What in the Heck is Anaphylaxis?

An Update on Anaphylaxis Definitions

Jay Lieberman, MD
Associate Professor
The University of Tennessee Health Science Center
LeBonheur Children’s Hospital

Objectives

• The learner should be able to:
  1. Assess current definitions of anaphylaxis
  2. Discuss how the definitions differ
  3. Debate pros and cons of current definitions
The Journey Begins

From Richet’s Nobel Prize Lecture in 1913

“This neologism I invented twelve years ago on the assumption, which I think is still valid, that a new idea calls for a new word in the name of scientific precision of language.

*Phylaxis*, a word seldom used, stands in the Greek for protection. *Anaphylaxis* will thus stand for the opposite. *Anaphylaxis*, from its Greek etymological source, therefore means that state of an organism in which it is rendered hypersensitive, instead of being protected.”

https://www.nobelprize.org/prizes/medicine/1913/richet/lecture/
Where Are We Now?

<table>
<thead>
<tr>
<th>NIAID</th>
<th>Practice Parameters</th>
<th>WAO</th>
<th>EAACI</th>
<th>Brighton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death.</td>
<td>An acute life-threatening systemic reaction with varied mechanisms, clinical presentations, and severity that results from the sudden release of mediators from mast cells and basophils.</td>
<td>Anaphylaxis is a serious systemic hypersensitivity reaction that is usually rapid in onset and may cause death.</td>
<td>Anaphylaxis is a severe (potentially) life-threatening generalized or systemic hypersensitivity reaction.</td>
<td>Anaphylaxis is an acute hypersensitivity reaction with multi-organ-system involvement that can present as, or rapidly progress to, a severe life-threatening reaction.</td>
</tr>
</tbody>
</table>

J Allergy Clin Immunol 2006;117:391-7
J Allergy Clin Immunol 2010;126:477-80 e1-42
World Allergy Organ J 2020;13:100472
Allergy 2014;69:1026-45
Vaccine 2007;25:5675-84
Why Does it Matter?

- Epidemiologic studies
- Clinical studies for biomarkers of disease
- Clinical studies for therapeutics
- Direct care for the patient

NIAID/FAAN

“Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death.”

TABLE I. Clinical criteria for diagnosing anaphylaxis

Anaphylaxis is highly likely when any one of the following 3 criteria are fulfilled:

1. Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (eg, generalized hives, pruritus or flushing, swollen lips-tongue-uvula)

   AND AT LEAST ONE OF THE FOLLOWING

   a. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)
   b. Reduced BP or associated symptoms of end-organ dysfunction (eg, hypotension [collapse], syncope, incontinence)

2. Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours):

   a. Involvement of the skin-mucosal tissue (eg, generalized hives, itch-flush, swollen lips-tongue-uvula)
   b. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)
   c. Reduced BP or associated symptoms (eg, hypotension [collapse], syncope, incontinence)
   d. Persistent gastrointestinal symptoms (eg, crampy abdominal pain, vomiting)
   e. Reduced BP after exposure to known allergen for that patient (minutes to several hours):
      - Infants and children: low systolic BP (age specific) or greater than 30% decrease in systolic BP*.
      - Adults: systolic BP of less than 90 mm Hg or greater than 30% decrease from that person’s baseline

PEF: Peak expiratory flow; BP, blood pressure.
*Low systolic blood pressure for children is defined as less than 70 mm Hg from 1 month to 1 year, less than (70 mm Hg + [2 × age]) from 1 to 10 years, and less than 90 mm Hg from 11 to 17 years.
WAO 2020

Anaphylaxis is highly likely when any one of the following 2 criteria are fulfilled:

1. Acute onset of an illness (minutes to several hours) with simultaneous involvement of the skin, mucosal tissue, or both (eg, generalized hives, pruritus or flushing, swollen lips-tongue-uvula)

AND AT LEAST ONE OF THE FOLLOWING:

a. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)

b. Reduced BP or associated symptoms of end-organ dysfunction (eg, hypotonia [collapse], syncope, incontinence)

c. Severe gastrointestinal symptoms (eg, severe crampy abdominal pain, repetitive vomiting), especially after exposure to non-food allergens

2. Acute onset of hypotension\(^a\) or bronchospasm\(^b\) or laryngeal involvement\(^c\) after exposure to a known or highly probable allergen\(^d\) for that patient (minutes to several hours), even in the absence of typical skin involvement.

A Quick Experiment

- A 12-month-old with a history of mild eczema eats scrambled egg for the first time.
- Within minutes, he develops hives all over his body and vomits

Is This Anaphylaxis

- Yes 82%
- No 18%

Would You Treat with Epi

- Yes 67%
- No 33%

# Does This Case Meet Criteria?

<table>
<thead>
<tr>
<th>NIAID</th>
<th>WAO</th>
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<tr>
<td>Criterion 2: Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours):</td>
<td>1. Acute onset of an illness (minutes to several hours) with simultaneous involvement of the skin, mucosal tissue, or both (eg, generalized hives, pruritus or flushing, swollen lips-tongue-uvula) AND AT LEAST ONE OF THE FOLLOWING:</td>
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<td>a. Involvement of the skin-mucosal tissue (eg, generalized hives, itch-flush, swollen lips-tongue-uvula)</td>
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<td>b. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)</td>
<td>b. Reduced BP or associated symptoms of end-organ dysfunction (eg, hypotonia [collapse], syncope, incontinence)</td>
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<td>c. Reduced BP or associated symptoms (eg, hypotonia [collapse], syncope, incontinence)</td>
<td>c. Severe gastrointestinal symptoms (eg, severe crampy abdominal pain, repetitive vomiting), especially after exposure to non-food allergens</td>
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<tr>
<td>d. Persistent gastrointestinal symptoms (eg, crampy abdominal pain, vomiting)</td>
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## A Quick Experiment

- A 14-year-old atopic boy with grass allergy and moderate persistent asthma, currently controlled on medium-dose inhaled corticosteroid develops generalized itching and wheezing when playing touch football on his lawn during the summer while the neighbor was mowing his grass.

**Is This Anaphylaxis**

- Yes: 21%
- No: 79%

**Would You Treat with Epi**

- Yes: 14%
- No: 86%
### Does This Case Meet Criteria?

**NIAID**

**Criterion 1:**

Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (e.g., generalized hives, pruritus or flushing, swollen lips-tongue-uvula) AND AT LEAST ONE OF THE FOLLOWING:

- a. Respiratory compromise (e.g., dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)
- b. Reduced BP or associated symptoms of end-organ dysfunction (e.g., hypotonia [collapse], syncope, incontinence)

**WAO**

1. Acute onset of an illness (minutes to several hours) with simultaneous involvement of the skin, mucosal tissue, or both (e.g., generalized hives, pruritus or flushing, swollen lips-tongue-uvula) AND AT LEAST ONE OF THE FOLLOWING:

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   - b. Reduced BP or associated symptoms of end-organ dysfunction (e.g., hypotonia [collapse], syncope, incontinence)
   - c. Severe gastrointestinal symptoms (e.g., severe crampy abdominal pain, repetitive vomiting), especially after exposure to non-food allergens

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### And Don’t Get Me Started About Severity

[Link to article: Standardizing double-blind, placebo-controlled oral food challenges: American Academy of Allergy, Asthma & Immunology-European Academy of Allergy and Clinical Immunology PRACTALL consensus report](https://j-a-acad-allergy-immunol-2013-13-0268-tx.10.1016/j.jaai.2013.05.017)


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**Le Bonheur Children’s Hospital**
The Most Recent Version

Severity grading system for acute allergic reactions (Pocket Guide)

<table>
<thead>
<tr>
<th>Severity grades</th>
<th>Clinical criteria examples (see sub-grading system for complete criteria)</th>
</tr>
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<tbody>
<tr>
<td>5 ANY Severe: Cardiovascular, Neurologic, Respiratory</td>
<td>Cardiovascular: anaphylactic shock, cardiac arrest; Infants: hypotension</td>
</tr>
<tr>
<td>Neurologic: Glasgow Coma Scale (GCS: <a href="https://www.mdcalc.com/glasgow-coma-score-chart">https://www.mdcalc.com/glasgow-coma-score-chart</a>) &lt; 13, ataxia; Infants: hypotonia</td>
<td></td>
</tr>
<tr>
<td>Respiratory: respiratory failure, stridor with increased work of breathing (WOB), bronchospasm with minimal/no air movement and increased WOB</td>
<td></td>
</tr>
<tr>
<td>4 ANY Moderate: Cardiovascular, Neurologic, Respiratory OR</td>
<td>Cardiovascular: hypotension, syncope; Infants: mottling, cyanosis</td>
</tr>
<tr>
<td>Neurologic: GCS 3-14; Infants: lethargy</td>
<td></td>
</tr>
<tr>
<td>Respiratory: new onset persistent cough, hypoxemia, increased WOB (+/- wheezing), stridor w/o increased WOB</td>
<td></td>
</tr>
<tr>
<td>Mucosal/angioedema: severe oropharyngeal (tongue/ palate/uvula) swelling</td>
<td></td>
</tr>
<tr>
<td>3 ANY MILD: Cardiovascular, Neurologic, Respiratory</td>
<td>Cardiovascular: weak, dizziness, palpitations; Infants: tachycardia not related to other causes such as crying, discomfort, or medications</td>
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<tr>
<td>Neurologic: confusion, drowsiness; Infants: unexplained irritability, decreased activity</td>
<td></td>
</tr>
<tr>
<td>Respiratory: dyspnea, chest tightness; new onset cough, wheezing w/o increased WOB</td>
<td></td>
</tr>
<tr>
<td>Mucosal/angioedema: mild oropharyngeal swelling</td>
<td></td>
</tr>
<tr>
<td>2 or more MILD, ANY Moderate: Skin, Gastrointestinal, Mucosal/angioedema</td>
<td>Skin: MILD localized urticaria, erythema; Moderate: generalized urticaria, erythema</td>
</tr>
<tr>
<td>Gastrointestinal: Mild: 1-2 episodes of emesis/diarrhea; Moderate: ≥ 3 episodes of emesis/diarrhea</td>
<td></td>
</tr>
<tr>
<td>Mucosal/angioedema: Mild: facial swelling, rhinorrhea; Moderate: moderate oropharyngeal swelling</td>
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<tr>
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So . . . . We Have the 3 Stages of Anaphylaxis Knowledge
Objectives

- Understand the evidence for epinephrine as first line therapy for anaphylaxis and barriers associated with epinephrine hesitancy
Epinephrine is the treatment of choice for anaphylaxis

- α1-adrenergic agonist
  - ↑ vasoconstriction, peripheral vascular resistance
  - ↓ mucosal edema

- β1-adrenergic agonist
  - ↑ cardiac output

- β2-adrenergic agonist
  - Bronchodilation
  - ↓ mediator release from mast cells and basophils

Efficacy of epinephrine

- No randomized clinical trials in humans

- Venom immunotherapy study showed that patients with systemic reactions to sting challenge responded to epinephrine (n=21)

- Cohort studies of fatal and near fatal anaphylaxis suggest that delayed epinephrine was a risk factor for fatal reactions
  Sampson HA, et al. NEJM 1992
Rate of epinephrine use for community reactions is low

- Low rates of pre-EMS epinephrine use for anaphylaxis from any cause – range from 1.4-74.7% (20 studies)
  - 5 US studies: mean pre-EMS epi use = 26.4%
- Pre-hospital epinephrine use was significantly higher for children vs adults (20.98% vs 7.17%, p=0.0027)

Many barriers to epinephrine use

Survey – 164 caregivers previously prescribed epinephrine autoinjectors for their child, asked details of their most severe reaction

<table>
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<tr>
<th>Reason Epi not used when warranted (N = 73), n (%)</th>
<th>n (%)</th>
</tr>
</thead>
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<tr>
<td>Concerned about adverse effects</td>
<td>5 (6.8)</td>
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<tr>
<td>Do not like to give child medication</td>
<td>5 (6.8)</td>
</tr>
<tr>
<td>Child scared or nervous about needle</td>
<td>3 (4.1)</td>
</tr>
<tr>
<td>Did not know when to use</td>
<td>2 (2.7)</td>
</tr>
<tr>
<td>Did not want to go to emergency department</td>
<td>2 (2.7)</td>
</tr>
<tr>
<td>Caregiver not with child</td>
<td>1 (1.4)</td>
</tr>
<tr>
<td>Did not want to call 911</td>
<td>1 (1.4)</td>
</tr>
</tbody>
</table>

Reason: Symptoms did not seem severe enough

Spectrum of allergic reactions

Mild allergic reaction

- Acute onset of an illness with involvement of the skin, mucosal tissue, or both
- Respiratory compromise and/or Reduced BP or symptoms of end-organ dysfunction

Severe reaction/Anaphylaxis

- Exposure to a likely allergen and 2 or more:
  - Skin-mucosal symptoms
  - Respiratory compromise
  - Reduced BP or associated symptoms of end-organ dysfunction
  - Persistent GI symptoms

- Exposure to known allergen and
  - low systolic BP or greater than 30% decrease from that patient’s baseline

### Not all reactions have skin symptoms

<table>
<thead>
<tr>
<th>Category</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cutaneous</strong></td>
<td>urticaria, angioedema, pruritus, flushing, rash</td>
</tr>
<tr>
<td>80-90%</td>
<td></td>
</tr>
<tr>
<td><strong>Respiratory</strong></td>
<td>upper airway $\rightarrow$ rhinitis, stridor, hoarseness, sneezing</td>
</tr>
<tr>
<td>up to 70%</td>
<td>lower airway $\rightarrow$ cough, wheeze, dyspnea, cyanosis</td>
</tr>
<tr>
<td><strong>Cardiovascular</strong></td>
<td>vasodilation, tachycardia, arrhythmia, hypotension, shock</td>
</tr>
<tr>
<td>up to 45%</td>
<td></td>
</tr>
<tr>
<td><strong>Gastrointestinal</strong></td>
<td>swelling of lips/tongue, palatal itch, nausea, vomiting, abdominal cramps, diarrhea</td>
</tr>
<tr>
<td>up to 45%</td>
<td></td>
</tr>
<tr>
<td><strong>Neurologic</strong></td>
<td>anxiety, headache, seizure, LOC</td>
</tr>
<tr>
<td>up to 15%</td>
<td></td>
</tr>
</tbody>
</table>

### Signs and symptoms described differently for young children

**Table IV.** Alternative, age-specific symptoms/signs used in this study to help identify anaphylaxis in infants/toddlers

<table>
<thead>
<tr>
<th>Language used in current diagnostic criteria*</th>
<th>Language used in AAFA Infant Toddler Anaphylaxis Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pruritus</td>
<td>Tongue thrusting, tongue pulling, repetitive lip licking, or licking of hands or objects. Throat itching. Ear pulling, scratching, or putting fingers in the ears. Eye rubbing, eye itching</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>Belly breathing, fast breathing, nasal flaring, chest or neck “tugging”</td>
</tr>
<tr>
<td>Stridor</td>
<td>Hoarse voice, hoarse cry. Barking/croup-like cough</td>
</tr>
<tr>
<td>Reduced PEF</td>
<td>(Currently no appropriate and practical way to get FEV&lt;sub&gt;1&lt;/sub&gt; in this population in acute setting)</td>
</tr>
<tr>
<td>Reduced BP (low systolic BP [age specific] or greater than 30% decrease in systolic BP)</td>
<td>(Blood pressure in this population can be challenging to acquire and interpret. Hypotension is also a late phase cardiovascular symptom in this age group. Tachycardia may be an earlier vital sign change) Wobbly appearance, lethargic, floppy, poor head control, difficult to wake up. Craniness, withdrawn or clingy, inconsolable crying, subdued or less active, limp. Motting of the skin or blue/grey skin (cyanosis) around mouth/lips or hands/feet</td>
</tr>
<tr>
<td>Hypotonia (collapse), syncope</td>
<td>Wobbly appearance, lethargic, floppy, poor head control, difficult to wake up. Craniness, withdrawn or clingy, inconsolable crying, subdued or less active, limp</td>
</tr>
<tr>
<td>Incontinence</td>
<td>(Can be challenging to differentiate in diaper wearing population) Abdominal pain, diarrhea, hiccups, spitting up, back arching, vomiting</td>
</tr>
<tr>
<td>Persistent gastrointestinal symptoms</td>
<td>Abdominal pain, diarrhea, hiccups, spitting up, back arching, vomiting</td>
</tr>
</tbody>
</table>

*Clinical criteria for diagnosing anaphylaxis from Sampson et al. \(^3\)

Underuse of epinephrine in ED

- 1090 ED patients who met NIAID/FAAN criteria for anaphylaxis at the Mayo Clinic between 2010-2018
- Patients triaged using the Emergency Severity Index (ESI)

<table>
<thead>
<tr>
<th></th>
<th>Higher acuity (level 1 or 2) N=541</th>
<th>Lower acuity (level 3 or 4) N=549</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received epinephrine</td>
<td>53%</td>
<td>40%</td>
</tr>
<tr>
<td>Time to epinephrine</td>
<td>13 min</td>
<td>28 min</td>
</tr>
</tbody>
</table>

Recognizing and treating anaphylaxis are separate decisions

- Survey study, 1001 pediatricians completed survey
- Presented with 8 case-based scenarios of allergic reactions with the following 2 questions for each case:
  - Does this case represent anaphylaxis?
  - If this patient immediately presented to you, would you treat the patient with epinephrine during the reaction?
Discordance between anaphylaxis diagnosis and epinephrine treatment in 8% of the cases.

Average of 5% indicated that the case represented anaphylaxis but would not warrant epinephrine

Average of 3% suggested that the case did not represent anaphylaxis but that epinephrine was warranted

### Table 1

Case scenarios | Does this case represent anaphylaxis? | Would you treat this patient with epinephrine? | Discordant: anaphylaxis, no epinephrine | Discordant: no anaphylaxis, yes epinephrine
---|---|---|---|---
1. A 16-year-old female with a history of urticaria after eating egg for the first time. Within minutes, she develops hives all over her body and vomits. | 55% | 55% | 11% | 1%
2. A 5-year-old child with no medical history is stung by an insect that she believes to be a wasp. Within minutes, she develops hives and swelling at the site of the sting and generalized itching. Approximately 30 minutes after, she develops a sense of dyspnea. No vomiting is noted on examination. | 80% | 80% | 11% | 1%
3. A 4-year-old child with a history of egg allergy and who had a history of anaphylaxis to egg develops hives minutes after tasting a cookie brought to school by a friend. | 85% | 85% | 11% | 1%
4. A 12-year-old with a history of peanut allergy and with urticaria at the site of previous treatment. | 95% | 95% | 11% | 1%
5. A 10-year-old child with known postural anaphylaxis and acute urticaria. | 82% | 82% | 11% | 1%
6. A healthy 15-year-old boy who eats an egg and begins experiencing the inability to sit up with hives all over his body, respiratory distress, severe abdominal pain, and vomiting. He was first seen when he was 2 hours old and developed symptoms within minutes. | 82% | 82% | 11% | 1%
7. A 7-year-old girl with a history of anaphylaxis after eating chicken, and now with hives all over her body, severe abdominal pain, and vomiting. | 42% | 42% | 11% | 1%
8. A 2-year-old girl exhibits respiratory distress with suspected anaphylaxis. | 42% | 42% | 11% | 1%

*Percentages represent the number of responders who selected “yes” to the question asked.

**Case:** A 12-month old with a history of mild eczema eats scrambled egg for the first time. Within minutes, he develops hives all over his body and vomits.
Reason: Used other medication instead (of epinephrine)

Epinephrine is first line treatment

- Antihistamines are considered 2\textsuperscript{nd} line
- Corticosteroids have no role in the acute management of anaphylaxis

“Patients with complete resolution of symptoms with epinephrine do not need to be prescribed antihistamines or corticosteroids thereafter.”

**Early use of epinephrine is associated with improved outcomes**

- Hasbro Children’s Hospital/Rhode Island Hospital
  Early epinephrine associated with significantly decreased risk of hospitalization

- Canada (C-CARE study)
  Pre-ED epinephrine associated with decreased likelihood of multiple epinephrine doses in the ED

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehospital epinephrine</td>
<td>0.22*</td>
<td>0.13-0.37</td>
</tr>
<tr>
<td>Prehospital corticosteroids</td>
<td>0.79</td>
<td>0.19-3.39</td>
</tr>
<tr>
<td>Prehospital antihistamines</td>
<td>0.50*</td>
<td>0.41-0.82</td>
</tr>
</tbody>
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**Delayed epinephrine is a risk factor for biphasic reactions**

- Pooled estimate of biphasic reactions = 3.92% (95% CI, 2.88, 5.32)

- Delayed epinephrine associated with risk of biphasic reaction
  - Median time from symptoms onset to first epinephrine dose was longer for those with biphasic reactions (78 vs 45 min, p=0.005)

- First epinephrine dose in ED and delay of 30 min between symptom onset and epinephrine dose were associated with biphasic reactions (OR 3.72 and 3.39, respectively)

Key Clinical Advice

- Severe anaphylaxis and/or needing multiple epinephrine doses are risk factors for biphasic anaphylaxis

- Antihistamines and glucocorticoids are not reliable interventions to prevent biphasic anaphylaxis
Reason: Concerned about adverse effects

IM epinephrine is safe

Retrospective observational study of ED cases of anaphylaxis

- 362 doses of epinephrine for 301 patients
- 8 CV adverse events and 4 overdoses with 8 different patients
- Adverse CV events: 10% IV vs 1.3% IM (OR 8.7 [95% CI, 1.8-40.7], P = .006)
- Overdose: 13.3% IV vs 0% IM (odds ratio 61.3 [95% CI, 7.5 to ∞], P < .001)

No absolute contraindication

- Common side effects:
  - pallor, tremor, anxiety, palpitations, headache, dizziness

- Rare, severe:
  - pulmonary edema, ventricular arrhythmia, myocardial infarction, intracranial hemorrhage
  - usually due to errors: incorrect dose, incorrect route, inappropriate dilution

Reason: Scared/nervous about the reaction

Boyce et al. J Allergy Clin Immunol 2010
Stress of the reaction can impact management

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</tbody>
</table>


Other barriers to epinephrine use
Epinephrine is not always prescribed

- Epinephrine prescription rates – North American studies show range of 23.6-45.74%
- Factors influencing Rx
  - History of previous reactions to the allergen
  - High parental anxiety
  - Nut allergy
- No difference in prescribing patterns between allergists vs generalists


Health literacy impacts management

- 100 caregivers surveyed
- Health literacy assessed using the Newest Vital Sign (NVS)
- validated index with 6 questions related to ability to read an ice cream label

Lower health literacy associated with sub-optimal allergy management

- High likelihood of limited health literacy (15%) or possible limited health literacy (35%)
- Lower health literacy (lower NVS score)
  - Fewer correct steps for epinephrine autoinjector use
  - Failure to carry epinephrine autoinjector
  - Higher rate of food allergy reactions in the previous 12 months
  - Knowledge gaps in treatment of allergic reactions


Adolescent behavior with epinephrine autoinjectors

- 9816 students from the SchoolNuts study
- 10-14 years (and their parents) completed self-administered questionnaires
- 620 students had likely IgE-mediated food allergy
  - 234 (38%) of these had been prescribed an epinephrine autoinjector

Adolescents are inconsistently self-carrying

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provided their EAI and anaphylaxis action plan to their school</td>
<td>93%</td>
</tr>
<tr>
<td>Never carrying their EAI in 1 or more locations</td>
<td>49%</td>
</tr>
<tr>
<td>Never carried it when they were by themselves</td>
<td>32%</td>
</tr>
<tr>
<td>Never carried it while out with friends</td>
<td>28%</td>
</tr>
<tr>
<td>Never carried their EAI to sporting activities</td>
<td>36%</td>
</tr>
</tbody>
</table>


Summary

- Epinephrine is the treatment of choice for anaphylaxis
- Signs and symptoms of anaphylaxis are not always easy to identify
- Clinicians do not always agree on the diagnosis and epinephrine use for anaphylaxis
- Many barriers to epinephrine use have been identified and further research is needed to determine best strategies to overcome them
Thank you!