

Food allergy research priorities: Results from a patient-centered study

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Clinical Implications

- Despite some differences, there was much agreement on research priority areas among food allergy researchers and other stakeholders. Future research efforts can be designed to incorporate patient-centered outcomes that reflect the lived experience of food allergy management.

TO THE EDITOR:

Food allergy (FA) is a growing public health concern that affects 15 million Americans, including 5.9 million children.¹ Between 1997 and 2011, the prevalence of pediatric FA increased by almost 50%, with an increase in peanut and tree nut allergy.² An estimated 200,000 people need emergency medical care annually due to a food-related adverse reaction in the United States.³ In addition, FA is associated with increased anxiety and reduced quality of life (QOL).⁴

Patient-centered outcomes research emphasizes patient and caregiver collaboration and input in an effort to improve communication, decision making, QOL, and treatment outcomes. Patient-centered outcomes research has been successfully applied in asthma research, to address gaps in asthma care related to race and ethnicity.⁵ It is necessary to incorporate patient concerns and expectations into FA research agendas.⁶ Therefore, Food Allergy Research & Education established 4 multidisciplinary, regional outcomes research advisory boards (ORABs) through an engagement award from the Patient-Centered Outcome Research Institute. The primary goal of the members (n = 44) is to actively shape FA research by identifying research needs, preferences, and stakeholder priorities. The purpose of this study was to compare the research priorities of stakeholders who identified themselves as FA researchers with those stakeholders who did not identify as researchers (hereafter other FA stakeholders).

The ORABs and their academic partners administered a survey to assess research priorities among attendees of an annual FA Research Retreat sponsored by Food Allergy Research & Education in April 2017. Retreat attendees included patients with FA, parents of children with FA, health care professionals, researchers (basic, translational, and clinical FA scientists), advocates, industry representatives, government regulators, and other members of the FA community.

The questionnaire was developed from a thematic analysis of white papers prepared by each regional ORAB during the first 9 months of the engagement grant and finalized by reaching consensus during quarterly regional meetings; 5 priority areas were reflected in the questionnaire domains (see Table 1).

Respondents rated each item within a domain according to its importance using a 4-point Likert scale where 1 = not at all important, 2 = slightly important, 3 = fairly important, and 4 = very important. Respondents also ranked the 5 priority areas head-to-head from 1 to 5 (1 being the most important). Data on demographic characteristics were also collected.

The anonymous survey was administered via an online survey tool. A total of 107 of 125 Research Retreat attendees (n = 62 FA researchers; n = 45 other FA stakeholders) completed the survey in the week before the Research Retreat. We performed both domain-level and item-level analyses to assess differences in the distribution of rankings between FA researchers and other FA stakeholders. Because respondents ranked multiple items in each domain, we fit domain-specific cumulative logistic regressions on the ordinal Likert scale data using the method of generalized estimating equations. The generalized estimating equations method provides a population-average effect of the log odds of FA researchers versus other FA stakeholders' rankings while adjusting for clustering by respondent. For the cumulative logistic models, we tested the proportional odds assumption that the relationship between pairs of item rankings is the same using a score test. When the assumption was violated (diagnostic testing and developing treatments domains), we used multinomial logistic regression and treated the outcomes as nominal. Observations with missing items rankings (2%-4% per domain) were excluded from the analysis. As a sensitivity analysis, we conducted a complete case analysis using data from respondents who ranked all items within a domain.

An item-specific analysis was performed for each domain with significant odds ratios of item rankings. We used χ^2 or Fisher exact tests to assess the association between item ranking and stakeholder group. We used the same method to examine the differences in top priority ranking in a head-to-head comparison as well as differences in respondent characteristics across groups. All analyses were conducted using SAS statistical software, version 14.2 (SAS Institute Inc, Cary, NC).

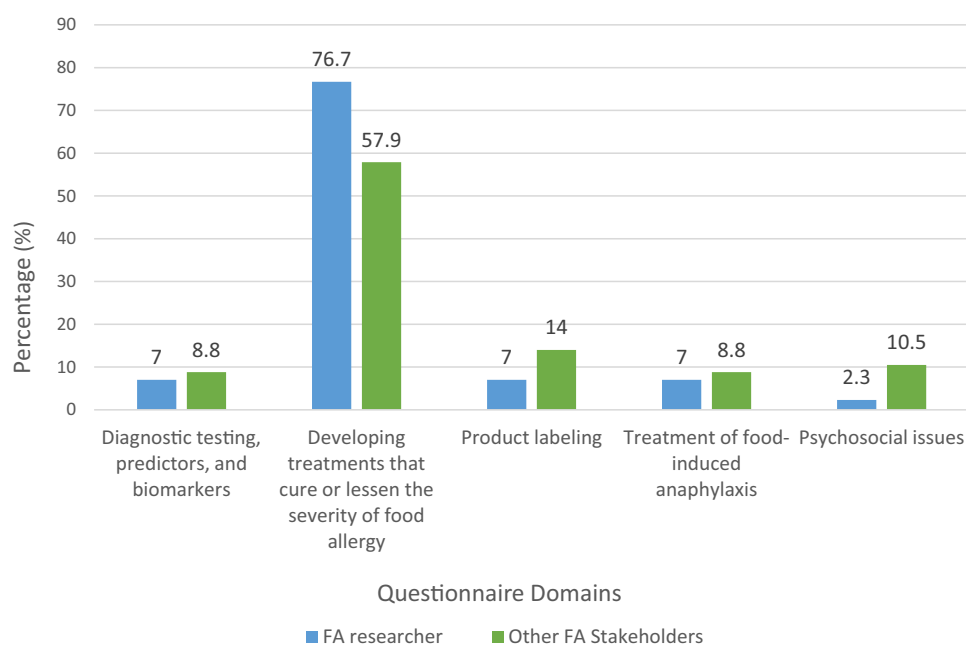
FA researchers and other FA stakeholders differed significantly in several characteristics (see Table E1 in this article's Online Repository at www.jaci-inpractice.org). Table 1 presents the results of the logistic regressions by questionnaire domain. There were significant odds ratios in all the domains except psychosocial issues. In the first 2 domains (diagnostic testing and developing treatments), there was a single value that was more likely to be ranked by FA researchers. Specifically, FA researchers had 4.3 times the odds of ranking diagnostic testing items as "not at all important" (vs very important) and 2.2 times the odds of ranking developing treatments as "slightly important" compared with other FA stakeholders ($P < .05$). In the 2 domains in which the proportional odds assumption held, FA stakeholders had greater odds of ranking an item as *less important* than other FA stakeholders. Specifically, they had 2.23 times the odds of ranking product labeling and 1.98 times the odds of ranking treatment of food-induced anaphylaxis as *less important* than other FA stakeholders ($P < .01$). The sensitivity analysis (see Table E2 in this article's Online Repository at www.jaci-inpractice.org) supported all findings except in the diagnostic testing domain in which there was no significant difference between FA researchers

TABLE 1. Differences in domain-specific item ranking by stakeholder type

Domains	FA researcher responses	Other FA stakeholders responses	Odds ratio estimates for FA researcher vs other FA stakeholder item rating*
Diagnostic testing, predictors, and biomarkers (10 items)	N = 442	N = 566	—
Not at all important	19 (4.3)	6 (1.1)	4.31 [†]
Slightly important	54 (12.2)	66 (11.7)	1.11
Fairly important	128 (29.0)	166 (29.3)	1.05
Very important	241 (54.5)	328 (58.0)	Reference
Developing treatments that cure or lessen the severity of FA (14 items)	N = 613	N = 827	—
Not at all important	12 (2.0)	12 (1.5)	1.47
Slightly important	62 (10.1)	41 (5.0)	2.23 [†]
Fairly important	160 (26.1)	215 (26.0)	1.10
Very important	379 (61.8)	559 (67.6)	Reference
Product labeling (5 items)	N = 219	N = 304	2.27 [‡]
Not at all important	5 (2.3)	2 (0.7)	—
Slightly important	32 (14.6)	25 (8.2)	—
Fairly important	80 (36.5)	74 (24.3)	—
Very important	102 (46.6)	203 (66.8)	Reference
Treatment of food-induced anaphylaxis (9 items)	N = 389	N = 546	1.98 [‡]
Not at all important	6 (1.5)	9 (1.6)	—
Slightly important	75 (19.3)	55 (10.1)	—
Fairly important	134 (34.4)	145 (26.6)	—
Very important	174 (44.7)	337 (61.7)	Reference
Psychosocial issues (8 items)	N = 337	N = 476	1.81
Not at all important	4 (1.2)	10 (2.1)	—
Slightly important	73 (21.7)	58 (12.2)	—
Fairly important	130 (38.6)	152 (31.9)	—
Very important	130 (38.6)	256 (53.8)	Reference

Values are n (%).

*Rank-specific odds ratios are presented for domains in which a nominal multinomial logistic regression was the best-fitting model, whereas the single odds ratio for the FA researcher coefficient is presented when the cumulative logistic regression was used. All models estimate the odds of being a FA researcher vs other FA stakeholder on item ranking using the method of generalized estimating equations.

[†]P < .05.[‡]P < .01.**FIGURE 1.** Percentage of respondents ranking domain as top priority by stakeholder type.

and other FA stakeholders among respondents responding to all items.

Tables E3 to E6 (see in this article's Online Repository at www.jaci-inpractice.org) present the item-specific analysis for the 4 priority areas with significant domain-level group differences. In each domain, 2 to 3 items were associated with stakeholder groups.

Figure 1 presents the head-to-head assessment of domain priority. There was no statistically significant association between stakeholder group and top-ranked domain. Most respondents most often ranked the development of treatments as the top priority (76% FA researchers, 57.9% other FA stakeholders). This finding differed from the rank based on mean domain score in both groups.

Despite an enhanced focus on factors affecting FA management and QOL, efforts to engage patients and families of children with FA in research are still in their infancy.⁶ Thus, our study is one of the first in the literature to present and compare research priorities of researchers and other stakeholders in FA.

Respondents in our survey were not aligned in the area of product labeling, a key issue impacting FA stakeholders' food purchasing experience. Reliable precautionary allergen labeling (PAL) holds the promise to reduce anxiety associated with food purchasing.⁷ Despite all efforts to improve PAL statements,⁷ previous research demonstrates that consumers' ratings of risk and adherence to PAL vary depending on the word choice and country.⁸ The results of our study demonstrate that consumers continue to place product labeling high on the list of research priorities.

Respondents also diverged in their assessment of the importance of the treatment of food-induced anaphylaxis. One item rated higher by other FA stakeholders focused on the need for developing alternative medications, administration routes, and devices to treat anaphylaxis as well as treatment guidelines for emergency responders. This finding is supported by a recent study that found rates of epinephrine administration before hospital arrival to be low and unchanged by the implementation of 2006 NIAID anaphylaxis treatment guideline.⁹ These data and the present study underscore the need for further work to improve overall adherence of treatment guidelines.

We are encouraged that psychosocial issues had similar rankings in our 2 groups, particularly in light of the fact that behavioral health researchers were not represented in the study sample. Psychosocial issues have been an emerging area of FA research, and our study suggests that both researchers and stakeholders align in their perception of the importance of psychosocial research.

Limitations of our study include the fact that Research Retreat attendees and ORAB members may not be representative of the FA population at large. Balancing these limitations is the high response rate and patient-centered research process.

This study and the work of the ORAB represent a first step toward turning research priorities into actionable initiatives.

Since the time of the Research Retreat, ORAB members have engaged in the dissemination and implementation of their findings and intend to remain organized.

Based on the results of this patient-centered research study, future research should focus on food labeling and treatment of food-induced anaphylaxis. Our data emphasize the need for the clinical and research community to consider patient-centered outcomes in clinical care and future research because priorities may not always align.

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ONLINE REPOSITORY

TABLE E1. Characteristics of FA researchers and other FA stakeholders

Characteristic	% of FA researchers (n = 45)	% of other FA stakeholders (n = 62)	% of total (n = 107)	P value (χ^2 test)
Sex				
Male	55.6	30.6	41.1	.01
Female	44.4	69.4	58.9	
Education				
College degree	2.2	19.4	12.1	<.0001
Master's degree	0.0	37.1	21.5	
Doctoral degree	97.8	43.5	66.4	
Role				
Parent of a child diagnosed with FA	11.1	64.5	42.1	<.0001
Individual diagnosed with FA	11.1	11.3	11.2	.98
Health care provider for patients with FA	46.7	17.7	29.9	<.0001
Employee/organizing member of an FA patient advocacy organization	4.4	21.0	14.0	.02
Other	8.9	33.9	23.4	<.0001
Observed anaphylaxis				
Yes	80.0	80.6	80.4	.93
No	20.0	19.4	19.6	
Member of ORAB				
Yes	22.2	46.8	36.4	.01
No	77.8	53.2	63.6	
First-degree relative with FA				
Yes	29.5	71.0	53.8	<.0001
No	70.5	29.0	46.2	

P value reflects the probability that the distribution of each characteristic is independent of stakeholder type.

TABLE E2. Complete case analysis of differences in domain-specific item ranking by stakeholder type

Domains	FA Researcher responses	Other FA stakeholders responses	Odds ratio estimates for FA researcher vs other FA stakeholder item rating*
Diagnostic testing, predictors and biomarkers (10 items)	N = 400	N = 430	1.45
Not at all important	20 (5.0)	7 (1.6)	—
Slightly important	58 (14.5)	49 (11.4)	—
Fairly important	132 (33.0)	135 (31.4)	—
Very important	190 (47.5)	239 (55.6)	Reference
Developing treatments that cure or lessen the severity of FA (14 items)	N = 588	N = 686	—
Not at all important	13 (2.2)	12 (1.7)	1.49
Slightly important	62 (10.5)	24 (3.5)	3.55†
Fairly important	164 (27.9)	171 (24.9)	1.32
Very important	349 (59.4)	479 (69.8)	Reference
Product labeling (5 items)	N = 215	N = 280	2.54‡
Not at all important	5 (2.3)	1 (0.4)	—
Slightly important	33 (15.3)	20 (7.1)	—
Fairly important	77 (35.8)	67 (23.9)	—
Very important	100 (46.5)	192 (68.6)	Reference
Treatment of food-induced anaphylaxis (9 items)	N = 342	N = 477	1.93‡
Not at all important	6 (1.8)	11 (2.3)	—
Slightly important	76 (22.2)	58 (12.2)	—
Fairly important	114 (33.3)	123 (25.8)	—
Very important	146 (42.7)	285 (59.7)	Reference
Psychosocial issues (8 items)	N = 312	N = 448	1.70
Not at all important	5 (1.6)	12 (2.7)	—
Slightly important	71 (22.8)	62 (13.8)	—
Fairly important	115 (36.9)	137 (30.6)	—
Very important	121 (38.8)	237 (52.9)	Reference

The complete case analysis includes only those respondents who ranked all items within the domain.

*Rank-specific odds ratios are presented for domains in which a nominal multinomial logistic regression was the best-fitting model, whereas the a single odds ratio for the FA researcher coefficient is presented when the cumulative logistic regression was used. All models estimate the odds of being a FA researcher vs other FA stakeholder on item ranking using the method of generalized estimating equations.

† $P < .05$.

‡ $P < .01$.

TABLE E3. Mean item scores for diagnostic testing, predictors, and biomarkers domain by stakeholder type

Diagnostic testing, predictors, and biomarkers items	FA researcher (n = 45), mean ± SD	Other FA stakeholders (n = 62), mean ± SD	P value (χ^2 or Fisher test)
1. Developing tests that more accurately diagnose FA	3.89 ± 0.3	3.76 ± 0.5	.32
2. Developing biomarkers that can predict the risk of anaphylaxis	3.93 ± 0.3	3.77 ± 0.5	.12
3. Developing diagnostic tests that can better predict the likelihood of resolution of FA	3.50 ± 0.7	3.54 ± 0.6	.55
4. Understanding how the accuracy of diagnostic tests may differ by race/ethnicity	3.36 ± 0.7	3.17 ± 0.8	.42
5. Identifying biomarkers that reflect disease activity, particularly for eosinophilic esophagitis	3.60 ± 0.7	3.44 ± 0.7	.22
6. Identifying biomarkers that predict successful treatment with oral immunotherapy	3.70 ± 0.6	3.66 ± 0.6	.93
7. Further developing basophil activation testing as a diagnostic test	2.65 ± 1.0	3.23 ± 0.9	.03
8. Further developing T-cell markers as a diagnostic test	3.14 ± 0.9	3.34 ± 0.8	.53
9. Further expanding component-resolved diagnostic testing (“component testing”)	2.69 ± 0.8	3.29 ± 0.7	.01
10. Investigating whether genetic screening may identify individuals at risk for FA	2.84 ± 0.9	3.10 ± 0.9	.46

P value reflects the probability that each domain item distribution is independent of stakeholder type. Fisher exact test is used when expected cell sizes are <5.

Scale for item responses is as follows: 1 = Not at all important, 2 = Slightly important, 3 = Fairly important, 4 = Very important.

TABLE E4. Mean item scores for developing treatments that cure or lessen the severity of FA questionnaire domain by stakeholder type

Diagnostic testing, predictors, and biomarkers items	FA researcher, mean $\pm$ SD	Other FA stakeholders, mean $\pm$ SD	<i>P</i> value (χ^2 or Fisher test)
1. Understanding how genetics and the environment contribute to the development of FA	3.43 $\pm$ 0.8	3.51 $\pm$ 0.6	.09
2. Understanding the biologic mechanisms of FA and tolerance	3.77 $\pm$ 0.5	3.70 $\pm$ 0.5	.52
3. Identifying strategies to prevent FA before it develops	3.84 $\pm$ 0.5	3.80 $\pm$ 0.4	.22
4. Developing the optimal dosing protocol (starting dose, dosing interval, goal dose) for immunotherapy (IT)	3.41 $\pm$ 0.8	3.67 $\pm$ 0.7	.22
5. Understanding if combining IT with biologic therapies (omalizumab, dupilumab, lebrikizumab) is safer and/or more effective	3.55 $\pm$ 0.7	3.65 $\pm$ 0.6	.85
6. Identifying the optimal age to maximize effectiveness of IT	3.41 $\pm$ 0.7	3.48 $\pm$ 0.7	.18
7. Comparing the effectiveness and safety of different forms of IT (oral, sublingual, epicutaneous)	3.40 $\pm$ 0.7	3.67 $\pm$ 0.7	.01
8. Determining whether IT protocols that include multiple foods allergens simultaneously are safe and effective	3.36 $\pm$ 0.8	3.73 $\pm$ 0.6	.02
9. Understanding if patients may be transitioned from IT to food-grade (vs pharmaceutical grade) treatments	3.02 $\pm$ 1.0	3.55 $\pm$ 0.7	.01
10. Determining if there are racial, sex, or age differences in response to IT and other treatments	3.23 $\pm$ 0.8	3.08 $\pm$ 0.9	.82
11. Developing therapies that do not carry a risk of anaphylaxis as a result of treatment	3.66 $\pm$ 0.6	3.74 $\pm$ 0.5	.73
12. Developing therapies that do not have to be taken for life	3.55 $\pm$ 0.8	3.60 $\pm$ 0.6	.41
13. Developing therapies that will be affordable and/or covered by insurance	3.86 $\pm$ 0.3	3.76 $\pm$ 0.5	.57
14. Understanding how the microbiome affects FA and developing related treatments	3.19 $\pm$ 0.8	3.41 $\pm$ 0.7	.45

P value reflects the probability that each domain item distribution is independent of stakeholder type. Fisher exact test is used when expected cell sizes are <5 .

Scale for item responses is as follows: 1 = Not at all important, 2 = Slightly important, 3 = Fairly important, 4 = Very important.

TABLE E5. Mean item scores for product labeling domain by stakeholder type

Product labeling items	FA researcher (n = 45), mean $\pm$ SD	Other FA stakeholders (n = 62), mean $\pm$ SD	<i>P</i> value (χ^2 or Fisher test)
1. Identifying additional foods that should be included on food labels on the basis of prevalence of FA (ie, sesame)	3.21 $\pm$ 0.8	3.53 $\pm$ 0.7	.07
2. Determining the product labeling method that best benefits patients and industry	3.48 $\pm$ 0.7	3.77 $\pm$ 0.5	.04
3. Developing product labeling that eliminates the confusion of advisory labels	3.55 $\pm$ 0.6	3.76 $\pm$ 0.5	.08
4. Studying how health literacy influences understanding of food labels	2.93 $\pm$ 0.8	3.16 $\pm$ 0.8	.40
5. Identifying what amount of a food allergen could be safely ingested ("threshold levels") for purposes of food labeling	3.20 $\pm$ 0.9	3.62 $\pm$ 0.6	.03

P value reflects the probability that each domain item distribution is independent of stakeholder type. Fisher exact test is used when expected cell sizes are <5 .

Scale for item responses is as follows: 1 = Not at all important, 2 = Slightly important, 3 = Fairly important, 4 = Very important.

TABLE E6. Mean item scores for treatment of food-induced anaphylaxis domain by stakeholder type

Treatment of anaphylaxis items	FA researcher (n = 45), mean $\pm$ SD	Other FA stakeholders, (n = 62) mean $\pm$ SD	P value (χ^2 or Fisher test)
1. Identifying factors that help and/or prevent people from managing their FA (avoiding their allergens, carrying epinephrine)	3.44 $\pm$ 0.7	3.67 $\pm$ 0.6	.20
2. Understanding differences in FA self-management based on race/ethnicity, socioeconomic status, and geography	3.05 $\pm$ 0.8	3.03 $\pm$ 0.9	.36
3. Studying how health literacy influences understanding of emergency care plans	3.20 $\pm$ 0.9	3.20 $\pm$ 0.8	.82
4. Identifying the best methods for teaching patients, caregivers, and health providers how to manage anaphylaxis	3.64 $\pm$ 0.6	3.77 $\pm$ 0.5	.11
5. Studying dissemination of treatment guidelines to emergency responders	3.23 $\pm$ 0.8	3.57 $\pm$ 0.6	.06
6. Identification of real-time biomarkers of early anaphylaxis to help guide treatment decisions	3.40 $\pm$ 0.8	3.55 $\pm$ 0.7	.62
7. Developing alternative medications, administration routes, (inhaled, oral), or devices for the treatment of anaphylaxis	3.14 $\pm$ 0.8	3.69 $\pm$ 0.6	<.01
8. Developing anaphylaxis treatments with longer expiration dates	3.23 $\pm$ 0.8	3.58 $\pm$ 0.7	.02
9. Clarifying how many epinephrine autoinjectors need to be carried	2.67 $\pm$ 0.8	3.27 $\pm$ 0.9	<.01

P value reflects the probability that each domain item distribution is independent of stakeholder type. Fisher exact test is used when expected cell sizes are <5.

Scale for item responses is as follows: 1 = Not at all important, 2 = Slightly important, 3 = Fairly important, 4 = Very important.

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