

# Are primary care physicians following National Institute of Allergy and Infectious Disease guidelines for the prevention of peanut allergy? A survey-based study

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## ABSTRACT

**Background:** The 2017 addendum to the National Institute of Allergy and Infectious Diseases (NIAID) guidelines on peanut allergy prevention significantly altered recommendations for patients at risk of developing peanut allergies. It is unknown if primary care physicians are aware of or are following these guidelines.

**Objective:** To assess the knowledge and practice of the NIAID guidelines among primary care physicians.

**Methods:** A survey was developed to assess the knowledge, awareness, and practice behaviors of the NIAID guidelines. It was distributed to pediatric, family medicine, and medicine-pediatric residents and attending physicians at two large academic centers. Responses were analyzed with binary logistic regression.

**Results:** The survey was distributed to 605 providers, with a response rate of 35% (n = 210). The average score was 4.8 of seven questions answered correctly. Of the participants, 53% incorrectly recommended at-home peanut introduction in patients with egg allergy. In addition, 40% of the participants incorrectly believed that the earliest age for peanut introduction was >1 year of age. More than half of the participants were unaware of the new guidelines. On logistic regression, factors associated with adequate knowledge assessment scores were awareness of the guidelines (odds ratio [OR] 2.98 [confidence interval [CI], 1.34–6.60]), graduation from residency within 5 years (OR 3.60 [95% CI, 1.14–11.35]), and affiliation with the medicine-pediatrics department (OR 4.59 [95% CI, 1.07–19.65]).

**Conclusion:** The primary care providers incorrectly answer one-third of the questions related to the prevention of peanut allergy. Increasing awareness of the 2017 NIAID guidelines may provide an opportunity to improve patient outcomes. There is an urgent need to develop innovative education strategies to publicize these guidelines.

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Food allergy has become a growing health concern. Peanut allergy is of particular interest when considering its widespread effects on patients and families' quality of life and communities as they strive to create safe environments for children with peanut allergy.<sup>1</sup> One survey in the United States suggested that self-reported peanut allergy nearly tripled from 1997 to 2008.<sup>2</sup> The approach to the prevention of peanut allergy has drastically changed over the past 20 years.<sup>3</sup> In 2000, the American Academy of Pediatrics recommended the delay of peanut introduction into the infant diet until 3 years of age.<sup>4</sup> In 2008, this recommendation was removed, but there were insufficient data to suggest that early introduction of allergens was

helpful.<sup>5</sup> The National Institute of Allergy and Infectious Disease (NIAID) released a similar statement in 2010, reiterating the low quality of evidence available to recommend early or delayed introduction of allergenic foods.<sup>6</sup>

However, the LEAP (Learning Early About Peanut Allergy) study<sup>7</sup> demonstrated that early introduction of peanut in infants at high risk was associated with a reduction in peanut allergy. This revealed an 86.1% relative reduction in the prevalence of peanut allergy in an early consumption high-risk group. These results were so robust that, in 2017, the NIAID released an addendum to their previous 2010 guidelines, which encourages early introduction of peanut in higher risk infants at 4–6 months of age, when appropriate.<sup>8</sup>

When considering the new time frame for food introduction, it is apparent that pediatric primary care providers are at the front line of food allergy prevention. Due to the nature of frequent infant screening examinations, primary care providers are in a unique position to educate parents and provide guidance on the introduction of peanuts to prevent food allergy. However, it is unclear how well the updated guidelines have been disseminated and adopted by the primary care community. The purpose of this study was to assess the awareness,

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knowledge, and practice behaviors of primary care providers in the prevention of peanut allergy.

## METHODS

An anonymous and voluntary survey was developed. It was approved by the institutional review board, and written informed consent was not required. The online survey was distributed *via* e-mail to all residents and primary care faculty and staff physicians, nurse practitioners, and physician assistants affiliated with the family medicine, general pediatric, and medicine-pediatric divisions at two academic centers. The survey remained open for ~5 weeks at each institution and was distributed in August 2018 through November 2018. Two reminder e-mails were sent to each department.

### Survey Development

The survey consisted of 14 questions. As listed below, three major categories of questions included the following: demographics, previous experience in allergy/immunology education, and a knowledge assessment of the NIAID addendum guidelines.<sup>8</sup> Questions were developed by the authors and were reviewed for face validity by a panel of allergy/immunology physicians at one site (University of Michigan). All questions were multiple choice. A copy of the questionnaire can be found in Supplemental Appendix A.

### Measures

*Demographics and Previous Allergy Experience.* The participants were asked to provide age, gender, specialty, and years since completion of residency. They were also asked if they had attended a conference or presentation specifically on food allergy, if they had participated in an allergy/immunology elective during residency, and if they had seen an infant with eczema in their clinic within the past year.

*Knowledge of the NIAID Addendum Guidelines.* The participants were asked if they were aware of the 2017 NIAID "Addendum guidelines for the prevention of peanut allergy in the United States<sup>8</sup>" with the following three options: "no"; "yes, but have not read the guidelines personally"; or "yes, I have read the guidelines in either its entirety or in summary." Next, there were seven case-based questions with brief vignettes and multiple-choice answers. These questions focused on the following topics: recognition of an allergic reaction to peanut or egg based on the provided history; the association of peanut and egg allergies; assessment of developmental readiness before trying peanut-containing foods; screening for peanut allergy before introduction in infants with severe eczema; and interpretation of peanut-specific immunoglobulin E (IgE) levels and subsequent referral to an allergist if needed. An additional question asked the earliest age

recommended for introduction of peanut to infants at high risk, with answer choices that included four age ranges, from 2 months to >3 years. The answers to all the questions were consistent with the two-page Addendum Guidelines for the Prevention of Peanut Allergy in the United States, Summary for Clinicians<sup>9</sup> and were meant to be unambiguous.

### Statistical Analyses

Participants' characteristics were examined. Binary regression models were constructed in which all variables were entered in a single step. Statistical significance was determined by using a 2-sided  $\alpha$  of 0.05. All analyses were performed by using IBM SPSS Statistics (released 2017. IBM SPSS Statistics for Windows, version 25.0; IBM Corp. Armonk, NY).

## RESULTS

In total, 605 clinicians were invited to participate and 210 agreed to participate (response rate, 35%).

### Demographics

The participants' demographics are shown in Table 1. A significant portion of the participants were less than 30 years of age, and approximately half of the participants were still in residency. Most of the participants were female and in the pediatric department. There were only six participants who identified themselves as nurse-practitioners or physician assistants. Approximately one-third of the participants had attended a conference or presentation specifically on food allergy, and a similar proportion had completed an elective in allergy/immunology during residency. Almost all providers had seen an infant with eczema in their clinic within the past year.

### Knowledge of the NIAID Addendum Guidelines

The average score was 4.8 of seven questions answered correctly. More than half of participants incorrectly recommended at-home introduction of peanuts without IgE testing in an infant with a history of hives and wheezing after ingestion of scrambled eggs. In addition, 40% of the participants incorrectly believed that the earliest age for introduction of peanuts in infants at high risk was >1 year of age. Further details on the age of introduction recommended by the participants can be seen in Fig. 1. Most of the participants were able to interpret peanut-specific IgE levels to risk stratify patients and recommend either at-home and/or office peanut introduction (68.3%) or avoidance of peanut and referral to an allergy specialist (70.9%). The participants were also able to recognize symptoms of an allergic reaction to peanut in an infant (84.8%) and knew to assess for developmental readiness before peanut introduction (80.6%). More than half of the participants reported that they were not

**Table 1 Demographics of survey population**

| Demographic                                                 | Result, n (%) |
|-------------------------------------------------------------|---------------|
| Age                                                         |               |
| <30 y                                                       | 105 (50.0)    |
| 31–40 y                                                     | 56 (26.7)     |
| 41–50 y                                                     | 20 (9.5)      |
| 51–60 y                                                     | 15 (7.1)      |
| >60 y                                                       | 7 (3.3)       |
| Gender                                                      |               |
| Female                                                      | 164 (78.1)    |
| Male                                                        | 38 (18.1)     |
| Specialty                                                   |               |
| Pediatrics                                                  | 136 (64.8)    |
| Family medicine                                             | 51 (24.3)     |
| Medicine-pediatrics                                         | 23 (11.0)     |
| Years since completion of residency                         |               |
| Currently in residency                                      | 116 (55.2)    |
| After residency                                             |               |
| 1–5 y                                                       | 36 (17.1)     |
| 6–10 y                                                      | 9 (4.3)       |
| >10 y                                                       | 41 (19.5)     |
| Provider type                                               |               |
| M.D.                                                        | 204 (97.1)    |
| Advanced provider (nurse practitioner, physician assistant) | 6 (2.9)       |
| Seen an infant with eczema in clinic within the past year?  |               |
| Yes                                                         | 145 (94.2)    |
| No                                                          | 9 (5.8)       |
| Attended a conference or presentation on food allergy?      |               |
| Yes                                                         | 65 (32.0)     |
| No                                                          | 138 (68.0)    |
| Completed an allergy elective in residency?                 |               |
| Yes                                                         | 62 (31.5)     |
| No                                                          | 135 (68.5)    |

aware of the new guidelines, and only 8% of all the participants had read any part of the guidelines or their summary (Fig. 2).

The participants were stratified based on how many questions were answered correctly. The median score was 4.8 of seven questions answered correctly, and, therefore, those who answered five of seven questions correctly were considered to have an adequate knowledge score of the guidelines. With this cutoff, 62.7% of the participants scored  $\geq 5$ . As seen in Fig. 3, the participants currently in residency had the lowest proportion of adequate knowledge scores (51%), whereas at least 75% of clinicians who have completed residency had adequate knowledge scores.

The participants who reported being aware of the guidelines but had not read them personally as well as

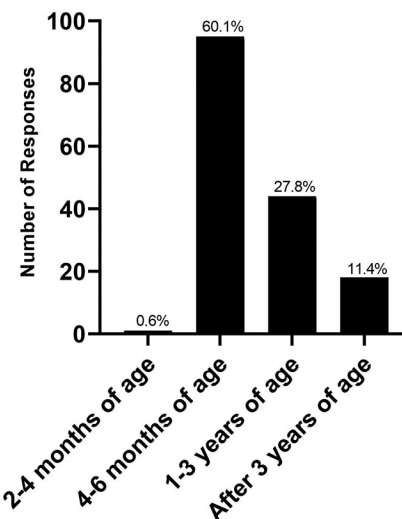


**Figure 1.** Survey responses to the question, “What is the current recommended earliest age for introduction of peanut to infants at high risk of development of peanut allergy?”

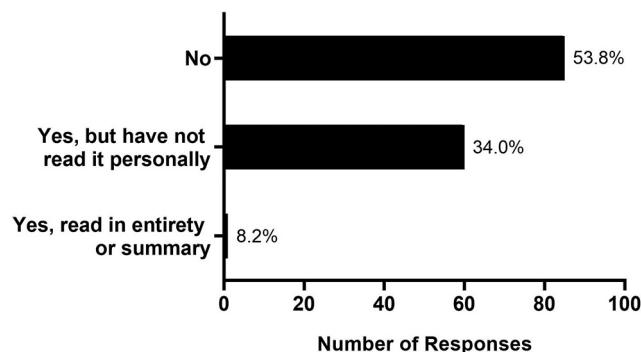


**Figure 2.** Survey responses to the question, “Are you aware of the 2017 NIAID addendum guidelines for the prevention of peanut allergy in the US?”

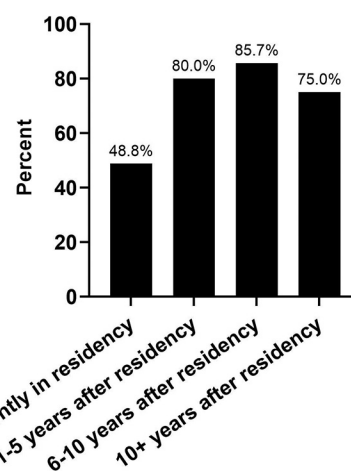


**Figure 3.** Knowledge scores stratified by time since completion of residency.

Table 2 Variables associated with adequate knowledge scores by using binary logistic regression

| Variable                                                      | <i>p</i> | Odds Ratio (95% CI) |
|---------------------------------------------------------------|----------|---------------------|
| Aware of guidelines                                           | 0.01     | 2.98 (1.34–6.60)    |
| Seen an infant with eczema in the clinic within the past year | 0.13     | 3.74 (0.68–20.47)   |
| Allergy elective in residency                                 | 0.55     | 1.31 (0.55–3.15)    |
| Attended food allergy conference                              | 0.78     | 1.14 (0.46–2.79)    |
| Years after residency                                         |          | 1.8 (0.91–3.86)     |
| Currently in residency                                        | Ref      | Ref                 |
| 1-5 y                                                         | 0.03     | 3.60 (1.14–11.35)   |
| 6-10 y                                                        | 0.23     | 4.22 (0.41–44.08)   |
| >10 y                                                         | 0.13     | 2.29 (0.79–6.67)    |
| Gender                                                        |          |                     |
| Female                                                        | Ref      | Ref                 |
| Male                                                          | 0.99     | 1.00 (0.38–2.61)    |
| Department                                                    |          |                     |
| Pediatrics                                                    | Ref      | Ref                 |
| Medicine-pediatrics                                           | 0.04     | 4.59 (1.07–19.65)   |
| Family medicine                                               | 0.74     | 1.19 (0.42–3.34)    |

CI = Confidence interval; Ref = reference.

those who reported having read the guidelines in summary or in their entirety were considered to be aware of the guidelines. On binary logistic regression analysis (Table 2), awareness of the guidelines was associated with an adequate knowledge score ( $p=0.01$ ), with an odds ratio (OR) of 2.98 (95% confidence interval [CI], 1.34–6.60). Also, when compared with the participants currently in residency, those who had graduated residency in the past 1–5 years were significantly more likely to have adequate knowledge scores ( $p=0.03$ ), with an OR of 3.60 (95% CI, 1.14–11.35). Compared with the pediatrics department, affiliation with the medicine-pediatrics department was associated with adequate knowledge scores ( $p=0.04$ ) with OR 4.59 (95% CI, 1.07–19.65). Other variables, including gender, seeing an infant with eczema in clinic, attending a peanut allergy–focused conference and/or lecture, and participating in an allergy elective during residency, were not found to be associated with adequate knowledge scores.

When considering that awareness of the guidelines was the only modifiable predictor for adequate knowledge, further analysis was done to identify factors associated with awareness of the updated NIAID guidelines. On binary logistic regression, only taking an elective in allergy and immunology had a statistically significant association with awareness of the updated guidelines, with  $p=0.01$  and OR 3.21 (95% CI, 1.38–7.47). There was no statistically significant association between awareness of the guidelines and attending a conference focused on food allergy, seeing an infant with eczema in the clinic, the time since residency, age, gender, or department (data not shown).

## Discussion

Although the results of the 2015 landmark LEAP study<sup>7</sup> led to drastic changes in guideline recommendations on the prevention of food allergy, it has been unclear if primary care providers have adopted these changes into practice. One year after the NIAID addendum guidelines<sup>8</sup> were published, fewer than half of academic pediatric, family medicine, and medicine-pediatric primary care providers were aware of this update. Forty percent of the participants recommended that peanut introduction be delayed until  $\geq 1$  year of age. This was extremely concerning because an early introduction may be the most important aspect in the prevention of peanut allergy in infants at higher risk. The prevalence of this misconception could delay peanut introduction and specialist referral.

Current residents had the lowest percentage of adequate knowledge scores. This may reflect the heavy inpatient focus of residency. Alternatively, preventing food allergy may not be a priority in caring for the complex patients seen in academic centers. Regardless, these findings indicate that the current resident education on the prevention of peanut allergy is in need of improvement. Nonetheless, recent graduates from residency were more likely to have an adequate knowledge score. Those who go on to practice primary care after residency may have recently reviewed the literature on preventing peanut allergy to fill in any knowledge gaps from residency because this is a common concern among parents.<sup>10</sup> Providers >5 years since completion of residency may not have reviewed the recent literature because older clinicians may rely more heavily on clinical experience and adhere less to

clinical guidelines.<sup>11</sup> Although affiliation with the medicine-pediatrics department was associated with higher scores, this was limited by the small number of medicine-pediatrics practitioners.

Increased awareness of the guidelines was the only predictive factor for adequate knowledge scores that could provide the opportunity for an actionable intervention. Unfortunately, the best method to increase awareness and knowledge of the NIAID addendum is not entirely clear. Although taking an allergy elective in residency was associated with increased awareness, it was not associated with adequate knowledge scores. More traditional forms of disseminating information, such as conferences and lectures, were not associated with increased awareness or knowledge of the updated guidelines. When considering these negative results, it may be worthwhile to use features of the electronic medical record system, such as best practice alerts. Similar systems have been used to successfully increase rates of adult vaccination<sup>12</sup> and hypertension control.<sup>13</sup> Further research is needed to understand the efficacy of implementing such a system for the prevention of peanut allergy and on the practices of physicians who use them.

There were limitations to this study. Because this survey was completed in two large academic centers with a large percentage of resident physicians, further research of physicians in private practice settings would be beneficial to assess the generalizability of these findings. In addition, the residents were not asked to identify their postgraduate year, which may limit the interpretation of their responses. The association with medicine-pediatrics and adequate knowledge scores may have been influenced by the small number of medicine-pediatric affiliated participants. The response rate was 35%, which is somewhat higher than other physician surveys, but no comparison was made between those who did and did not respond. Although survey questions were meant to be unambiguous and were evaluated for face validity, content validity testing was not performed. Furthermore, it is unclear if accurate knowledge with regard to the existence and content of published guidelines translates into correct clinical practice behaviors.<sup>14</sup> In addition, this survey did not ascertain the method by which clinicians determine a patient is "high risk" for peanut allergy.

## CONCLUSION

Significant deficits in awareness and content of the updated NIAID guidelines for the prevention of peanut allergy remain in the primary care community. These deficits may negatively impact practice behaviors among physicians. Future efforts to increase awareness of the guidelines should focus on the earliest recommended age for peanut introduction and

the association between peanut and egg allergy because these were the areas with the largest deficiencies. Although food allergy guidelines can reasonably be expected to be updated over time, further research is needed to identify the optimal way to disseminate and implement such guideline updates.

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