz NV, Fiocchi A, Bahna SL. Survey of physicians' approach to food allergy, part 2: allergens, diagnosis, treatment, and prevention. *Ann Allergy Asthma Immunol*. 2008;100(3):250–255
- Cruz NV, Wilson BG, Fiocchi A, Bahna SL. Survey of physicians' approach to food allergy, part 1: prevalence and manifestations. *Ann Allergy Asthma Immunol*. 2007;99(4):325–333
- Krugman SD, Chiaramonte DR, Matsui EC. Diagnosis and management of food-induced anaphylaxis: a national survey of pediatricians. *Pediatrics*. 2006;118(3). Available at: www.pediatrics.org/cgi/content/full/118/3/e554
- Wang J, Sicherer SH, Nowak-Wegrzyn A. Primary care physicians' approach to food-induced anaphylaxis: a survey. *J Allergy Clin Immunol*. 2004;114(3):689–691
- Eigenmann PA, Sicherer SH, Borkowski TA, Cohen BA, Sampson HA. Prevalence of IgE-mediated food allergy among children with atopic dermatitis. *Pediatrics*. 1998;101(3). Available at: www.pediatrics.org/cgi/content/full/101/3/e8
- Sateia MJ, Reed VA, Christian Jernstedt G. The Dartmouth sleep knowledge and attitude survey: development and validation. *Sleep Med*. 2005;6(1):47–54
- Gupta RS, Kim JS, Springston EE, Pongratic JA, Wang X, Holl J. Development of the Chicago Food Allergy Research Surveys: assessing knowledge, attitudes, and beliefs of parents, physicians and the general public. *BMC Health Serv Res*. 2009;9:142
- Zou G. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol*. 2004;159(7):702–706
- Branum AM, Lukacs SL. Food allergy among US Children: trends in prevalence and hospitalizations. *NCHS Data Brief*. 2008(10):1–8
- Lack G. Clinical practice: food allergy. *N Engl J Med*. 2008;359(12):1252–1260
- Sicherer SH, Munoz-Furlong A, Sampson HA. Prevalence of seafood allergy in the United States determined by a random telephone survey. *J Allergy Clin Immunol*. 2004;114(1):159–165
- Høst A, Halcken S. A prospective study of cow milk allergy in Danish infants during the first 3 years of life: clinical course in relation to clinical and immunological type of hypersensitivity reaction. *Allergy*. 1990;45(8):587–596
- Skripak JM, Matsui EC, Mudd K, Wood RA. The natural history of IgE-mediated cow's milk allergy. *J Allergy Clin Immunol*. 2007;120(5):1172–1177
- Skolnick HS, Conover-Walker MK, Koerner CB, Sampson HA, Burks W, Wood RA. The natural history of peanut allergy. *J Allergy Clin Immunol*. 2001;107(2):367–374
- Pickering LK, ed. *2006 Red Book: Report of the Committee on Infectious Diseases*. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006
- Bock SA, Munoz-Furlong A, Sampson HA. Fatalities due to anaphylactic reactions to foods. *J Allergy Clin Immunol*. 2001;107(1):191–193
- Nowak-Wegrzyn A, Conover-Walker MK, Wood RA. Food-allergic reactions in schools and preschools. *Arch Pediatr Adolesc Med*. 2001;155(7):790–795
- Baptist AP, Baldwin JL. Physician attitudes, opinions, and referral patterns: comparisons of those who have and have not taken an allergy/immunology rotation. *Ann Allergy Asthma Immunol*. 2004;93(3):227–231
- American College of Allergy, Asthma, & Immunology. Food allergy: a practice parameter. *Ann Allergy Asthma Immunol*. 2006;96(3 suppl 2):S1–S68
- Sicherer SH, Muñoz-Furlong, Murphy R, Wood RA, Sampson HA. Symposium: pediatric food allergy. *Pediatrics*. 2003;111(6):1591–1680
- Yu JE, Kumar A, Bruhn C, Teuber SS, Sicherer SH. Development of a food allergy education resource for primary care physicians. *BMC Med Educ*. 2008;8:45
- Schmidt WC. World-wide Web survey research: benefits, potential problems, and solutions. *Behav Res Methods Instrum Comput*. 1997;29(2):274–279
- Kaplowitz MD, Hadlock TD, Levine R. A comparison of Web and mail survey response rates. *Public Opinion Quarterly*. 2004;68(1):94–101
- Schleyer TK, Forrest JL. Methods for the design and administration of Web-based surveys. *J Am Med Inform Assoc*. 2000;7(4):416–425

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Ruchi S. Gupta, Elizabeth E. Springston, Jennifer S. Kim, Bridget Smith, Jacqueline
A. Pongracic, Xiaobin Wang and Jane Holl
Pediatrics published online Dec 7, 2009;
DOI: 10.1542/peds.2009-1116

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