Food Allergy and Asthma: Management Overview

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Learning Objectives

1. Discuss Immunologic Principals in Diagnosis of Food Allergy and Asthma

2. Describe food allergy and asthma management strategies

3. Consider approaches for disease modification and prevention

Can Food Allergy and Asthma Co-Exist?

Remember Noah- multiple morbidities- COMMON

Food Allergy History

- **Peanut** allergy since infancy (hives on first exposure; IgE positive)
- Strict avoidance of peanut; tolerates tree nuts
- Severe reaction to **sesame/tahini** 4 months ago → ED care with IM epinephrine, O_2, albuterol

Asthma History

- Onset age 4; **suboptimal control**
- ACT = **17**; albuterol ~3×/week
- 2 prednisone bursts/year
- On budesonide/formoterol 80/4.5, 2 puffs BID

Atopic Comorbidities

- Chronic itchy/runny nose; partial control on loratadine + fluticasone
- Infantile eczema, mild recurrence

Charlie

8 y.o. boy with **food allergy (peanutand tree nuts),** pollen food allergy and allergic rhinoconjunctivitis

No acute systemic allergic reactions to foods

Mouth itchy to to raw apple (cooked fine)

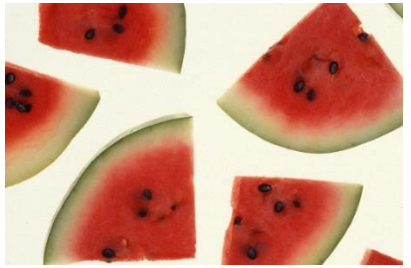
Allergy testing positive for peanut, tree nuts and multiple inhalants, including tree pollen.

Since then he has been avoiding peanuts and tree nuts and apples. He tolerates carrots, peaches and cherries.

Before the age of 6 years he occasionally ate nut mixes that likely contained also peanuts without problem.

He is receiving immunotherapy for birch pollen.

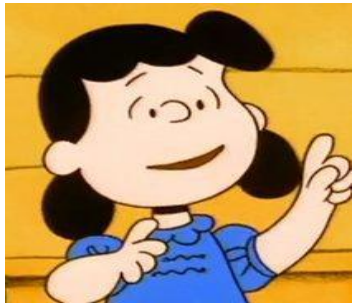
Oral Allergy Syndrome
Mix of Food/Respiratory Allergy



- Clinical features: rapid onset oral pruritus, rarely progressive
- Epidemiology: prior sensitization to pollens
- Key foods: raw fruits and vegetables
- Allergens: Profilins and pathogenesis–related proteins
  - Heat labile (cooked food usually OK)
- Cause: cross reactive proteins pollen/food
- Aeroallergen Immunotherapy can be helpful

Birch ⟶ Apple, carrot, celery, cherry, pear, hazelnut
Ragweed ⟶ Banana, cucumber, melons
Grass ⟶ Melon, tomato, orange
Mugwort ⟶ Melon, apple, peach, cherry, mustard

Lucy



- 18-year-old BU pre-med student
- History of tree-nut allergy- has Epi Pen
- Past April and last weekend, developed puffy face, itching, throat tightness after a run.
- First reaction ate freeze dried mangos 30 minutes before the run
- Most recent reaction had corn salsa, fries and chips about 30 minutes prior to the run
- Tolerated these foods before
- What's going on?

Exercise-induced anaphylaxis-food- asthma like attack

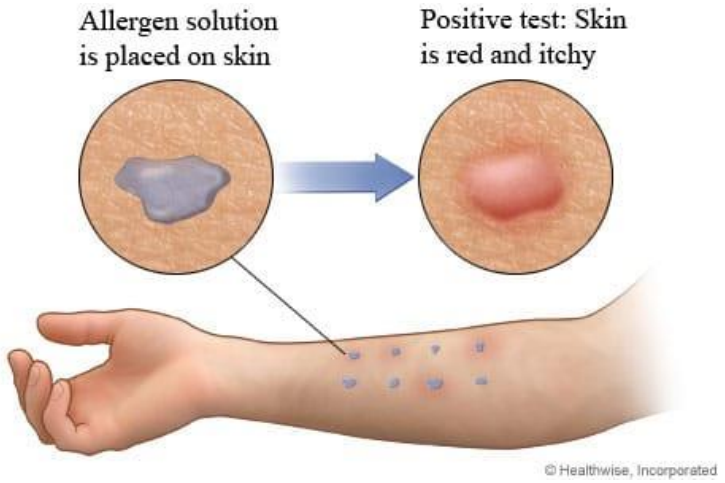
Induced by physical exercise; foods tolerated at rest

Generalized urticaria and/or severe reaction such as anaphylactic shock

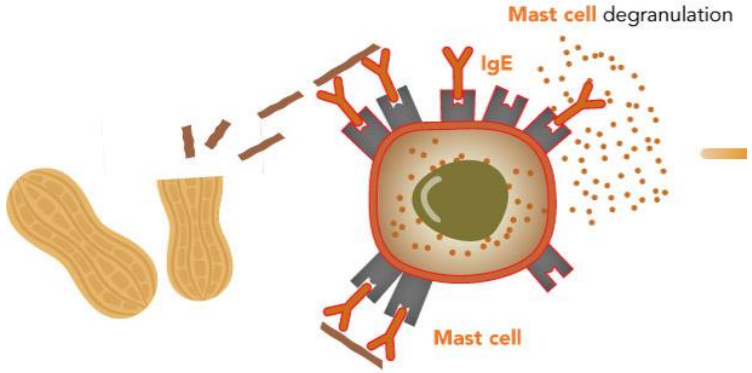
Avoid eating prior to exercise
Carry Epi Pen with Exercise
Exercise with a someone

Scherf KA ,B rockow K, Biedermann T. Wheat-dependent exercise-induced anaphylaxis. Clin Exp Allergy. 2016 Jan;46(1):10-20

What is our role as allergists in making the Diagnosis?



Educate on the Definitions



- **Allergic Trigger:**
  —An adverse health effect arising from a specific **immune response** that occurs **reproducibly** on exposure to a given allergen.

- **Allergen**
  —Specific component of (typically **protein**) that is recognized by **allergen-specific immune cells** and elicits a specific immunologic reaction, resulting in characteristic symptoms of food allergy and asthma.

1. Baker MG et al, *J Allergy Clin Immunol*, 2025

Remember Noah…

Old Allergy Records (3 months ago)

- Total IgE: **1,000 IU/mL**
- Skin tests: >10 mm to **peanut**, **sesame**, HDM, cat, dog; negative to tree nuts
- Serum IgE: peanut **30 IU/mL**, sesame **20 IU/mL**
- Spirometry: normal
- FeNO: **45 ppb**
- Blood eosinophils: **600**
- C-ACT: **17**

Environment

- Lives with parents; dog + cat in home
- Bedroom HDM control; HEPA filter; pet restriction

Testing Today

- Spirometry: normal
- FeNO: **45 ppb**
- ACT: **17**

Exam

- Vitals normal; clear rhinorrhea; Dennie–Morgan lines; Flexural erythema; lungs clear

Diagnostic Challenges in Asthma and Food Allergy

Asthma

- Diagnosis relies heavily on history, physical, and response to medication
- Diagnostic testing can be helpful, especially in ruling out asthma ▪ PFTs ▪ Impulse/Airway oscillometry ▪ FeNO ▪ Methacholine challenge
- Markers of Type 2 inflammation can aid in management (IgE, FeNO, Eos)

Food Allergy

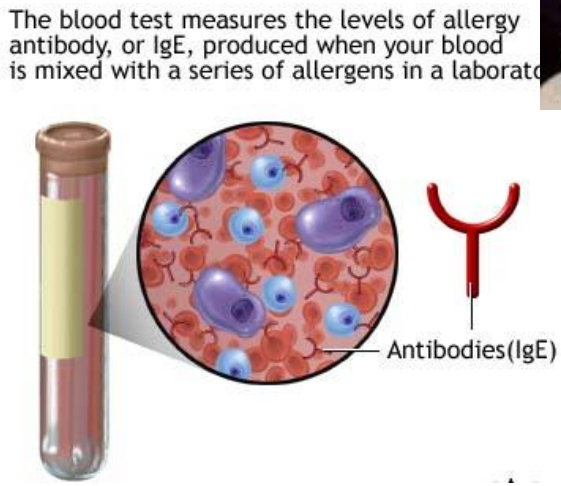
- Let's face it: testing for food allergy STINKS **do not predict severity** of a reaction
- Different Foods, Different Cutoffs
- Skin testing:
  - —Good NPV (negative testing 90-95% NPV)
  - —Poor PPV (<50% PPV)
- Component Testing helps

(Ara 2,3 vs. Ara 8, 9, Hazelnut Cor 8,9, 14 vs. 1 Walnut Jug 1,3)

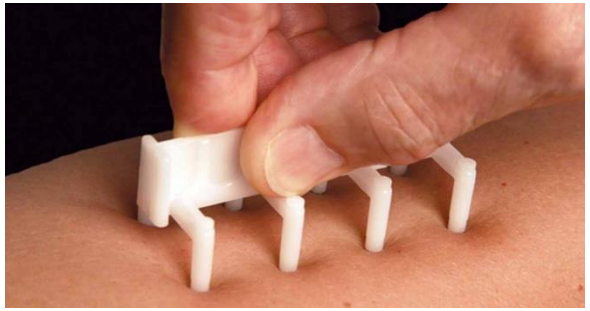
- Still need for oral food challenges to confirm diagnosis

Testing

- If **history** is consistent with IgE-mediated reactions allergy…
  - Blood testing (aka specific IgE testing, ImmunoCap testing)
  - Rapid results (labs typically back in several days)
  - Reproducible
  - Safe
  - No need to discontinue antihistamines
  - Can be performed in the setting of a recent allergic reaction



- Skin prick testing (aka scratch testing)
  - Minimally invasive
  - Rapid results (~15 minutes)
- Words of caution:
  - Must be able to **discontinue antihistamines**
  - Cannot be performed in the setting of a recent severe allergic reaction (need 2-4 weeks)
  - Impractical in patients with severe atopic dermatitis
  - Small risk of systemic reaction
- Challenge **(gold standard)**



Food Allergens and Components

	Pollen cross-reactive components birch for nuts and soy, timothy for wheat	LTP	Pollen non-cross-reactive components (storage seed proteins)
Peanut	Ara h 8 Ara h 5	Ara h 9	Ara h 1; Ara h 2; Ara h 3 Arah 4; Ara h 6; Ara h 7
Hazelnut	Cor a 1 Cor a 2	Cor a 8	Cor a 9, Cor a 14
Cashew	Ana o—cashew profilin	—	Ana o 1; Ana o 2; Ana o 3
Walnut	Jugr 5–PR-10 Jugr 7–profilin	Jugr 3	Jugr 1; Jugr 2; Jugr 35
Sesame	Ses i-profilin		Ses i 1; Ses i 2; Ses I 3; Ses i 4; Ses i 5, Ses i 7
Soybean	Gly m 4 Gly m 3	Gly m 1	Gly m 5 Gly m 6
Wheat	Tri a 12	Tri a 14 (baker's asthma)	Tri a 19 (ω-5 gliadin) Tri a 21 –alfa gliadin Tri a 26 –HMW glutenin Tri a 28 –AAI dimer 0.19

PRP-10

Profilin

Resistance to heating ↑

Second Opinion By P. C. Vey

"If these test results are correct, you're allergic to these tests."

Food allergy diagnosis

Before 2008 | 2010-now | Next decade

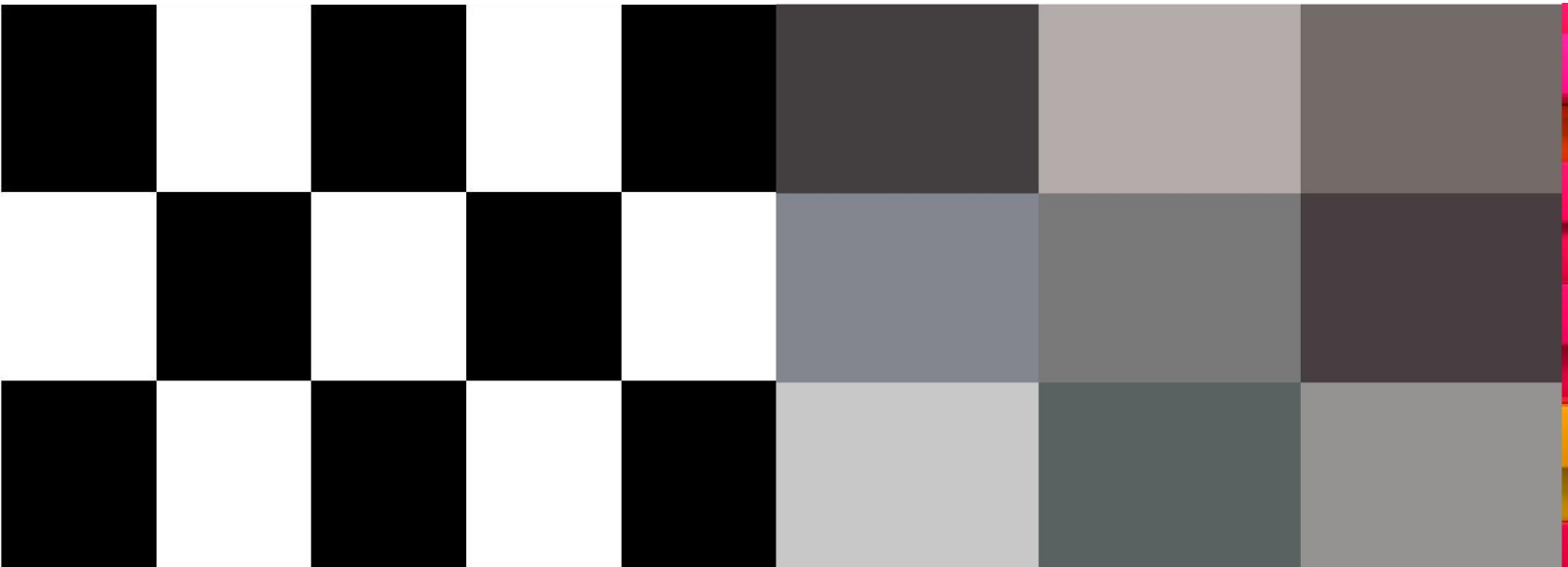
Past: sIgE to whole foods

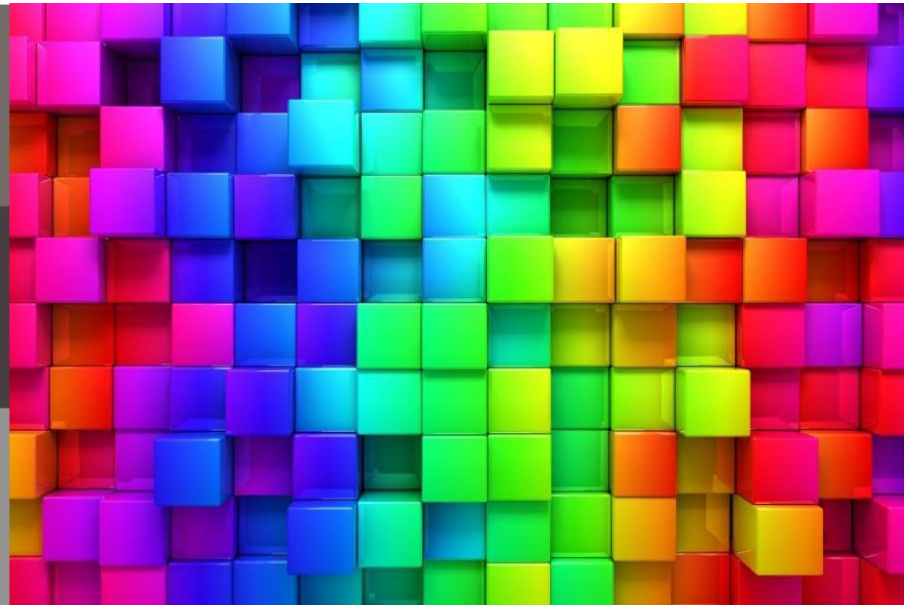
Present: sIgE to individual allergens / proteins (components)

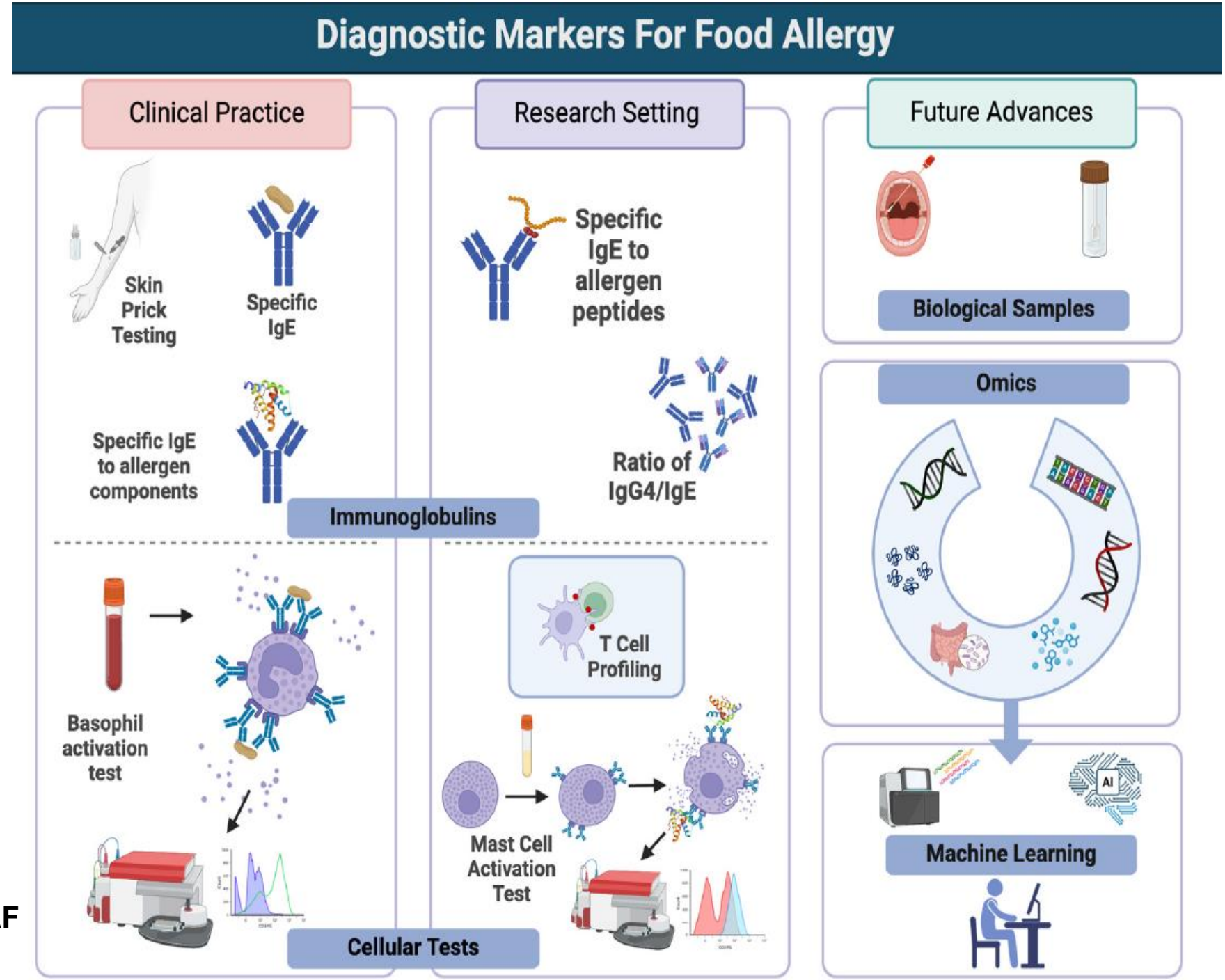
ImmunoCAP

ISAC microarray

Future: sIgE to individual allergenic epitopes





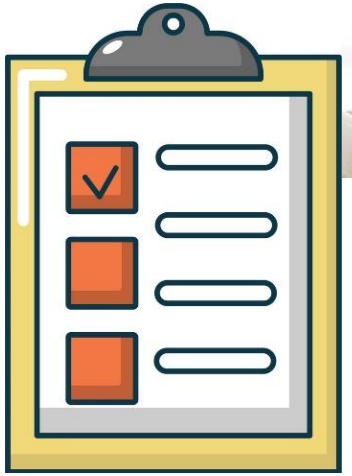


Boyd H & Santos AF
JACI 2025

How do we manage food allergies? Current and Future?

Strategies to Manage Food Allergies

- Avoiding specific food triggers
- Emergency medications
- Written Emergency Action Plans
- Education and training
- Oral food challenge



SCAMP Recommended Location for Challenge

(Patient should meet both SSIge and SPT criteria below) * If age < 3, **Not Recommended to Challenge**

	Home	Clinic	CAT/CR	Best Clinical Judgment	Not Recommended
Egg	SSIgE ≤ 0.35 ku/L SPT ≤ 5 mm	SSIgE ≥ 0.35 and ≤ 0.6 ku/L SPT ≤ 5 mm	SSIgE ≥ 0.35 and ≤ 2 ku/L SPT > 5 and ≤ 6 mm	SSIgE ≥ 2 and < 6 ku/L SPT > 6 and < 7 mm	SSIgE ≥ 6 ku/L SPT ≥ 7 mm
Baked Egg	SSIgE ≤ 1 ku/L (ovomucoid) SPT ≤ 7 mm	SSIgE > 1 and ≤ 4 ku/L (ovomucoid) SPT > 7 and ≤ 35 mm	Best Clinical Judgment	SSIgE ≥ 4 ku/L SPT > 35 mm	
Milk	SSIgE ≤ 0.35 ku/L SPT ≤ neg (0)	SSIgE > 0.35 and ≤ 0.8 ku/L SPT > 0 and ≤ 5 mm	SSIgE > 0.8 and ≤ 2 ku/L SPT > 5 and ≤ 7 mm	SSIgE > 2 and < 15 ku/L SPT > 7 and < 9 mm	SSIgE ≥ 15 ku/L SPT ≥ 9 mm
Baked Milk	SSIgE ≤ 1 ku/L SPT ≤ 7 mm	SSIgE > 1 and ≤ 15 ku/L SPT < 7 and ≤ 13 mm	Best Clinical Judgment	SSIgE ≥ 15 ku/L SPT > 13 mm	
Peanut	Exit SCAMP	SSIgE ≤ 0.35 ku/L * SPT ≤ 5 mm	SSIgE > 0.35 and ≤ 0.7 ku/L SPT ≤ 5 mm Ara h2 ≤ 0.35 ku/L	SSIgE > 0.8 and < 15 ku/L SPT > 5 and < 15 mm Ara h2 > 0.35 and < 1 ku/L	SSIgE ≥15 ku/L SPT ≥ 15 mm Ara h2 ≥ 1 ku/L
Tree Nut	Exit SCAMP	SSIgE ≤ 0. 5 ku/L * SPT ≤ 5 mm	SSIgE > 0.5 and ≤ 3 ku/L SPT > 5 and ≤ 6 mm	SSIgE > 3 and <18 ku/L SPT > 6 and < 8 mm	SSIgE ≥ 18 ku/L SPT ≥ 8 mm
Fish	Exit SCAMP	SSIgE ≤ 0.9 ku/L * SPT ≤ 5 mm	SSIgE > 0.9 and ≤ 5 ku/L SPT ≤ 5 mm	SSIgE > 5 and < 10 ku/L SPT > 5 and < 20 mm	SSIgE ≥ 10 ku/L SPT ≥ 20 mm
Shell Fish	Exit SCAMP	SSIgE ≤ 1 ku/L * SPT ≤ 5 mm	SSIgE > 1 and ≤ 5 ku/L SPT ≤ 5 mm	SSIgE > 5 and < 20 ku/L SPT > 5 and < 40 mm	SSIgE ≥ 20 ku/L SPT ≥ 40 mm
Soy	Exit SCAMP	SSIgE ≤ 2 ku/L SPT ≤ 5 mm	SSIgE > 2 and ≤ 5 ku/L SPT > 5 and ≤ 10 mm	SSIgE > 5 and < 65 ku/L SPT > 5 and <5 mm	SSIgE ≥ 65 ku/L SPT ≥ 20 mm
Wheat	Exit SCAMP	SSIgE ≤ 2 ku/L SPT ≤ 5 mm	SSIgE > 2 and ≤ 10 ku/L SPT > 5 and ≤ 10 mm	SSIgE > 10 and < 80 ku/L SPT > 10 and < 20 mm	SSIgE ≥ 80 ku/L SPT ≥ 20 mm
Sesame Seed	Exit SCAMP	SSIgE ≤ 1 ku/L SPT ≤ 3 mm	SSIgE > 1 and ≤ 7 ku/L SPT > 3 and ≤ 6 mm	SSIgE > 7 and < 10 ku/L SPT > 6 and < 8 mm	SSIgE ≥ 10 ku/L SPT ≥ 8 mm
Sunflower Seed	Exit SCAMP	SSIgE ≤ 5 ku/L SPT ≤ 5 mm	SSIgE > 5 and ≤ 7 ku/L SPT > 5 and ≤ 6 mm	SSIgE > 7 and < 10 ku/L SPT > 6 and < 8 mm	SSIgE ≥ 10 ku/L SPT ≥ 8 mm
Fruits/ Vegetables	Exit SCAMP	SSIgE ≤ 5 ku/L SPT ≤ 10 mm	SSIgE > 5 and ≤ 15 ku/L SPT > 10 and ≤ 15 mm	SSIgE > 15 and < 30 ku/L SPT > 15 and < 25 mm	SSIgE ≥ 30 ku/L SPT ≥ 25 mm
Meats	Exit SCAMP	SSIgE ≤ 5 ku/L SPT ≤ 10 mm	SSIgE > 5 and ≤ 15 ku/L SPT > 10 and ≤ 15 mm	SSIgE > 15 and < 30 ku/L SPT > 15 and < 25 mm	SSIgE ≥ 30 ku/L SPT ≥ 25 mm
Grains	Exit SCAMP	SSIgE ≤ 5 ku/L SPT ≤ 10 mm	SSIgE > 5 and ≤ 15 ku/L SPT > 10 and ≤ 15 mm	SSIgE > 15 and < 30 ku/L SPT > 15 and < 25 mm	SSIgE ≥ 30 ku/L SPT ≥ 25 mm
Other foods	Exit SCAMP	SSIgE ≤ 1 ku/L SPT ≤ 3 mm	SSIgE > **1** and ≤ 15 ku/L SPT > **3** and ≤ 15 mm	SSIgE > 5 and ≤ 15 ku/L SPT > 10 and ≤ 15 mm	SSIgE > 15 ku/L SPT > 15 mm

Dietary food allergy management

Past:

Strict dietary food allergen avoidance

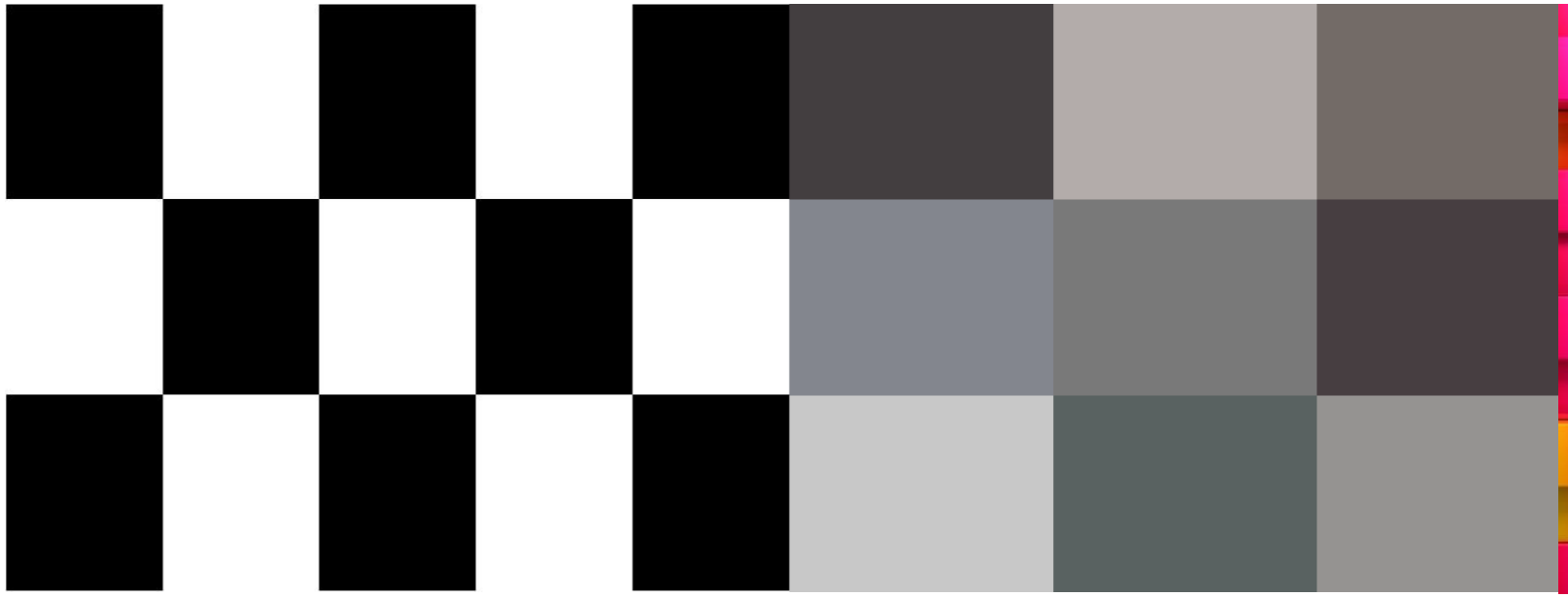
Present:

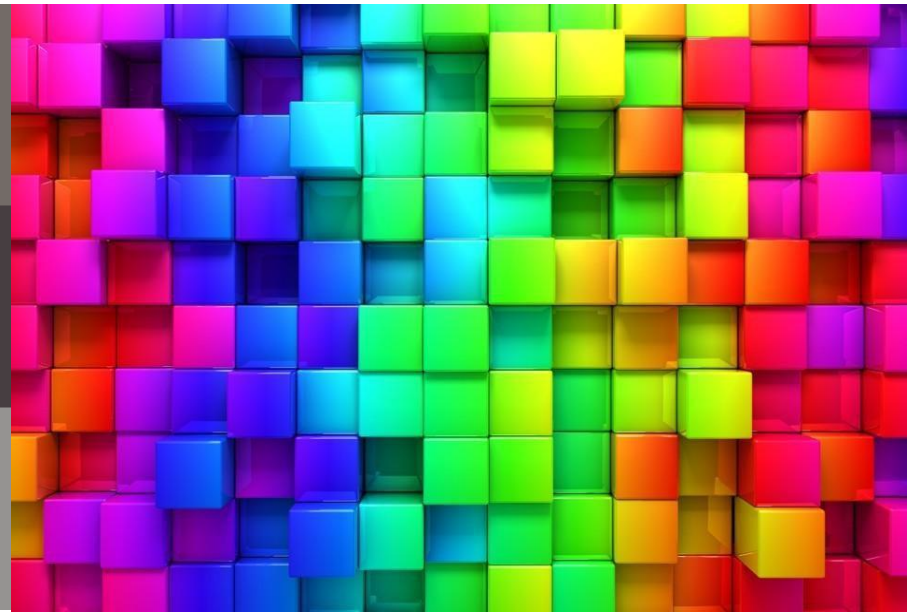
Baked

milk & egg diets, raw vs. cooked plant foods, birch cross-reactivity and nuts

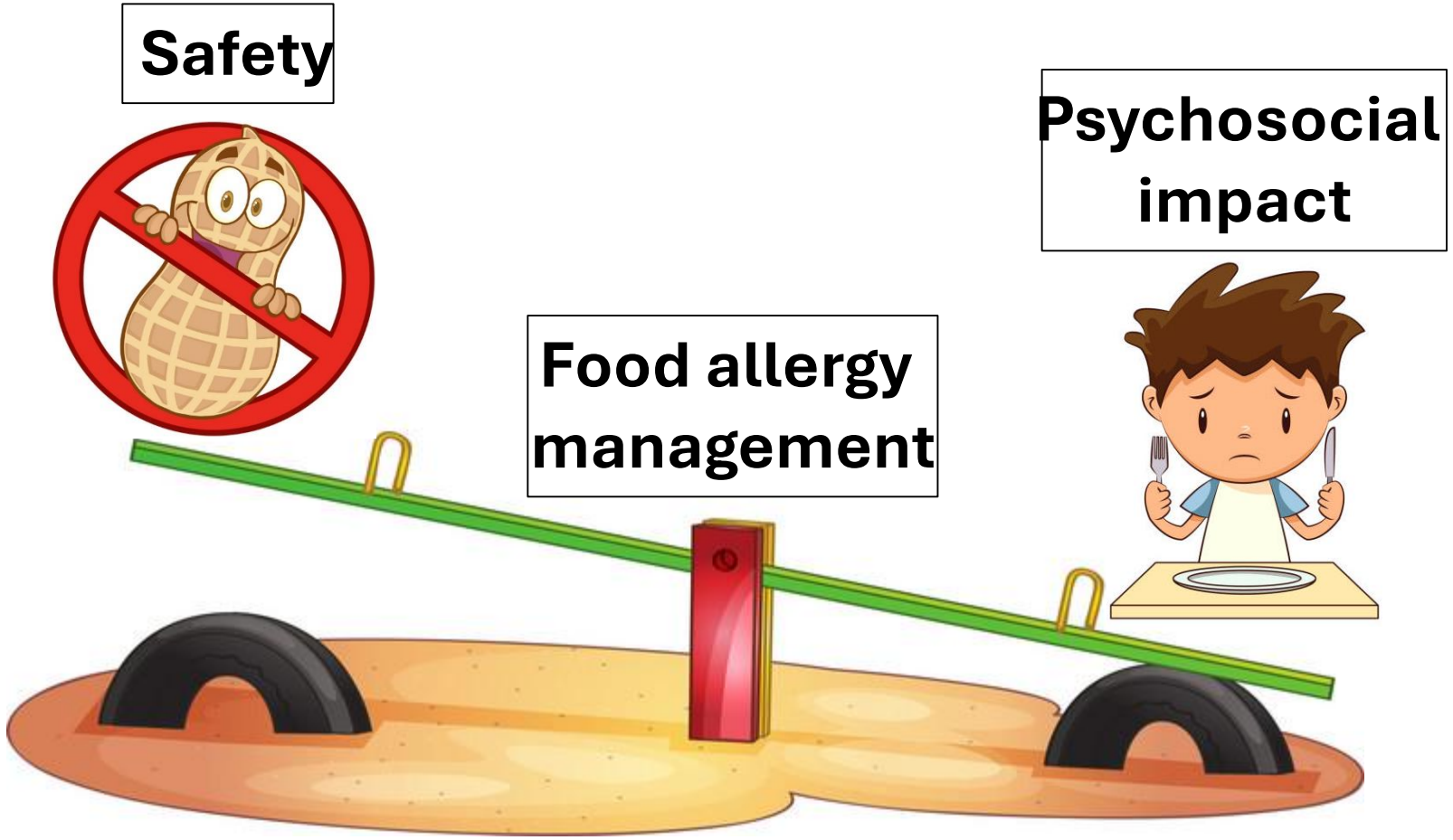
Future:

Personalized diets based on the individual molecular profiles of sensitization





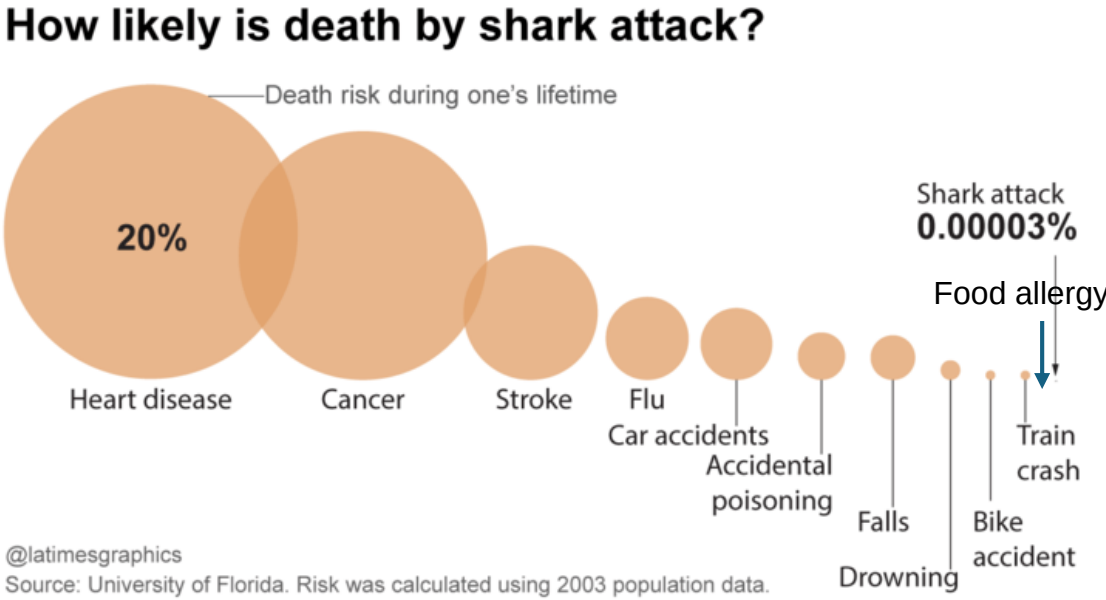
Striking the Right Balance- Reality Versus Fear



Food Allergy and Asthma: Mortality Risk?

Metric	Asthma	Food Allergy
Annual Deaths	In 2021, 3,517 people in the US died from asthma.	The CDC reported 150–200 deaths annually from food allergies in a 2017 analysis.
Mortality Rate	10.6 deaths per million people in 2021.	0.03–0.3 deaths per million people per year, based on population-wide studies of fatal food anaphylaxis.

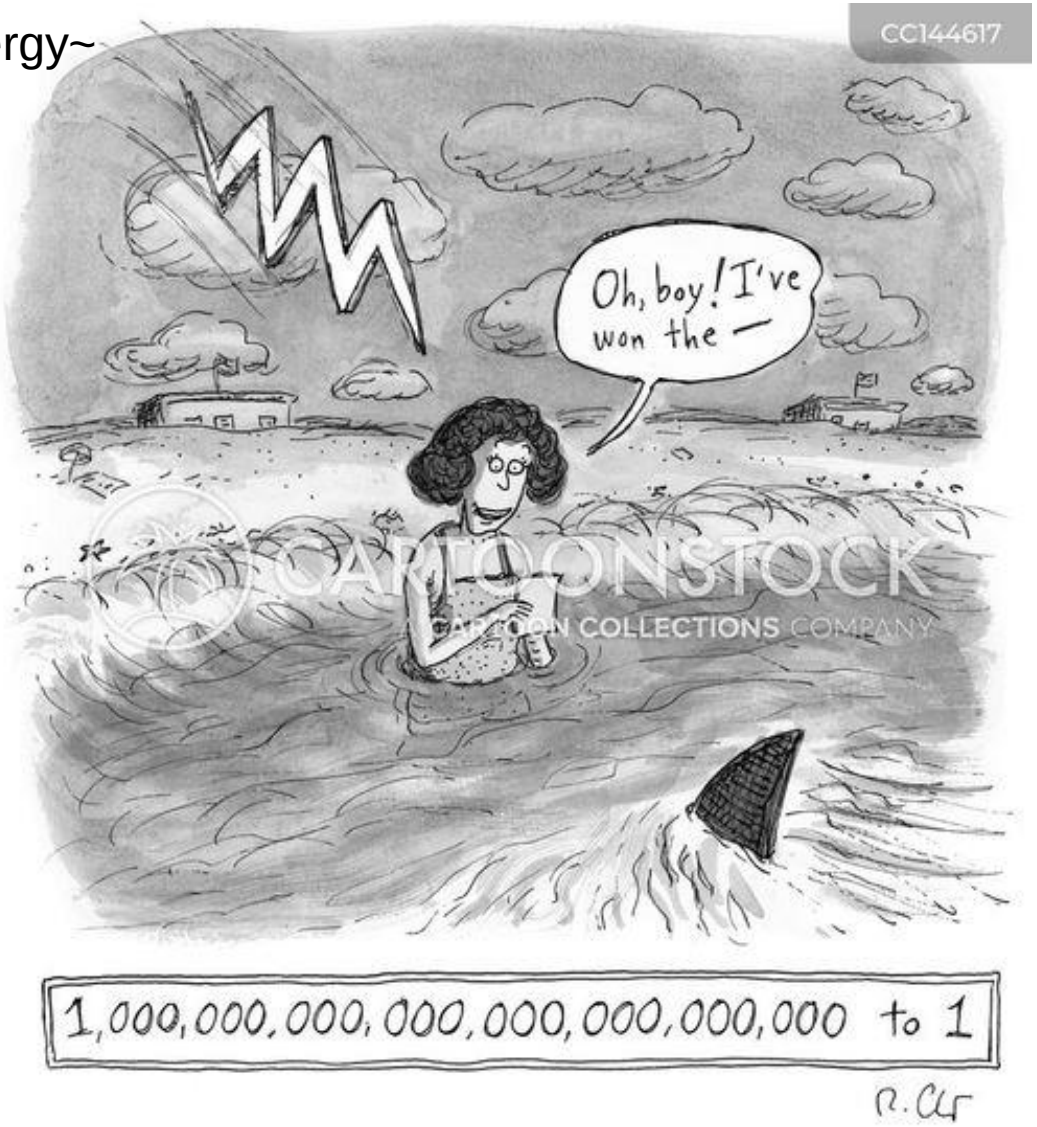
Cause of Death	Annual Estimated Deaths (US)	Comparison to Food Allergy Death
Heart Disease	Over 680,000	Thousands of times more likely
Cancer	Over 613,000	Thousands of times more likely
Unintentional Injuries	Over 222,000	Hundreds of times more likely
Accidental Poisoning (Drug Overdoses)	Around 100,000 in 2022	Hundreds of times more likely
Motor Vehicle Accidents	Tens of thousands	Dozens of times more likely
Homicide	Tens of thousands	Dozens of times more likely



Umasunthar T, Clin Exp Allergy 2013 Volume 43:

Risk of Death Food Allergy~

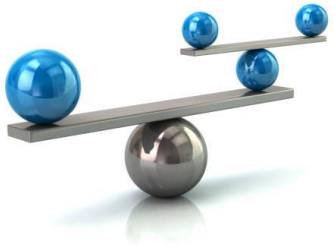
1 in 815,000,000



Psychosocial Burden of Food Allergy

JAMA Network | Open

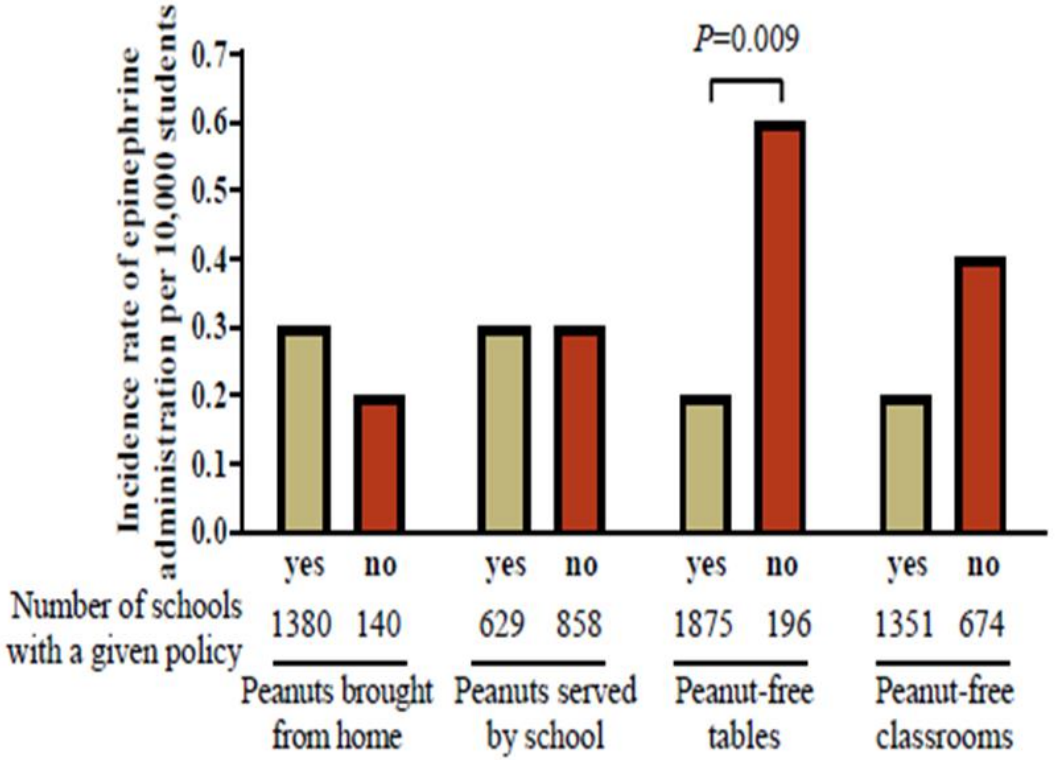
- Like other chronic illnesses, food allergy requires daily management.
- The **chronic and unpredictable** nature of food allergy can impact patient and family psychosocial functioning.
- Children with food allergy and their parents report:
  - ↓ **quality of life**
  - ↑ **anxiety** and **worry**
  - ↑ **bullying**



Household Food Allergen Exclusion Practices and Food Allergy-Related Psychosocial Functioning

Hana B. Ruran; Gabrielle D'Ambrosi, MPH; Roxanne Dupuis, PhD; Linda J. Herbert, PhD; Scott H. Sicherer, MD; Wanda Phipatanakul, MD, MS; Lisa M. Bartnikas, MD

Bartnikas, Phipatanakul JACI 2017



Approach to Management Food Allergy and Asthma

Remember Noah….

Medications

- Epinephrine autoinjector 0.15 mg
- Budesonide/formoterol BID
- Albuterol PRN
- Loratadine; fluticasone nasal spray

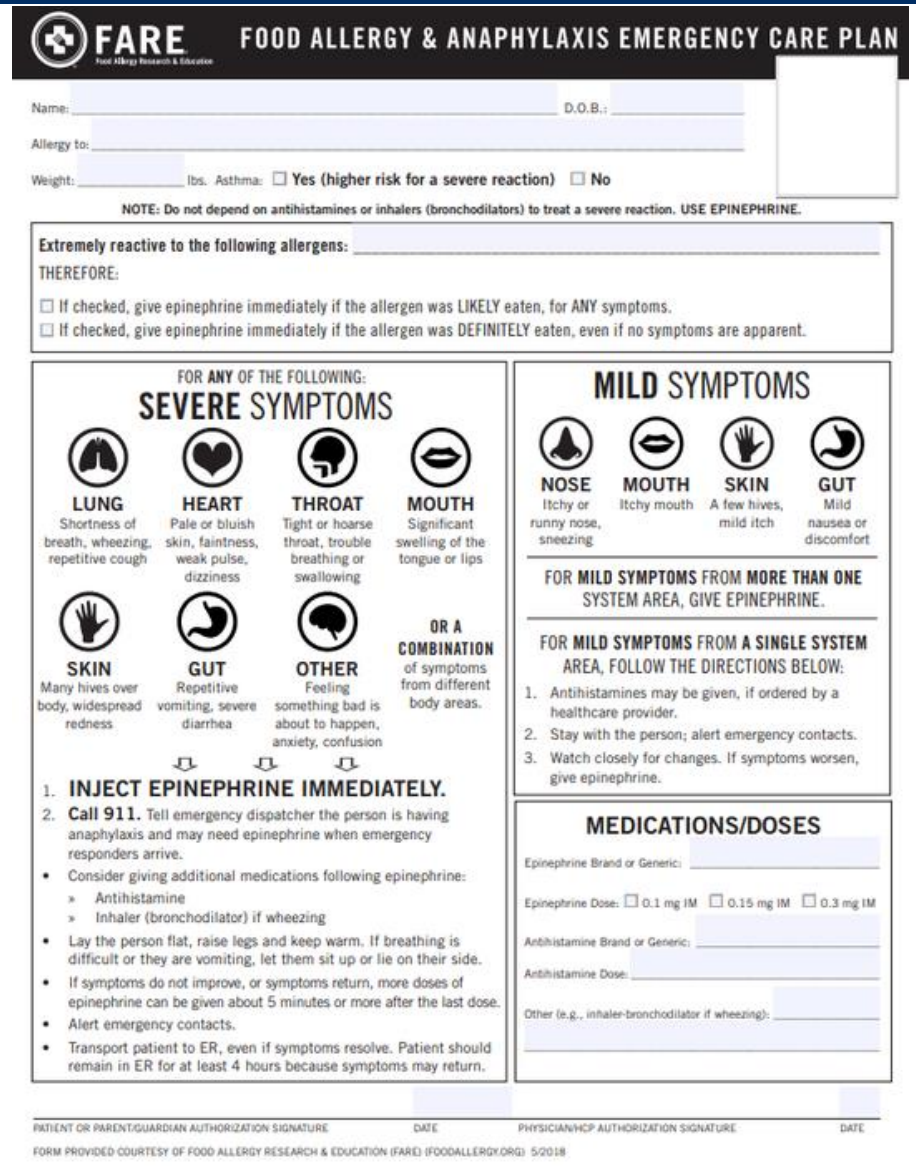
Approach to Management Food Allergy and Asthma

Feature	Food Allergy	Asthma
Primary Approach	Main strategy is strict avoidance of the trigger food. In some patients- consideration of OIT or anti-IgE, but until established- avoidance-	Treatment revolves around managing chronic airway inflammation and preventing attacks with long-term daily medication.
Emergency Treatment	A self-injectable epinephrine auto-injector is first-line treatment for anaphylaxis.	A rescue SABA/ICS inhaler, is used to quickly open the airways during an asthma attack.
Action Plan	Emergency plan for accidental exposure, with instructions for when to use epinephrine.	Requires a written asthma action plan to guide daily management, medication adjustments, and emergency response during a flare-up.

Anaphylaxis Emergency Plan

Epinephrine (subcutaneous or nasal)

Antihistamines (cetirizine)



FARE FOOD ALLERGY & ANAPHYLAXIS EMERGENCY CARE PLAN

Name: _____ D.O.B.: _____

Allergy to: _____

Weight: _____ lbs. Asthma: ☐ Yes (higher risk for a severe reaction) ☐ No

NOTE: Do not depend on antihistamines or inhalers (bronchodilators) to treat a severe reaction. USE EPINEPHRINE.

Extremely reactive to the following allergens: _____

THEREFORE:

☐ If checked, give epinephrine immediately if the allergen was LIKELY eaten, for ANY symptoms.

☐ If checked, give epinephrine immediately if the allergen was DEFINITELY eaten, even if no symptoms are apparent.

FOR **ANY** OF THE FOLLOWING:

SEVERE SYMPTOMS

- **LUNG** — Shortness of breath, wheezing, repetitive cough
- **HEART** — Pale or bluish skin, faintness, weak pulse, dizziness
- **THROAT** — Tight or hoarse throat, trouble breathing or swallowing
- **MOUTH** — Significant swelling of the tongue or lips
- **SKIN** — Many hives over body, widespread redness
- **GUT** — Repetitive vomiting, severe diarrhea
- **OTHER** — Feeling something bad is about to happen, anxiety, confusion

OR A COMBINATION of symptoms from different body areas.

1. **INJECT EPINEPHRINE IMMEDIATELY.**
2. **Call 911.** Tell emergency dispatcher the person is having anaphylaxis and may need epinephrine when emergency responders arrive.
- Consider giving additional medications following epinephrine:
  - Antihistamine
  - Inhaler (bronchodilator) if wheezing
- Lay the person flat, raise legs and keep warm. If breathing is difficult or they are vomiting, let them sit up or lie on their side.
- If symptoms do not improve, or symptoms return, more doses of epinephrine can be given about 5 minutes or more after the last dose.
- Alert emergency contacts.
- Transport patient to ER, even if symptoms resolve. Patient should remain in ER for at least 4 hours because symptoms may return.

MILD SYMPTOMS

- **NOSE** — Itchy or runny nose, sneezing
- **MOUTH** — Itchy mouth
- **SKIN** — A few hives, mild itch
- **GUT** — Mild nausea or discomfort

FOR **MILD SYMPTOMS** FROM **MORE THAN ONE** SYSTEM AREA, GIVE EPINEPHRINE.

FOR **MILD SYMPTOMS** FROM **A SINGLE SYSTEM** AREA, FOLLOW THE DIRECTIONS BELOW:

1. Antihistamines may be given, if ordered by a healthcare provider.
2. Stay with the person; alert emergency contacts.
3. Watch closely for changes. If symptoms worsen, give epinephrine.

MEDICATIONS/DOSES

Epinephrine Brand or Generic: _____

Epinephrine Dose: ☐ 0.1 mg IM ☐ 0.15 mg IM ☐ 0.3 mg IM

Antihistamine Brand or Generic: _____

Antihistamine Dose: _____

Other (e.g., inhaler-bronchodilator if wheezing): _____

PATIENT OR PARENT/GUARDIAN AUTHORIZATION SIGNATURE DATE PHYSICIAN/HCP AUTHORIZATION SIGNATURE DATE

FORM PROVIDED COURTESY OF FOOD ALLERGY RESEARCH & EDUCATION (FARE) (FOODALLERGY.ORG) 5/2018

Patient's Weight Dosage ≥30 kg or One spray of nasal epinephrine 2 mg

15 kg to <30 kg One spray of nasal epinephrine 1 mg

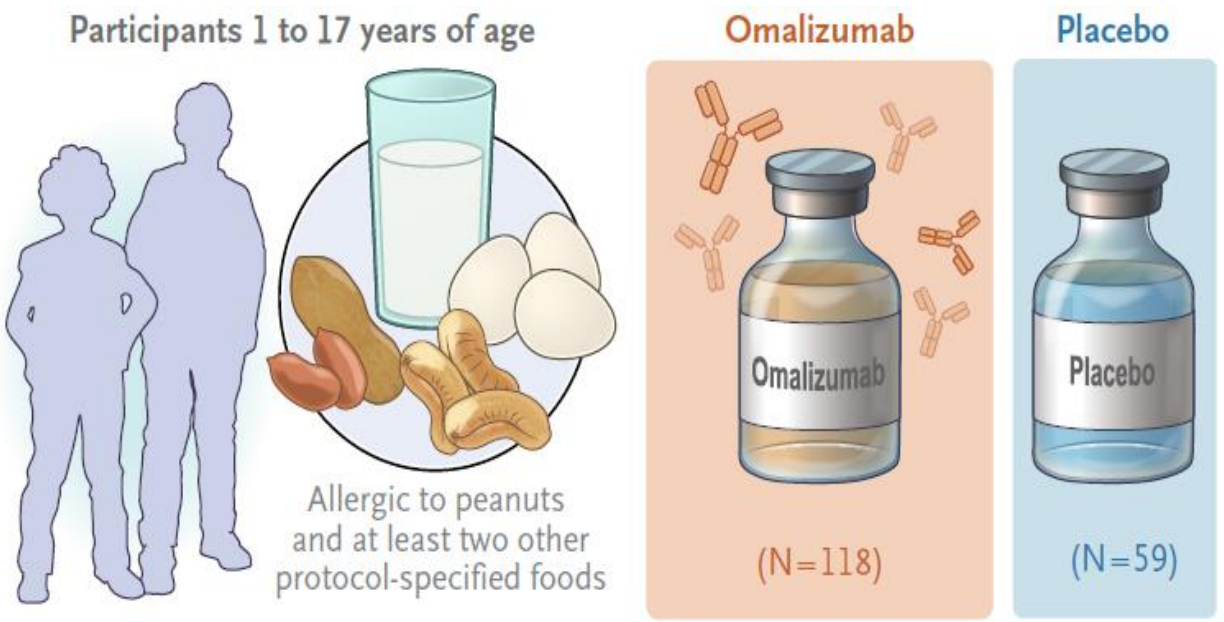
Therapeutic Approach	Food Allergy	Asthma
Biologics	Omalizumab: Approved to reduce the risk of allergic reactions from accidental exposure to multiple foods. It blocks the antibody immunoglobulin E (IgE), which triggers allergic reactions.	Omalizumab :Used to treat moderate-to-severe allergic asthma by blocking IgE. Other biologics: (e.g., mepolizumab, dupilumab, tezepelumab).
Immunotherapy (Desensitization)	Oral Immunotherapy (OIT): Eating gradually increasing amounts of allergen under medical supervision to build tolerance. FDA-approved OIT product for peanut only Arachis hypogaea Peanut allergen-dnfp (powder/capsule) Other forms: Sublingual (SLIT) and epicutaneous (EPIT) immunotherapies under investigation	Allergy shots (SCIT): Treats allergic asthma by gradually desensitizing the body to airborne triggers Under-the-tongue tablets (SLIT): Used for some specific allergens, including certain pollens.
Corticosteroids	Oral steroids: May be used short-term to treat some food allergy symptoms, ie rash or asthma flare during rxn Do NOT prevent or stop anaphylaxis.	Inhaled corticosteroids: Mainstay controller medicine for asthma, taken daily to reduce chronic airway inflammation. Oral steroids: Used for severe, short-term asthma flare-ups.

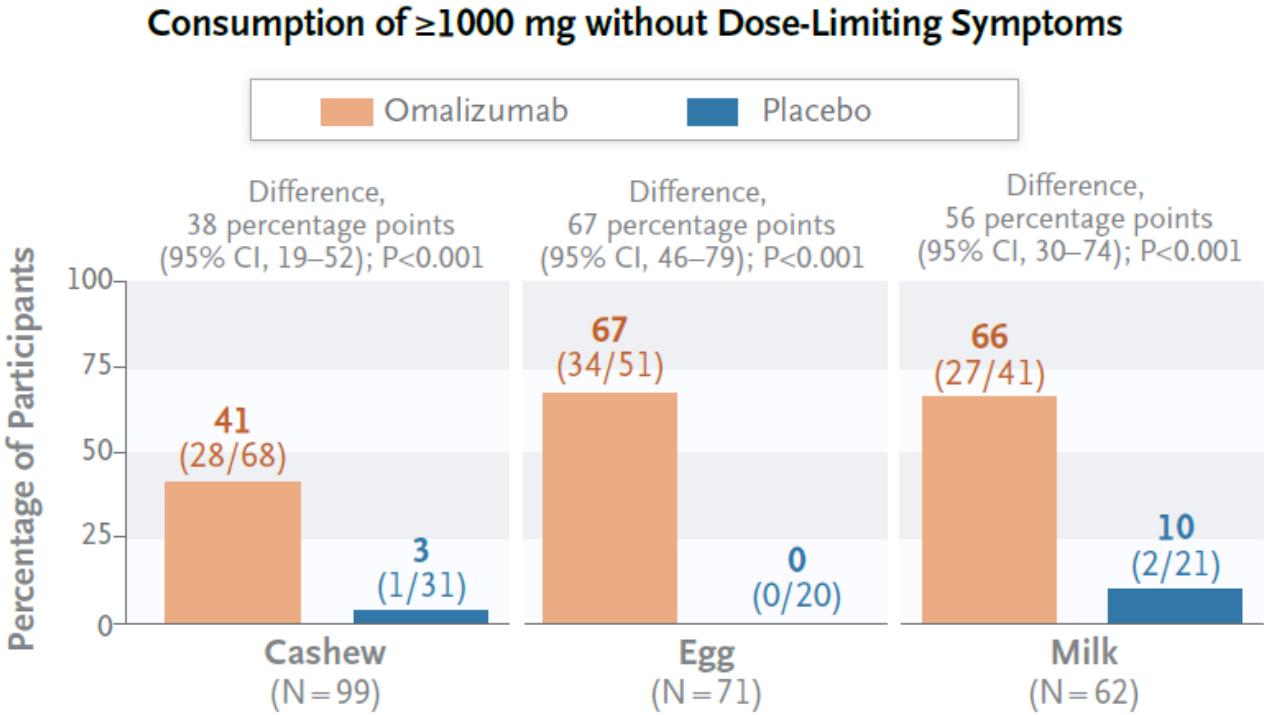
New Treatments

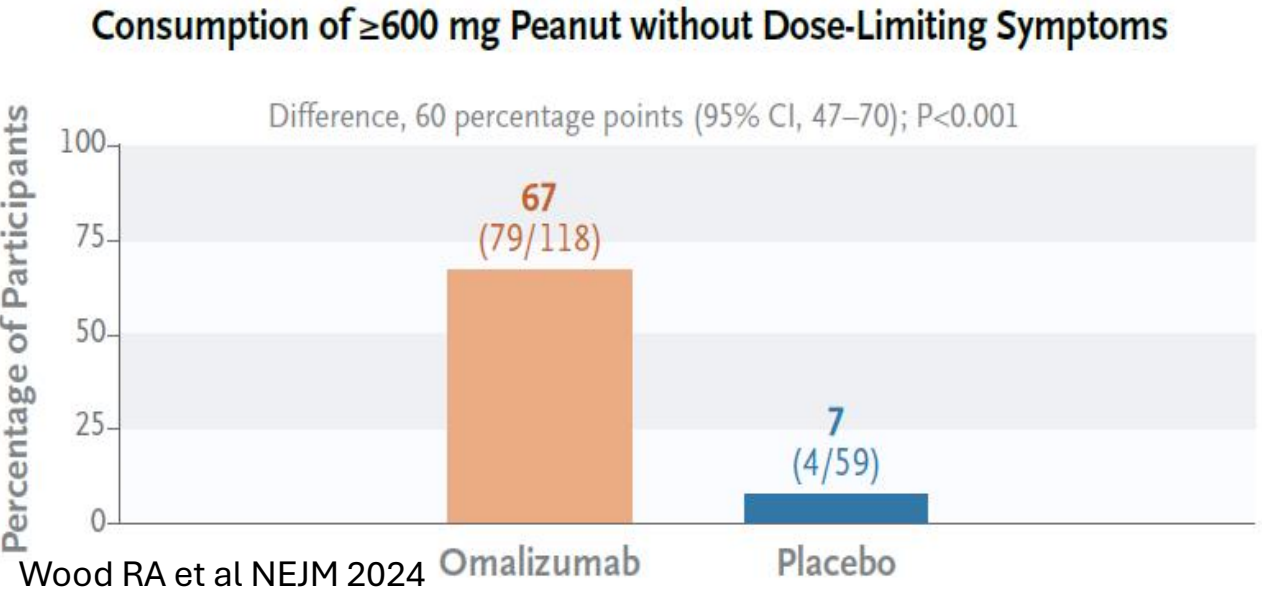
- Biologics (e.g., omalizumab) and immunotherapy (OIT), either alone or in combination, are effective in achieving desensitization while on treatment.
  - — Omalizumab
  - —Injection (shot) given every 2 or 4 weeks
    - Reduces allergic reactions to any food
  - — OIT
    - Arachis hypogaea Peanut allergen-dnfp (powder/capsule) is only FDA-approved OIT
    - OIT being done for other foods
    - Daily dosing
    - Reduces allergic reactions to specific food
- Limited evidence for sustained unresponsiveness/remission
- Additional studies on long-term safety are needed

Clinical Pearl: These therapies help patients be "bite safe"—they still need to avoid the foods they are allergic to

1. Riggioni et al, *Allergy*, 2024
2. Vickery et al, *N Engl J Med*, 2018
3. Wood et al, *N Engl J Med*, 2024







~2½ peanuts
600 mg

~4½ peanuts
1000 mg

~3½ cashews
1000 mg

~2 tablespoons of 1% milk
1000 mg

~¼ egg
1000 mg

Wood RA et al NEJM 2024

Treatment Considerations

- **Target of Treatment:** Food allergy treatment is primarily focused on risk mitigation from external, ingested allergens, with epinephrine as the critical emergency intervention. Asthma treatment focuses on controlling internal, chronic inflammation, with inhalers used for both daily control and urgent relief.

- **Shared Drug:** Omalizumab was initially used for asthma and is now also approved for food allergies, providing an additional layer of protection against severe reactions caused by accidental exposure.

- **Allergic Asthma:** When asthma is triggered by allergies, controlling the underlying allergy through therapies like immunotherapy can also help manage asthma symptoms.

What about Risk and Interrelationship Food Allergy & Asthma Does that pave the way for Prevention/ Disease Modification/….Cure??

Food allergen sensitization as a determinant of disturbed airway function in young infants: First step on the path to persistent asthma?

W. Gerald Teague, MD 2008

Trust, but verify: a new potential association between food allergy and asthma in children

2023

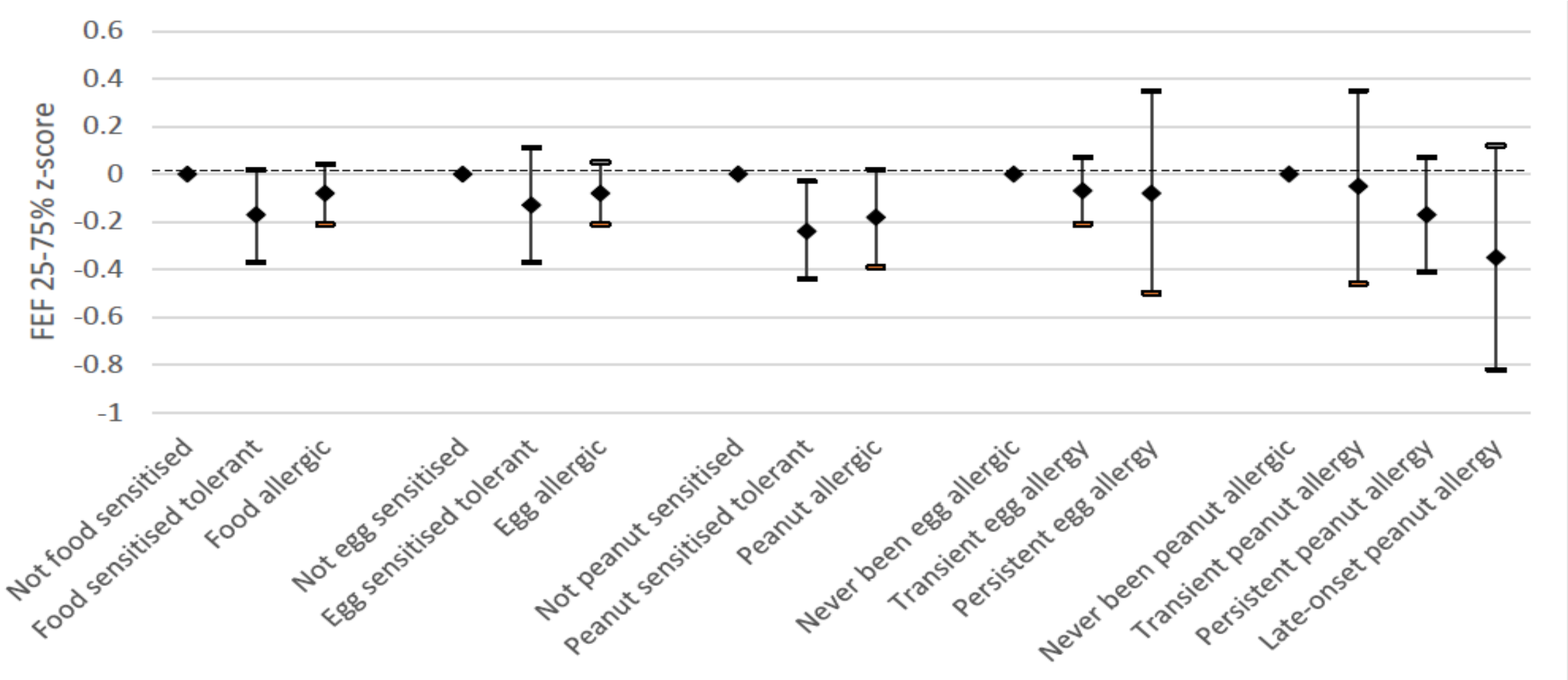
*Matthew Greenhawt, Wanda Phipatanakul
matthew.greenhawt@childrenscolorado.org

THE LANCET
Child & Adolescent Health

Infant food allergy phenotypes and association with lung function deficits and asthma at age 6 years: a population-based, prospective cohort study in Australia

Peters RL, et al Sept 2023

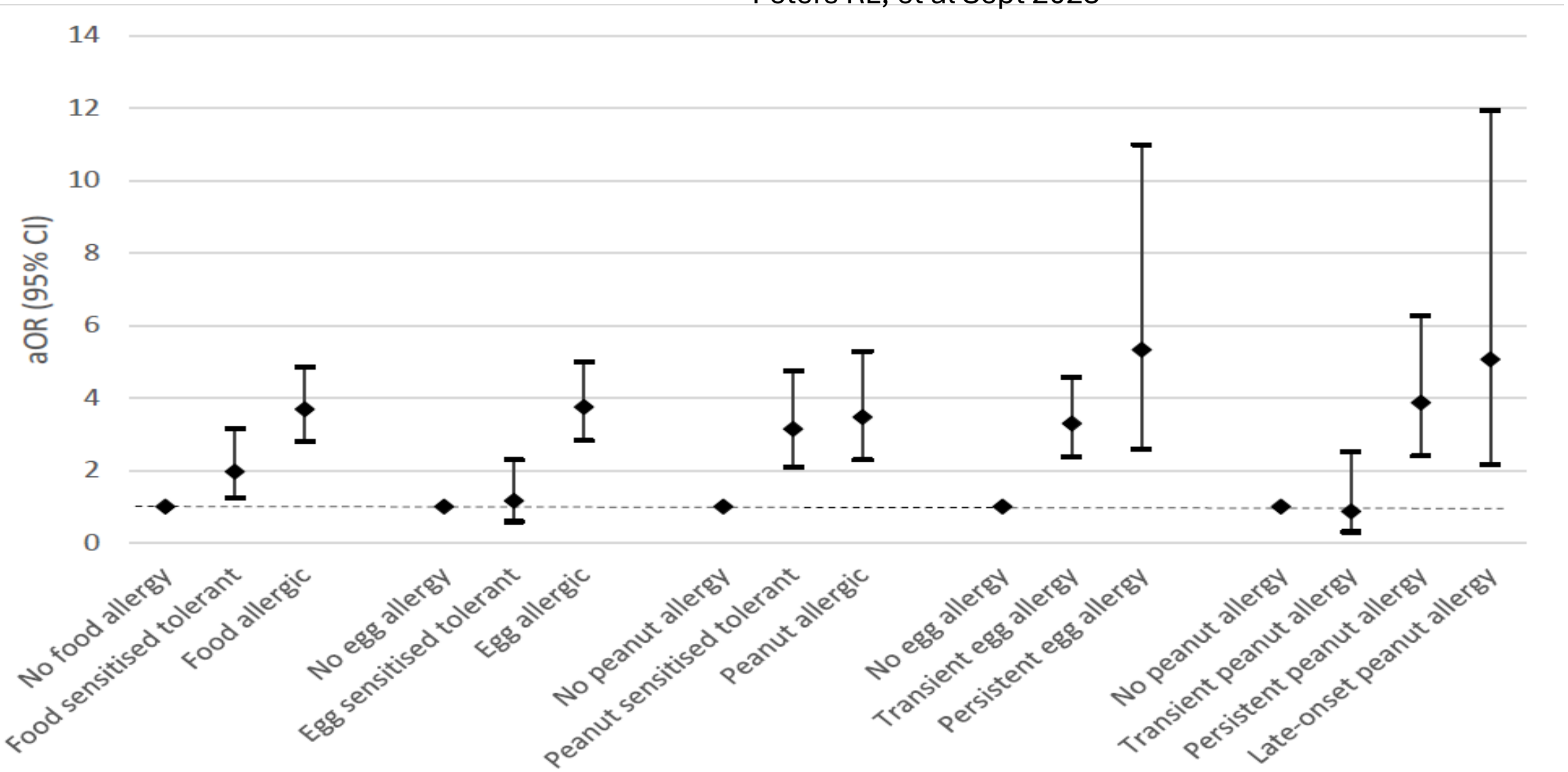
THE LANCET
Child & Adolescent Health



Does Food Allergy Increase Asthma?

THE LANCET
Child & Adolescent Health

Peters RL, et al Sept 2023



Key Takeaways

- History is the most important factor in diagnosing food allergies and asthma- In many patients they are interrelated
- There are more reliable diagnostic tools for asthma, but we are still limited.
- Testing and Diagnosis remain a challenge particularly for food allergy
- Last decade has exploded in immune based therapies for asthma with headway in food allergy
- Appropriately evaluating for and managing food allergies can impact and improve patient care.
- Education and shared-decision making key
- Hope in the future for prevention, disease modification
- Hope for CURE in the Horizon

Thank You!

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https://bchasthmaresearch.com