

BRIEF COMMUNICATION

## A majority of parents of children with peanut allergy fear using the epinephrine auto-injector

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### Keywords

epidemiology; epinephrine auto-injectors; food allergy; peanut allergy.

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### Abstract

Prompt epinephrine administration is crucial in managing anaphylaxis, but epinephrine auto-injectors (EAI) are underutilized by patients and their families. Children with peanut allergy were recruited from the Allergy Clinics at the Montreal Children's Hospital, food allergy advocacy organizations and organizations providing products to allergic individuals. Parents of children who had been prescribed an EAI were queried on whether they were fearful of using it and on factors that may contribute to fear. A majority of parents (672/1209 = 56%) expressed fear regarding the use of the EAI. Parents attributed the fear to hurting the child, using the EAI incorrectly or a bad outcome. Parents whose child had longer disease duration or a severe reaction and parents who were satisfied with the EAI training or found it easy to use were less likely to be afraid. Families may benefit from simulation training and more education on the recognition and management of anaphylaxis.

Prompt epinephrine administration is crucial in managing anaphylaxis, but epinephrine auto-injectors (EAI) are underutilized by physicians and patients and their families (1–6). Although others have described deficiencies in parental knowledge regarding indications and technical aspects of EAI administration, (7–10) few have examined the parental anxiety associated with its use (11, 12). We identified factors that might contribute to parental fear of using an EAI.

### Abbreviations

CI, confidence interval; EAI, epinephrine auto-injector; MCH, Montreal Children's Hospital; SD, standard deviation; SPT, skin prick test.

### Methods

#### Study design

Children with peanut allergy (eligibility criteria below) were recruited from the Allergy Clinics at the Montreal Children's Hospital (MCH) and allergy advocacy organizations (Table 1). Details on the cohort have been published elsewhere (3).

Children diagnosed at the MCH with peanut allergy between 2000 and 2004 were retrospectively identified through chart review, and those diagnosed at the MCH between 2004 and December 2011 were identified prospectively at their visit. Recruitment from other sources began in 2006, and children were only included once an allergist

**Table 1** Characteristics of respondents and nonrespondents

	Respondents (n = 1229)	Nonrespondents (n = 410)	Difference (95% CI)
Age at recruitment, years			
Mean (SD)	6.9 (3.9)	7.6 (4.0)	-0.7 (-1.2, -0.3)
Range	0-17	0-17	
Age at diagnosis†, years, mean (SD)	2.2 (1.8)	2.4 (2.1)	-0.2 (-0.4, 0.1)
Disease duration at recruitment, years, mean (SD)	4.7 (3.9)	5.3 (4.1)	-0.6 (-1.0, -0.1)
Sex, % boys	62.2	60.5	1.7 (-3.8, 7.1)
Ethnic background of child, % Caucasian	91.9	86.6	5.4 (1.7, 9.0)
Personal atopic history, %			
Atopic dermatitis	53.4	45.6	7.8 (2.2, 13.3)
Asthma	49.5	56.6	-7.1 (-12.7, -1.6)
Allergic rhinitis	37.6	37.6	0.0 (-5.4, 5.4)
Other food allergies	50.7	54.4	-3.7 (-9.3, 1.9)
At least 1 atopic comorbidity	88.1	85.6	2.5 (-1.3, 6.4)
Severity of most severe reaction, %			
No reaction	9.2	13.9	-4.7 (-8.6, -0.9)
Mild (1 or 2 mild symptoms‡)	21.3	25.3	-4.0 (-8.9, 0.9)
Moderate‡	49.8	47.4	2.4 (-3.3, 8.1)
Severe‡	19.8	13.4	6.4 (2.3, 10.4)
Source of recruitment§%, Montreal Children's Hospital	54.4	76.1	-21.7 (-26.6, -16.7)
Age of parents			
Mother, years, mean (SD)	37.9 (5.7)	38.3 (6.0)	-0.4 (-1.0, 0.3)
Father, years, mean (SD)	40.0 (6.2)	40.8 (6.3)	-0.8 (-1.5, -0.1)
Mother's education and work status, %			
Completed high school	8.6	16.6	-8.0 (-11.9, -4.0)
Completed college education	27.3	28.9	-1.6 (-6.7, 3.5)
Completed university education	62.9	52.0	10.8 (5.2, 16.5)
Currently employed	70.6	64.1	6.5 (1.2, 11.8)
Father's education and work status, %			
Completed high school	14.7	21.9	-7.2 (-11.8, -2.6)
Completed college education	26.8	21.4	5.4 (0.6, 10.2)
Completed university education	54.4	51.0	3.3 (-2.4, 9.0)
Currently employed	89.5	87.1	2.4 (-1.2, 6.1)

†Age of first reaction to peanut or age at diagnosis after confirmatory testing.

‡Mild signs/symptoms: pruritus, urticaria, flushing, rhinoconjunctivitis; moderate: angioedema, throat tightness, gastrointestinal complaints, breathing difficulties other than wheeze; severe: wheeze, cyanosis, circulatory collapse.

§Other sources included Anaphylaxis Canada, Association Québécoise des Allergies Alimentaires, the Allergy/Asthma Information Association, MedicAlert Foundation, Paladin, Allergic Living magazine and Dejour les Allergies Alimentaires.

confirmed their diagnosis. Parents provided information on personal and family demographics, atopic history and their child's most severe reaction to peanut.

Parents of children who were prescribed an EAI completed a questionnaire (mailed between January 2008 and December 2011) on whether and why they were afraid to use the EAI, whether their child had ever been treated with an EAI, the type of prescribing physician, whether they had received training and from whom, their level of satisfaction with the training, whether the EAI was easy to use, the interval between the first reaction and the EAI prescription, the initial type of EAI prescribed, whether they had changed devices, and the number of EAIs purchased.

The study was approved by the McGill University Health Centre Research Ethics Board.

#### Criteria for diagnosis of peanut allergy

Children were considered allergic to peanut if they had:

- A convincing history (13) of an allergic reaction and a positive skin prick test (SPT) to peanut or peanut-specific IgE  $\geq 0.35$  kU/l (14) or
- An uncertain or no history of an allergic reaction and either a positive SPT and peanut-specific IgE  $\geq 15$  kU/l (15) or a positive challenge to peanut.

#### Statistical analysis

Descriptive statistics were compiled for all variables. Univariate and multivariate logistic regression analyses were used to examine potential predictors (Table 2) of parental fear (i.e.

**Table 2** Characteristics of participants† stratified by degree of parental fear

	Afraid/somewhat afraid (n = 672)	Not afraid (n = 537)	Difference (95% CI)
<b>Child factors‡</b>			
Age at EAI questionnaire§, years			
Mean (SD)	7.5 (4.1)	9.0 (4.3)	-1.5 (-2.0, -1.0)
Age at diagnosis, years, mean (SD)	2.2 (1.6)	2.2 (1.9)	-0.1 (-0.3, 0.1)
Disease duration at EAI questionnaire, years, mean (SD)	5.4 (4.0)	6.8 (4.4)	-1.4 (-1.9, -1.0)
Sex, % boys	63.7	60.5	3.2 (-2.3, 8.7)
Ethnic background of child, % Caucasian	92.7	91.4	1.3 (-1.8, 4.4)
Personal atopic history, %			
Atopic dermatitis	55.1	51.4	3.7 (-2.0, 9.3)
Asthma	48.7	50.3	-1.6 (-7.3, 4.1)
Allergic rhinitis	36.3	39.1	-2.8 (-8.3, 2.7)
Other food allergies	50.4	51.2	-0.8 (-6.4, 4.9)
At least 1 atopic comorbidity	89.4	86.4	3.0 (-0.7, 6.7)
Severity of most severe reaction, %			
No reaction	9.2	7.8	1.4 (-1.8, 4.6)
Mild (1 or 2 mild symptoms)	21.0	22.0	-1.0 (-5.8, 3.7)
Moderate	52.5	46.7	5.8 (0.1, 11.6)
Severe	17.3	23.5	-6.2 (-10.9, -1.6)
Has required EAI, %	15.8	21.8	-6.0 (-10.5, -1.5)
Source of recruitment%, Mtl Children's Hospital	56.8	50.8	6.0 (0.4, 11.7)
<b>Parental factors</b>			
Age of parents			
Mother, years, mean (SD)	37.2 (5.6)	38.9 (5.7)	-1.6 (-2.3, -1.0)
Father, years, mean (SD)	39.3 (6.2)	40.9 (6.2)	-1.6 (-2.3, -0.9)
Mother's education and work status, %			
High education (college and above)	90.5	89.7	0.8 (-2.6, 4.2)
Currently employed, %	71.3	69.5	1.8 (-3.4, 7.0)
Father's education and work status, %			
High education (college and above)	81.2	80.8	0.4 (-4.1, 4.9)
Currently employed, %	90.8	87.7	3.1 (-0.5, 6.6)
Satisfaction with EAI training, %			
Satisfied	63.0	72.6	-9.5 (-14.9, -4.2)
Somewhat satisfied	14.4	9.6	4.8 (1.0, 8.5)
Not satisfied	3.4	1.0	2.5 (0.8, 4.1)
No training received	19.2	16.9	2.3 (-2.1, 6.7)
EAI easy to use, %	68.0	81.9	-13.9 (-18.7, -9.1)
<b>EAI factors</b>			
Initial prescriber, %			
Paediatrician	10.9	10.4	0.5 (-3.0, 4.0)
Allergist	48.5	50.4	-1.9 (-7.6, 3.8)
Family physician	19.2	21.6	-2.3 (-7.0, 2.3)
Emergency doctor	20.2	16.1	4.1 (-0.3, 8.4)
Other doctor	1.2	1.5	-0.3 (-1.6, 1.0)
Initial Instructor (may be more than 1), %			
Paediatrician	8.0	6.3	1.6 (-1.3, 4.5)
Allergist	35.1	37.7	-2.6 (-8.0, 2.9)
Family Physician	7.1	7.3	-0.2 (-3.2, 2.7)
Emergency Doctor	3.3	2.4	0.9 (-1.0, 2.8)
Other Doctor	0.5	0.6	-0.1 (-0.9, 0.7)
Pharmacist	27.2	22.2	5.0 (0.1, 9.9)
Nurse	11.0	12.7	-1.7 (-5.4, 2.0)
Other or unknown	4.7	4.7	0.0 (-2.4, 2.4)
Time of prescription, %			
Immediately after reaction	33.3	33.7	-0.4 (-5.7, 5.0)
<1 month	16.5	14.3	2.2 (-1.9, 6.3)

**Table 2** (Continued)

	Afraid/somewhat afraid (n = 672)	Not afraid (n = 537)	Difference (95% CI)
1–6 months	18.0	20.3	–2.3 (–6.8, 2.2)
6–12 months	4.5	4.5	0.0 (–2.3, 2.3)
More than 1 year	3.9	5.0	–1.2 (–3.5, 1.2)
Before reaction	12.9	10.8	2.1 (–1.5, 5.8)
At time of diagnosis	2.8	5.0	–2.2 (–4.4, 0.0)
Unknown	8.0	6.3	1.7 (–1.2, 4.6)
Kind of EAI initially prescribed (may be >1), %			
EpiPen	91.5	94.6	–3.1 (–5.9, –0.2)
TwinJect	9.1	7.1	2.0 (–1.1, 5.1)
Other	0.3	0.2	0.1 (–0.4, 0.7)
Unknown	0.7	0	0.7 (0.1, 1.4)
Type of device changed, %	22.3	23.3	–0.9 (–5.7, 3.8)
Number of EAI's purchased (SD)	2.7 (1.3)	2.7 (1.5)	–0.1 (–0.2, 0.1)

EAI, epinephrine auto-injectors.

†1209 of 1229 total respondents responded to the questionnaire on parental fear.

‡Potential predictors for the multivariate regression included the child factors listed above – age at completion of EAI questionnaire, disease duration, sex, ethnicity, other atopic conditions, severity of most severe reaction to peanut, whether the child was ever treated with an EAI and the source of recruitment. Parental factors included age, education, employment, satisfaction with EAI training and ease of use of EAI. Epinephrine auto-injectors factors included who prescribed the initial EAI, who provided the initial EAI training, interval between first reaction and EAI prescription, the type and number of EAI's purchased, and whether the parent had changed the type of device. Model selection to predict the outcome of interest (i.e. afraid or somewhat afraid) was based on the Bayesian information criteria.

§Refers to the EAI questionnaire that parents completed; for some, this was at the time of recruitment, and for others, it was after recruitment into the peanut allergy database.

parents responded either ‘afraid’, ‘somewhat afraid’ or not afraid).

training at the time of the initial prescription (19.2% and 16.9%).

**Results**

**Patient and parental characteristics**

Of 1639 parents surveyed, 1229 (75%) responded with 54.4% recruited from the MCH (Table 1). The mean age at diagnosis was 2.2 years, and participants were recruited a mean of 4.7 years after diagnosis. Participants were predominantly male (62.2%) and Caucasian (91.9%).

Respondents were similar to nonrespondents with respect to age at diagnosis, sex, percentage with at least one atopic comorbidity and maternal age. Respondents were slightly younger with shorter disease duration, more likely to be Caucasian, more likely to have experienced a severe reaction and mothers were more likely to have completed university and be employed.

Almost 56% of parents reported being afraid or somewhat afraid to use the EAI (Table 2). Of the 65.4% of parents citing a reason, the most frequently cited fears included hurting the child (34.6%), using the EAI incorrectly (32.5%) or fear of a bad outcome or death (24.5%).

Both groups of parents reported that they most often received the initial EAI prescription from an allergist (48.5% and 50.4%) (Table 2). Similarly, they reported that they most often received instruction at the time of the initial prescription from an allergist (35.1% and 37.7%). Comparable proportions in each group received no

**Predictors of fear**

The parents who were afraid or somewhat afraid had a child with peanut allergy who was slightly younger (7.5 vs 9.0 years) with shorter disease duration (5.4 vs 6.8 years) (Table 2). Further, these parents were less likely to have a child who had experienced a severe reaction (17.3% vs 23.5%) or who had required the EAI (15.8% vs 21.8%). Parents expressing fear were also slightly younger, were less satisfied with the EAI training (63.0% vs 72.6%) and were less likely to find the EAI easy to use (68.0% vs 81.9%).

In the multivariate analysis, parents of children who never had a severe reaction (odds ratio [OR] 1.54, 95% CI, 1.13, 2.10), had either no EAI training or were only somewhat satisfied (OR 1.42, 95% CI, 1.08, 1.90) or were not satisfied with their training (OR 4.00, 95% CI, 1.47, 10.90), or did not find the EAI easy to use (OR 1.89, 95% CI, 1.42, 2.50) were more likely to express fear. However, parents of children with a longer disease duration (OR per year 0.95, 95% CI, 0.92, 0.99) or whose mother was older (OR per year 0.97, 95% CI 0.95, 1.00) were less likely to express fear.

**Discussion**

Our study, with 1209 participants, is the largest on parental attitudes towards the EAI and factors associated with fear of

use. The only other study (11) to examine parental comfort with EAI use involved 165 parents; a study (12) evaluating patient attitudes towards the EAI surveyed only 70 respondents. Our response rate was high (75%), and respondents and nonrespondents were reasonably similar. A majority reported being afraid/somewhat afraid to use the EAI, highlighting an important barrier to the management of anaphylaxis. It is understandable that parents who were not satisfied with their training or did not find the EAI to use were more likely to be afraid. Families may benefit from simulation training that would not only focus on developing technical competence in EAI administration, but would also provide education on the recognition and broader management of anaphylaxis.

Parents whose children had had a severe reaction were less likely to be afraid, possibly because they were more aware of the gravity of anaphylaxis and confident that the benefits of the EAI outweighed its risks. Further, parents of children with more remote diagnoses of peanut allergy were also less fearful, likely because they had become more accustomed to its management.

Our study is limited in that there was little ethnic diversity, and the majority of parents were highly educated and employed. Further, those who participated may have been motivated by greater disease severity. Had a more varied sample participated, an even greater proportion may have expressed fear.

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## Author contributions

Conception and design: LC, MB-S, YA, SC, RA, YS-P, AC.

Acquisition of data: MB-S, YA, RA, LH, MA, AC.

Interpretation of data: SC.

Analysis and interpretation of data: LC, MB-S, YA, RA, YS-P, AC.

Drafting of article: LC, AC.

Revision of article critically for important intellectual content: LC, MB-S, YA, SC, RA, YS-P, LH, MA, AC.

Approval of the version to be published: LC, MB-S, YA, SC, RA, YS-P, LH, MA, AC.

## Conflict of interest

None.