Food Allergy
What Every School Nurse Should Know

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Definitions
Adverse Food Reactions

Immunologic

IgE-Mediated (most common)
- Systemic (Anaphylaxis)
- Oral Allergy Syndrome
- Immediate gastrointestinal allergy
- Asthma/rhinitis
- Urticaria
- Morbilliform rashes and flushing
- Contact urticaria

Non-IgE Mediated Cell-Mediated
- Protein-Induced Enterocolitis
- Protein-Induced Enteropathy
- Eosinophilic proctitis
- Dermatitis herpetiformis
- Contact dermatitis

Pathophysicsiology
Allergens

• Proteins or glycoproteins (not fat or carbohydrate)
  – Generally heat resistant, acid stable

• Major allergenic foods (>85% of food allergy)
  – Children: milk, egg, soy, wheat, peanut, tree nuts
  – Adults: peanut, tree nuts, shellfish, fish, fruits and vegetables
**Immune Mechanisms**

- **IgE-Mediated**
  - IgE-receptor
  - Mast cell
  - Histamine

- **Protein digestion**
- **Antigen processing**
- **Some Ag enters blood**

- **IgE-Mediated Immune Mechanisms**

- **Non-IgE Mediated**
  - TNF-α
  - IL-5

- **APC**

- **B cell**
- **T cell**
Clinical Manifestations
Fatal Food Anaphylaxis

- Frequency: ~150 deaths / year
- Clinical features:
  - Biphasic reaction can contribute – initially better, then recurs
  - Cutaneous symptoms may not be present
  - Respiratory symptoms prominent
- Risk factors:
  - Underlying asthma – Delayed epinephrine
  - Symptom denial – Previous severe reaction
  - Adolescents, young adults
- History: known food allergen
- Key foods: *peanuts and tree nuts dominate* (~90% of fatalities), fish, crustaceans
- Most events occurred away from home

Cutaneous Reactions

• Acute urticaria/angioedema – common
• Contact urticaria - common
• Food allergy rarely causes chronic urticaria/angioedema
• 1/3 of children with moderate to severe atopic dermatitis may have food allergy (especially cow’s milk, egg, soy, wheat). Morbilliform rashes may be seen in these children upon food challenge.
• Contact dermatitis (food handlers)
Respiratory Responses

• Upper and lower respiratory tract symptoms may be seen (rhinoconjunctivitis, laryngeal edema, asthma)
• Rarely isolated, usually accompany skin and GI symptoms
• Inhalational exposure may cause respiratory symptoms that can be severe
  • Occupational
  • Restaurants
  • Kitchen/Home

Example: crabs to be boiled
GI Symptoms

- Itchy mouth
- Nausea
- Vomiting
- Cramping
- Severe abdominal pain
- Diarrhea delayed
Pollen-Food Syndrome or Oral Allergy Syndrome

- 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

Birch → Apple, carrot, celery, cherry, pear, hazelnut
Ragweed → Banana, cucumber, melons
Grass → Melon, tomato, orange
Mugwort → Melon, apple, peach, cherry
Disorders Not Proven to be Related to Food Allergy

- Migraines
- Behavioral / Developmental disorders
- Arthritis
- Seizures
- Inflammatory bowel disease
Prevalence and Natural History
Prevalence of Food Allergy

• Perception by public: 20-25%
• Confirmed allergy (oral challenge)
  – Adults: 2-3.5%
  – Infants/young children: 6-8%
• Specific Allergens
  – Dependent upon societal eating and cooking patterns
• Prevalence higher in those with:
  – Atopic dermatitis
  – Certain pollen allergies
  – Latex allergy
• Prevalence seems to be increasing
## Estimated Prevalence of Food Allergy

<table>
<thead>
<tr>
<th>Food</th>
<th>Children (%)</th>
<th>Adults (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow’s milk</td>
<td>2.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Egg</td>
<td>1.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Soy</td>
<td>0.3-0.4</td>
<td>0.04</td>
</tr>
<tr>
<td>Peanut</td>
<td>0.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Tree nut</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Crustaceans</td>
<td>0.1</td>
<td>2.0</td>
</tr>
<tr>
<td>Fish</td>
<td>0.1</td>
<td>0.4</td>
</tr>
</tbody>
</table>

## Prevalence of Clinical Cross Reactivity Among Food “Families”

<table>
<thead>
<tr>
<th>Food Allergy</th>
<th>Prevalence of Allergy to &gt; 1 Food in Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>30% - 100%</td>
</tr>
<tr>
<td>Tree Nut</td>
<td>15% - 40%</td>
</tr>
<tr>
<td>Grain</td>
<td>25%</td>
</tr>
<tr>
<td>Legume</td>
<td>5%</td>
</tr>
<tr>
<td>Any</td>
<td>11%</td>
</tr>
</tbody>
</table>

Natural History

- Dependent on food & immunopathogenesis
- ~85% of cases of cow milk, soy, egg and wheat allergy remit by age 3 yrs
  - Declining/low levels of specific-IgE predictive
  - IgE binding to conformational epitopes predictive
- Non-IgE-mediated GI allergy
  - Infant forms resolve in 1-3 years
  - Toddler / adult forms more persistent
Natural History (cont’d)

- Allergies to peanuts, tree nuts, seafoods, and seeds typically persist.
- ~20% of cases of peanut allergy resolve by age 5 years.

Prognostic factors include:
- PST < 6mm
- ≥ 2 years avoidance
- History of mild reaction
- Few other atopic diseases
- Low levels of peanut-specific IgE
- Rarely re-develop allergy: role for regular ingestion?
Evaluation
Evaluation of Food Allergy

• Suspect IgE-mediated
  – Panels/broad screening should NOT be done without supporting history because of high rate of false positives.
  – Prick skin tests (prick-prick with fresh food if pollen-food syndrome)
  – In vitro tests for food-specific IgE

• Suspect non-IgE-mediated
  – Consider biopsy of gut, skin

• Suspect non-immune, consider:
  – Breath hydrogen
  – Sweat test
  – Endoscopy
Evaluation: Interpretation of Laboratory Tests

• Positive prick test or specific IgE
  – Indicates presence of IgE antibody NOT clinical reactivity
  – ~90% sensitivity
  – ~50% specificity
  – ~50% false positives
  – Larger skin tests/higher IgE correlates with likelihood of reaction but not severity

• Negative prick test or specific IgE
  – Essentially excludes IgE antibody (>95% specific)
## Specific IgE Levels Associated with 95% Risk of Reaction

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Food</th>
<th>Serum IgE (kU/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>Egg</td>
<td>≥ 7</td>
</tr>
<tr>
<td>&lt;2 years</td>
<td>Egg</td>
<td>≥ 2</td>
</tr>
<tr>
<td>Child</td>
<td>Cow Milk</td>
<td>≥ 15</td>
</tr>
<tr>
<td>&lt;2 years</td>
<td>Cow Milk</td>
<td>≥ 5</td>
</tr>
<tr>
<td>Child</td>
<td>Peanut</td>
<td>≥ 14</td>
</tr>
<tr>
<td>Child</td>
<td>Fish</td>
<td>≥ 20</td>
</tr>
</tbody>
</table>

Component Immuno-Cap

• Specific proteins now may be isolated and tested.
  – Proflins
  – PR-10 Proteins
  – LTP Proteins
  – Storage Proteins
Managing Allergies in School

• EpiPen policy
  - It is not sufficient to have an EpiPen in a cabinet or drawer in the classroom. It must be on the child whenever he/she leaves the classroom (recess, gym, bathroom, field trips etc…)
  - designated hanging spot for an EpiPouch to be taken when leaving the classroom.

• Illinois EpiPen guidelines
  - EpiPens should be carried at all times by a person with severe allergies, because it is not enough to have one nearby.

• In the event of a reaction:
  - Administer EpiPen immediately - even mild allergy symptoms can rapidly progress to a life-threatening situation
  - Call 911

• Everyone who has been treated with epinephrine must be taken to hospital immediately for evaluation because the symptoms may recur and further injections may be required. One epinephrine shot is good for 10-20 minutes.

Increasing risk of systemic reactions

<table>
<thead>
<tr>
<th></th>
<th>Profilin</th>
<th>PR-10 protein</th>
<th>LTP</th>
<th>Storage Proteins</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEANUT</td>
<td>Profilin</td>
<td>Ara h 8</td>
<td>Ara h 9</td>
<td>Ara h 1, Ara h 2, Ara h 3</td>
</tr>
<tr>
<td>HAZEL NUT</td>
<td>Profilin</td>
<td>Cor a 1</td>
<td>Cor a 8</td>
<td>Cor a 9, Cor a 14</td>
</tr>
<tr>
<td>WALNUT</td>
<td>Profilin</td>
<td></td>
<td>Jug r 3</td>
<td>Jug r 1</td>
</tr>
<tr>
<td>BRAZIL NUT</td>
<td>Profilin</td>
<td></td>
<td></td>
<td>Ber e 1</td>
</tr>
<tr>
<td>CASHEW NUT</td>
<td>Profilin</td>
<td></td>
<td></td>
<td>Ana o 3</td>
</tr>
</tbody>
</table>
Management: Dietary Elimination

- Hidden ingredients in restaurants/homes (peanut in sauces, egg rolls)
- Labeling issues ("spices"); changes, errors
- Cross contamination (shared equipment)

Seeking assistance:
- Food allergy specialist
- Registered dietitian: www.eatright.org
- Food Allergy & Anaphylaxis Network (www.foodallergy.org; 800-929-4040) and local support groups

**Peanut (f13)**

- Ara h 1 + Ara h 2 + Ara h 3 (f422) (f423) (f424)
- Ara h 9 (f427)
- Ara h 8 (f352)

- Storage proteins
- Stable to heat and digestion
- Associated with severe reactions

- Lipid transfer protein (LTP)
- Stable to heat and digestion
- Associated with both severe and local reactions
- Associated with allergy to peach and peach related fruits

- PR-10 Protein
- Labile to heat and digestion
- Associated with local reactions
- Associated with allergy to birch and birch related tree pollens
Management
Management of Food Allergy

- Complete avoidance of specific food trigger
- Ensure nutritional needs are being met
- Education
- Anaphylaxis Emergency Action Plan if applicable
  - most accidental exposures occur away from home

This frozen dessert could have peanut, tree nut, cow’s milk, egg, wheat
Label reading used to be very challenging!

Example: Cow’s Milk

Contain cow’s milk: Artificial butter flavor, butter, butter fat, buttermilk, casein, caseinates (sodium, calcium, etc.), cheese, cream, cottage cheese, curds, custard, Half&Half®, hydrolysates (casein, milk, whey), lactalbumin, lactose, milk (derivatives, protein, solids, malted, condensed, evaporated, dry, whole, low-fat, non-fat, skim), nougat, pudding, rennet casein, sour cream, sour cream solids, sour milk solids, whey (delactosed, demineralized, protein concentrate), yogurt.

MAY contain milk: brown sugar flavoring, natural flavoring, chocolate, caramel flavoring, high protein flour, margarine, Simplesse®.

AS of January 1, 2006, all food containing “Big Eight Allergens” (cow’s milk, peanut, tree nut, hen’s egg, soy, wheat, fish, crustacean) in the U.S. MUST declare the ingredient on the label in COMMON language. Does NOT apply to non-Big 8 allergens (e.g., sesame).

Food Allergen Labeling and Consumer Protection Act of 2004 (P.L. 108-282) (FALCPA)
**Nutrition Facts**

Serving Size: ½ cup (30g)
Serving Per Container: About 8

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>Calories</th>
<th>Calories from Fat 50% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat 6g</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Saturated Fat 1g</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Trans Fat 0.5g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Sodium 390mg</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate 20g</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Dietary Fiber less than 1g</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>Sugars 2g</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Protein 3g</td>
<td>2%</td>
<td></td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

<table>
<thead>
<tr>
<th>Amount</th>
<th>Calories</th>
<th>Fat</th>
<th>Carbohydrate</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,000</td>
<td>2,200</td>
<td>65g</td>
<td>20g</td>
</tr>
<tr>
<td></td>
<td>80g</td>
<td>25g</td>
<td>300mg</td>
<td>25g</td>
</tr>
<tr>
<td></td>
<td>2,400mg</td>
<td>3,400owned</td>
<td>300g</td>
<td>300g</td>
</tr>
<tr>
<td></td>
<td>2,200</td>
<td>2,400mg</td>
<td>375g</td>
<td>375g</td>
</tr>
</tbody>
</table>

Not a significant source of vitamin A, vitamin C and calcium.

INGREDIENTS: ENRICHED FLOUR (WHEAT FLOUR, MALTED BARLEY FLOUR, NIACIN, IRON, THIAMIN MONONITRATE, RIBOFLAVIN, FOLIC ACID), Degermed YELLOW CORN MEAL, WHOLE WHEAT, VEGETABLE OIL (SOYBEAN, RICE BRAN AND/OR CANOLA), ENRICHED FLOUR BLEACHED (WHEAT FLOUR, NIACIN, IRON, THIAMIN MONONITRATE, RIBOFLAVIN, FOLIC ACID), PARTIALLY HYDROGENATED SOYBEAN OIL, SUGAR, SALT, CONTAINS 2% OR LESS OF: MONOSODIUM GLUTAMATE, MALTODEXTRIN, RYE FLOUR, YEAST, GARLIC POWDER, CORN SYRUP SOLIDS, HIGH FRUCTOSE CORN SYRUP, MARGARINE (PARTIALLY HYDROGENATED SOYBEAN OIL, SALT, MONO AND DIGLYCERIDES, SOY LECITHIN, WHEY, BETA CAROTENE, VITAMIN A PALMITATE, NATURAL FLAVOR), MALT, BAKING SODA, BARLEY MALT EXTRACT, CORN SYRUP, NATURAL & ARTIFICIAL FLAVOR, MALT SYRUP, SPICES, SOY LECITHIN.

CULTURED NONFAT MILK, SODIUM DIACETATE, ONION POWDER, DISTILLED MONOGLYCERIDES, MOULASSES, WHEAT STARCH, GARLIC, YELLOW CORN FLOUR, COLOR ADDITED, TRISODIUM PHOSPHATE, WHEY, CALCIUM CARBONATE, DISODIUM GUANYLATE, DISODIUM INOSINATE, MONONUCALCIUM PHOSPHATE, SODIUM ACID PYROPHOSPHATE, SOY SAUCE (WHEAT, SOYBEANS, SALT, MALTODEXTRIN, CARAMEL COLOR), TAMARIND EXTRACT, SESAME SEED, ALMOND FLOUR, PEANUT FLOUR, FRESHNESS PRESERVED BY BHT.

**Carbohydrate Choices:** 1

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Every allergic reaction has the possibility of developing into a life-threatening and potentially fatal anaphylactic reaction. This can occur within minutes of exposure to the allergen.
What Schools Can Do

• Schools can be expected to create an ‘‘allergy-safe” environment. It is unrealistic, however, to expect an ‘‘allergen-free” environment.
Key Questions for the Food Allergic Child

• What are the food allergies that cause an anaphylactic reaction?
• What was the previous reactions?
• How did the reaction occur?
• How much was required?
• Does the child have asthma?
• What was the response to treatment?
• When was the last testing performed?
What a Child May Say If They are Having a Reaction

- I think I am going to throw up
- My mouth/tongue itches
- My chest feels tight
- I feel itchy
- My tongue feels hot/burning/tingling/heavy
- There’s something in my throat
- My lips feel tight
- My tongue feels like there is hair on it
- Feels like bugs are in my ears

Food Allergy News, Vol 13, No 2; 2003
What are the school responsibilities for students with anaphylaxis?

• Identify students with life-threatening food allergies
• Develop school policies and protocol for management of anaphylaxis
• Emergency and Individual Health Care Plans
• Training of staff on condition, medications, and emergency plan
• Develop strategies to minimize risk of exposure
Management in the school and classroom

- Nothing is 100% safe
- Cross-contamination is a serious threat
- Label reading is critical
- Peanuts/nuts can be in unusual items (not even food related)
- Know the students – know the plan
  - Locations of medication
  - How to recognize reaction
  - How to use medication
Managing Allergies at School - Prevention

- **Safety = Complete Avoidance**
  - STRICT no food sharing policy.

- The child should wear a **medic alert bracelet** and the office should be provided with **complete information about the allergies**, e.g., foods to avoid, treatment, and emergency contact numbers.

- **Post the child’s photo** with allergy list:
  - In that child’s classrooms, the gymnasium and teachers lounge.

- **Lunch and snack time**
  - **In the classroom**
    - Clean desk/table policy, placemats, hand-washing & **no food sharing**
    - Letter to class parents regarding the child’s allergies - Ask for their cooperation in reinforcing class food rules with their children.
  - **Outside the classroom** (playground, field trips, buses, arenas etc…)
    - All volunteers and teachers need to be aware of the child’s allergies
    - Accommodations must be made when a child cannot attend a trip to an unsafe location (ie. farm or baseball stadium etc…)
Managing Allergies at School - Prevention

• **Special Occasions at School**
  – Pizza & bake sale days
  – BBQ days
  – Birthday parties
    • Hosting parent to provide advance notice so that the allergic child’s parent can send safe food & treats
    • Request that parents *not* include allergens in *that child’s* school bags and Halloween, Christmas, Valentine or Easter treats/gifts

• **The allergic child should not eat if he/she does not have their EpiPen with them.**

• **The allergic child should not sit at a table where spillable milk products (e.g. milk, yogurt) or egg sandwiches/eggs are being consumed.**

• Have children wash their hands after each meal/snack – always have wipes at the classroom door.

• Review all baking, arts & crafts activities for allergens

• No animals in the child’s classrooms
Parents Concerns

• Every parent is so different
  – Some want isolation, other none
• Classrooms
• Field Trips
• Hand washing
• Contact Allergens? Possible Anaphylaxis
• Lawsuits- Both allergic and non-allergic
Bullying in Schools

- Kids are MEAN
- Parents often cannot understand the issues
- Kids threatening harm
  - Case last year where a child smeared PB on student.
Management: Emergency Treatment of Anaphylaxis

• Epinephrine: drug of choice
  – Self-administered epinephrine readily available at all times
  – If administered, seek medical care IMMEDIATELY
  – Train patients, parents, contacts: indications/technique

• Antihistamines: secondary therapy only: WILL NOT STOP ANAPHYLAXIS

• Don’t forget about Albuterol MDI- May give 2 puffs and repeat if no response.

• Written Anaphylaxis Emergency Action Plan
  – Schools, spouses, caregivers, mature sibs / friends

• Emergency identification bracelet
Respond Quickly!

- Administer epinephrine quickly
- Activate EMS – 911
- Then, call emergency contacts
Key Points in the use of MDI’s and EPI-Pens in School:

- Ensure that emergency plans are in place for accidental ingestion of allergic foods.
- Ensure that all teachers and caregivers are aware of the potential food allergies.
- Ensure that back-up plans are in place for substitute teachers.
- Ensure that contact from food allergens is avoided (use hand washing and wipes).
Key Points in the use of MDI’s and EPI-Pens in School:

• Keep several EPI-PENs at school if needed and child has had a severe reaction.
• Treat acute brochospasm that results in children who are exposed to peanuts, nuts, etc.
• Always have the school call 911 when an acute reaction results in Epi-Pen use.
• SCHEDULE REGULAR FOLLOW-UP VISITS!!!!
The Illinois Emergency Epinephrine Act,

- **PA97-0361**, allows schools to stock a supply of epinephrine auto-injectors, authorizes schools to enter into an agreement with a physician to provide the school with a prescription to obtain the auto-injectors, and gives school nurses (RN) the power to administer the epinephrine to any student whom the registered nurse believes is having an anaphylactic reaction.
Tool Kit for Epi-Pen Use in Schools

- The Illinois Attorney General's office and other agencies and associations last year produced the "Physician’s Toolkit", which among other objectives, can assist a physician in writing the school prescription. The "toolkit" also answers physician questions on liability.

Accidents Are Never Planned

Emergency medications and a treatment plan must be immediately available and accessible at all times!

HAVE ANAPHYLAXIS DRILLS!!!
This is available for download. Parents can add their child’s photo on the plan and review it with caregivers/schools.

Available at: www.aaaai.org

MYTH: Prior Episodes Predict Future Reactions

• No predictable pattern

• Severity depends on:
  – Sensitivity of the individual
  – Dose of the allergen
  – Other factors (e.g., food matrix effects, exercise, concurrent medications, airway hyperresponsiveness)

• Must always be prepared for an emergency
Additional Resources

• Food Allergy and Anaphylaxis Network -- http://www.foodallergy.org

• Allergy & Asthma Network/Mothers of Asthmatics, Inc. -- http://www.aanma.org

• American Academy of Allergy, Asthma, and Immunology -- http://www.aaaai.org

• American Academy of Pediatrics -- http://www.aap.org
Additional Resources

- American College of Allergy, Asthma, and Immunology -- http://www.acaai.org
- Asthma & Allergy Foundation of America -- http://www.aafa.org/home
- Food Allergy Initiative -- http://www.foodallergyinitiative.org
- International Food Information Council Foundation -- http://www.ific.org
My Contact Information

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Questions?????