

## Original Article

# Characteristics of Food Allergic Reactions in United States Restaurants

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**What is already known about this topic?** Food allergic reactions occur while dining out. Prior studies have shown that restaurant patrons fail to communicate allergies to restaurant staff and restaurant staff lack fundamental food allergy knowledge that could help decrease allergic reactions.

**What does this article add to our knowledge?** Peanut, tree nuts, and milk are the most commonly implicated foods in restaurant allergic reactions, with tree nuts the most common cause of epinephrine use. More than 1 in 4 reactions result in epinephrine use.

**How does this study impact current management guidelines?** Data presented here of the circumstances surrounding food allergic reactions will help counsel food allergic patients and advance advocacy efforts for mandatory declaration of allergenic ingredients on menus and food allergy training of restaurant staff.

**BACKGROUND:** Food allergic reactions of varying severity occur in restaurants. Studies to date have shown that there are gaps in knowledge of and communication between restaurant staff and food allergic individuals.

**OBJECTIVE:** We sought to characterize allergic reactions in restaurants to better inform the restaurant industry, food allergic individual, and allergist so that mitigation strategies can be implemented.

**METHODS:** Data collected over a 2-year period from 2827 individuals in the Food Allergy Research & Education registry were analyzed using descriptive statistics.

**RESULTS:** Dining out accounted for the second most common location for a food allergic reaction, after one's home, and many were severe with 28.0% requiring 1 dose and 6.2% requiring 2

doses of epinephrine. Cafes, fast food establishments, and Asian restaurants were frequently implicated sites. Peanut, tree nuts, and milk were the most common inciting allergens, and tree nuts resulted in the most common use of epinephrine. Of the allergic reactions, 53.9% occurred despite conveyance of food allergy to restaurant staff, 26.6% occurred when allergens were declared on the menu, and 13.7% occurred when allergens were declared on the menu and restaurant staff were informed of a food allergy. **CONCLUSIONS:** Allergic reactions in restaurants are common and can be severe. Findings presented here underscore the need for restaurant staff training and mandatory declaration of allergenic ingredients in meals. This updated knowledge will help support advocacy efforts and inform patients, allergists, and the restaurant industry on best practices for dining out to improve the quality of life for food allergic individuals. © 2020 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2020;■:■-■)

**Key words:** Food allergy; Restaurant; Dining out; Allergic reaction; Accidental ingestion

Severe and sometimes fatal food allergic reactions occur in restaurants.<sup>1-8</sup> Despite this, there are few policies in the United States mandating formalized training of restaurant staff on food allergic issues.<sup>9-12</sup> Moreover, declaration of allergenic ingredients in meals is not compulsory in food-serving establishments. Compounding the problem, studies have also consistently shown that many food allergic individuals do not inform restaurant staff of their food allergy.<sup>4,6,7,13</sup>

In a study using interviews of restaurant employees, conducted by the Centers for Disease Control and Prevention Environmental Health Specialists Network (EHS-Net), less than half of restaurant managers, food workers (ie, those who prepare or cook food), and servers (ie, those who take orders or serve food to patrons) received food allergy training.<sup>9</sup> When food allergy training did occur, the topics covered included discussion of

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*Abbreviations used*

AAAAI- American Academy of Allergy, Asthma & Immunology  
 EHS-Net- Environmental Health Specialists Network  
 FARE- Food Allergy Research & Education  
 ICU- Intensive care unit

major food allergens, cross-contamination, and actions to be taken if a customer has a food allergy. However, restaurant managers, food workers, and servers were trained on each of these topics only to a varying degree. Key food allergy issues inconsistently addressed included review of menu items with allergens, symptoms consistent with an allergic reaction, and restaurant action plan should an allergic reaction occur.<sup>9</sup> EHS-Net investigators also found that in this group interviewed, more than 10% of managers and restaurant staff presumed that a food allergic individual could safely consume a small amount of their allergen.<sup>10</sup> Currently, the Food and Drug Administration Food Code 2017 advises, not requires, that the person-in-charge of the restaurant establishment (ie, manager) ensure that employees are properly trained in food allergy awareness in order for them to safely perform duties related to food allergies. It should be noted that not all states implement the Food Code.<sup>14</sup> At the time of this publication, there is still no federal legislation mandating food allergy training for restaurant staff.

Many food allergic individuals do not dine out because of the risk of an allergic reaction.<sup>5</sup> In 2001, using data from the United States Peanut and Tree nut Allergy Registry, investigators found that 13.7% of registry participants reported an allergic reaction to peanut or tree nuts in restaurants.<sup>15</sup> In a survey conducted in 2007 at the Food Allergy & Anaphylaxis Network conference, 34% of survey respondents reported at least 1 food allergic reaction in a restaurant, with 36% of those respondents reporting at least 3 reactions in restaurants.<sup>5</sup> In addition to inadequate food allergy knowledge by restaurant staff, other studies have outlined additional reasons for these allergic reactions including the presumption by patrons of food served being safe if there was no obvious use of allergen (eg, hidden ingredient in sauce) as well as patrons not notifying restaurant staff of their allergy.<sup>4,6,7,13</sup>

The present study sought to characterize food allergic reactions in restaurants to better inform the food allergic individual, physician providing counseling on dining out, and restaurant industry.

## METHODS

The primary data source for this study was Food Allergy Research & Education's (FARE) Patient Registry, a national online repository of data collected from participants with food allergy. Data collection is ongoing through the Invitae survey platform. Potential participants were informed about the Registry using FARE's e-mail list of over 200,000 food allergy-interested consumers. In addition, the Registry was advertised through social media posts, FARE websites, and local food allergy support groups. Allergists at 33 clinical research centers across the United States were provided with information to promote the Registry to their patients. Online informed consent was obtained before data entry by the individuals with food allergy and family members of children with food allergies. Deidentified self- and parental-reported data from September 2017 to September 2019 from the voluntary Registry were reviewed. Demographics, location of the most recent allergic reaction, type of

food-serving establishment, implicated food, and treatment received were analyzed using descriptive statistics. The  $\chi^2$  test or Fisher's exact test was used to compare categorical variables between groups. Analyses of contingency tables were accomplished using the method of adjusted standardized residuals described by Beasley and Schumacker.<sup>16</sup> A result was considered statistically significant at the  $P < .05$  level of significance. Analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC) and R version 3.6 (R Foundation for Statistical Computing, Vienna, Austria).

## RESULTS

Allergic reactions to food were reported for 2827 individuals from the United States over the 2-year period examined (1579 children <18 years, 40% female; 1248 adults, 82% female). For both children and adults, dining out was the second most common location for these reported allergic reactions ( $n = 597$ , 21%), the most common location being one's home ( $n = 1231$ , 44%). Demographics of survey respondents reporting reactions while dining out are shown in [Tables I and II](#). School accounted for 6% of allergic reactions in children, and the workplace comprised 11% of reactions in adults ([Figure 1](#)). The distribution of location where allergic reactions occurred differed significantly between the pediatric and adult groups ( $P < .0001$ ). Adult allergic reactions occurred more frequently while dining out (31% vs 13%) and less frequently at home (35% vs 51%) compared with pediatric allergic reactions. Cafes (15%), fast food restaurants (10%), ice cream parlors (7%), and Asian restaurants (7%) were the most frequently identified food-serving establishments where children experienced an allergic reaction ([Figure 2A](#)). Cafes (18%), fast food restaurants (10%), Asian restaurants (10%), and bars (7%) were the most often cited locations for allergic reactions in adults ([Figure 2B](#)). The distribution of type of food-serving establishment in which allergic reactions occurred differed significantly between the pediatric and adult groups ( $P < .0001$ ).

The most common food allergens that caused an allergic reaction for both children and adults while dining out were peanut, tree nuts, and milk ([Figure 3](#)). Egg (15%), shellfish (5%), and sesame (3%) were also noted to be triggers in children, whereas shellfish (11%), wheat (9%), and egg (5%) were identified as triggers in adults ([Figure 3](#)). The distribution of culprit food allergens associated with allergic reactions differed significantly between the pediatric and adult groups ( $P < .0001$ ). Adult allergic reactions occurred more frequently with wheat (9% vs 2%) and less frequently with eggs (5% vs 15%), compared with pediatric allergic reactions.

In 53.9% of cases, an allergic reaction occurred despite informing restaurant staff of their food allergy. A list of ingredients (5.0%), allergens (9.2%), and/or precautionary statement (3.5%) was included on the menu in a minority of cases. In 26.6% of cases, a reaction occurred in the setting of ingredients, allergens, or a precautionary statement declared on the menu. In instances when staff were informed and menu information was available, 13.7% of individuals still had an allergic reaction. Instances of "hidden" food allergens accounted for 16.9% of reactions. A total of 9.7% of respondents had not been previously exposed to the culprit allergen.

In children and adults who dined out, the majority of allergic symptoms occurred within 30 minutes of ingestion of their meal. H1 antihistamines were used in 74.4% of dining out allergic

**TABLE I.** Demographics of survey respondents who had food-induced allergic reactions at restaurants: demographics of children and adults

	Age 0-5	Age 6-11	Age 12-17	Age 18-25	Age 26-40	Age 41-59	Age 60-80	Age 80+
<b>Sex</b>								
Male	17 (50.0)	48 (66.7)	55 (53.4)	19 (23.2)	18 (16.1)	16 (12.4)	16 (26.2)	1 (25.0)
Female	17 (50.0)	24 (33.3)	48 (46.6)	63 (76.8)	94 (83.9)	113 (87.6)	45 (73.8)	3 (75.0)
Total	34	72	103	82	112	129	61	4
Average age (y)	4.1	9.2	15.1	21.8	32.9	50.0	67.0	90.1
<b>Race</b>								
American Indian or Alaska Native	1 (2.9)	2 (2.8)	2 (1.9)	0 (0.0)	2 (1.8)	2 (1.6)	1 (1.6)	0 (0.0)
Asian	5 (14.7)	8 (11.1)	10 (9.7)	8 (9.8)	8 (7.1)	7 (5.4)	2 (3.3)	0 (0.0)
Black	0 (0.0)	6 (8.3)	7 (6.8)	3 (3.7)	5 (4.5)	9 (7.0)	1 (1.6)	0 (0.0)
White	32 (94.1)	69 (95.8)	96 (93.2)	79 (96.3)	104 (92.9)	120 (93.0)	56 (91.8)	4 (100.0)
Native Hawaiian or Other Pacific Islander	2 (5.9)	0 (0.0)	1 (1.0)	0 (0.0)	0 (0.0)	1 (0.8)	0 (0.0)	0 (0.0)
Unknown	1 (2.9)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)
<b>Ethnicity</b>								
Hispanic or Latino	4 (11.8)	4 (5.6)	5 (4.9)	4 (4.9)	8 (7.1)	7 (5.4)	1 (1.6)	0 (0.0)
Non-Hispanic or Latino	24 (70.6)	55 (76.4)	72 (69.9)	59 (72.0)	78 (69.6)	82 (63.6)	36 (59.0)	3 (75.0)
Unknown	6 (17.6)	13 (18.1)	26 (25.2)	19 (23.2)	26 (23.2)	40 (31.0)	24 (39.3)	1 (25.0)

Data are presented as n (%).

**TABLE II.** Demographics of survey respondents who had food-induced allergic reactions at restaurants: geographical distribution of survey respondents

	Northeast (n)	%	Southeast (n)	%	Southwest (n)	%	Midwest (n)	%	West (n)	%	Unknown (n)	%
Children	54	25.8	45	21.5	15	7.2	56	26.8	34	16.3	5	2.4
Adults	96	24.7	90	23.2	32	8.2	93	24.0	62	16.0	15	3.9
All	150	25.1	135	22.6	47	7.9	149	25.0	96	16.1	20	3.4

reactions. In some instances, reactions were severe requiring epinephrine (28.0%), with adults accounting for 61% of those reactions. Biphasic reactions, defined as a second wave of symptoms after initial symptoms disappear, were reported in 14.4% of cases. Epinephrine use ( $n = 166$ ) prompted seeking medical attention in 88.0% of cases ( $n = 146$ ), 9.6% sought help from family and/or friends ( $n = 16$ ), and 2.4% ( $n = 4$ ) did not seek help after use. Those food allergic individuals who sought medical help from various sources included the following: 911 or emergency medical services (36.7%,  $n = 61$ ), urgent care (3.6%,  $n = 6$ ), emergency department (66.3%,  $n = 110$ ), general practitioner (8.4%,  $n = 14$ ), and allergist (7.2%,  $n = 12$ ). After epinephrine use, survey respondents reported hospitalization in 16.3% ( $n = 27$ ) and intensive care unit (ICU) admission in 4.2% ( $n = 7$ ). In 6.2% of cases ( $n = 37$ ), 2 doses of epinephrine were used. Of those cases, 29.7% ( $n = 11$ ) were hospitalized and 18.9% ( $n = 7$ ) were admitted to the ICU. No deaths were reported.

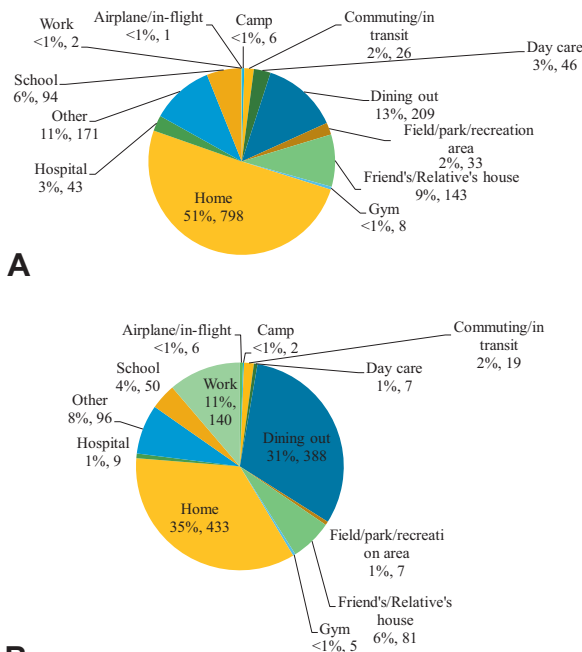
Overall, food allergic individuals were admitted to the hospital in 6.2% of cases and 1.8% were admitted to the ICU. The mean ages for children who required 2 doses of epinephrine, hospitalization, and ICU care were 11, 14, and 8 years, respectively; for adults, the averages were 28, 29, and 56 years, respectively. Additional details of those who experienced severe allergic reactions in restaurants are shown in [Table III](#). Reaction outcomes did not differ in terms of age, gender, race, or ethnicity. Characteristics of those who were in the ICU are detailed in [Table IV](#). When noted by the survey respondent, the most common food allergens that necessitated 1 or 2 doses of epinephrine were

peanut, tree nuts, and milk, with tree nuts being the most common cause of epinephrine use in restaurant establishments ([Table V](#)). There was no significant difference in food triggers in relation to epinephrine requirement. Of the 3 children who required ICU care, 2 reported milk as the culprit allergen and 1 reported egg. Of the 7 adults who required the ICU for management of their allergic reaction, 3 were from tree nuts, 2 from milk, 1 from shellfish, and 1 reported alcohol. Regarding pediatric cases that required non-ICU hospitalization ( $n = 16$ ), peanut was the most common trigger, followed by tree nuts and milk. For hospitalized adults ( $n = 25$ ), when identified, shellfish, peanut, and tree nuts were the most common triggers. [Table VI](#) details the food allergens that led to hospitalizations or ICU care.

## DISCUSSION

Although dining out at restaurants contributes substantially to the morbidity including anxiety of food allergic individuals, formal procedures in restaurants aimed at preventing and managing allergic reactions and governmental oversight in the form of legislation are lacking.

After one's home, restaurants are the second most common location for food allergic reactions and those reactions can be severe. The most common types of establishments for food allergic reactions were cafes and fast food restaurants. In children, dining out accounted for 13% of allergic reactions, more than double the number of reactions that occur in school (6%), possibly because there are voluntary guidelines in place set forth by the federal government to aid in mitigating allergic reactions



**FIGURE 1.** Most recent location for an allergic reaction reported as percentage, number of subjects. (A), Children <18 years (n = 1579). (B) Adults ≥18 years (n = 1248). Other refers to unsure or no response.

in school.<sup>17</sup> There are no guidelines or legislative measures in place for the restaurant industry despite accounting for 13% and 31% of food allergic reactions in children and adults, respectively.

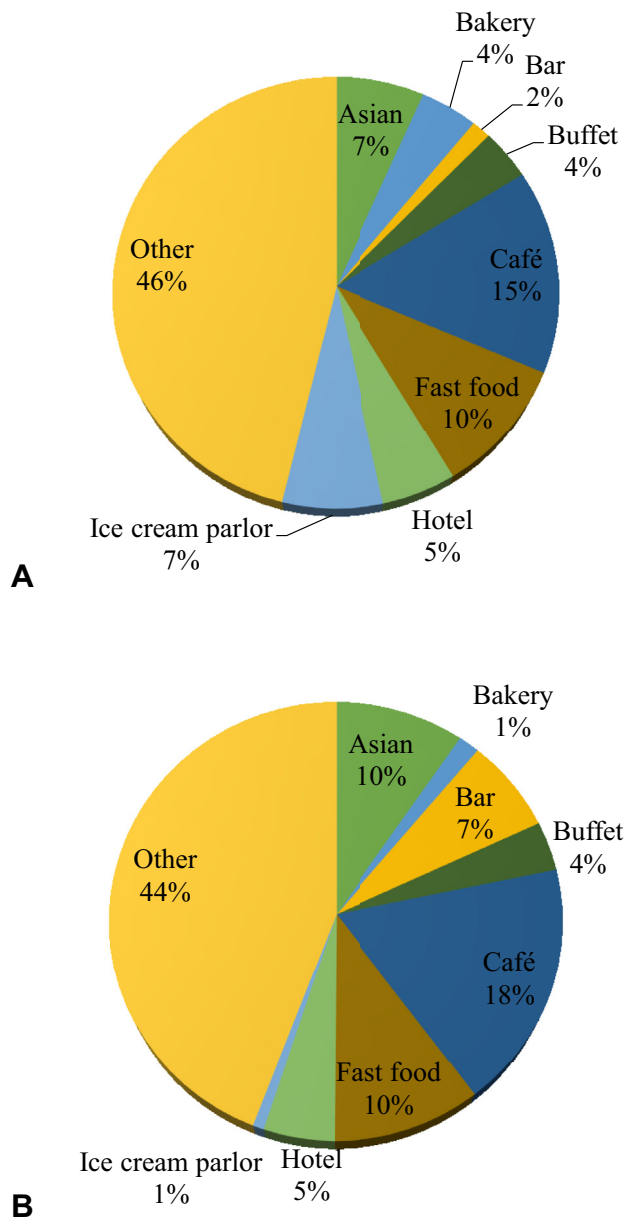
Although the majority of food allergic reactions were treated with antihistamines, more than 1 of 4 reactions that occurred in food-serving establishments resulted in the use of epinephrine. In 2.4% of cases, after using their epinephrine autoinjector, food allergic individuals did not seek additional medical assistance. These findings reinforce the importance of counseling food allergic individuals to carry their epinephrine autoinjectors at all times and reviewing the emergency action plan at regular intervals. Moreover, it further emphasizes the need for guidelines for the restaurant industry on preventing and managing food allergic reactions. Although a workgroup report was recently published by the American Academy of Allergy, Asthma & Immunology (AAAAI) to help guide the restaurant industry, legislative action requiring training of restaurant staff on food allergic topics (eg, most common food allergens, cleaning methods for removal of allergens, cross-contact, hidden ingredients, symptoms of an allergic reaction, appropriate treatment) and labeling of menu items containing top allergens remains critical.<sup>18</sup>

Individuals with allergies to milk, peanut, or tree nuts are at the highest risk for allergic reactions in restaurants and at the highest risk for severe reactions requiring epinephrine. Nearly half of those needing 2 epinephrine doses needed a higher level of care (ie, hospitalization, ICU admission), potentially indicating more severe reactions. This finding highlights the importance of raising awareness of allergic reactions occurring in restaurants and promoting efforts to reduce these reactions.

Increased public awareness of peanut allergy and lower awareness of tree nut allergies by restaurant staff may be the reason for our finding that tree nuts instead accounted for the most common cause of epinephrine use while dining out. Other possibilities include that individuals were unaware of their tree nut allergy or use of different nuts in a dish that the family or restaurant staff may not associate with specific dishes (eg, pesto made with walnuts or cashews instead of pine nuts). Another possibility is that individuals were unaware of their tree nut allergy. Peanut was also not implicated in severe allergic reactions that required ICU care in both children and adults. Instead, peanut was the most commonly reported allergen for pediatric cases hospitalized, not requiring ICU care.

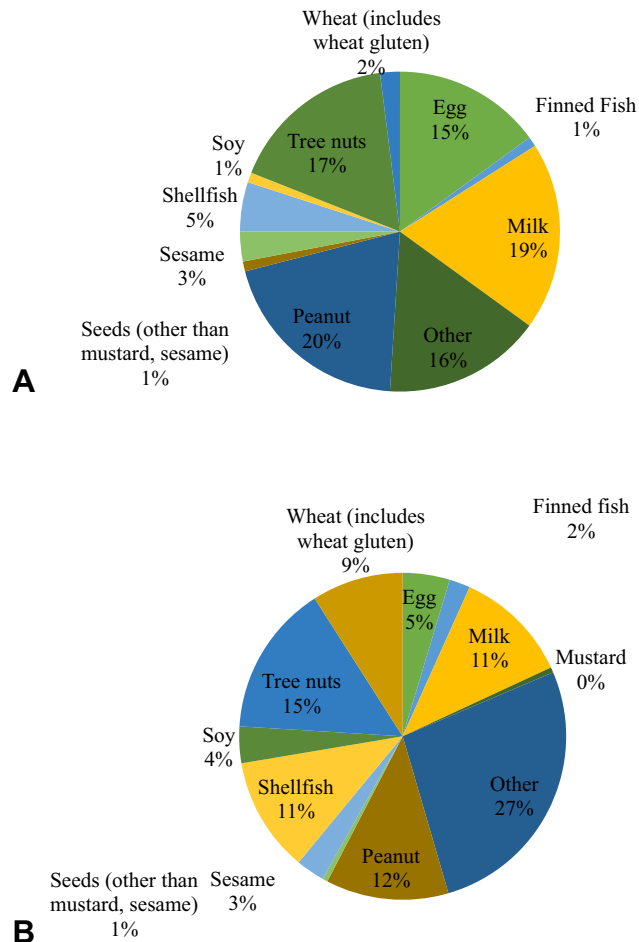
Factors such as food allergic individuals not informing restaurant staff of an allergy and absence of information on menus regarding allergens contribute to the considerable number of allergic reactions in food-serving establishments. The possibility of communication breakdowns (eg, language barrier, perceptual difference, distraction/noise in a busy restaurant) between patron, server, and kitchen staff may contribute to why allergic reactions still occur despite informing staff and allergenic ingredient information provided on the menu.<sup>18</sup> Cross-contact with allergens during preparation and serving is another consideration. In this study, only 53.9% of food allergic patrons who had an allergic reaction while dining out informed restaurant staff of their allergy. This lack of communication between restaurant staff and food allergic individual has been consistently reported in the literature.<sup>4,6,7,13,19</sup> Prior studies demonstrate that food allergic individuals rely on visual identification of their allergen in a dish or are embarrassed to disclose their allergy.<sup>4,20</sup> Allergists should stress the importance of informing restaurant staff of their food allergy because visualization alone is not a reliable way to decrease allergic reactions as allergens can be hidden. Food allergic individuals not informing restaurant staff of a food allergy can be prevented by the server proactively inquiring whether or not any individual at the table has any dietary restrictions. Although this is occurring with increasing frequency in restaurants in the United States, it should be a routine question asked when patrons are ordering their food. The combination of allergists emphasizing the importance of disclosing allergy information and restaurants incorporating a question about dietary restrictions as part of routine practice will facilitate transfer of this important information and help decrease the number of food allergic reactions that occur while dining out. It should be underscored, however, that even when restaurant staff are informed of a food allergy and allergen information is present on the menu, we found that more than 1 in 10 will still have an allergic reaction. Undoubtedly, more than improved communication by the restaurant patron and staff is necessary to reduce the occurrence of food allergic reactions in restaurants. Continued education for patients, caregivers, and restaurant staff is necessary to decrease the incidence of allergic reactions further.

There are limitations to our study. First, allergic reactions were self- or parent-reported, which is subject to recall bias. Second, allergic reactions in restaurants were less frequently reported by individuals from the southwestern and western regions of the United States, likely due to a lower number of overall registry participants from these states. Because this registry is dependent on awareness of the registry, people choosing to participate in this study, and it is a survey promoted by FARE, our study is also



**FIGURE 2.** Type of food-serving establishment in which an allergic reaction occurred. (A), Children <18 years. (B), Adults ≥18 years.

subject to participation bias and may not be representative of the general population of individuals with food allergies. As a consequence, it is difficult to know the exact reason for observed geographical differences. Third, the majority of adult respondents were female, and all respondents were disproportionately white, non-Hispanic, or Latino. Fourth, the percentage of biphasic reactions might be an overestimate because there was limited information provided to the survey participant regarding the definition of a biphasic reaction. Two subjects were excluded from the analysis because of reporting a biphasic reaction less than 1 hour after the disappearance of initial symptoms. Fifth, “other” was a possible option for many fields in the registry and accounted for a substantial number of responses by survey respondents. In some cases, “other” did not allow for a typeable, free-text response. In other cases, the answers did not fit in any



**FIGURE 3.** Culprit food allergens while dining out. (A), Children <18 years. Other refers to fruits, vegetables, herbs or spices, or unspecified by the survey respondent. (B), Adults ≥18 years. Other refers to fruits, vegetables, herbs or spices, cereals, and grains other than wheat, beans, legumes, or pulses other than soy, meats, non-food items, or unspecified by the survey respondent.

other category (examples include allergist’s office, grocery store, place of worship, or hotel as the site of an allergic reaction). Sixth, the registry did not have a field for takeout or delivery items from a restaurant as an option for the location of an allergic reaction. Some reactions may have been incorrectly categorized as reactions occurring at home. The number of allergic reactions in restaurants due to errors in restaurant-prepared food that is subsequently delivered or carried out is absent. Therefore, data shown here are likely an underestimate. In our current era of massive online ordering with delivery and takeout options, we must also consider mandatory declaration of allergenic ingredients in online meal options and mechanisms for patrons to declare their food allergies that ensure visualization by restaurant staff.

In summary, mitigation strategies that can be employed by the food allergic individual to decrease the occurrence of food allergic reactions while dining out include choosing restaurants that declare allergenic ingredients on their menu as this was shown to be more effective than informing restaurant staff of their allergy. Dining at a restaurant with allergenic ingredients declared in

**TABLE III.** Characteristics of severe food allergic reactions while dining out

	No epinephrine		Two doses of epinephrine used		Hospitalized		Intensive care unit	
	n	%	n	%	n	%	n	%
Children <18 y of age								
Sex								
Male	72	55.39	9	81.80	11	68.75	3	100
Female	58	44.61	2	18.20	5	31.25	0	0
Total	130		11		16		3	
Average age (y)	11		11		14		8	
Race								
American Indian or Alaska Native	4	3.08	0	0	0	0	1	33.30
Asian	15	11.54	0	0	2	12.50	0	0
Black	11	8.46	0	0	1	6.25	0	0
White	120	92.31	11	100	14	87.50	3	100
Native Hawaiian or Other Pacific Islander	3	2.31	0	0	0	0	0	0
Unknown	0	0	0	0	1	6.25	0	0
Ethnicity								
Hispanic or Latino	10	7.69	1	9.10	1	6.25	0	0
Non-Hispanic or Latino	95	73.08	8	72.70	11	68.75	3	100
Unknown	25	19.23	2	18.20	4	25	0	0
Adults >18 y of age								
Sex								
Male	39	14.83	3	11.50	8	32.00	2	28.60
Female	224	85.17	23	88.50	17	68.00	5	71.40
Total	263		26		25		7	
Average age (y)	43		28		29		56	
Race								
American Indian or Alaska Native	4	1.52	0	0	0	0	0	0
Asian	17	6.46	3	11.50	3	12.00	0	0
Black	14	5.32	1	3.80	0	0	1	14.30
White	240	91.25	25	96.20	24	96.00	7	100
Native Hawaiian or Other Pacific Islander	1	0.38	0	0	0	0	0	0
Unknown	1	0.38	0	0	0	0	0	0
Ethnicity								
Hispanic or Latino	16	6.08	1	3.80	1	4.00	0	0
Non-Hispanic or Latino	163	61.98	23	88.50	18	72.00	5	71.40
Unknown	84	31.94	2	7.70	6	24.00	2	28.60

In some cases, percentages are >100% due to those individuals of mixed race.

**TABLE IV.** Details of food allergic individuals in the intensive care unit

Patient	Age (y)	Sex	Allergen	Prior history	Food	Type of establishment	Two or more doses of epinephrine	Biphasic reaction
1	8	M	Egg*	Yes	—	Fast food	N, IV only	N
2	59	F	Tree nuts	Yes	Bread or salad	Other	Y	Unsure
3	56	M	Tree nuts†	Yes	Sandwich	Café	N, IV only	N
4	19	M	Milk*, †	Yes	Cheese	Fast food	Y	Y
5	15	M	Milk†	Yes	Pizza	Other	Y‡	N
6	36	F	Tree nuts (pine nut)	No	Pesto in Italian wrap	Bar	Y, late‡	N
7	60	F	Shellfish*, †	Yes	Oyster sauce	Asian	N, IV only	Y
8	4	M	Milk†	Yes	Butter	Other	Y	Y
9	61	F	Other	No	Alcohol	Other	Y	Y
10	28	F	Milk†	Yes	Cheese	Other	Y	Y

\*List of ingredients, allergens, or a precautionary statement on menu.

†Staff informed about the allergy.

‡More than 3 doses of epinephrine reported.

**TABLE V.** Culprit food allergens that required no epinephrine, 1 dose of epinephrine, or 2 doses of epinephrine

Food allergen	No epinephrine		One dose of epinephrine		Two doses of epinephrine	
	n	%	n	%	n	%
Cereals and grains (other than wheat)	1	0.3	0	0.0	0	0.0
Beans, legumes, or pulses (other than soy)	0	0.0	3	3.0	0	0.0
Egg	37	9.4	3	3.0	0	0.0
Finned fish	9	2.3	1	1.0	0	0.0
Fruits	8	2.0	2	2.0	0	0.0
Herbs or spices	11	2.8	2	2.0	0	0.0
Meats	12	3.1	4	4.0	0	0.0
Milk	54	13.7	12	12.1	5	20.0
Mustard	1	0.3	1	1.0	0	0.0
Other	52	13.2	10	10.1	3	12.0
Peanut	48	12.2	15	15.2	6	24.0
Seeds (other than mustard, sesame)	2	0.5	1	1.0	0	0.0
Sesame	10	2.5	4	4.0	1	4.0
Shellfish	39	9.9	9	9.1	2	8.0
Soy	14	3.6	2	2.0	1	4.0
Tree nuts	48	12.2	21	21.2	7	28.0
Vegetables	12	3.1	4	4.0	0	0.0
Wheat (includes wheat gluten)	33	8.4	5	5.1	0	0.0
Non-food items	2	0.5	0	0.0	0	0.0

**TABLE VI.** Food allergens implicated in hospitalized individuals and those who required ICU care.

Children <18 y of age	Adults >18 y of age							
	Hospitalized		ICU		Hospitalized		ICU	
	n	%	n	%	n	%	n	%
Milk	3	18.75	2	66.67	3	12	2	28.57
Egg	2	12.5	1	33.33	1	4	0	0
Soy	0	0	0	0	1	4	0	0
Wheat	0	0	0	0	2	8	0	0
Peanut	5	31.25	0	0	4	16	0	0
Tree nuts	3	18.75	0	0	4	16	3	42.86
Shellfish	1	6.25	0	0	5	20	1	14.29
Other	2	12.5	0	0	5	20	1	14.29
Total cases	16		3		25		7	

ICU, Intensive care unit.

combination with informing restaurant staff of their allergy was shown to be the most effective means to decrease an allergic reaction. Informing restaurant staff in the absence of allergenic ingredients declared on the menu only prevented allergic reactions less than 50% of the time. Allergists can provide this information, along with information on high-risk restaurant types (ie, cafes, fast-food restaurants, Asian restaurants), to food allergic individuals when counseling patients on dining out. Informing patients that 1 in 4 reactions while dining out require the use of epinephrine underscores the importance of having epinephrine always accessible. Allergists should emphasize, at every visit, the importance of carrying 2 epinephrine auto-injectors at all times. The allergist should also review the

emergency action plan at each visit and emphasize that early use of epinephrine leads to improved outcomes.

Studies have shown that most restaurant staff are ill equipped to manage an allergic reaction underscoring the need for prevention of allergic reactions and education of restaurant employees.<sup>9-11</sup> Specific approaches that can be employed by the restaurant industry include mandatory and regularly scheduled training for all restaurant staff—this training should not be limited to restaurant managers. Food allergy issues that should be addressed in the training include: (1) cross-contact issues (eg, small amount of allergen can lead to allergic reactions; designated allergen-free areas and separate cookware for allergic individuals can help decrease risk of cross-contamination), (2) effective methods for removal of allergen (eg, washing of hands with soap and water or commercial wipes, not antibacterial hand sanitizer or water alone), and (3) symptoms concerning for an allergic reaction and appropriate response by restaurant staff. Other means by which restaurants can decrease allergic reactions include establishing a protocol for obtaining and transmitting information about any food allergies (eg, routine question asked when taking order, note on menu stating to inform server of any allergies, direct communication of the food allergy with the chef preparing the food, full disclosure of allergenic ingredients, computerized orders with allergy highlighted). Given the current COVID-19 pandemic, it may be an apt time for the restaurant industry to implement measures such as these as they institute other practices for ensuring patron safety. Servsafe from the National Restaurant Association is an online option for training that can be considered by restaurateurs. More detailed information on strategies that can be employed by allergists, food allergic individuals, and restaurant staff can be found in the recently published Workgroup report from the AAAAI.<sup>18</sup>

To our knowledge, this is the largest study describing food allergic reactions while dining out. The data presented here are an update to the first comprehensive report of food allergic reactions in restaurants, which detailed peanut and tree nut allergic reactions in food-serving establishments.<sup>15</sup> The findings shown here using the Food Allergy Patient Registry from FARE apprise physicians, food allergic individuals, and restaurant staff of circumstances surrounding food allergic reactions while dining out. This current knowledge of food allergic reactions in restaurants is essential to support advocacy efforts relating to food allergen labeling on restaurant menus and mandatory training for restaurant staff. At the time of publication, the following states and cities have legislative policies designed to make dining out safer for food allergic individuals: Maryland, Massachusetts, Michigan, Minnesota, Rhode Island, Virginia, New York City, New York, St. Paul, Minnesota.<sup>21,22</sup> There is a great need to expand this list. These data will also help inform families and clinicians on best practices for dining out at restaurants with the goal of improving the quality of life of food allergic individuals.

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