

Food Allergy Prevalence, Severity, and Disparities

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Learning Objectives

 Describe the prevalence and severity of pediatric and adult food allergy in the U.S.

 Characterize the various barriers to managing food allergies, including access to care, economic impact, and food insecurity.

1. Offer recommendations and resources for addressing the burden of food allergy.





The Public Health Impact of Food Allergy in the U.S.

THE FOOD ALLERGY EPIDEMIC



イネイネイ 1 in 10 ネイネイネ adults

1 in 13 children

Reactions can range from...

Mild

Life-threatening (anaphylaxis)



The Public Health Impact of Parent-Reported Childhood Food Allergies in the United States

Ruchi S. Gupta, MD, MPH, a,b,c,d Christopher M. Warren, BA, Bridget M. Smith, PhD,c,f Jesse A. Blumenstock, BS,c Jialing Jiang, BA,c Matthew M. Davis, MD, MAPP,a,b,c,d,g Kari C. Nadeau, MD, PhDh

Gupta RS, Warren CM, Smith BM, Blumenstock JA, Jiang J, Davis MM, et al. The Public Health Impact of Parent-Reported Childhood Food Allergies in the United States. Pediatrics. 2018;142(6):e20181235.



8% of US children have food allergies? Luckily very little of what they eat is technically food...

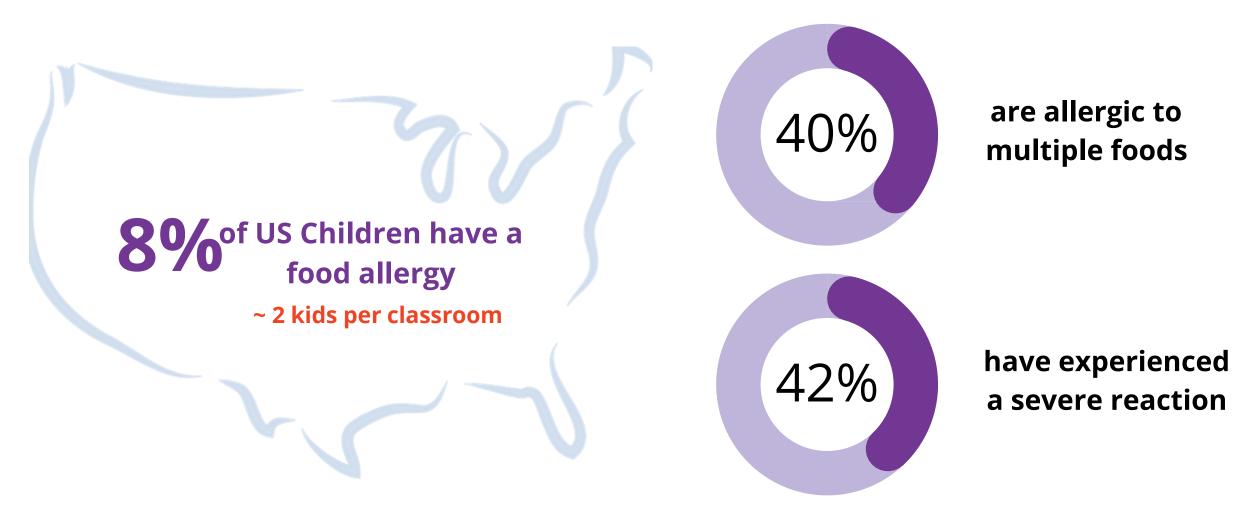
BERT Mon - Thurs 11:30p / 10:30c

PEDIATRICS[®]

The Prevalence, Severity, and Distribution of Childhood Food Allergy in the United States



Childhood Food Allergy Prevalence in the U.S.



Childhood Food Allergy Prevalence in the U.S.

3. **■** Convincing Food Allergy Physician-diagnosed Food Allergy 2.2 **Convincing FA = 7.6% (95% CI: 7.1%-8.1%)** 2.25 Physician-Diagnosed FA = 4.7% (95% CI: 4.3%-5.0%) 1.9 1.8 Parent-Reported FA = 11.4% (95% CI: 10.8%-12.0%) 1.5 1.3 1.2 1.0 0.9 0.9 0.8 0.75 0.6 0.5 0.5 0.2 0. Fin Fish Milk **Tree Nut** Egg Wheat Soy **Shellfish** Sesame **Peanut**



Food Allergen Prevalence by Age





	Peanut	Tree Nut	Milk	Shellfish	Egg	Fin Fish	Wheat	Soy	Sesame
<1 Year	20.2%	9.0%	53.0%	7.1%	13.5%	2.6%	14.9%	15.4%	4.6%
1 Y	24.6%	8.0%	37.8%	5.1%	22.8%	6.4%	6.0%	16.6%	4.9%
2 Y	24.5%	10.9%	43.5%	11.5%	14.1%	6.0%	9.9%	8.6%	2.3%
3-5 Y	25.1%	15.9%	33.6%	13.0%	15.0%	6.2%	6.6%	6.9%	2.7%
6-10 Y	32.8%	17.6%	24.4%	18.4%	10.8%	7.8%	6.4%	6.5%	3.3%
11-13 Y	30.5%	21.3%	14.9%	20.2%	12.8%	7.1%	6.2%	3.6%	1.8%
>14 Y	29.5%	13.3%	16.0%	21.3%	6.6%	7.9%	5.4%	3.0%	2.1%

Gupta RS, Warren CM, Smith BM, Blumenstock JA, Jiang J, Davis MM, Nadeau KC. The Public Health Impact of Parent-Reported Childhood Food Allergies in the United States. Pediatrics 2018-1235

CoFAR Grading Scale for Systemic Allergic Reactions in Food Allergy

Grade 1 Generalized urticaria, localized angioedema, rhinitis, and abdominal pain

Grade 2 Mild, multisystem reactions

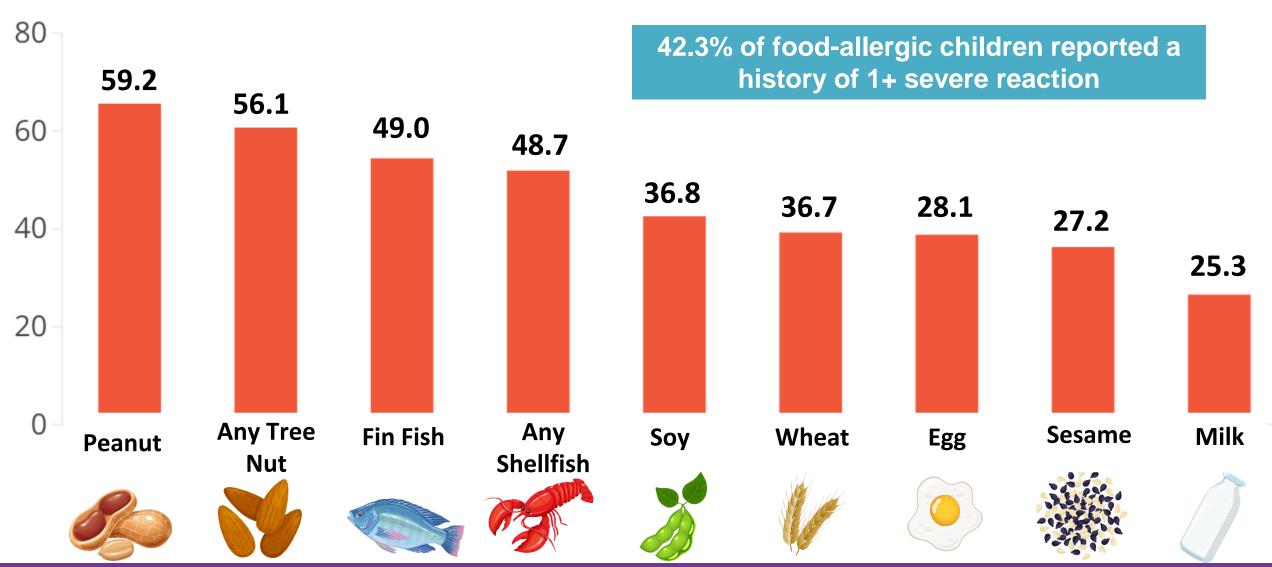
Grade 3 Moderate reactions with lower respiratory tract symptoms responsive to therapy

Grade 4 Severe reactions requiring multiple doses of epinephrine or mechanical ventilation

Grade 5 Life-threatening reactions resulting in death



Childhood Food Allergy Severity





Patterns of Convincing Multi-Food Allergy Among US

	Peanut	Tree Nut	Sesame	Chile	dren	Fin Fish	Shellfish	Soy	Wheat
Peanut	100	61	55	15	29	38	25	33	22
Tree Nut	33	100	44	9	18	24	14	24	18
Sesame	5	8	100	3	6	9	5	11	13
Milk	13	15	23	100	35	15	11	37	43
Egg	12	13	26	17	100	20	11	25	21
Fin Fish	9	11	23	4	12	100	24	14	12
Shellfish	15	15	31	7	16	57	100	20	21
Soy	7	10	26	9	13	12	7	100	26
Wheat	5	8	31	11	12	11	8	27	100

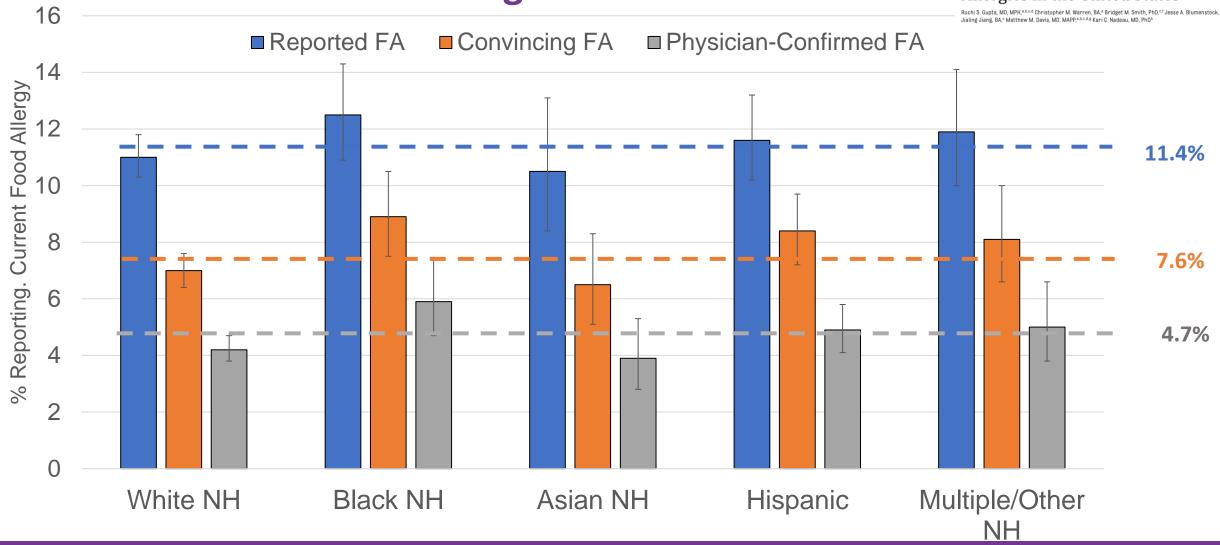
(% of children with convincing column allergy who are also allergic to the row allergen)



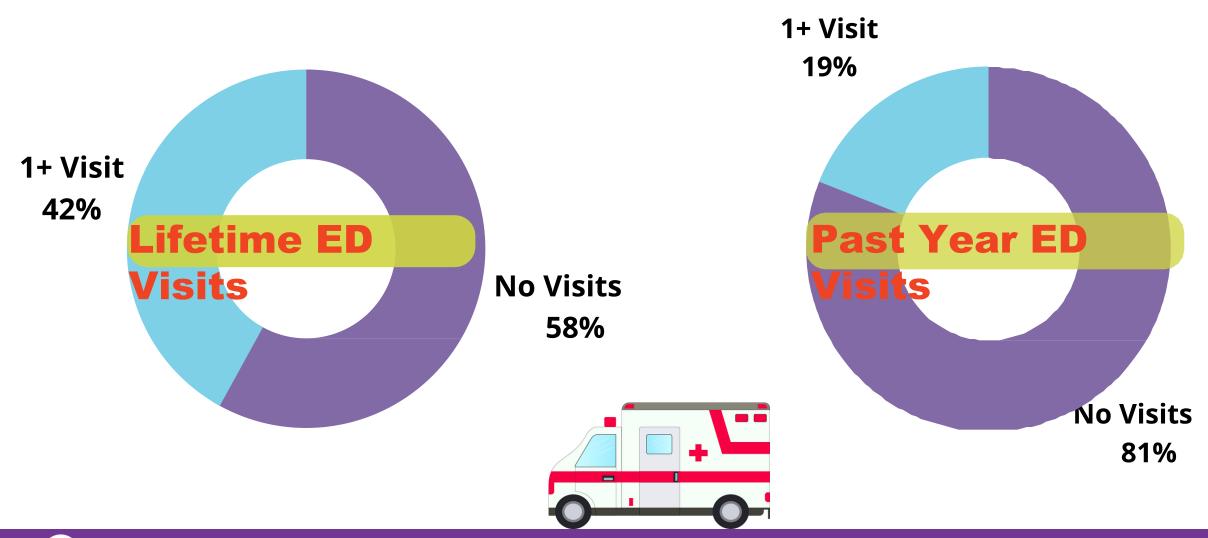
Racial and Ethnic Differences in Current Food Allergy **Prevalence among US Children**

PEDIATRICS°

The Public Health Impact of Parent-Reported Childhood Food Allergies in the United States



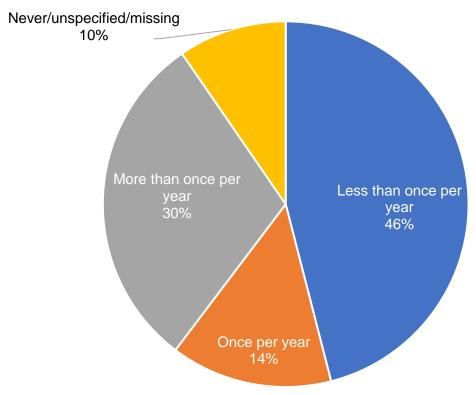
Pediatric FA Emergency Department Visits

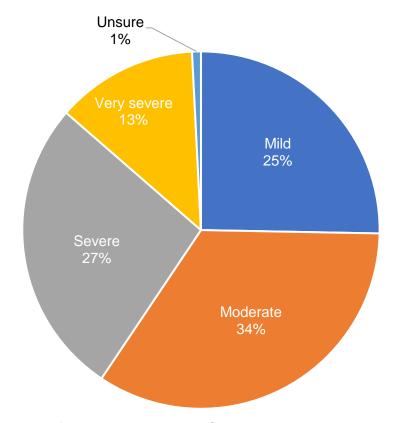




Parent-Reported Reaction History

National Patient Registry





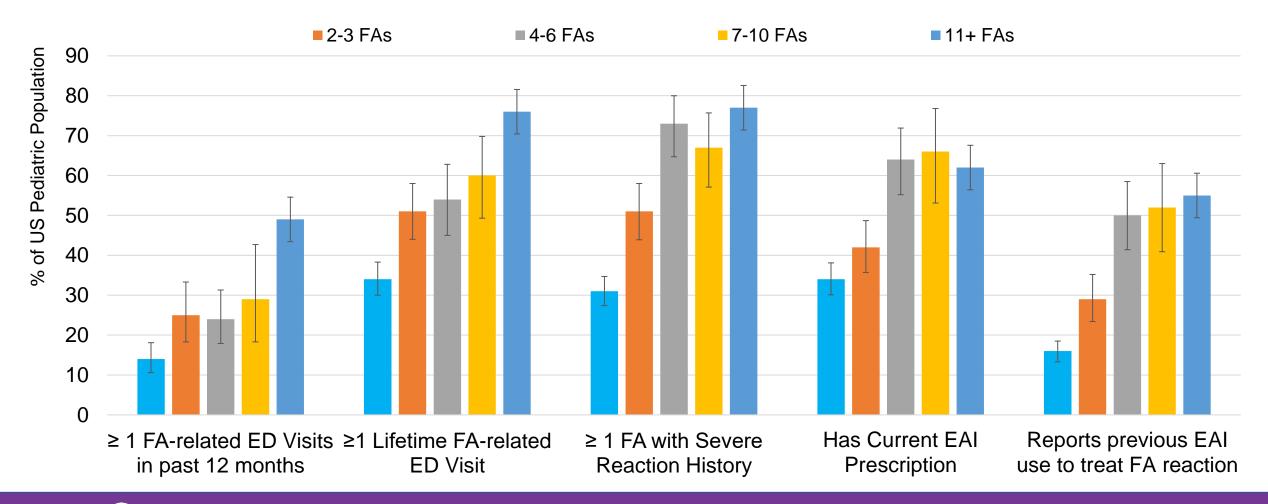
Average Number of Reactions

Perceived Severity of Most Recent Reaction



Pediatric Clinical Outcomes

By Number of Current Convincing Food Allergies





Pediatric Atopic Comorbidities

Rates of physician-diagnosed atopic conditions were significantly higher among children with convincing FA compared with other children

Physician Diagnosed Comorbid Conditions	All Children	Children with FA	P-Value
Asthma	12.2 (11.4–13.0)	32.6 (29.5–35.9)*	<.001*
Atopic Dermatitis	5.9 (5.3–6.5)*	14.9 (12.5–17.7)*	<.001*
Eosinophilic Esophagitis (EoE)	0.2 (0.10-0.2)*	0.7 (0.4–1.1)*	<.001*
Allergic Rhinitis	12.8 (12.0–13.6)*	30.4 (27.6–33.4)*	<.001*
Other Chronic Condition	4.2 (3.7–4.7)*	10.1 (8.2–12.3)*	<.001*







Original Investigation | Allergy

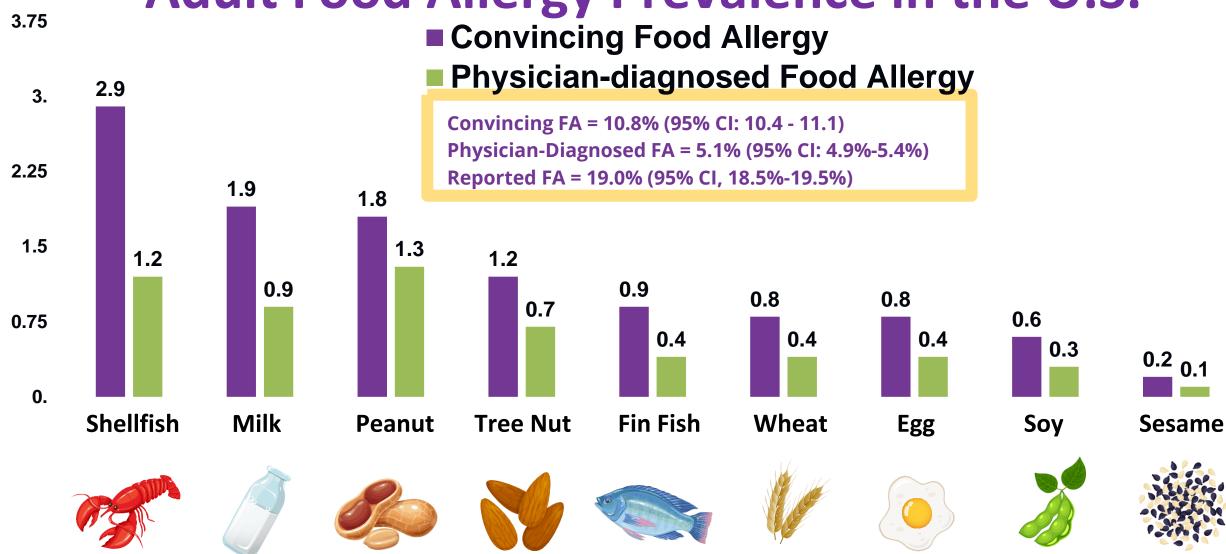
Prevalence and Severity of Food Allergies Among US Adults

Ruchi S. Gupta, MD, MPH; Christopher M. Warren, BA; Bridget M. Smith, PhD; Jialing Jiang, BA; Jesse A. Blumenstock, BS; Matthew M. Davis, MD, MAPP; Robert P. Schleimer, PhD; Kari C. Nadeau, MD, PhD

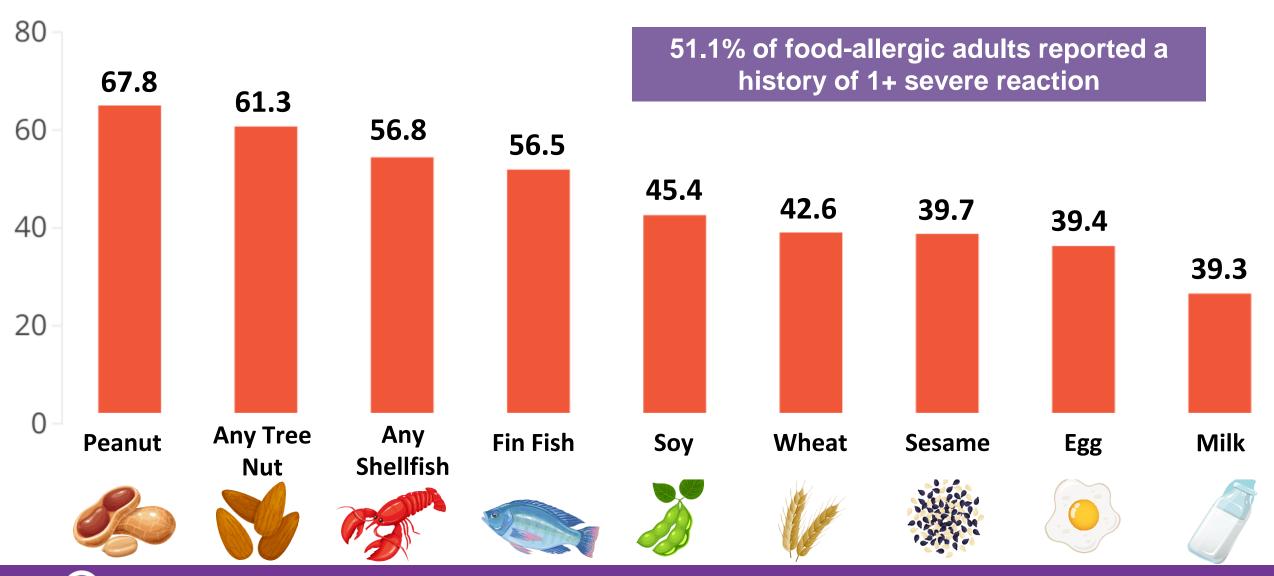
Gupta RS, Warren CM, Smith BM, Jiang J, Blumenstock JA, Davis MM, et al. Prevalence and Severity of Food Allergies Among US Adults. JAMA Network Open. 2019;2(1):e185630-e185630.



Adult Food Allergy Prevalence in the U.S.

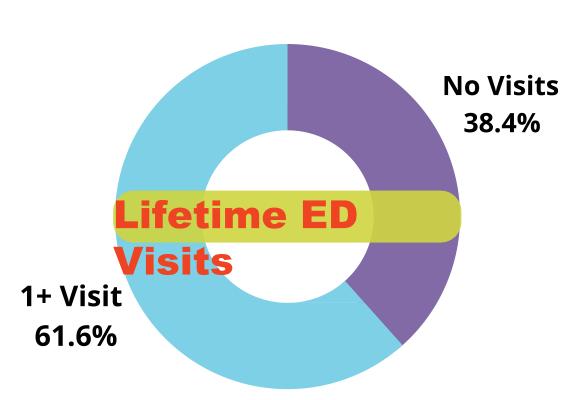


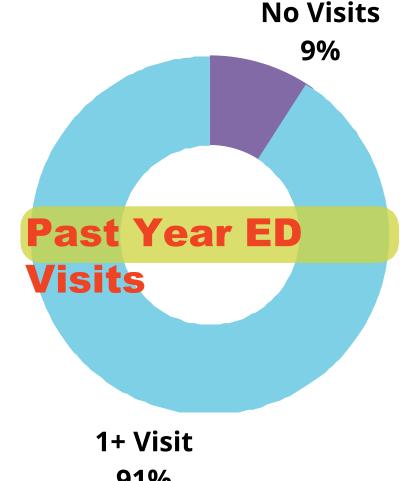
Adult Food Allergy Severity





Adult FA Emergency Department Visits



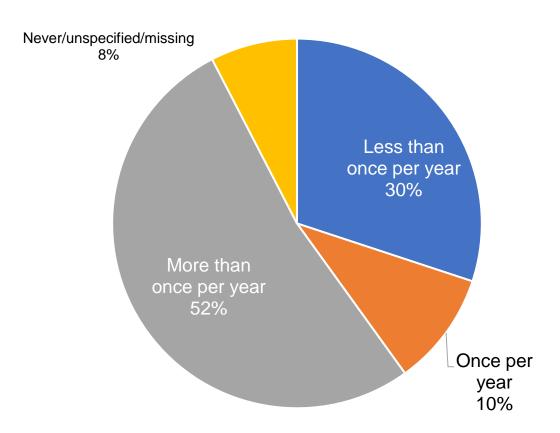


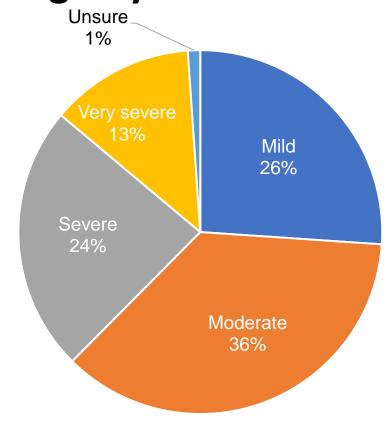


91%

Adult Self-Reported Reaction History

FARE National Patient Registry





Average Number of Reactions

Perceived Severity of Most Recent Reaction



Food Allergies in Adults

More than 10% of U.S. adults - or more than 26 million people - have a history of food allergy.

Doctors Surprised by Scope of Adult-Onset Food New research shows nearly 11% of U.S. adults have food allergies, more than many expected, with

shellfish most common among adult-onset ones

More adults developing food allergies but many go undiagnosed

More adults than children have food allergies and a new study suggests there's more to learn.

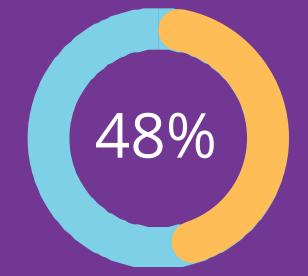






Peanut allergies affect over 4.6 million adults in the US, study finds





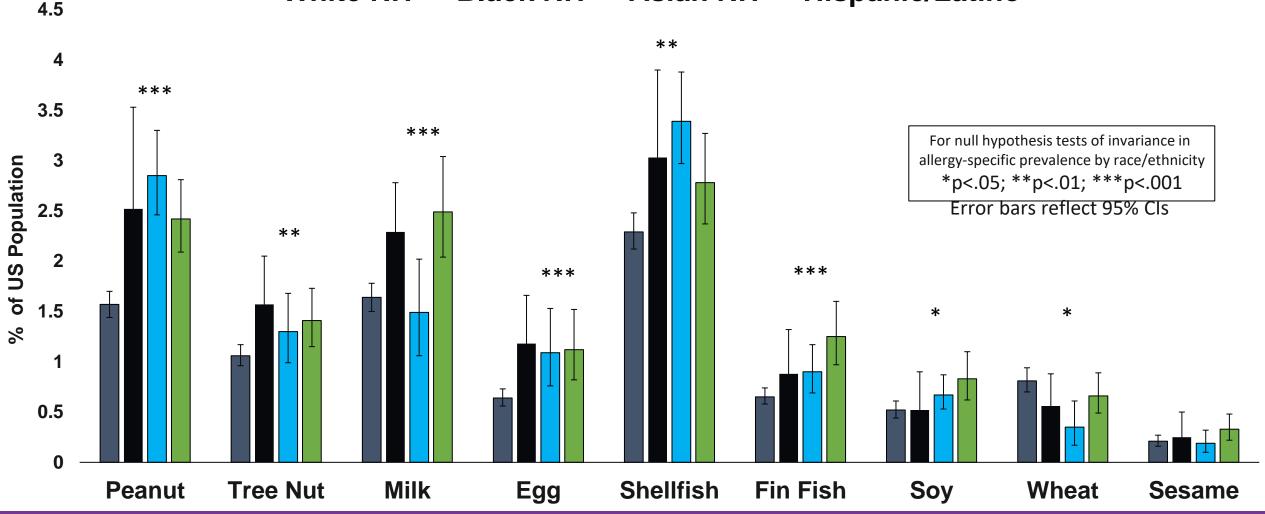
of food allergic-adults reported an adult onset food allergy



Nearly 1 in 5 Americans report they have had a severe reaction to food

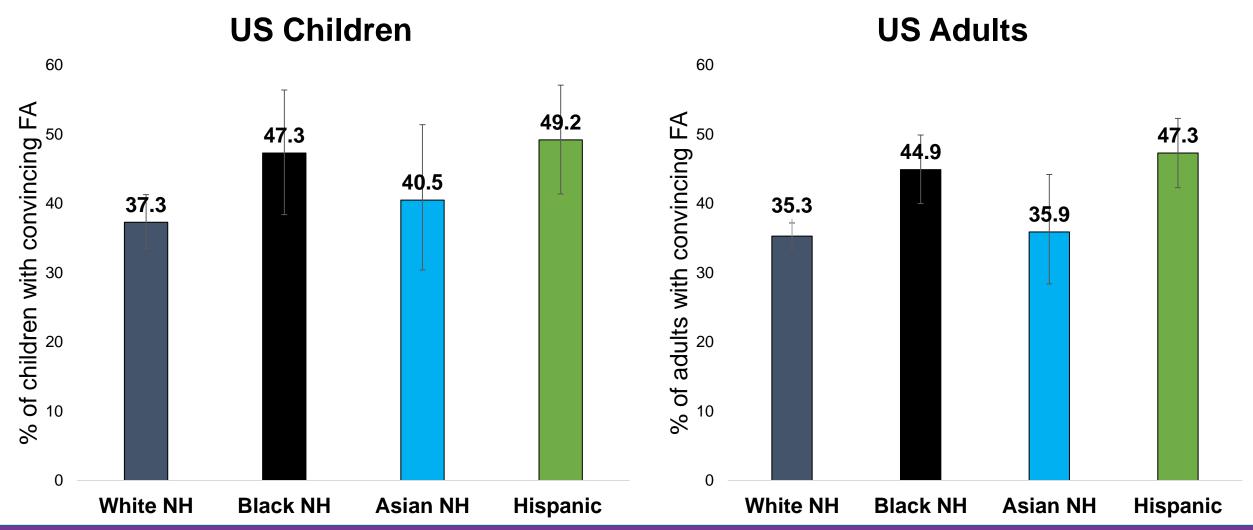
Top Allergens by Race/Ethnicity





Peanut, Milk, Shellfish, Finfish allergy are significantly higher among minority populations compared to White Americans

Lifetime FA-related Emergency Department Visits Higher in Black and Hispanic Populations





Retrospective Analysis Uncovers Pronounced Racial Differences in Food Allergy Phenotype and Health Care Utilization

Original Article

Racial Differences in Food Allergy Phenotype and Health Care Utilization among US Children



Mahboobeh Mahdavinia, MD, PhD^a, Susan R. Fox, PA^a, Bridget M. Smith, PhD^{b,c,d}, Christine James, MD^e, Erica L. Palmisano, MD^a, Aisha Mohammed, MD^a, Zeeshan Zahid, MD^a, Amal H. Assa'ad, MD^e, Mary C. Tobin, MD^a, and Ruchi S. Gupta, MD, MPH^{b,d} Chicago and Hines, Ill; and Cincinnati, Ohio

What is already known about this topic? There is a paucity of data in the epidemiology of food allergy (FA) as it relates to race and/or ethnicity. The limited existing data show that African American children are at an increased risk for FA and its associated morbidities, and there are no data on Hispanic children with FA.

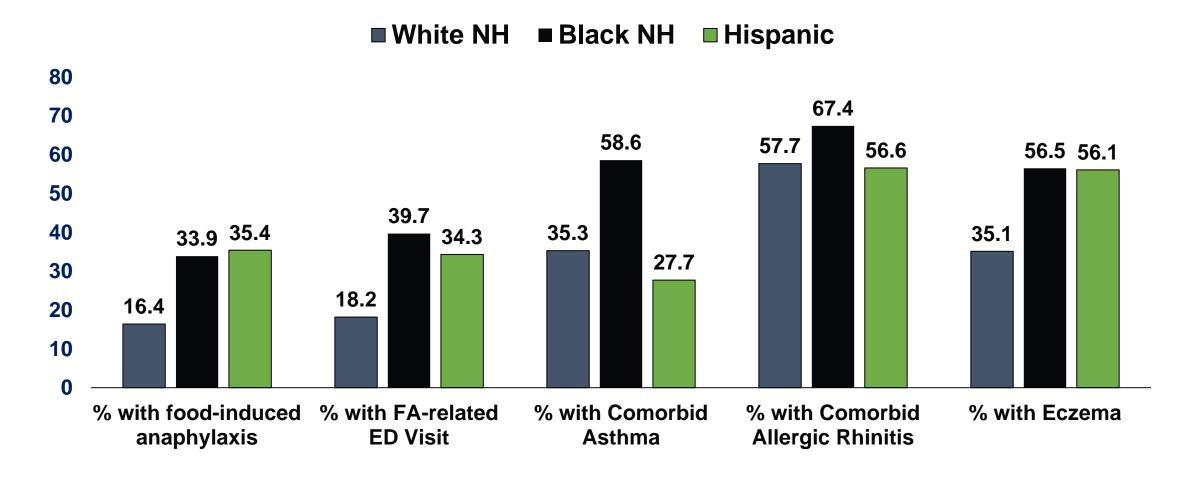
What does this article add to our knowledge? We found that African American (AA) and Hispanic children had different food allergen profiles, higher rates of associated atopic conditions, and increased rates of FA-associated anaphylaxis and emergency department visits than white children.

How does this study impact current management guidelines? The higher rates of asthma and anaphylaxis among minority children are concerning, especially when considered in the context of increased anaphylaxis in AA children. These findings highlight the need for culturally sensitive educational programs to improve FA outcomes in these children.

- Multi-center, retrospective cohort study of children aged 0-17 years with FA seen in allergy/immunology clinics at 2 US urban tertiary care centers
- N=817: 35% Black, 12% Hispanic,
 53% non-Hispanic white



Racial Differences in Food Allergy Phenotype and Health Care Utilization







- Original 5-year, multi-site, NIH/NIAID funded R01 study (R01 ID #AI130348) to examine food allergies in White, Black, and Hispanic/Latinx populations
- Clinical EMR data extraction, quarterly surveys, biospecimen collection
- Goal: Understand differences in food allergy phenotypes/endotypes, diagnosis, management, quality of life by race/ethnicity in order to improve equitable care











Access to Care

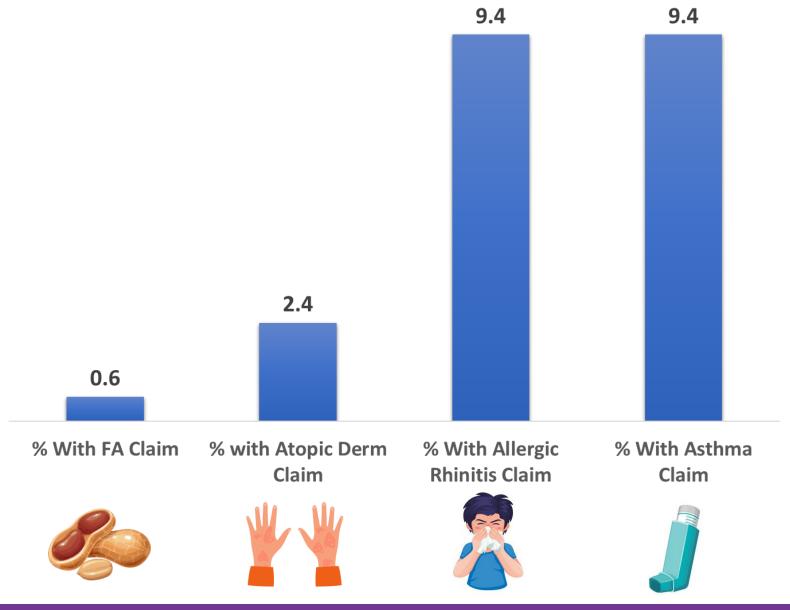


Diagnosis

Prevalence of FA diagnosis among Medicaid-enrolled US children is <u>substantially lower (0.6%)</u> compared to previous national estimates using parent surveys (7.6%) and reports of physician confirmation of food allergy (4.7%)



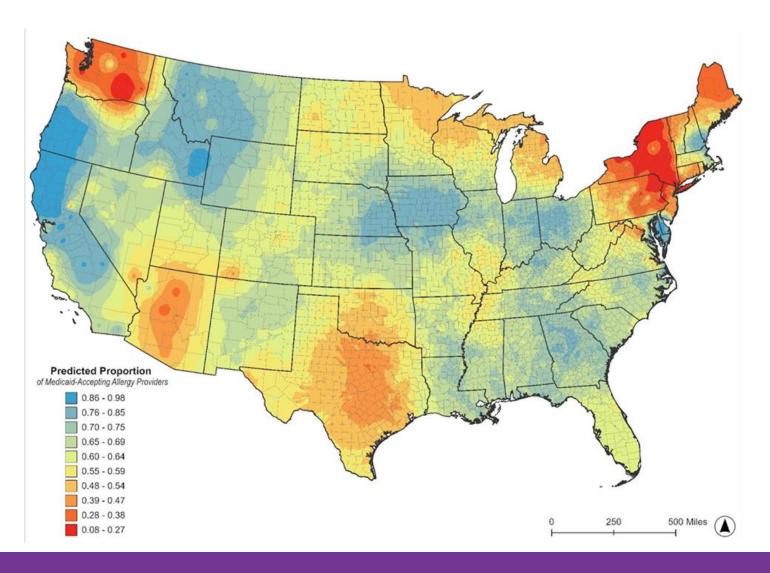
Atopic Condition Claims Among Medicaid Enrolled Children





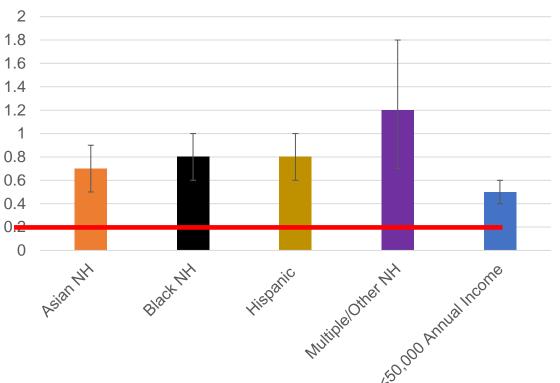
Medicaid-Accepting Allergists

 Only 55.5% of allergists accept Medicaid nationwide

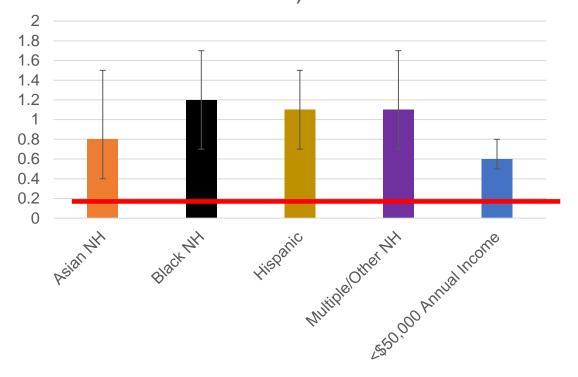


Pediatric Trends in Physician-diagnosis by Race and Household Income 2011-2018

2011 Odds of Physician-diagnosed FA (among patients reporting convincing FA)



2018 Odds of Physician-diagnosed FA (among patients reporting convincing FA)

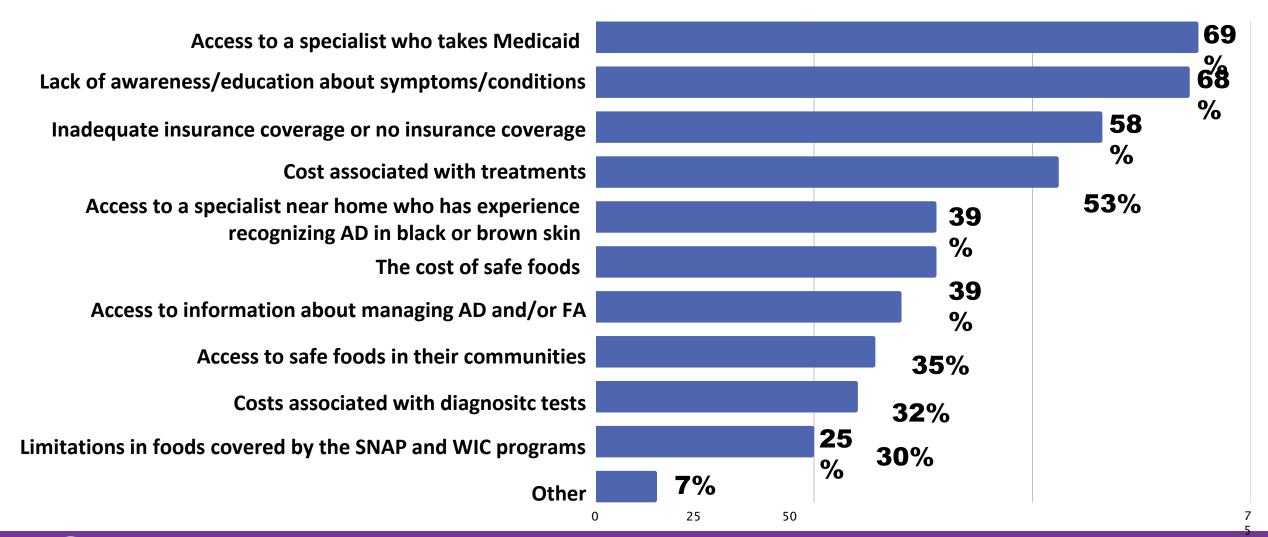


Eczema / Atopic Dermatitis

- Highest rates observed in non-Hispanic Black children
- Non-Hispanic Black and Hispanic children develop more severe cases relative to non-Hispanic White Children
- Currently, few resources to identify eczema in different skin tones
 - Most pictures only of lighter skin tones
- Early detection of high-risk infants is key for early intervention!



Challenges Reported by Patients of Color in Getting Diagnosis and Treatment for AD or Food Allergy





Access to Care

Medicaid-enrolled U.S. children with FA less likely to receive guideline-informed care

Children of color and those living in high poverty counties were:

- Less likely to have visited an allergist for FA or receive diagnostic testing
- More likely to have an FA-related ED visit compared with White children and those not living in a high-poverty county

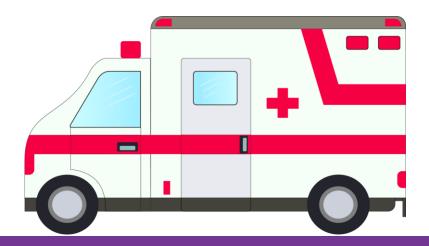




Outcomes and Factors Associated with Pre-Hospital Treatment of Pediatric Anaphylaxis

Children with Medicaid received pre-ED EPI less frequently than children with private insurance (24.5% v. 43.8%, p=.001).

Medicaid insurance was associated with decreased likelihood of prehospital EPI (OR .33 [95% CI .16-.66]).





Access to Treatment

- OIT and SLIT are treatments
 offered by limited number of
 allergists and mostly out of pocket
- Additional costs for office visits, travel, time off work, unanticipated ED visits



OIT Awareness

- Among a nationally representative sample of FA patients and pediatric caregivers, <u>awareness of OIT is low</u>
 - 72% of respondents did not know what OIT was prior to the survey
- Significantly greater odds of reporting any OIT awareness among:
 - Households with income >\$100,000
 - (odds ratio 2.0; 95% confidence interval 1.2-3.4)
 - Those with college degree
 - (odds ratio 1.9; 95% confidence interval 1.2-3.0)

Compared to low income households and those without a college degree





Economic Impact



Economic Impact of Food Allergies in the US

Cross-sectional survey administered to 1,643 US caregivers of children with current food allergy to determine:

Frequency of Allergic Events & Associated Costs:

Medical

Hospitalizations

ED visits

Out-of-pocket

Special diets

Changes in childcare or schools due to child's food allergy

Lost labor productivity

Caregiver time spent attending medical visits for food allergic children

Food allergy-related opportunity costs

Forgone labor market activities (e.g., job loss, part-time work)

















Economic Impact of Food Allergy

Overall Economic Cost

Direct Medical Costs

Family Cost













Direct Medical Costs*

	Children With Visit,	isit, Visits per Child, Mean (SE) Visit	Cost, US \$			
Characteristic	% (SE)		Visit	Child	Overall Annual (in Millions)	
Visits						
Pediatrician	42 (2)	.82 (.05)**	112	92	543	
Allergist	41 (2)	.79 (.05)**	175	138	819	
Pulmonologist	14 (1)	.07 (.01)**	175	12	71	
Nutritionist	17 (1)	.16 (.04)**	100	16	96	
Alternative Provider	17 (1)	.23 (.05)**	100	23	136	
Emergency Department	13 (1)	.18 (.02)***	711	129	764	
Inpatient Hospitalization Stays	4(1)	.05 (.01)***	6269	314	1863	
Total Direct Medical Costs				\$724 child	\$4.3 Billion	

^{*}Direct medical costs are medical costs borne by the health care system associated with prevention, diagnosis, and treatment of food allergies.



^{**}Source: Hospital Outpatient Prospective Payment System

^{***}Source: Patel et al. Estimating the economic burden of food-induced allergic reactions and anaphylaxis in the United States.

Out-of-Pocket Costs

Mean Direct Out-of-

Pocket Costs, US\$ (SE)

123 (30)

756 (59)

% Reporting Cost

(SE)

15 (1.6)

37.7 (2.0)

Additional/change in child care	6.7 (0.8)	2158 (323)	145	857
Legal guidance	2.3 (0.6)	402 (122)	9	55
Counseling or mental health services	4.5 (0.7)	571 (123)	26	152
Special summer camp	3 (0.7)	702 (183)	21	125
A change in schools was needed due to food allergy	4.2 (0.7)	2611 (497)	110	650
Other expenses (e.g., cleaning supplies)	9.5 (1.1)	396 (86)	36	216
Any out-of-pocket costs	74.3 (2.1)	1252 (90)	931	5516

Out-of-pocket costs: medical costs borne by patient associated with the prevention, diagnosis, and treatment of food allergies. Includes all costs associated with protecting the child from exposure to allergens, including special child care arrangements. The out-of-pocket costs exclude the



Variable

Costs associated with special diets and

Non-traditional medicine

allergen-free food

Overall Annual Cost

(in Millions), US\$

110

1689

Cost Per Child, US\$

19

285

Comparing WTP & Measure of Actual Cost

	Annual Costs, US\$					
Characteristic				95% CI		
Cital acteristic	Total (in Billions)		Per Child	Total (in Billions)	Per Child	
Willingness to Pay (WTP)	20.8		3504	(15.7-25.7)	(2652-4344)	
Costs borne by families						
Out-of-pocket treatment	5.5		931	(4.7-6.4)	(793-1080)	
Lost labor productivity	0.77		130	(0.53-1.0)	(89-175)	
Opportunity	14.2		2399	(10.5-18.4)	(1771-3104)	
Total						
Direct medical costs	4.3		724	(2.8-6.3)	(472-1063)	
Reported costs borne by families	20\5		3457	(16.7-24.9)	(2816-4208)	
Reported costs	24.8		4184	(20.6-29.4)	(3475-4960)	



Direct Out-of-Pocket Costs by Household Income

	Mean Annual Costs (SE), US\$					
Type of Cost	<\$50K	\$50K-99K	≥\$100K			
Total Direct Costs borne by health care system	1374 (274)	1024 (125)	940 (128)			
ER and Hospitalization costs*	1021 (209)	434 (106)	416 (94)			
Specialist costs**	228 (21)	330 (27)	311 (18)			
Total Out-of-Pocket Costs borne by families	3174 (858)	3434 (658)	5062 (1168)			
Medication costs***	171 (26)	275 (30)	366 (44)			
Special food costs	744 (216) *p<0.05, **	941 (230) *p<0.01, ***p<0.001 for F-tes	1545 (347) st of equality of means across groups.			



Families with Low Income

Spend 2.5x more on FA ED Visits and hospitalizations

Spend less on **specialty** visits

Spend less on out-of-pocket costs for medications







Food Insecurity

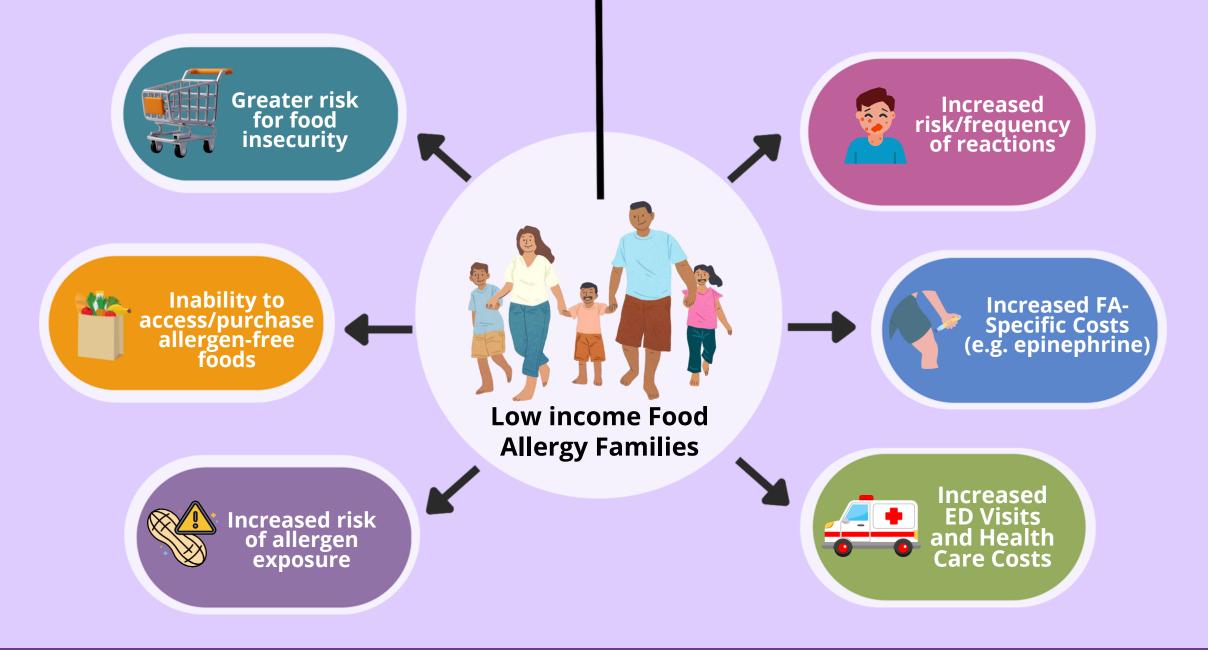


Food Insecurity



"I would say the biggest challenge is finding food that fits all of his restrictions"





^{1.} Tackett AP, Roberts CM, Farrow M, McQuaid EL. Food insecurity and caregiver perceptions of food allergen risk by food purchase location in children with food allergies. Transl Behav Med. 2019 May 16;9(3):404-412. doi: 10.1093/tbm/ibz059. PMID: 31094448; PMCID: PMC6771765.

Food Insecurity Screening

Many physicians have limited insecurity screening tools/resources available in their practices

It is often difficult to provide patients with comprehensive support or "prescribe" foods that are safe and nutritious



^{1.} Bilaver LA, Das R, Martinez E, Brown E, Gupta RS, Love M. Addressing the social needs of individuals with food allergy and celiac disease during COVID-19: A new practice model for sustained social care. Soc Work Health Care. 2021;60(2):187-196. doi: 10.1080/00981389.2021.1904323. Epub 2021 Mar 28. PMID: 33775233.

^{2.} Shroba J, Das R, Bilaver L, et al. Food Insecurity in the Food Allergic Population: A Work Group Report of the AAAAI Adverse Reactions to Foods Committee. J Allergy Clin Immunol Pract. 2022;10(1):81-90. doi:10.1016/j.jaip.2021.10.058

Food Insecurity in the Food Allergic Population: A work group report of the AAAAI Adverse Reactions to Foods Committee

Aim of Study: To survey AAAAI members about food insecurity knowledge and practices

59 responses received from practices allergists, immunologist, fellows in training, residents, and allied health members over survey period [Sept-Oct 2020]

Patients were on average White (63.4%), Black (14.8%), Hispanic/Latinx (12.6%), Asian (7.4%) and Other (5.0%)

Insurance coverage for most patients was either private (adult 62.7%, child 60.0%) or public (adult 37.2%, child 43.3%)



Findings



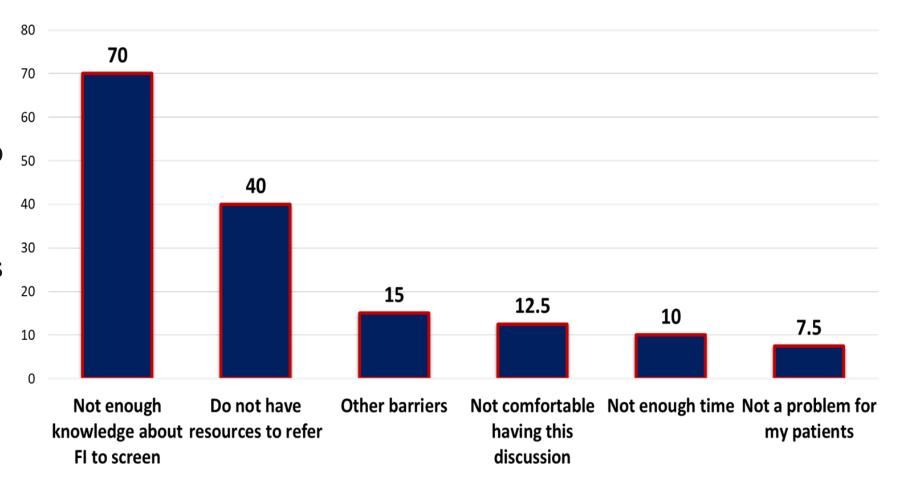
71.2% of respondents <u>were unaware</u> of whether their patients with FA faced FI within the past 6 months

15.1% reported screening patients with FA



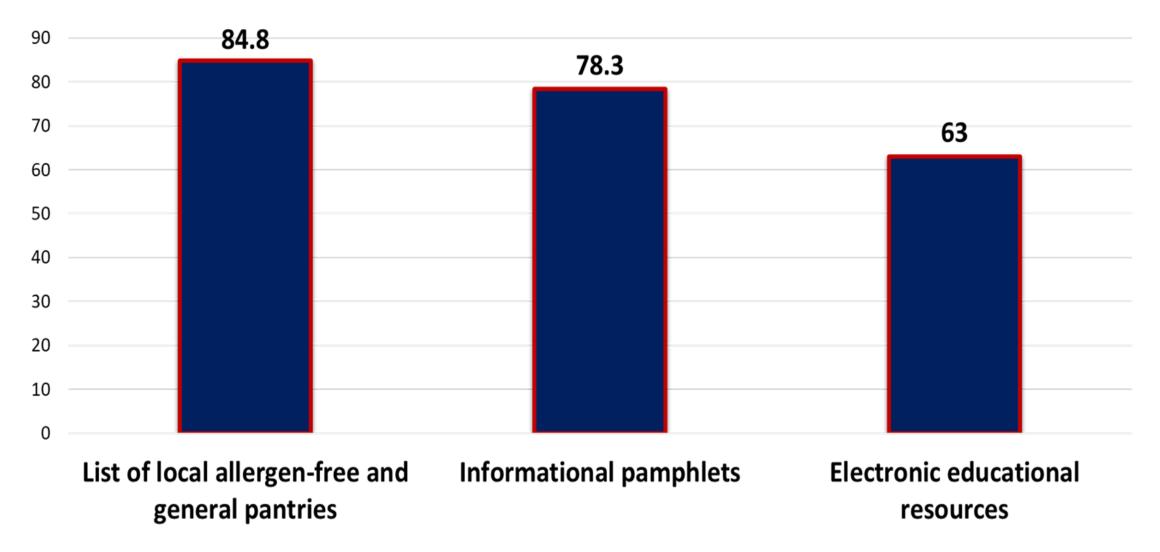
Most Endorsed Barriers

- Not enough knowledge about FI to screen patients (70%)
- Do not have resources to refer to food insecure patients (40%)



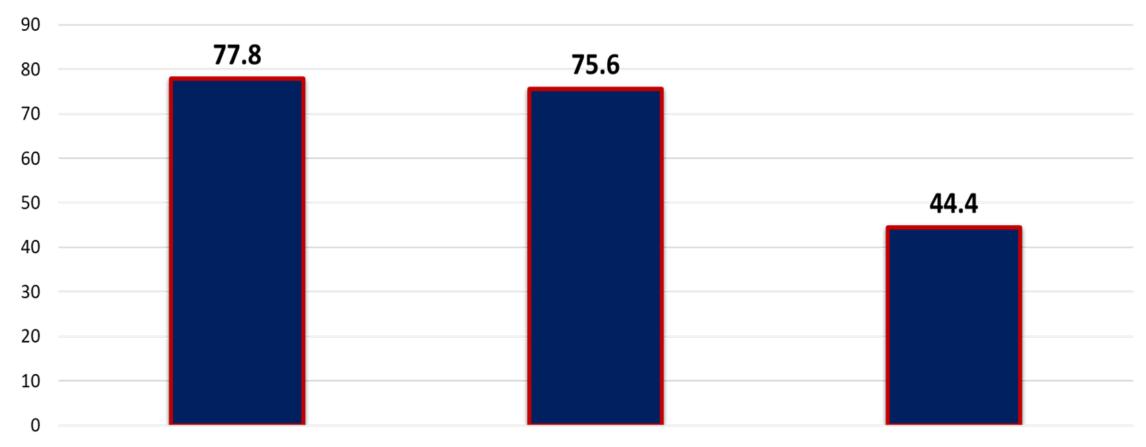


Types of Resources Preferred





Types of Tools Preferred



Tips on including food security in conversation

Validated questionnaires

Guides for structural clinical interviews





What Can We Do?



Incorporate Food Insecurity Screening into Clinic Workflow

- Existing food insecurity instruments include:
 - U.S. Household Food Security Survey Module (USDA)
 - Six-Item Short Form of the Food Security Survey Module (USDA)
 - American Academy of Pediatrics Recommended Hunger Vital SignTM

Example questions to include from Hunger Vital SignTM:

- 1. In the past 12 months, we worried whether our food would run out before we got money to buy more.
 - Often true
 - Sometimes true
 - Never true
- 2. In the past 12 months, the food we bought just did not last and we did not have money to get more.
 - Often true
 - Sometimes true
 - Never true



Identify Opportunities for Partnerships and Referrals

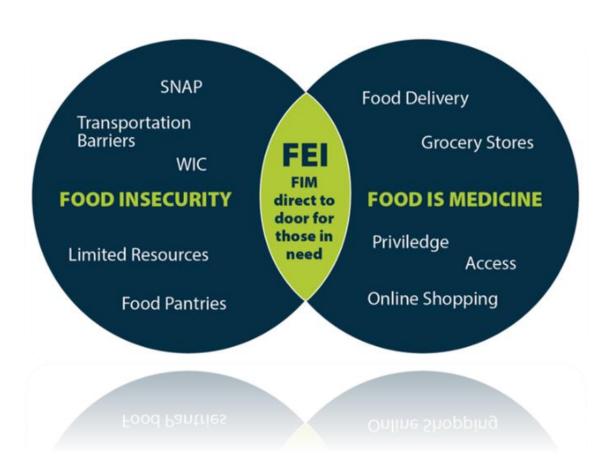
- Connect with food panties who serve patients with FA
 - https://foodequalityinitiative.org/
 - https://freefrommarket.com/contact-us/
 - https://foodiversity.org/
 - https://securingsafefood.org/













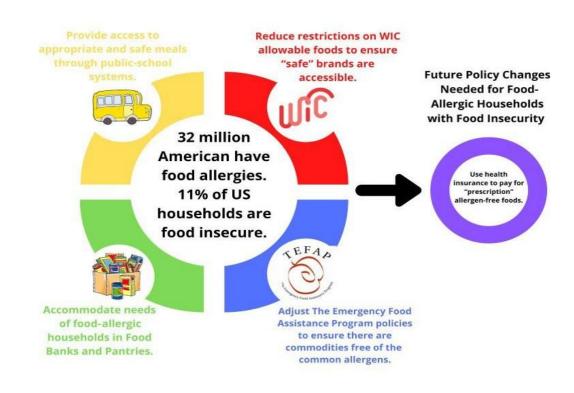
Join Working Groups and Advocate for Policy Change

Working Groups:

ACAAI and AAAAI Working Group

Advocate for policy changes:

- Strengthening federal nutrition programs
- Fewer restrictions on substitutions in the WIC program with more offerings of allergy-friendly foods and nutritionally equivalent offerings
- Insurance coverage on food as medicine



Improve Racial Representation in Food Allergy Research

Delphi method:

Discussions food allergy clinicians, advocacy leaders, communityengaged researchers, and patients

Created **18 recommendations** to combat inequitable research paradigms and increase participation of racially underrepresented populations in FA research.

4 Domains:

Community Partnership

Intentional Engagement and Messaging

Recruitment Activities

Dissemination



Increase Awareness and Policies for New Treatments

- Educate patients on what different treatments are available, what might work best for them, what is accessible, etc.
- Consider hosting community-facing events or virtual panels to reach patient population
- Advocate for FDA Approval and Insurance coverage for new treatments



Share Management Tools: Food Allergy Passport

Personalized tool that helps caregivers and children manage their food allergies more easily and with greater confidence.

Available for free on CFAAR website. **Create your own/share with patients:** www.foodallergypassport.com!

After filling out personalized FA Passport™, it can be printed or sent via email.



http://www.foodallergypassport.com





Share Management Tools: Food Allergy Workbook

Managing Food Allergies Workbook Parent's checklist: V Review common signs of an allergic reaction Teach your child where important reaction information is located in passport Review where epinephrine is kept at home and at school For Parent and Child: Review Details of Past Reactions What food was eaten? What were your symptoms? What actions were taken? What worked? What did not work? What new actions will you take? Pro Tip: Make sure to share these details with your allergist at your child's next appointment. Create a list of questions you would like to ask the allergist. Make sure to jot down their answers, too!





Helpful Videos

https://youtu.be/Fne6rMAOT9c

https://youtu.be/HjU5d1gE3E8

https://youtu.be/sXMuOW3FEv8

them prepare if the event were to occur



Share Management Tools: Peer-to-Peer Educational Videos







K – 3rd Grade

4th - 7th Grade

8th - 12th Grade

Available at cfaar.northwestern.edu



Provide Resources for Patients

















FAACT

Connection Team

Food Allergy & Anaphylaxis













Conclusion

Food allergy prevalence, economic impact, outcomes, access to timely diagnosis and care, and access to safe foods differ significantly by race and socioeconomic status

Physicians, allergists, industry leaders, and policy makers must continue to work together to address these disparities through prioritizing comprehensive education, screening, and systematic policy change to achieve equitable care for all patients





Do the best you can until you know better. Then when you know better, do better.

- Maya Angelou









Browse all CFAAR Resources here or by visiting cfaar.northwestern.edu





June 27-29 | Chicago, IL

2025 CFAAR FOOD ALLERGY SUMIT Advancing Food Allergy Prevention, Equity, & Pediatric Education

https://www.feinberg.northwestern.edu/sites/cfaar/events/index.html





Thank you!

Connect with CFAAR cfaar@northwestern.edu





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Center for Food Allergy & Asthma Research



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