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Original Article

Patterns of allergenic food introduction in Los Angeles inner-city children

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Conflict of Interest
The authors have no financial conflicts of interest.

ABSTRACT

Background: Early introduction of allergenic foods is recommended to reduce the risk of developing food allergies, but it is unclear whether recommendations are being followed.
Objective: We examine patterns of allergenic food introduction in inner-city children enrolled in an academic pediatric practice in the greater Los Angeles area.
Methods: This was a prospective study with patients ages 12 to 24 months recruited from the pediatrics continuity clinic at an inner-city tertiary medical center in the greater Los Angeles area. Caregivers were asked via anonymous surveys about their child's history of atopic diseases and at what age they first introduced egg, soy, wheat, peanut, tree nuts, fish, shrimp, and shellfish into their child's diet.
Results: Two hundred caregivers responded to the survey. The average age of introduction of egg was 9.2 months, soy 10 months, wheat 9.3 months, peanut 10.5 months, tree nuts 10.9 months, fish 10.9 months, shrimp 11.3 months, and shellfish 11.5 months. Between ages 4–11 months, 65.3% of children were introduced egg, 19.1% soy, 55.8% wheat, 28.6% peanut, 17.1% tree nuts, 28.1% fish, 13.6% shrimp, and 7.0% shellfish. By age 24 months, 92% of children were introduced egg, 37.7% soy, 85.4% wheat, 67.3% peanut, 47.7% tree nuts, 67.8% fish, 48.2% shrimp, and 30.2% shellfish. Of the 14 children with eczema or egg allergy, 26.1% were introduced peanut by age 4-6 months and 50% by age 4–11 months.
Conclusion: Despite recommendations, inner-city caregivers may not be introducing allergenic foods in a timely manner to their children.

Keywords: Allergenic food introduction; Child; Early; Inner-city

INTRODUCTION

National guidelines regarding the timing of allergenic food introduction have shifted over the years. With the publication of The Learning Early about Peanut Allergy (LEAP) trial in 2015, a shift in the culture of allergic food introduction occurred as early introduction of peanut at age 4–11 months was shown to decrease the risk of developing peanut allergy [1]. Following

Author Contributions

Conceptualization: Kenny Yat-Choi Kwong, Paulina Tran, Erica Chen, Lyne Scott. Formal analysis: Erica Chen, Maryam Masood, Spencer Boyle, Kenny Yat-Choi Kwong. Investigation: Erica Chen, Paulina Tran, Sydney Leibel, Lyne Scott. Methodology: Kenny Yat-Choi Kwong, Paulina Tran, Erica Chen. Project administration: Spencer Boyle, Kenny Yat-Choi Kwong, Lyne Scott. Writing - original draft: Kenny Yat-Choi Kwong, Erica Chen, Sydney Leibel, Lyne Scott. Writing - review & editing: Kenny Yat-Choi Kwong, Maryam Masood, Spencer Boyle.

LEAP, in 2017, the American Academy of Pediatrics (AAP) and the National Institute of Allergy and Infectious Diseases (NIAID)-sponsored expert panel published addendum guidelines supporting early introduction of peanut in the high-risk pediatric population, those infants with severe eczema, egg allergy, or both [2]. Current recommendations for the introduction of allergenic foods, especially peanut, are more aligned with that of early complementary food introduction at 4 to 6 months.

Although not delaying allergenic food introduction and early introduction of peanut are recommended to reduce the risk of developing food allergies, it is unclear whether recommendations are being followed. In a recent clinical communication published in the Journal of Allergy and Clinical Immunology in Practice 2018, surveys sent to family physicians, pediatricians, and allergists showed a discrepancy in the implementation of NIAID guidelines [3]. The study showed that of those surveyed, family physicians were more likely to recommend the introduction of allergenic foods at age 1 or more, whereas pediatricians and allergists were more likely to recommend early introduction of allergenic foods. In this study, we examine patterns of allergenic food introduction among inner-city children enrolled in an academic pediatric practice to determine whether current recommendations are being followed by caregivers of this pediatric population.

MATERIALS AND METHODS

Study design

This was a prospective cross-sectional study examining when parents introduced various allergenic foods to their infants during the first 2 years of life. Patients and parents were recruited from the Pediatric Primary Care Continuity Clinic at Los Angeles County + University of Southern California (LAC+USC) Medical Center. An anonymous survey instrument in both English and Spanish was distributed by nurses and Pediatric residents to caregivers of children ages 12 to 24 months during well-child visits from June 1, 2018 to April 30, 2019 (**Fig. 1**). The survey assessed timing of introduction to the common allergenic foods: cow's milk, egg, soy, wheat, peanut, tree nuts, fish, shrimp, and shellfish. Additional information about child and family history of atopic diseases, ethnicity, birth order, number of siblings, and length of breastfeeding was obtained. Caregivers were asked about the barriers they encountered during food introduction.

This study was approved by the Institutional Review Board (IRB) of the University of Southern California Keck School of Medicine (IRB number: HS-18-00457). The IRB also approved waiver of informed consent.

Statistical analysis

Descriptive statistics were used to describe the results. Analysis of variance was used to determine any significance between mean time to introduction of various allergenic foods.

RESULTS

Two hundred caregivers were surveyed. The children were predominantly Hispanic and breastfed. The majority did not have reported food allergies. Nine children had reported allergies to cow's milk, egg, peanut, shrimp, and shellfish. Another 3 reported allergies to

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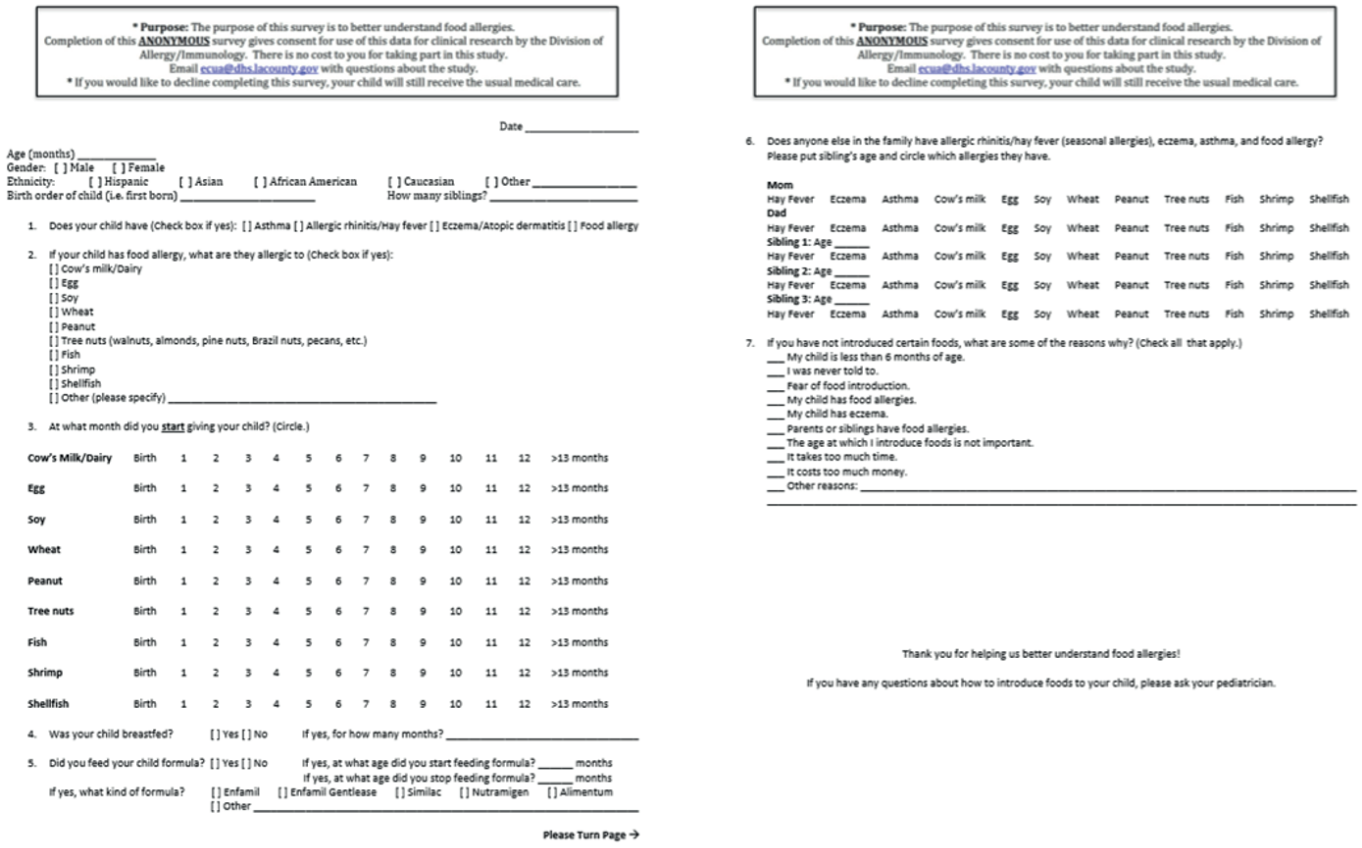

*** Purpose:** The purpose of this survey is to better understand food allergies.
Completion of this **ANONYMOUS** survey gives consent for use of this data for clinical research by the Division of Allergy/Immunology. There is no cost to you for taking part in this study.
Email ecua@dhs.lacounty.gov with questions about the study.
* If you would like to decline completing this survey, your child will still receive the usual medical care.

Date _____

Age (months) _____
Gender: [ ] Male [ ] Female
Ethnicity: [ ] Hispanic [ ] Asian [ ] African American [ ] Caucasian [ ] Other _____
Birth order of child (i.e. first born) _____ How many siblings? _____

1. Does your child have (Check box if yes): [ ] Asthma [ ] Allergic rhinitis/Hay fever [ ] Eczema/Atopic dermatitis [ ] Food allergy

2. If your child has food allergy, what are they allergic to (Check box if yes):
[ ] Cow's milk/Dairy
[ ] Egg
[ ] Soy
[ ] Wheat
[ ] Peanut
[ ] Tree nuts (walnuts, almonds, pine nuts, Brazil nuts, pecans, etc.)
[ ] Fish
[ ] Shrimp
[ ] Shellfish
[ ] Other (please specify) _____

3. At what month did you start giving your child? (Circle.)

Cow's Milk/Dairy	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Egg	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Soy	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Wheat	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Peanut	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Tree nuts	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Fish	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Shrimp	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months
Shellfish	Birth	1	2	3	4	5	6	7	8	9	10	11	12	>13 months

4. Was your child breastfed? [ ] Yes [ ] No If yes, for how many months? _____

5. Did you feed your child formula? [ ] Yes [ ] No If yes, at what age did you start feeding formula? _____ months
If yes, at what age did you stop feeding formula? _____ months
If yes, what kind of formula? [ ] Enfamil [ ] Enfamil Gentlease [ ] Similac [ ] Nutramigen [ ] Alimentum
[ ] Other _____

Please Turn Page →

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Email ecua@dhs.lacounty.gov with questions about the study.
* If you would like to decline completing this survey, your child will still receive the usual medical care.

6. Does anyone else in the family have allergic rhinitis/hay fever (seasonal allergies), eczema, asthma, and food allergy? Please put sibling's age and circle which allergies they have.

Mom
Hay Fever Eczema Asthma Cow's milk Egg Soy Wheat Peanut Tree nuts Fish Shrimp Shellfish
Dad
Hay Fever Eczema Asthma Cow's milk Egg Soy Wheat Peanut Tree nuts Fish Shrimp Shellfish
Sibling 1: Age _____
Hay Fever Eczema Asthma Cow's milk Egg Soy Wheat Peanut Tree nuts Fish Shrimp Shellfish
Sibling 2: Age _____
Hay Fever Eczema Asthma Cow's milk Egg Soy Wheat Peanut Tree nuts Fish Shrimp Shellfish
Sibling 3: Age _____
Hay Fever Eczema Asthma Cow's milk Egg Soy Wheat Peanut Tree nuts Fish Shrimp Shellfish

7. If you have not introduced certain foods, what are some of the reasons why? (Check all that apply.)
___ My child is less than 6 months of age.
___ I was never told to.
___ Fear of food introduction.
___ My child has food allergies.
___ My child has eczema.
___ Parents or siblings have food allergies.
___ The age at which I introduce foods is not important.
___ It takes too much time.
___ It costs too much money.
___ Other reasons: _____

Thank you for helping us better understand food allergies!

If you have any questions about how to introduce foods to your child, please ask your pediatrician.

Fig. 1. Early food introduction food questionnaire.

coffee, pineapple, and peas. A total of 7 children had reported atopic dermatitis, and 46 children had a family history of atopy, which included history of asthma, allergic rhinitis, atopic dermatitis, and food allergies (**Table 1**).

Of those caregivers surveyed, the average age of introduction of egg was 9.2 months, soy 10 months, wheat 9.3 months, peanut 10.5 months, tree nuts 10.9 months, fish 10.9 months, shrimp 11.3 months, and shellfish 11.5 months (**Fig. 2**). Cow's milk and dairy was excluded from the study after we learned that many of our caregivers believed that formula which they fed their children early in life were not categorized as cow's milk or dairy. There was no statistical difference between when the different foods were introduced. By age 4–11 months, 65.3% of children were introduced egg, 19.1% soy, 55.8% wheat, 28.6% peanut, 17.1% tree nuts, 28.1% fish, 13.6% shrimp, and 7.0% shellfish (**Fig. 3**). By age 24 months, 92% of children were introduced egg, 37.7% soy, 85.4% wheat, 67.3% peanut, 47.7% tree nuts, 67.8% fish, 48.2% shrimp, and 30.2% shellfish (**Fig. 4**). Of the allergenic foods, egg was the earliest food introduced to the children, whereas soy, peanut, tree nuts, shrimp, and shellfish were not as commonly introduced. Of the 14 children with eczema or egg allergy, 26.1% were introduced peanut by age 4–6 months and 50% by age 4–11 months, compared to 7.6% and 23.1% in patient without atopic dermatitis (**Fig. 5**). There was statistical significance due to the small sample size. Barriers of food introduction noted by caregivers include a fear of food introduction, lack of parental education by pediatricians regarding

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food introduction, hesitation to introduce foods due to their child having eczema and other atopic diseases, cost of certain allergenic foods (namely fish and shellfish), and their own cultural practices.

Table 1. Patient characteristics (n = 200)

Characteristic	Value
Sex	
Male	88 (44.0)
Female	107 (53.5)
Unreported	5 (2.5)
Ethnicity	
Hispanic	171 (85.5)
Black/African American	7 (3.5)
Asian	5 (2.5)
Hispanic Asian	3 (1.5)
White	3 (1.5)
Armenian	3 (1.5)
Hispanic Armenian	1 (0.5)
Unreported	7 (3.5)
Breast fed	
Yes	159 (79.5)
No	41 (20.5)
Food allergy	
None	189 (94.5)
Egg	3 (1.5)
Cow's milk	3 (1.5)
Peanut	1 (0.5)
Shrimp	1 (0.5)
Shellfish	1 (0.5)
Other	3 (1.5)
Atopic dermatitis	
Yes	14 (7.0)
No	186 (93.0)
Family history of atopy	
Yes	46 (23.0)
No	154 (77.0)

Values are presented as number (%).

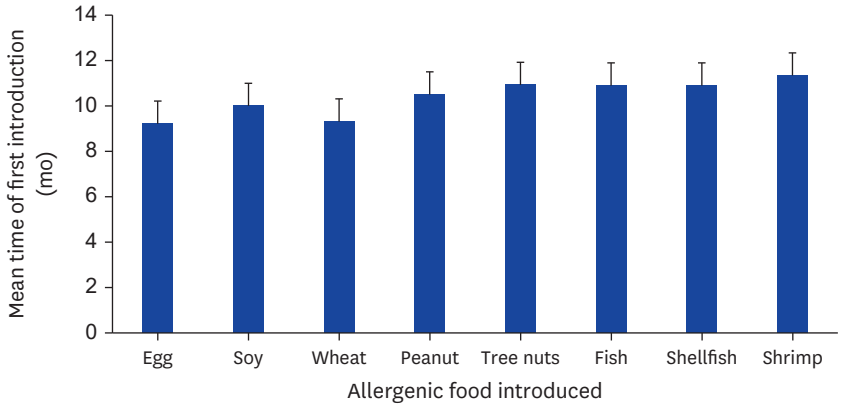

Fig. 2. Mean time of first introduction of allergenic food.

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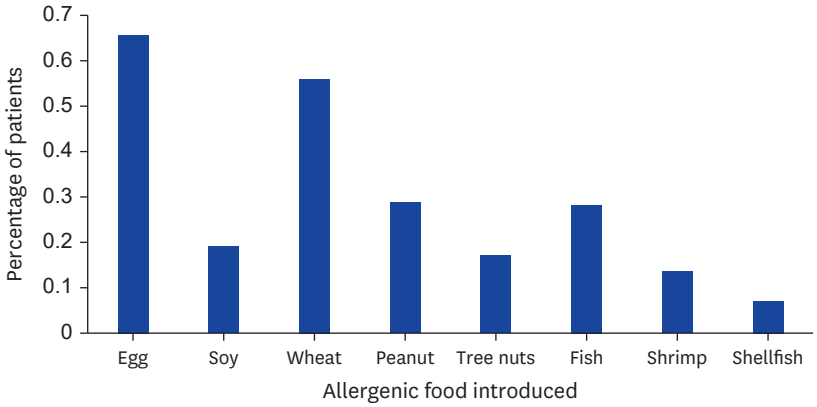

Fig. 3. Percentage of patients who were introduced allergenic foods at 4–11 months of age.

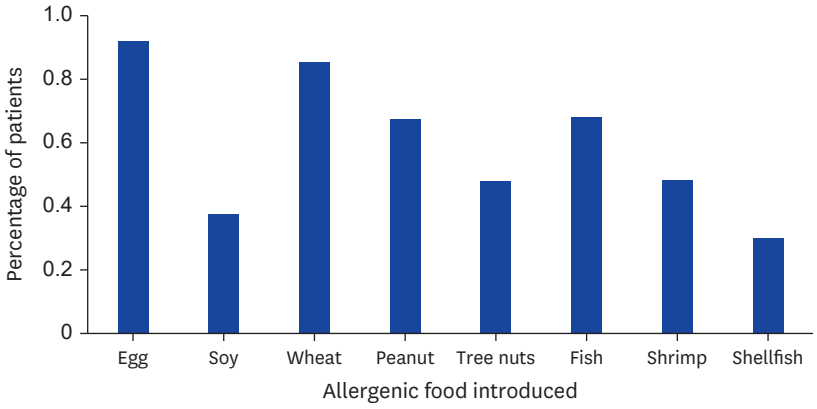

Fig. 4. Percentage of patients who were introduced allergenic foods at 24 months of age.

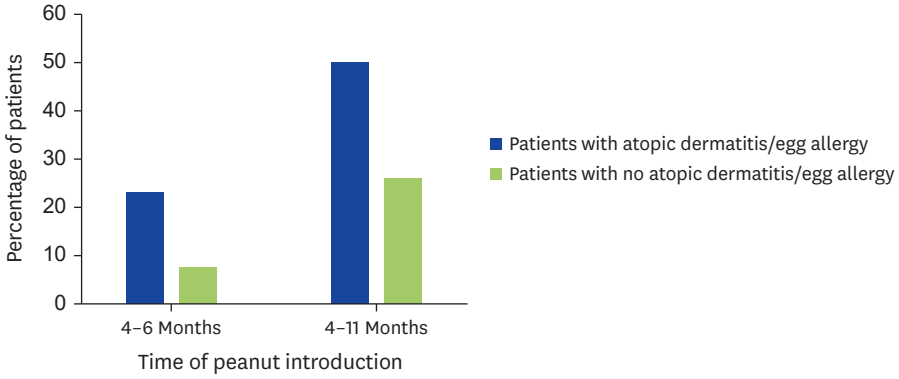

Fig. 5. Percentage of patients with and without atopic dermatitis/egg allergy who were introduced to peanut at 4–6 months and 4–11 months of age.

DISCUSSION

This study shows that caretakers residing in the inner-city in the greater Los Angeles area were not introducing allergenic foods to their children during early childhood as recommended by current guidelines [1-3]. The age of introduction to an allergenic food ranged from 4 months to more than 13 months. By 2 years of age, 8% of children had not

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been introduced to egg, 62.8% to soy, 14.6% to wheat, 32.7% to peanut, 52.3% to tree nuts, 32.2% to fish, 51.8% to shrimp, and 69.8% to shellfish.

Current guidelines support early allergenic food introduction in contradistinction to the previous 2000 AAP guidelines recommending delaying the introduction of certain highly allergenic foods in high-risk children in an effort to prevent the development of allergic diseases such as atopic dermatitis [4]. In 2008, due to the increasing incidence of allergic disease and food allergies, the AAP re-evaluated its previous recommendations and concluded that there was not enough evidence to promote this strategy for primary prevention of allergic disease in children [5]. Since the publication of the landmark trial LEAP, early introduction of peanuts has been shown to decrease the risk of developing peanut allergy [1]. The most recent guidelines from the AAP in 2019 states that there is no evidence that delaying the introduction of allergenic foods beyond 4 to 6 months prevents atopic disease [6].

The aforementioned previous and long held belief that early introduction of allergenic foods results in higher probability of developing food allergies may be a major reason why the children in our study were introduced to allergenic foods after an average of 9 months of age. The complete reversal of allergenic food introduction and food allergy paradigm within a short period of time may have resulted in confusion among parents in regards to the best strategies in feeding their infants allergenic foods. Moreover, this new food introduction paradigm may run counter to the cultural practices of some of our patients. We did not quantify reasons why parents in our patient cohort chose to delay introduction of allergenic foods however significant number of parents delayed allergenic food introduction because if their cultural practices and hesitation because they believed that it would result in development of atopic disease.

Similar to our results, other investigators have also reported delays in allergenic food introduction. Tran et al. [7] in Canada, found that 76% parents introduced egg between 7 and 12 months, and only 36% introduced peanut between 7 and 12 months, with most parents (63%) avoiding giving peanut during the first year of life. In contrast to our patient population in inner-city Los Angeles and that in the Canadian study, Schiess et al. [8] found that in 5 European countries, including Germany, Belgium, Italy, Spain, and Poland, some infants were introduced to allergenic foods much earlier than the recommended minimum age of 4 months. This dichotomy in timing of allergenic food introduction is consistent with a small survey of the providers in LAC+USC Medical Center Pediatrics Primary Care in regards to timing of food introduction for their own children. This group of parents introduced food introduction to their own children, allergenic foods such as egg, soy, peanut, and tree nuts were introduced at an average of 6 months of age, much earlier than the children in their medical care (data not shown).

One of the reasons cited by parents of our cohort for late introduction of allergenic foods was lack of pediatrician advice. Leo et al. [9] surveyed providers in British Columbia and found that pediatricians were less aware than dietitians of the recommendation of no benefit in delaying allergenic food introduction beyond 4 to 6 months. In our study, however, the pediatricians were aware of current recommendations of early allergenic food introduction as many of them followed guidelines for their own children. Therefore, there appears to be a disconnect between pediatrician knowledge and caregiver implementation of these recommendations. This finding could be due to provider time limitation during well-child visits to provide recommendations about nutrition when other anticipatory guidance needs to be communicated. In a national survey of 907 primary care pediatricians, Galuska et al. found that fewer than 11% of

pediatricians usually discussed all 6 anticipatory guidance topics included in the survey during well-child care visits [10, 11]. Diet/nutrition is but one topic amongst the many topics that need to be discussed, including seatbelt/car seat use, firearm safety, smoking in the home, healthy weight, and physical activity. Other barriers may include limited parental health literacy and challenges in coordinating all aspects of the anticipatory guidance.

When looking specifically at the high-risk population, which includes infants with severe eczema, egg allergy, or both, early introduction of peanut is recommended by the AAP and NIAID [2, 6]. In our study, 26.1% of high-risk infants were introduced peanut by age 4–6 months and 50% by age 4–11 months. Although there are low percentages, infants with severe eczema and/or egg allergy were more likely to be introduced to peanut than the general population, though our sample size was small. It is possible that our providers who are aware of guidelines were more likely to emphasize early introduction of peanuts among patients at higher likelihood of peanut allergy in contrast to those without significant risk.

Finally, a consequence of delayed allergenic food introduction on a large population basis is an increased risk of food allergy among these large cohorts [2]. Previous studies have suggested that food allergy prevalence among children is higher in the urban environment [12-14]. This may in part be due to late introduction of allergenic foods among inner-city children residing in these areas.

Limitations of our study include a fairly homogenous population with the majority being Hispanic and breastfed. The sample size of patients with atopic dermatitis and egg allergy was extremely small. Moreover, physician diagnosis of eczema/egg allergy was not correlated to the reported diagnoses since the survey was anonymous. We surveyed caregivers of children ranging from 12 months to 24 months of age, and recall bias for those children in the older age range may exist. Documentation of provider education was not reviewed. However, caregiver perception is a proxy for real life understanding and where focus should be to have true impact in patient care.

In conclusion, inner-city caregivers are not introducing allergenic foods in a timely manner to their children as recommended by current guidelines. This may lead to increased likelihood of developing food allergy among these children. Further efforts need to be focused on elucidating reasons for the disconnect between evidenced based guidelines and their implementation. These will be basis for strategies in reducing development of food allergies in this population.

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