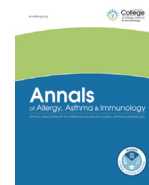




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# Factors contributing to underuse of epinephrine autoinjectors in pediatric patients with food allergy



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## ABSTRACT

**Background:** Epinephrine autoinjectors (EAs) are the standard of care for severe food allergic reactions, although they are frequently underused or misused.

**Objective:** To understand the factors associated with underuse of EA by caregivers of pediatric patients with food allergy.

**Methods:** A survey was administered to 200 caregivers of pediatric patients with food allergies to assess most severe lifetime allergic reaction, EA education, and use and factors associated with incorrect use or underutilization.

**Results:** A total of 164 surveys were completed; of which 118 (72%) of lifetime most severe reactions warranted EA use, but the EA was used in only 45 (38.1%). Reasons caregivers indicated for not administering the EA included the following: reactions did not seem severe enough; it was the patient's first allergic reaction; use of other medication; and fear of using EA.

**Conclusion:** Multiple factors contribute to underuse of EA in the treatment of severe allergic reactions. Results from this study highlight the need for continuous EA education in caregivers of and pediatric patients with food allergies, using a multipronged approach targeting clear symptom recognition and alleviation of fear of EA use.

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## Introduction

Anaphylaxis is a life-threatening condition that is estimated to occur in 1.6% of the population in the United States.<sup>1</sup> Food is the most common trigger for anaphylaxis in children, and up to 8% of children in the United States have food allergy.<sup>1–5</sup> There are approximately 125,000 food-induced allergic reaction emergency department visits per year in the United States, 14,000 of which are

due to anaphylaxis.<sup>6</sup> Anaphylactic reactions are frequently under-treated.<sup>6–8</sup>

Despite education about food avoidance, reactions owing to accidental ingestion of food allergens still occur.<sup>5,6</sup> The treatment of choice for anaphylaxis is intramuscular epinephrine, and guidelines support the prescription of epinephrine autoinjector (EA) to patients with food allergy to ensure prompt access to life-saving medication if anaphylaxis occurs outside the medical setting.<sup>1</sup> Correct use of EA is surprisingly low, ranging from 16% to 32%, measured through both observational studies and patient report.<sup>9–14</sup> Although patients or their caregivers are advised to carry an EA with them at all times, studies reveal that only approximately half of the patients regularly carry an unexpired EA.<sup>15</sup> A recent meta-analysis of EA use found that the most common reasons for pitfalls in the use of EA are lack of autoinjector availability, inadequate education of parents on how to administer the epinephrine, concern for systemic effects, failure to administer correctly, and accidental administration.<sup>16,17</sup> This study aimed to identify parental factors that contribute to the underuse of EA during anaphylactic reactions in pediatric patients.

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## Methods

### Study Participants

Participants were recruited from the Jaffe Food Allergy Institute at the Mount Sinai Hospital in New York, New York. Surveys were offered to 200 caregivers of children with food allergy during office visits from June 1, 2017, to October 1, 2018. Anonymous surveys were completed before allergy education was provided during the visit. Inclusion criteria required physician-diagnosed food allergy, and all patients must have previously been prescribed EA. The study was approved and written informed consent was waived by the Icahn School of Medicine at Mount Sinai Hospital Institutional Review Board.

### Survey

A trained research assistant or clinical nurse distributed the survey to caregivers of children with food allergies. The anonymous survey was self-administered and collected at the end of the visit. Information collected included demographics, allergy and anaphylaxis history and previous experience with EA use, education, and confidence. The participants were asked to rate their confidence in EA use on the basis of past experience and training, with a score of 1 being “very confident” and 5 being “not confident at all.” The allergy history section of the survey focused on lifetime allergens, symptoms at time of most severe reaction, medication use (EA and other) at time of most severe reaction, and reasons for medication use or lack of use during most severe reaction (eSupplement 1).

### Statistics

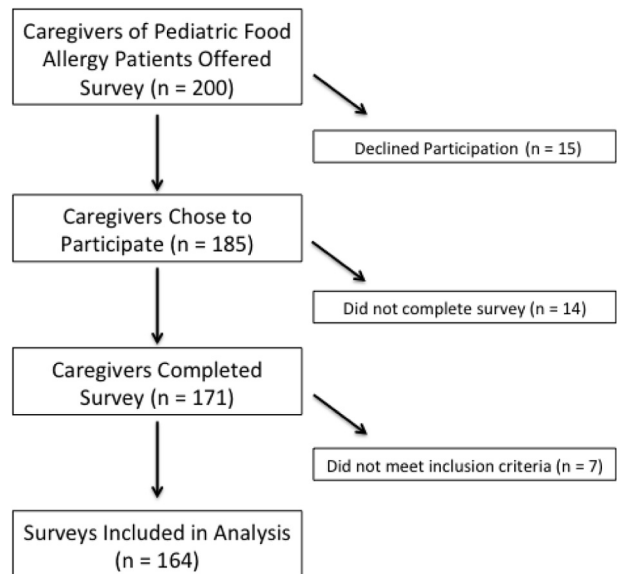
Data were analyzed using frequency analysis for demographic trends and descriptive statistics. Multiple regression analysis (Statistical Product and Service Solutions [SPSS Inc, Chicago, Illinois], R [The R Foundation, Vienna, Austria]) was conducted to evaluate the relationship between the lack of EA use (when it should have been used) and (1) type of EA education received by caregiver, (2) patient food allergen, (3) symptoms experienced at time of most severe reaction, (4) caregiver level of confidence in using the EA, and (5) patient-reported cause for lack of EA use. Analyses were conducted by Pearson’s correlation and Fisher’s chi-square tests. *P* values less than .05 were considered statistically significant findings.

## Results

A total of 200 surveys were distributed to caregivers during the study time frame. There were 15 caregivers who declined participation; 14 agreed to participate but did not return the survey to the study investigators. Of the remaining 171 surveys, 7 did not meet the inclusion criteria (3 patients had never received prescription for EA and 4 patients did not have a definitive diagnosis of food allergy). A total of 164 completed surveys were included for analysis (Fig 1).

A total of 69.5% of the pediatric patients were boys. The mean patient age was 7.5 years ( $\pm 5.2$  years), and the average caregiver age was 40.6 years ( $\pm 10.2$  years). The caregivers were 76.8% patient mothers, 22.6% fathers, and 0.06% other. Further demographic information on the surveyed population can be found in Table 1. The most common food allergens were tree nuts ( $n = 139$ ; 84.8%), peanuts ( $n = 108$ ; 65.9%), egg ( $n = 58$ ; 35.4%), sesame ( $n = 48$ ; 29.3%), and milk ( $n = 47$ ; 28.7%). Most patients had an associated atopic condition, including eczema ( $n = 117$ ; 71.3%), pollen allergy ( $n = 89$ ; 54.3%), and asthma ( $n = 60$ ; 36.6%).

All but one of the caregivers reported previously receiving education on how to use the prescribed EA (Table 2). The most common mode of teaching was by verbal instruction ( $n = 149$ ; 90.9%), most frequently done by allergy specialist physicians



**Figure 1.** Flow of survey distribution in Mount Sinai Faculty Practice clinic office visits. A trained research assistant or nurse distributed all the surveys. Patient caregivers completed the survey without help from the staff.

( $n = 156$ , 95.1%). General pediatricians were the second most common teacher of how to use the EA ( $n = 63$ ; 38.4%). In addition to verbal instructions, caregivers were educated using printed materials ( $n = 137$ ; 83.5%) and live demonstrations ( $n = 134$ ; 81.7%). When asked how confident they were in their ability to use the EA in the case of a severe allergic reaction, 71 (43.3%) caregivers stated “very confident,” whereas 69 (42.1%) stated “fairly confident,” 21 (12.2%) stated “somewhat confident,” 3 (1.8%) stated “not too

**Table 1**  
Demographics

Child age (mean $\pm$ SD)	7.5 $\pm$ 5.2 y
Child sex (%)	
Male	69.5
Female	29.9
Caregiver age (mean $\pm$ SD)	40.5 $\pm$ 10.2 y
Caregiver relationship to child (%)	
Mother	76.8
Father	22.6
Legal guardian	0.6
Marital status (%)	
Married	90.2
Single, never married	3.4
Divorced	3.4
Decline to respond	2.4
Living with partner	0.6
Self-identified race (%)	
White	79.3
Asian	13.4
Black or African American	4.3
Other	2.4
Native Hawaiian or Pacific Islander	0.6
Level of school completed (%)	
Graduate degree	62.2
4-y college	34.1
2-y college	3.7
Number of people in household (mean $\pm$ SD) =	4.0 $\pm$ 1.1
Annual household income (%)	
>\$150,000	75.6
\$100,000-\$150,000	14.6
\$75,000-\$100,000	3.7
\$50,000-\$75,000	0.6
Do not know	1.2
Declined to respond	4.3

**Table 2**  
EA Education

Provider responsible for caregiver education, n (%)	
Allergist	156 (95.1)
Pediatrician (PCP)	63 (38.4)
Nurse	23 (14.0)
Another doctor	18 (11.0)
Online	6 (3.7)
Nutritionist	4 (2.4)
Pharmacist	1 (0.6)
Other <sup>a</sup>	1 (0.6)
Teaching method, n (%)	
Verbal	149 (90.9)
Printed	137 (83.5)
Demonstration	134 (81.7)
Other <sup>b</sup>	1 (0.6)
Time since previous EA education, n (%)	
Today	11 (6.7)
1-3 mo ago	41 (25.0)
4-6 mo ago	21 (12.8)
7-9 mo ago	11 (6.7)
10-12 mo ago	19 (11.6)
>12 mo	58 (35.4)
Other <sup>a</sup>	1 (0.6)
Caregiver EA use confidence, n (%)	
Very confident	71 (43.3)
Fairly confident	69 (42.1)
Somewhat confident	20 (12.2)
Not too confident	3 (1.8)

Abbreviations: EA, epinephrine autoinjector; PCP, primary care provider.

NOTE: Caregivers were instructed to check off as many answers that apply for all questions, rather than just one response. Total numbers are reflective of this.

<sup>a</sup>Not specified by caregiver; education might have been provided by more than 1 provider.

<sup>b</sup>Video.

confident,” and 1 failed to respond. No caregivers stated that they were not at all confident in administering EA. There was no correlation between the time since receiving EA education and the self-reported caregiver level of confidence in administering EA.

The survey inquired about the most severe allergic reaction the child had ever experienced. All participants reported at least 1 past food-related allergic reaction for their child. The most typically reported symptom (Table 3) was hives (n = 139; 84.8%), followed by itching of skin (n = 82; 50.0%), vomiting (n = 68; 41.5%), swelling of lips (n = 62; 37.8%), itching in throat (n = 61; 37.2%), cough (n = 55; 33.5%), swelling of eye (n = 52; 31.7%), trouble in breathing (n = 51; 31.1%), wheezing (n = 46; 28.0%), pain in stomach (n = 31; 18.9%), change in behavior (n = 27; 16.5%), swelling of tongue (n = 16; 9.8%), chest tightening (n = 13; 7.9%), and diarrhea (n = 10; 6.1%). Severe reactions likely warranting EA use were defined as reactions in which symptoms included any one of the following: trouble in breathing, wheezing, cough, swelling of tongue, dizziness, unintentional urination, chest tightness, loss of consciousness, low blood pressure, or a combination of at least one skin symptom, including pruritus or hives, and at least one gastrointestinal symptom, including itching in throat, swelling of lips, swelling of tongue, swelling of eye, vomiting, or diarrhea. A total of 118 (72.0%) of the reported reactions were classified as severe. Of these severe reactions, EA was used for a minority of reactions (n = 45 [38.1%]).

The caregivers who did not use EA when it was warranted were further questioned about the reason behind this choice (Table 3). Average confidence in EA use was 1.7 plus or minus 0.7 in the cohort at large and 1.95 plus or minus 0.9 in this particular subset. This scales to between “very confident” and “fairly confident” on the distributed survey. The most common reason for lack of EA use in this cohort was that the symptoms did not seem severe enough (n = 35; 47.9%). A significant correlation between lack of use of EA when warranted and belief that symptoms did not seem severe

enough was noted, with a Pearson’s correlation of 0.18 (95% confidence interval [CI], 0.04-0.33; *P* = .016), as found in Table 4. Most of the caregivers used oral antihistamine (diphenhydramine) instead (n = 56; 76.7%). A significant correlation between lack of use of EA when warranted and use of oral antihistamine was noted, with a Pearson’s correlation of 0.27 (95% CI, 0.12-0.40; *P* < .001). A total of 29% (n = 21) reported that they did not use EA because the caregiver was scared or nervous about the reaction; a significant correlation between lack of use of EA when warranted and fear of reaction was noted, with a Pearson’s correlation of 0.26 (95% CI, 0.11-0.40; *P* < .001). In addition, 3 caregivers reported specific fear of the needle as the cause for not using the EA. Another reason that contributed to lack of use of EA in this population was that the patient was evaluated by a nearby doctor (Pearson’s correlation and *P* < .001). No caregivers reported not knowing how to use the EA as a reason for not using it. No one cited financial constraints as a reason for not having the EA available. Moreover, 16 (21.9%) caregivers reported not using the EA not because they were scared or nervous, but because they did not want to administer it.

**Table 3**  
Characteristics of Food Allergies and Reaction

Lifetime allergens, n (%)	
Tree nut	139 (84.8)
Peanut	108 (65.9)
Egg	58 (35.4)
Sesame	48 (29.3)
Milk	47 (28.7)
Other <sup>a</sup>	46 (28.0)
Soy	17 (10.4)
Wheat	16 (9.8)
Symptoms at time of most severe reaction, n (%)	
Hives	139 (84.8)
Pruritus	82 (50.0)
Vomiting	68 (41.5)
Swelling of lips	62 (37.8)
Itching in throat	61 (37.2)
Cough	55 (33.5)
Swelling of eye	52 (31.7)
Trouble breathing	51 (31.1)
Wheezing	46 (28.0)
Pain in stomach	31 (18.9)
Change in behavior	27 (16.5)
Swelling of tongue	16 (9.8)
Other <sup>b</sup>	14 (8.5)
Chest tightening	13 (7.9)
Diarrhea	10 (6.1)
Low blood pressure	4 (2.4)
Loss of consciousness	3 (1.8)
Reason EA not used when warranted (N = 73), n (%)	
Symptoms did not seem severe enough	35 (47.9)
First reaction	30 (41.1)
Used other medication instead	26 (35.6)
Caregiver scared/nervous about reaction	21 (28.8)
Close to hospital or doctor	12 (16.4)
Not nervous or scared, but did not want to give	8 (11.0)
Other (patient-specific scenarios)	7 (9.6)
On way to hospital or doctor	6 (8.2)
Concerned about adverse effects	5 (6.8)
Do not like to give child medication	5 (6.8)
Child scared or nervous about needle	3 (4.1)
Did not know when to use	2 (2.7)
Did not want to go to emergency department	2 (2.7)
Caregiver not with child	1 (1.4)
Did not want to call 911	1 (1.4)

Abbreviation: EA, epinephrine autoinjector.

NOTE: Caregivers were instructed to check off as many answers that apply for all questions, rather than just one response. Total numbers are reflective of this.

<sup>a</sup>Fish/shellfish (n = 20; 12.2%), legumes (n = 12; 7.3%), and mustard (n = 8; 4.9%).

<sup>b</sup>Symptoms include the following: dizziness, unexpected urination, swelling of extremities, feeling of dread, confusion, sleepiness, change in color, runny nose, watery/glossy eyes, bad taste in mouth, itching of ears, swelling of face, sneezing, raspy voice/change in voice, runny nose, and bloody nose.

**Table 4**  
Factors Affecting EA Use With Significant Correlation to Lack of Use at the Time of Severe Reaction

Reason EA not used when warranted	Pearson's correlation; 95% CI; P value
Symptoms did not seem severe enough	0.18; 0.04-0.33; $P = .016$
Used oral antihistamine instead	0.27; 0.12-0.40; $P < .001$
Caregiver scared/nervous about reaction	0.26; 0.11-0.40; $P < .001$
Close to hospital or doctor	0.28; 0.13-0.42; $P < .001$

Abbreviations: CI, confidence interval; EA, epinephrine autoinjector.

There was no statistically significant relationship between patient or caregiver age or caregiver confidence and lack of EA use when the reaction was severe. This was true for both reactions defined as severe owing to airway symptoms and those defined as severe owing to a combination of skin and gastrointestinal symptoms. There was no correlation between the type of education received by caregiver (including both methods of teaching and person who taught) or time since receiving education and the reason caregivers chose not to use EA at the time of the reaction. A total of 24 (14.6%) of all the participants stated that they would have used EA if they had received different education. Furthermore, 15 (20.5%) of the participants that did not use EA when it was likely warranted stated that they would have used EA if they had received different education. Symptoms of cough, trouble breathing, and vomiting were significantly associated with use of EA to treat the allergic reaction (Pearson's correlation and all  $P < .001$ ).

## Discussion

The results of this survey reveal that there are multiple barriers to EA use in severe reactions, and a multipronged approach will be needed to increase EA use for severe reactions in the community setting. The majority of caregivers did not give their allergic children epinephrine at the time of their most severe allergic reactions, when epinephrine injection should have been administered, despite declaring confidence in their ability to treat allergic reactions. Although this is possibly owing to caregivers answering regarding their comfort level at the time of survey administration rather than time of reaction, and desirability bias of the survey-taker, the underuse of EA is not a new phenomenon. Previous studies have sought to address its cause.<sup>7,8</sup> An electronic survey of more than 1000 patients with food allergy has been used to address EA underuse. Researchers found that common causes of EA underuse include the following: lack of EA prescription, use of antihistamine medication at time of severe allergic reaction, mild severity of symptoms, and rapid disappearance of symptoms.<sup>7</sup> Although many of these themes were repeated in this present study, including the use of antihistamine medication and lack of recognition of symptom severity, this survey was different in that it focused solely on caregivers of pediatric patients with food allergy with EA prescriptions, rather than patients of all ages with food allergy without prescription restrictions. This was thus a unique opportunity to understand a population for whom patient education advances are particularly effective and can have lifelong effects.

Caregivers recognized that presence of respiratory symptoms (trouble breathing, cough) was an indication for administering epinephrine. However, many severe reactions were not recognized as needing epinephrine use because the combination of symptoms from multiple organ systems did not seem severe enough. This highlights a critical break in communication regarding what symptoms would be concerning and the benefits prompt administration of epinephrine as early as possible during the course of anaphylaxis. Hesitation to use EA when necessary may be particularly detrimental under circumstances of limited access to

emergency services, such as during the coronavirus disease 2019 pandemic, when proactive at-home management of food-induced anaphylaxis is of critical relevance.<sup>18</sup> Specifically, education must address the combination of less dramatic symptoms or gradual progression of symptoms to many organ systems as a possible presentation of anaphylaxis and the important indication for EA administration.

A third of children with severe reactions were treated with other medications instead. It is unclear whether this is due to more comfort with the other medications, uncertainty about indications for epinephrine, or other factors. This underscores the need for continued focus on educating patients and caregivers to recognize signs and symptoms of anaphylaxis and understanding the role of different allergy medications. A study of a new multidisciplinary educational tool for anaphylaxis management in the school setting revealed efficacy in improving management by school personnel. This aligns with the need to adopt multifaceted educational techniques by patients and caregivers in the healthcare setting.<sup>11</sup>

Another reason for not using the EA when warranted was fear and anxiety regarding the reaction itself on the part of the caregiver. Here, we revealed that despite caregivers reporting confidence and recent education about EA use in clinic, at times of reaction, they feel nervous and/or anxious. This highlights a need to develop effective training strategies to prepare caregivers and increase their confidence to act during stressful situations. This finding complements that found in a recent survey of caregivers of preschool-aged children with food allergies, which revealed that fears about epinephrine administration in young children (aged 3–15 months) limited use of EA at times of reactions.<sup>8</sup> Our results suggest that these feelings are similarly experienced by parents of older children. Physicians have attempted to prepare families for episodes of anaphylaxis by creating individualized emergency action plans, which are delineated procedures to follow during potential anaphylactic reactions in pediatric patients.<sup>19</sup> Data about the presence and use of emergency action plans during severe reactions were not collected in this survey, which is a noted limitation.

It is also remarkable that approximately one-fifth of the caregivers reported choosing not to administer EA. This included those concerned about adverse effects, not liking giving drugs to children, child being nervous about the injection, and not wanting to activate emergency services or go to the emergency department. This observation points toward the need for targeted education to address these concerns. Future research focusing on the effective education strategies and active involvement of pediatric patients and their caregivers in decision making is of great importance.<sup>20</sup>

This was an anonymous survey, and as such, several limitations are acknowledged. First, this study was conducted at 1 outpatient academic hospital-affiliated clinic in New York City, which limits generalizability of these results. Most of the participants reported both high education levels and high annual household incomes. Lower income is associated with greater difficulty in managing food allergies and decreased health literacy, which can result in lack of knowledge of EA use and greater food allergy reaction rates.<sup>10,12,21</sup> Therefore, our findings of lack of recognition of anaphylaxis symptoms and misconceptions regarding medications in this privileged group of highly educated caregivers with excellent access to health care resources are particularly alarming. A study of a broader population reflective of a wider sociodemographic would be needed to identify factors affecting EA use in the general population. Furthermore, selection bias could have skewed the results of this survey study, as caregivers who are more confident in their ability to treat anaphylaxis may have chosen to participate in the study, although only 7.5% declined participation. In addition, this study was subject to recall bias as participants were asked to describe their child's most severe lifetime allergic reaction, which



could have occurred months to years before the survey was completed.

Despite these limitations, strengths of this study include the broad variety of food allergens and allergic symptoms of the surveyed population, the myriad of reasons for lack of EA use listed on the survey, and the opportunity for participants to share their own unique responses. This allowed for a significant amount of data accumulation and a thorough evaluation of the study aim, adding tenacity to the results. Although previous studies have shed light on some causes of EA underuse, including lack of understanding of anaphylaxis diagnostic criteria and use of alternative medications, this survey is the first to highlight fear and anxiety of the reaction itself as a specific, statistically significant, cause of epinephrine underuse in the pediatric food allergy population.<sup>5,6,22</sup> Characterizing these barriers helps to lay the groundwork for educational efforts and novel interventions to improve food allergy management. In conclusion, it is important to account for emotional education, including continued emphasis on symptom recognition, that must take place when teaching families on how to use the EA in children with food allergies. Future research should include analysis of novel educational interventions, such as thorough description of anaphylaxis diagnostic criteria and emphasis on assuaging fear surrounding EA use, for patients with food allergy and the caregivers. Identifying and addressing the range of barriers to treating severe allergic reactions will lead to improved care for children with food allergy.

### Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jana.2020.09.012>.

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### Supplement 1. Food allergy history survey

The purpose of this survey is to better understand our patients' familiarity with their children's food allergies and medications, in order to create updated educational materials for parents. This survey is completely **voluntary** and **anonymous**. We will not collect any identifying information, such as your name or date of birth. We appreciate your time and effort.

#### Section 1: past allergy history

1. What food is your child currently not eating because he/she is allergic to it? (Please mark ALL foods your child is currently not eating because of an allergy to it)	<input type="checkbox"/> Milk <input type="checkbox"/> Egg <input type="checkbox"/> Peanuts <input type="checkbox"/> Tree Nuts <input type="checkbox"/> Soy <input type="checkbox"/> Wheat <input type="checkbox"/> Sesame <input type="checkbox"/> Other: _____
2. How old was your child when you were told he/she had a food allergy?	_____ years
3. Have you ever been told by a doctor that your child also has any of these? (Mark ALL that apply)	<input type="checkbox"/> Eczema <input type="checkbox"/> Asthma <input type="checkbox"/> Allergies to things other than food, like dust, pollen, cat, dog etc. <input type="checkbox"/> None of the above
4. Has your child been prescribed an epinephrine auto-injector for anaphylaxis?	<input type="checkbox"/> Yes <input type="checkbox"/> No If so, please specify which one <input type="checkbox"/> EpiPen <input type="checkbox"/> Auvi-Q <input type="checkbox"/> Adrenaclick <input type="checkbox"/> Other: _____
5. Has anyone taught you what to do when your child has a problem with a food that he/she is allergic to? (Please mark all that apply) If yes, who taught you? What type of information were you given? When were you last provided with this education? How confident are you in your ability to treat an allergic reaction?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Allergist <input type="checkbox"/> Pediatrician <input type="checkbox"/> Other Doctor <input type="checkbox"/> Nurse <input type="checkbox"/> Nutritionist <input type="checkbox"/> Pharmacist <input type="checkbox"/> Online source: _____ <input type="checkbox"/> Other: _____ <input type="checkbox"/> Told me using words <input type="checkbox"/> Gave me printed, written information or handout <input type="checkbox"/> Demonstration <input type="checkbox"/> Other: _____ <input type="checkbox"/> Today <input type="checkbox"/> 1-3 months ago <input type="checkbox"/> 3-6 months ago <input type="checkbox"/> 6-9 months ago <input type="checkbox"/> 9-12 months ago <input type="checkbox"/> More than 12 months ago <input type="checkbox"/> Very confident <input type="checkbox"/> Fairly confident <input type="checkbox"/> Somewhat confident <input type="checkbox"/> Not too confident <input type="checkbox"/> Not confident at all
6. Have any of the following happened to your child due to an allergic reaction? (Mark all that apply).	<input type="checkbox"/> Used an epinephrine auto-injector <input type="checkbox"/> Visited the emergency Room <input type="checkbox"/> Admitted to the Hospital <input type="checkbox"/> Admitted to the intensive care unit

**Section 2: Please choose the most severe of the allergic reactions EVER.**

This is the most important part of the survey, so please answer as honestly and accurately as possible.

7. What symptoms did you see? (check all that apply)  
Please circle the symptoms that worried you the most.

- Trouble Breathing
- Wheezing (breathe with a whistling sound)
- Cough
- Itching in throat
- Itching of skin
- Hives (red, raised, itchy rash)
- Swelling of his/her lips
- Swelling of his/her tongue
- Swelling of his/her eye
- Pain in his/her stomach
- Throw up (Vomiting)
- Diarrhea
- Feel Dizzy
- Pee without planning to
- Change in his/her behavior
- Chest felt tight
- Pass out
- Low blood pressure
- Other: \_\_\_\_\_

8. Was an epinephrine autoinjector available at the time of reaction?  
If yes, who did the medication belong to?  
Who was carrying the medication?

- Yes
- No
- My child
- Someone else present at the time
- School Nurse
- Doctor's Office
- Not sure
- Other: \_\_\_\_\_
- Me
- Someone else present at the time
- My child
- Other: \_\_\_\_\_

9. Was the epinephrine autoinjector used?

- Yes
- No

Did anything go wrong when the epinephrine autoinjector was used?  
If so, please explain.

- Yes
- No

Did your child go to the emergency room after the epinephrine was used?

- Yes
- No

10. If the epinephrine autoinjector was NOT used, what medication, if any, was used instead?

- Benadryl
- Zyrtec
- Claritin
- Albuterol
- Allegra
- None
- Not sure
- Other: \_\_\_\_\_

Why did you not use the epinephrine autoinjector?

Do you think if your doctor had trained you differently or explained the epinephrine autoinjector differently, you would have used the medication?

**Medication not available**

- I did not have it on me.
- I wasn't with my child.
- It was old/expired.
- My doctor did not prescribe epinephrine autoinjectors.
- This was the first reaction so I did not have medication available.

**Knowledge/other steps taken**

- The symptoms did not seem severe enough.
- I did not know how to use the epinephrine autoinjector.
- I did not know when to use the epinephrine autoinjector.
- I misfired it, and then did not have any epinephrine remaining.
- I used other medications instead.
- I was close to the hospital or doctor's office.
- I was on the way to the doctor's office.

**Emotional**

- I was scared/nervous about the reaction.
- I/my child is scared/nervous of needles.
- I was distracted so I did not give the medication.
- I was not nervous, scared, or distracted, but chose not to give the medication.



**Side Effects**

- I was concerned about the side effects of epinephrine.
- I don't like to give my child medications if it is not necessary.
- I did not want to call 911.
- I didn't want to have to go to the emergency room.

**Financial/economic concerns**

- I did not want to waste the medication.
- The medication is expensive so I was unable to fill the prescription.
- The medication is expensive so I did not want to use it unnecessarily.
- I did not want to call 911 or go to the ER because of the medical bills.
- Other: \_\_\_\_
- Yes
- No