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# Food allergy knowledge, attitudes, and beliefs in the United States

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**Background:** Members of the general public play a significant role in the well-being of food-allergic children, although little is known about the knowledge, attitudes, and beliefs of food allergy among the public.

**Objective:** To provide insight into food allergy knowledge and perceptions among the general US population.

**Methods:** A national sample of adults was recruited in February 2008 to complete the validated Web-based Chicago Food Allergy Research Survey for the General Public. Findings were analyzed to provide composite/itemized knowledge scores, describe attitudes and beliefs, and examine the effect of prior knowledge/familiarity with food allergy on knowledge, attitudes, and beliefs.

**Results:** A sample of 2,148 respondents was obtained. Participants answered 64.9% (range, 12.5%–100.0%) of knowledge-based items correctly. Strengths were identified in areas related to symptoms/severity and triggers/environmental risks of food allergy. Knowledge was poor concerning the distinction between food allergy and food intolerance, the absence of a cure, and current means to treat food allergy. Higher scores were significantly associated with self-report of prior knowledge/familiarity with food allergy, particularly among those with prior training in food allergy (median increase, 7.9%). Perceptions regarding food allergy were generally well distributed, although respondents tended to minimize the stigma associated with food allergy and to oppose specific food allergy policies in schools.

**Conclusions:** Increased food allergy knowledge among the general public is needed. Improved public awareness of the challenges faced by food-allergic children may encourage adoption of standardized school policies to keep affected children safe. These efforts are critical for protecting young children with food allergy and avoiding life-threatening anaphylactic reactions.

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## INTRODUCTION

Childhood food allergy is a growing health concern,<sup>1–4</sup> affecting an estimated 6% to 8% of children in the United States.<sup>5–7</sup> The severity of the problem is compounded by limited treatment options and the absence of a cure. Current treatment primarily consists of identification and strict avoidance of allergenic foods and recognition of symptoms that can lead to anaphylaxis.<sup>6,8,9</sup> Unfortunately, food-induced anaphylaxis is the most frequent type of anaphylactic reaction among children<sup>10</sup> and is responsible for an estimated 150 deaths per year in the United States alone.<sup>11</sup>

Members of the general public often interact with young children at restaurants, entertainment facilities, child-care facilities, and schools and, therefore, play a significant role in the health and well-being of food-allergic children. Specifi-

cally, many lifestyles depend on food prepared away from home,<sup>12</sup> and 76% of food allergy–related deaths follow consumption of foods outside the home.<sup>13</sup> Further, reactions in school settings are common, with approximately 18% of food-allergic children experiencing at least 1 reaction at school during a 2-year period.<sup>8</sup>

Accordingly, the public's food allergy knowledge and awareness are critical to the safety of children with food allergy. It is vital that members of the general public recognize the importance of allergen avoidance, promptly identify food allergy reactions, and are aware of essential steps in the treatment of anaphylaxis. The goal of this study was to gain insight into food allergy knowledge and perceptions of the public through the administration of the Chicago Food Allergy Research Survey for the General Public (CFARS-GP).

## METHODS

### Survey Instrument

The CFARS-GP was developed using methods known to generate effective knowledge tools with like objectives and applications.<sup>14,15</sup> Literature reviews were conducted to generate initial content domains. Initial domains were then submitted to an expert panel, which consisted of pediatricians, pediatric allergists with expertise in food allergy, survey researchers, and local/national leaders of food allergy advo-

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cacy efforts. The panel was asked to review the preliminary domains and to verify representation of all relevant food allergy topics.

Focus groups were held with members of the general public to identify emerging themes within each domain. Investigators trained in facilitating focus groups led the discussions, and standard moderation techniques were used throughout.<sup>16</sup> Themes were identified via a constant comparative method and were used in the construction of initial survey items.<sup>17,18</sup> Initial items were then submitted to the expert panel to rate the importance and face validity of each item. Survey items were rank ordered by average score and revised or deleted accordingly.

Cognitive interviews were conducted with the general public (n = 10); participants were instructed to complete the survey, evaluate its length and clarity, and rate the understandability of each item. Scores were then reviewed by domain and revised or deleted as needed. Revised items were subject to reliability testing (n = 13) in which participants were asked to complete the survey twice to account for response consistency over a brief interval. Items resulting in a predetermined degree of change were subject to revision. Item reduction (n = 54) followed and was used to avoid floor/ceiling effects and evaluate the importance/novelty of data generated from each item. Survey items producing a response cluster above a given threshold were subject to deletion. Participants in each stage of development received a small honorarium, and all responses were anonymous.

Final validation was conducted in tandem with the national administration of the survey, with the first 150 completed surveys used to ensure overall validity of the instrument. The final validated survey instrument consists of 35 items and may be obtained by contacting the author. Large food allergy organizations, local support groups, and public health organizations may find the general public survey useful for obtaining baseline assessments, determining community attitudes toward food allergy, and evaluating the effectiveness of educational campaigns and courses.

Nineteen of the survey items test food allergy knowledge (16 true/false and 3 multiple choice questions); the remainder evaluate food allergy attitudes and beliefs (13 Likert scale and 3 multiple choice questions). Each item corresponds 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*

Adult participants (aged  $\geq 18$  years) were recruited anonymously in February 2008 using a commercial vendor specializing in national sampling (e-Rewards Market Research, Dallas, Texas). The study pool obtained from the vendor was stratified by geographic region and race/ethnicity to best represent the general US population. A targeted e-mail broad-

cast was sent to potential participants and included a direct link to the Web-based CFARS-GP (English only); incentives were determined and distributed by the vendor to the first 2000 respondents. Parents of children with physician-diagnosed food allergy, pediatricians, family physicians, and individuals residing outside the United States were ineligible (n = 350). Incomplete surveys (n = 106) were not included in the analysis.

The development and launch of the CFARS-GP were approved by the institutional review boards of both Children's Memorial Hospital and Northwestern University in Chicago, Illinois.

### *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 include presentation of overall score, percentage of participants who answered each item correctly, and scores by respondent characteristics. Analysis of variance was used to measure the association between knowledge score and participant characteristics, including demographics and prior knowledge/familiarity with food allergy. Scores were adjusted by presenting the overall and itemized scores for participants with children younger than 18 years, with self-reported prior training in food allergy, and with a food-allergic acquaintance.  $\chi^2$  Tests were used to examine the relationship between itemized knowledge and prior knowledge/familiarity with food allergy. To examine 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.<sup>19</sup>

To describe perceptions of quality-of-life and policy considerations, response categories were collapsed into strongly disagree/disagree, neither agree nor disagree, and strongly agree/agree. Frequencies were calculated for each category. The percentage of participants with a child younger than 18 years, with prior training in food allergy, and with a food-allergic acquaintance who strongly agreed/agreed is also described.  $\chi^2$  Tests were used to test the association between prior knowledge/familiarity with food allergy and agreement with each of the quality-of-life and policy items.

All statistical analyses were performed using STATA 10 (StataCorp LP, College Station, Texas) with a type I error of  $P < .05$ .

## **RESULTS**

### *Sample Population*

Data collection was closed after 2,148 participants completed the survey (Table 1). Respondents represented all 50 states and mirrored national distribution across census regions. Approximately 40% were male; 57.2% self-identified as white, 16.8% as black, 12.0% as Asian, and 17.4% as Hispanic/Latino. To best represent members of the general public presumed most likely to come into contact with food-allergic

Table 1. Demographic Characteristics of the Sample Population

| Variable                       | No. (%) of the sample population (N = 2,148) |
|--------------------------------|--|
| Age group, y                   |  |
| 18–24                          | 365 (17.0)                                   |
| 25–44                          | 836 (38.9)                                   |
| 45–64                          | 705 (32.8)                                   |
| ≥65                            | 242 (11.3)                                   |
| Sex                            |  |
| Male                           | 824 (38.4)                                   |
| Female                         | 1,324 (61.6)                                 |
| Race/ethnicity <sup>a</sup>    |  |
| White                          | 1,229 (57.2)                                 |
| Black                          | 360 (16.8)                                   |
| Hispanic/Latino                | 374 (17.4)                                   |
| Asian                          | 258 (12.0)                                   |
| Other                          | 25 (1.2)                                     |
| Geographic region <sup>b</sup> |  |
| Northeast                      | 424 (19.8)                                   |
| Midwest                        | 464 (21.7)                                   |
| South                          | 757 (35.3)                                   |
| West                           | 497 (23.2)                                   |
| Education, degree              |  |
| <High school                   | 18 (0.8)                                     |
| High school                    | 408 (19.0)                                   |
| Associate                      | 541 (25.2)                                   |
| Bachelor                       | 694 (32.3)                                   |
| Graduate                       | 487 (22.7)                                   |
| Gross annual income, \$        |  |
| <25,000                        | 239 (11.1)                                   |
| 25,000–49,999                  | 528 (24.6)                                   |
| 50,000–74,999                  | 541 (25.2)                                   |
| 75,000–99,999                  | 383 (17.8)                                   |
| 100,000–149,999                | 285 (13.3)                                   |
| ≥150,000                       | 172 (8.0)                                    |
| Child <18 y                    |  |
| Yes                            | 919 (42.8)                                   |
| No                             | 1,229 (57.2)                                 |

<sup>a</sup> Multiple selections were allowed (the sum does not equal 100%).

<sup>b</sup> There were 6 missing responses.

children, parents of children younger than 18 years were oversampled and represented 42.8% of the sample population, with 35.9% having school-aged children (preschool to high school). Of the respondents, 14.0% reported formal training in food allergy and 64.3% indicated having a food-allergic acquaintance (ie, knowing ≥1 of the following food-allergic individuals: themselves, their child <18 years [without a formal diagnosis], a spouse or partner, a friend or relative, or a child's friend or relative).

#### Knowledge of Food Allergy

Participants answered 64.9% (range, 12.5%–100.0%) of knowledge-based items correctly. Although overall scores varied significantly among certain groups by sex, race, educational level, annual income, parental status, and prior knowledge/familiarity with food allergy, the margin of variation in the overall score for these groups was 5 percentage

points at most. Itemized knowledge scores were better distributed, as detailed in Table 2. Performance by domain is summarized as follows.

*Definition and diagnosis.* On average, participants correctly answered 64.2% (range, 0.0%–100.0%) of questions regarding the definition and diagnosis of food allergy.

*Symptoms and severity.* Knowledge was strongest regarding symptoms and severity of food allergy: participants correctly answered 80.3% (range, 16.7%–100.0%) of related knowledge items.

*Triggers and environmental risk.* On average, participants correctly answered 64.7% (range, 12.5%–100.0%) of questions regarding triggers and environmental risks for food allergy.

*Perceptions of susceptibility and prevalence.* Participants correctly answered an average of 56.9% (range, 0.0%–100.0%) of questions regarding susceptibility to and prevalence of food allergy.

*Treatment and use of health care.* Knowledge was weakest regarding food allergy treatment and use of health care: participants correctly answered 47.5% (range, 0.0%–100.0%) of related knowledge items.

*Policy issues.* More than half of all participants (59.0%) were aware that a law exists in the United States requiring foods to be labeled with information regarding potential allergens.

#### Adjusted Knowledge Scores

Itemized knowledge scores were adjusted to represent participants presumed more likely to have contact with food-allergic children. As indicated in Table 2, a trend effect was observed in the percentage of the population correctly responding to knowledge-based items among those with children younger than 18 years (n = 919), those reporting prior training in food allergy (n = 300), and those with food-allergic acquaintances (n = 1,381). Among the 3 groups, higher scores were most notable for those with prior training in food allergy. Scores for these respondents were significantly higher for 13 of the 19 knowledge-based items, with a median increase of 7.9 percentage points over the general public as a whole.

Similarly, multivariable regression analyses found that participants with prior training in food allergy did significantly better in areas relating to clinical knowledge of food allergy (Table 3). The odds of correctly identifying food allergy triggers and recognizing the signs of a milk allergy reaction were 42.0% and 12.0% greater, respectively, among respondents with prior training in food allergy. White participants also did significantly better in these 2 areas; however, black and Hispanic participants were more likely to recognize the importance of food allergen avoidance.

#### Food Allergy Attitudes and Beliefs

Perceptions regarding food allergy were generally well distributed across a 5-point Likert scale, ranging from strongly disagree to strongly agree. Responses to individual Likert items are detailed in Table 4 and summarized by domain as follows.

Table 2. Itemized Knowledge of General Public Stratified for Prior Knowledge/Familiarity With Food Allergy and Arranged by Content Domain

| Item  | Knowledge score, % correct (N = 2,148) |                                      |   |   |
|---|--|--------------------------------------|---|---|
|   | Unadjusted                             | Stratified by child age <sup>a</sup> | Stratified by prior training <sup>b</sup> | Stratified by acquaintance <sup>c</sup> |
| Overall mean score  | 64.9                                   | 66.0 <sup>d</sup>                    | 69.6 <sup>d</sup>                         | 66.3 <sup>d</sup>                       |
| Definition and diagnosis  |  |                                      |   |   |
| Allergic reaction when body considers food harmful (T)              | 78.9                                   | 79.0                                 | 85.7 <sup>d</sup>                         | 80.1                                    |
| Lactose intolerance same as milk allergy (F)                        | 49.4                                   | 51.0                                 | 57.0 <sup>d</sup>                         | 51.8 <sup>d</sup>                       |
| Symptoms and severity   |  |                                      |   |   |
| Food allergy reaction can be fatal (T)                              | 94.0                                   | 94.7                                 | 97.3 <sup>d</sup>                         | 96.5 <sup>d</sup>                       |
| Hives a common symptom of food allergy (T)                          | 79.0                                   | 82.3 <sup>d</sup>                    | 84.3 <sup>d</sup>                         | 83.1 <sup>d</sup>                       |
| Sign of milk allergy reaction                                       |  |                                      |   |   |
| Hyperactivity (F)   | 87.1                                   | 86.3                                 | 87.3                                      | 85.5                                    |
| Hives (T)   | 68.3                                   | 67.8                                 | 73.0                                      | 71.0 <sup>d</sup>                       |
| Tongue swelling/trouble breathing (T)                               | 73.9                                   | 76.6 <sup>d</sup>                    | 77.7                                      | 75.7 <sup>d</sup>                       |
| Stuffy nose (F)   | 79.2                                   | 77.9                                 | 75.3                                      | 76.8                                    |
| Triggers and environmental risk                                     |  |                                      |   |   |
| Allergic reaction from touching allergenic food (T)                 | 68.6                                   | 71.6 <sup>d</sup>                    | 78.7 <sup>d</sup>                         | 72.3 <sup>d</sup>                       |
| Milk-allergic child: safely drink low-fat milk (F)                  | 65.6                                   | 65.6                                 | 74.0 <sup>d</sup>                         | 68.1 <sup>d</sup>                       |
| Mother can pass food to child through breast milk (T)               | 85.9                                   | 88.9 <sup>d</sup>                    | 88.0                                      | 87.6 <sup>d</sup>                       |
| Acidic food: common cause of food allergy (F)                       | 40.0                                   | 39.7                                 | 42.3                                      | 40.6                                    |
| 3 Most common childhood food allergies                              |  |                                      |   |   |
| Egg   | 40.9                                   | 45.9 <sup>d</sup>                    | 43.0                                      | 40.2                                    |
| Milk  | 71.0                                   | 68.3                                 | 69.7                                      | 69.4                                    |
| Peanut  | 90.4                                   | 91.8 <sup>d</sup>                    | 91.3                                      | 91.0                                    |
| Most common adult food allergy: shellfish                           | 55.2                                   | 56.0                                 | 61.0 <sup>d</sup>                         | 55.6                                    |
| Perceptions of susceptibility and prevalence                        |  |                                      |   |   |
| Allergic diseases run in families (T)                               | 48.9                                   | 50.1                                 | 57.0 <sup>d</sup>                         | 51.7 <sup>d</sup>                       |
| Food allergy can go away with age (T)                               | 59.5                                   | 58.1                                 | 66.3 <sup>d</sup>                         | 64.2 <sup>d</sup>                       |
| Food allergy more common in children (T)                            | 48.3                                   | 49.4                                 | 57.0 <sup>d</sup>                         | 49.9                                    |
| Food allergy increasing in US children (T)                          | 71.1                                   | 71.7                                 | 83.3 <sup>d</sup>                         | 75.0 <sup>d</sup>                       |
| Treatment and use of health care                                    |  |                                      |   |   |
| There is a cure for food allergy (F)                                | 54.1                                   | 55.4                                 | 62.0 <sup>d</sup>                         | 56.6 <sup>d</sup>                       |
| Avoidance is the only way to prevent food allergy reaction (T)      | 56.8                                   | 59.5 <sup>d</sup>                    | 57.3                                      | 55.3                                    |
| Daily medicine can prevent food allergy reaction (F)                | 31.6                                   | 32.9                                 | 35.0                                      | 32.4                                    |
| Policy issue: law in United States requires foods to be labeled (T) | 59.0                                   | 62.6 <sup>d</sup>                    | 67.0 <sup>d</sup>                         | 60.0                                    |

Abbreviations: F, false; T, true.

<sup>a</sup> These participants had a child younger than 18 years (n = 919).

<sup>b</sup> These participants had prior training in food allergy (n = 300).

<sup>c</sup> These participants had a food-allergic acquaintance (n = 1,381).

<sup>d</sup> A score significantly higher than unadjusted ( $P < .05$ ).

*Stigma and acceptability.* Most respondents (65.0%) agreed that food allergy is a serious problem in the United States. When given more specified scenarios about the stigma associated with childhood food allergy, responses were better distributed.

*Treatment and use of health care.* Most participants (67.6%) affirmed that having injectable epinephrine (EpiPen or Twinject) is important for children with severe food allergy.

*Policy issues.* Nearly 85% of respondents agreed that schools should have plans to keep food-allergic children safe. Participants with school-aged children were asked more direct questions concerning food allergy policies in schools. Respondents tended to oppose specific policy action.

Multiple choice questions were also posed to evaluate policy issues (Table 5). All participants were asked to identify the single most important step to improve the lives of those with food allergy. Responses were widely distributed, with identifying the cause of food allergy being selected most frequently (38.6%). When asked the best way to learn about food allergy, 46.9% selected television. Parents with school-aged children were asked to further specify the best way by which schools could teach parents how to protect children with food allergy. Responses were primarily divided between the options “handouts/brochures in the mail” (32.9%) and “presentations at parent-teacher meetings” (31.9%).

Table 3. Multivariable Regression: Relationship of Participant Characteristics and Clinical Knowledge of Food Allergy<sup>a</sup>

| Characteristic                 | Able to identify 2 signs of a milk allergy reaction | Able to identify 3 triggers of food allergy | Recognize necessity of allergenic food avoidance | Aware that daily medicine cannot treat food allergy |
|--------------------------------|---|---|--|---|
| Aged ≥65 y                     | 0.81 (0.69–0.96) <sup>b</sup>                       | 0.72 (0.52–0.99) <sup>b</sup>               | 1.28 (1.14–1.43) <sup>b</sup>                    | 1.16 (0.95–1.42)                                    |
| Female sex                     | 1.26 (1.14–1.39) <sup>b</sup>                       | 1.02 (0.86–1.22)                            | 1.07 (0.99–1.16)                                 | 1.14 (1.00–1.31) <sup>b</sup>                       |
| Race                           |   |   |  |   |
| Black                          | 0.83 (0.73–0.95) <sup>b</sup>                       | 0.64 (0.48–0.84) <sup>b</sup>               | 1.13 (1.02–1.25) <sup>b</sup>                    | 1.02 (0.85–1.22)                                    |
| Hispanic                       | 0.80 (0.71–0.91) <sup>b</sup>                       | 0.68 (0.53–0.89) <sup>b</sup>               | 1.15 (1.04–1.26) <sup>b</sup>                    | 1.01 (0.85–1.21)                                    |
| Asian                          | 0.84 (0.72–0.97) <sup>b</sup>                       | 0.97 (0.76–1.25)                            | 1.06 (0.94–1.20)                                 | 1.04 (0.86–1.26)                                    |
| College graduate               | 0.96 (0.86–1.07)                                    | 1.05 (0.86–1.28)                            | 0.99 (0.90–1.09)                                 | 1.23 (1.06–1.42) <sup>b</sup>                       |
| Annual income <\$75,000        | 1.03 (0.94–1.12)                                    | 0.86 (0.72–1.02)                            | 1.09 (1.00–1.18)                                 | 0.92 (0.81–1.05)                                    |
| Parent of child <18 y          | 1.03 (0.94–1.13)                                    | 1.01 (0.85–1.21)                            | 1.11 (1.02–1.20) <sup>b</sup>                    | 1.07 (0.93–1.23)                                    |
| Prior training in food allergy | 1.12 (1.00–1.25) <sup>b</sup>                       | 1.42 (1.15–1.74) <sup>b</sup>               | 1.04 (0.93–1.15)                                 | 1.11 (0.94–1.31)                                    |
| Food-allergic acquaintance     | 1.22 (1.11–1.35) <sup>b</sup>                       | 1.03 (0.86–1.30)                            | 0.93 (0.86–1.01)                                 | 1.03 (0.90–1.18)                                    |

<sup>a</sup> Data are given as relative risk ratio (95% confidence interval).

<sup>b</sup> *P* < .05.

Table 4. Perceptions of Quality of Life and Policy Considerations of General Public, Adjusted for Prior Knowledge/Familiarity With Food Allergy and Arranged by Content Domain<sup>a</sup>

| Item  | Disagree | Neutral | Agree      |                                     |  |  |
|---|----------|---------|------------|-------------------------------------|--|--|
|   |          |         | Unadjusted | Adjusted for child age <sup>b</sup> | Adjusted for prior training <sup>c</sup> | Adjusted for acquaintance <sup>d</sup> |
| Stigma and acceptability  |          |         |            |                                     |  |  |
| Food allergy serious problem in United States                                       | 8.3      | 26.7    | 65.0       | 66.4                                | 77.0 <sup>e</sup>                        | 68.9 <sup>e</sup>                      |
| People with food allergies treated differently                                      | 33.1     | 31.9    | 35.0       | 35.8                                | 40.3                                     | 35.8 <sup>e</sup>                      |
| Parents of food-allergic child overprotective                                       | 37.2     | 30.6    | 32.2       | 32.5 <sup>e</sup>                   | 33.7                                     | 32.4 <sup>e</sup>                      |
| Food-allergic children teased at school   | 42.0     | 38.8    | 19.2       | 15.3 <sup>e</sup>                   | 20.0                                     | 20.0                                   |
| Perceptions of quality of life  |          |         |            |                                     |  |  |
| Avoiding allergenic food is difficult   | 27.2     | 26.3    | 46.5       | 45.5                                | 52.7                                     | 49.2 <sup>e</sup>                      |
| People worry a lot about their food allergy   | 13.2     | 34.9    | 51.9       | 53.7                                | 54.0                                     | 51.9                                   |
| Hard to eat out safely with food allergy  | 23.7     | 19.8    | 56.5       | 56.2                                | 60.3                                     | 58.7 <sup>e</sup>                      |
| Treatment and use of health care  |          |         |            |                                     |  |  |
| Having injectable epinephrine (EpiPen) important for child with severe food allergy | 4.2      | 28.2    | 67.6       | 71.6 <sup>e</sup>                   | 82.7 <sup>e</sup>                        | 72.6 <sup>e</sup>                      |
| Policy issue: schools should have plans to keep food-allergic children safe         | 5.4      | 10.0    | 84.6       | 87.3 <sup>e</sup>                   | 89.0 <sup>e</sup>                        | 87.3 <sup>e</sup>                      |
| Parents with school-aged children (preschool to high school) (n = 771)              |          |         |            |                                     |  |  |
| Stigma and acceptability  |          |         |            |                                     |  |  |
| Would worry about having over child with food allergy                               | 56.5     | 21.4    | 22.0       | NA                                  | NA                                       | NA                                     |
| Policy issues   |          |         |            |                                     |  |  |
| Schools should ban all products with nuts   | 67.8     | 20.5    | 11.7       | NA                                  | NA                                       | NA                                     |
| Schools should have special table for food-allergic child                           | 46.9     | 20.8    | 32.3       | NA                                  | NA                                       | NA                                     |
| Unfair if my child cannot have peanut butter sandwich                               | 18.5     | 17.9    | 63.6       | NA                                  | NA                                       | NA                                     |

Abbreviation: NA, not applicable.

<sup>a</sup> Data are given as percentage of the sample (N = 2,148).

<sup>b</sup> These participants had a child younger than 18 years (n = 919).

<sup>c</sup> These participants had prior training in food allergy (n = 300).

<sup>d</sup> These participants had a food-allergic acquaintance (n = 1,381).

<sup>e</sup> *P* < .05.

## DISCUSSION

To our knowledge, this study is the first to provide detailed information about the general public's food allergy knowl-

edge and to characterize the general public's attitudes and beliefs toward food allergy and food allergy policy. The public's overall knowledge was varied, with strengths iden-

Table 5. Policy Considerations of General Public Regarding Food Allergy

| Item  | No. (%) of respondents<br>(N = 2,148) |
|---|---------------------------------------|
| Most important step to improve the lives of those with food allergy?  |                                       |
| Develop a cure  | 430 (20.0)                            |
| Improve treatments  | 362 (16.9)                            |
| Determine the cause(s)  | 829 (38.6)                            |
| Promote school education  | 102 (4.7)                             |
| Promote public awareness  | 425 (19.8)                            |
| Best way to learn about food allergy?   |                                       |
| Radio   | 32 (1.5)                              |
| Television  | 1007 (46.9)                           |
| Handouts/brochures  | 332 (15.5)                            |
| Internet/e-mail   | 464 (21.6)                            |
| Newspapers/magazines  | 209 (9.7)                             |
| Other   | 104 (4.8)                             |
| Parents with school-aged children (preschool to high school [n = 771]): best way for schools to educate parents about food allergy? |                                       |
| Handouts/brochures in the mail  | 254 (32.9)                            |
| Presentations at parent-teacher meetings  | 246 (31.9)                            |
| Parents of food-allergic children talking to other parents  | 83 (10.8)                             |
| Physician or nurse talking to parents about food allergy  | 176 (22.8)                            |
| Other   | 12 (1.6)                              |

tified in areas relating to symptoms/severity and triggers/environmental risks and weaknesses identified in the areas of food allergy treatments and the distinction between food allergy and food intolerance. Perceptions regarding food allergy were generally well distributed, although respondents tended to downplay the stigma associated with childhood food allergy and parents without food-allergic children were likely to oppose specific food allergy policies in schools.

The public's knowledge was strongest regarding symptoms and severity of food allergy, with nearly 95% of participants recognizing food allergy as a potentially fatal condition (Table 2). Strengths were also observed concerning food allergy triggers and environmental risk: most participants correctly identified peanut as a common childhood food allergen and understood that mothers may pass food to a child through breast milk (Table 2). However, weaknesses in this area existed as well: participants frequently overlooked egg and shellfish as common allergenic foods in children and adults, respectively (Table 2). The public also tended to incorrectly identify acidic foods as a common food allergy trigger (Table 2).

Half of all participants mistakenly believed lactose intolerance and food allergy to be synonymous (Table 2), which may lend insight into the public's inclination to overestimate food allergy prevalence<sup>6</sup> and to overdiagnose food allergies in

themselves and their children.<sup>20</sup> Further, alarming misconceptions were observed in relation to food allergy treatment and use of health care. Almost half of participants erroneously believed that a cure exists for food allergy, and more than two-thirds stated that a daily medicine could be taken to prevent a food allergy reaction (Table 2). They also tended to overlook the necessity of strict allergen avoidance: more than 40% of participants indicated that other means exist to prevent life-threatening reactions (Table 2).

Our findings suggest that targeted educational interventions could meaningfully improve the public's knowledge of food allergy. Participants who reported prior training in food allergy scored significantly higher than the overall general public on most knowledge-based items (Table 2). Simply knowing someone with food allergy also resulted in higher scores on some items, although the margin of change was not to the extent observed for those with food allergy training (Table 2). The improved performance on knowledge-based items as a result of experience with food allergy is similar to trends observed for other diseases, such as asthma.<sup>21,22</sup>

When compared with other studies assessing the general public's health knowledge, food allergy knowledge appears to be weaker than that in other areas, such as asthma,<sup>21</sup> stroke,<sup>23</sup> and human immunodeficiency virus.<sup>24</sup> Funding allocations may contribute to this trend. For the 2008 fiscal year, the National Institutes of Health estimates funding for the latter diseases to range from \$293 million to \$2.9 billion.<sup>25</sup> Federal funding for food allergy is placed at only \$13.4 million.<sup>26</sup> Despite limited funds, national and local food allergy organizations have been working diligently to educate the general public about the signs, severity, and treatment of food allergy and anaphylaxis. Results from this study bolster the significance of such efforts and highlight the need for further national attention.

The general public's attitudes and beliefs support the perception that the challenges of food allergy are not well understood. Prior studies have established that families of children with food allergy have a lower quality of life<sup>9,27-30</sup> and that food allergy may lower general health perception, limit family activities, and have a significant emotional and economic impact on parents.<sup>27,28</sup> Although participants agreed that food allergy is a serious problem in the United States, they did not feel that people with food allergies were treated differently or that food-allergic children were teased at school (Table 4).

The most significant inconsistency in the public's attitudes toward food allergy involved school policy to keep affected children safe. Although most of those surveyed agreed that schools are in need of better policies to manage food allergy (Table 4), there was resistance among participants with school-aged children toward the implementation of specific policies. Most participants were opposed to banning peanut products and did not feel that schools should have special tables for food-allergic children (Table 4). Those with school-aged children without food allergy also felt it would be unfair

if their children were not able to have a peanut butter sandwich at school (Table 4).

There appears to be a discrepancy in the public's recognition of the need for food allergy policy and their willingness to implement proposed changes. At present, only 7 states (Connecticut,<sup>31</sup> Massachusetts,<sup>32</sup> New Jersey,<sup>33</sup> Tennessee,<sup>34</sup> Vermont,<sup>35</sup> Washington,<sup>36</sup> and New York<sup>37</sup>) have school-based food allergy policies and guidelines. Nationally, the Food Allergy and Anaphylaxis Management Act of 2008 is awaiting approval in the Senate; this legislation mandates the development of a voluntary policy to manage food allergy and anaphylactic risk in schools.<sup>38</sup> Our findings suggest that efforts to educate parents about the importance of such policies are needed to garner support for and hasten the implementation of food allergy initiatives in schools.

This study is not without limitations. Although a national sample of more than 2,000 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 were recruited. However, our final sample included participants from all 50 states and largely mirrors the characteristics of the US general population as reported by the US Census Bureau.<sup>39–41</sup> One exception may be educational level—graduate-level education was much more common among our sample and fewer participants reported having less than a high school education when compared with the US general population.<sup>42</sup> Intuitively, one might expect this to result in higher knowledge scores among participants in our study. Finally, 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 due to limited Internet access.<sup>43–45</sup> That being said, participation was carefully monitored to avoid duplicate respondents and the survey was deployed in a controlled and secure online environment, with particular attention paid to the demographic characteristics of participants.

In conclusion, increased food allergy knowledge and awareness among the general public is needed, especially regarding the distinction between food allergy and food intolerance, current treatments available for food allergy, the absence of a cure, and the lack of preventive medications. Further, increased public awareness of the challenges faced by food-allergic children and their families may encourage support for standardized school policies to keep affected children safe and may also help to improve the quality of life of food-allergic children and their families. These efforts are critical for protecting young children with food allergy and avoiding serious illness or loss of life.

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