Factors determining parents' perception of their child's risk of life-threatening food-induced anaphylaxis

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Factors that determine parents' perception of their child's risk of life-threatening food-induced anaphylaxis

AQ:1 Jennifer Ogg, M.B.B.Ch.,¹ Jayne Wong, M.B.B.Ch.,¹ Ming Wai Wan, Ph.D.,² Naomi Davis, M.D.,³ and Peter D. Arkwright, M.D., Ph.D.¹

ABSTRACT

Background: Although food allergy is known to be associated with increased disease burden, factors that shape parents' perception of their child's risk of future severe or fatal anaphylaxis are poorly understood.

Objective: This study aimed to evaluate factors associated with parents' perceived risk of food-induced anaphylaxis.

Methods: A questionnaire-based survey of 202 parents was conducted in a single specialist center outpatient clinic that treats children with food allergies. Parents' perceived risk of their child experiencing further food-induced anaphylaxis was assessed by using a validated food allergy independent measure. Demographic data as well as parents' anxiety and depression scores were assessed by using the Hospital Anxiety and Depression score.

Results: Nineteen percent of parents believed that their child had a moderate-to-high chance of dying from food-induced anaphylaxis. A lack of a university education, higher anxiety score, and, particularly, possession of an epinephrine autoinjector (relative risk 9.9 [95% confidence interval, 3.3–30]) were key factors associated with heightened risk perception. Caring for a child with multiple food allergies was the main factor associated with parents feeling less able to manage future reactions

AQ:2 relative risk 9.5 [95% confidence interval, 1.7–53]). Parents' risk perception of fatal anaphylaxis correlated with anxiety and mood scores.

Conclusion: Parents' education, affect, and possession of an epinephrine autoinjector were associated with a heightened perceived risk of future anaphylaxis. Clinicians should consider not only the child's needs but should also provide counseling for parents, particularly those who possess autoinjectors. Parents of children with multiple food allergies may need additional education and training to help them cope with future reactions.

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Food allergy is common, occurring in ~8% of children in Western societies.¹ Although there has been a sixfold increase in hospital admissions for food-induced anaphylaxis over the past 2 decades,^{2,3} deaths from anaphylaxis remain rare.^{4,5} Two concerns of both patients and their caregivers are the child's risk of future anaphylaxis and their ability to effectively manage future reactions. Anxiety has a negative impact on quality of life (QoL) of both the patient and his or her family. Over the years, many guidelines have been published with the aim of reducing anxiety and engendering patient and caregiver confidence by providing

information and advice on the management of allergies.^{6–16}

Addressing the key factors associated with heightened levels of a patient's and caregivers' anxiety would reduce the overall disease burden.^{17,18} Although a number of previous studies sought to determine the nature of these factors, conclusions have been quite diverse. For example, a European study of 244 children with food allergy found that allergen type and nationality but not history of previous reactions or possession of an epinephrine autoinjector (EAI) were important in determining health-related QoL.¹⁹ A U.S. survey of 305 caregivers concluded that a Food Allergy Quality of Life–Parental Burden index was affected by not only allergen type but also the number of allergens, patient's age, parental income, and history of reactions.²⁰ A follow-up study of 3541 caregivers by the same U.S. group administered through social media reinforced these findings and indicated that QoL was better in parents of children who had received epinephrine for previous anaphylactic reactions, possibly by increasing the confidence of families that future reactions would be managed successfully.²¹ Cummings *et al.*²² indicated that there was reduced anxiety in children and parents who possessed an EAI, but their study was small and only included five parents who had no EAI. In con-

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Table 1 Comparative questions in the questionnaire handed out to parents of children with food allergies and parents of children with injuries

FAIM Questionnaire	Accidental Injury Questionnaire
<p>Parents' Perceived Risk</p> <p>Stem</p> <p>The following questions are about the chance that you think something may happen to your child because of his or her food allergy; choose one of the answers provided; answer the questions by putting an "X" in the box next to the appropriate answer</p> <p>Questions</p> <p>Chance that your child will accidentally eat something to which he or she is allergic?</p> <p>Chance that your child will have a severe reaction if her or she eats something to which he or she is allergic?</p> <p>Chance that your child will die if he or she accidentally eats something to which he or she is allergic?</p> <p>Chance that you will not be able to effectively deal with an allergic reaction should your child accidentally eat something to which he or she is allergic?</p> <p>Response: Never (0% chance), very small chance, small chance, fair chance, great chance, very great chance, always (100% chance)</p> <p>Impact on Child's Life</p> <p>Questions</p> <p>How great is the impact of your child's food allergy on his or her school life?</p> <p>How great is the impact of your child's food allergy on his or her activities outside school?</p> <p>Response: Almost none, very small, small, moderate, great, very great, extremely great</p> <p>FAIM = Food Allergy Independent Measure.</p> <p>Differences in wording between the two questionnaires are highlighted.</p>	<p>Stem</p> <p>The following questions are about the chance that you think something may happen to your child because of another accidental injury; choose one of the answers provided; answer the questions by putting an "X" in the box next to the appropriate answer</p> <p>Questions</p> <p>Chance that your child will have another injury?</p> <p>Chance that your child will have a severe injury that needs a plaster cast or operation?</p> <p>Chance that your child will die because of a future injury?</p> <p>Questions</p> <p>How great is the impact of your child's injury on his or her school life?</p> <p>How great is the impact of your child's injury on his or her activities outside of school?</p>

trast, an Australian survey found that QoL of 167 caregivers assessed by using the Food-Allergy Quality of Life scale was poorer in those caregivers who possessed an EAI.²³ A subgroup of parents of children with food allergies, therefore, may benefit from additional support from health care professionals.²⁴

The aim of this study was to dissect out key psychological and physical factors associated with heightened parental perception of future anaphylaxis. As well as measuring levels of anxiety and depression, obsessive-compulsive tendencies of the parents were also assessed because we had previously observed a propensity to this personality trait in families with severe food allergies and atopic dermatitis.²⁵ We hypothesized that

a combination of demographic and psychological factors would be associated with parents' risk perception. Primeau *et al.*⁸ found that caring for a child with peanut allergy was a greater disruption to family life than caring for a child with other diseases, *e.g.*, arthritis. In this study, we compared the relative impact of a child with food allergy on parents' future risk perception with a group of children who had sustained accidental bony injuries and who were attending an adjoining fracture clinic. Accidental injuries, although not usually chronic, are similar to food-induced anaphylaxis in that they are unpredictable and a cause of concern for most parents. Inclusion of this group allowed for a direct comparison of parents' perceived risk of serious

adverse events or death of their child with either food allergies, which are rarely fatal, and accidental injuries, the most common cause of death in school-age children.

METHODS

Study Design

This was a prospective, questionnaire-based study. The study had local ethics committee approval from the National Research Ethics Service, Liverpool Central Committee; all the parents provided informed written consent. Data sets were complete for all the participants, and no parents withdrew from the study. J. Ogg and J. Wong contributed equally to the study.

Patient Recruitment

Participants in the allergy group were recruited from parents of consecutive children who attended a specialist pediatric allergy outpatient clinic for assessment and management of food allergies. Clinicians at our specialist pediatric allergy service and throughout the northwest of England prescribe EAI if patients have a clinical history of anaphylaxis (respiratory or circulatory symptoms)²⁶ to a food in which future avoidance is likely to be difficult (particularly peanut and tree nuts) or asthma is not controlled with low-dose inhaled steroids. Participants in the injury group were recruited from parents of children who attended an adjoining specialist pediatric fracture clinic for assessment and management of fractures and other bony injuries. Children who attended the fracture clinic and who had a history of food allergy, atopic dermatitis, asthma, or hay fever, or of chronic diseases that predisposed them to fractures were excluded from the study.

Data Collection

Parents were invited to complete a four-page standardized questionnaire. The questionnaire covered family demographics and details of the child's food allergy or injury. Parents' education and vocation were also recorded. Parental perceptions of the risk of future allergic reactions as well as information about disruption to daily life were collected by using the validated Food Allergy Independent Measure.²⁷ A comparable questionnaire was used for parents with children who sustained injuries (Table 1). Anxiety and depression scores were measured by using the Hospital Anxiety and Depression Scale.^{28,29} Obsessive-compulsive tendencies were measured by using the Obsessive-Compulsive Inventory-Revised.³⁰

Statistical Analysis

Data from questionnaires were collated and analyzed by using IBM SPSS Statistics. Continuous vari-

Figure 1. Details of the number of participants invited and enrolled in the study.

ables were displayed as median and interquartile range. Statistical differences between groups were calculated by using either the χ^2 test for discrete variables or Mann-Whitney *U* and Kruskal-Wallis tests for continuous variables. Potential confounding effects of multiple variables were assessed by using binomial regression multivariate analysis. Two-tailed *p* values of <0.05 were considered statistically significant unless otherwise stated.

RESULTS

Demographic and Clinical Features of Children with Food Allergies and Their Parents

A total of 333 parents of children who attended outpatient clinics at a single tertiary pediatric hospital were invited to take part in the study. Two hundred and eleven were parents whose children had a history of food allergy and who attended the specialist pediatric allergy clinic. Of these 211 parents, nine (4%) declined the invitation to participate, which gave a recruitment rate to this part of the study of 96%. From an adjoining orthopedic clinic, a further 112 parents of children who had sustained injuries were also invited to take part as a comparison group. Ten (9%) declined, and 11 were excluded because their children had either food allergies or atopic disease (Fig. 1).

The median age of the 202 children in the food allergy group was 5 years (range, 1–17 years), 121 (60%) were boys and 136 (67%) were white European; 53% had a history of allergic reactions to peanuts or tree nuts, 38% to milk, and 37% to egg. One hundred and twelve (55%) had a history of allergic reactions to multiple food groups. Fifty-seven children with food allergies (28%) had experienced breathing problems with previous allergic reactions, and 14 (7%) had felt faint. Seventy children (35%) had been prescribed an EAI, and 8 (4%) had used their autoinjector to treat a previous reaction. Eighty children (40%) had asthma,

F1

Table 2 Multivariate analysis of factors associated with parents' perceived risk of their child sustaining future allergic reactions to foods*#

Cofactors	High Perceived Chance by Parents of							
	Eating a Food To Which the Child Is Allergic		A Serious Future Allergic Reaction		Death from a Future Allergic Reaction		Able to Manage a Future Allergic Reaction	
	RR (95% CI)	p Value	RR (95% CI)	p Value	RR (95% CI)	p Value	RR (95% CI)	p Value
Mother vs father	3.7 (1.0–13.9)	0.06	1.0 (0.4–2.4)	0.9	2.3 (0.4–12.5)	0.3	1.1 (0.1–15.5)	0.9
White European vs other ethnicity	1.3 (0.6–2.6)	0.5	0.9 (0.5–1.9)	0.8	2.1 (0.8–5.7)	0.1	1.2 (0.4–4.4)	0.7
University education	1.2 (0.6–2.3)	0.7	0.9 (0.5–1.7)	0.8	0.3 (0.1–0.7)	0.01	1.0 (0.2–4.1)	0.1
Age of child	1.0 (0.9–1.1)	0.6	0.9 (0.9–1.0)	0.3	1.0 (0.9–1.1)	0.5	0.9 (0.7–1.1)	0.3
Son vs daughter	0.6 (0.3–1.3)	0.2	1.5 (0.8–2.9)	0.2	0.9 (0.4–2.4)	0.9	1.7 (0.4–6.8)	0.4
Nuts vs other allergen	0.5 (0.2–1.1)	0.1	1.6 (0.8–3.5)	0.1	0.9 (0.3–2.6)	0.8	1.3 (0.3–6.1)	0.7
Multiple allergen groups	0.9 (0.4–1.8)	0.7	1.2 (0.6–2.4)	0.5	1.0 (0.4–2.6)	1.0	0.1 (0.0–0.6)	0.01
Anaphylaxis vs milder reaction	1.4 (0.6–3.1)	0.4	2.6 (1.3–5.5)	0.01	1.6 (0.6–4.5)	0.3	0.7 (0.2–3.5)	0.7
History of asthma	1.0 (0.5–2.2)	0.9	1.6 (0.8–3.2)	0.2	0.5 (0.2–1.6)	0.3	0.8 (0.2–3.4)	0.7
Possession of an autoinjector	0.8 (0.4–1.8)	0.6	2.6 (1.2–5.5)	0.01	9.9 (3.3–30)	<0.001	2.5 (0.4–11.9)	0.4
Autoinjector used	3.1 (0.6–16.3)	0.2	0.9 (0.1–6.3)	0.9	0.2 (0.0–1.7)	0.1	0.1 (0.0–2.9)	0.2
HADS depression score	1.1 (0.9–1.2)	0.4	1.1 (0.9–1.3)	0.2	1.0 (0.8–1.2)	0.2	0.8 (0.6–1.1)	0.2
HADS anxiety score	1.1 (0.9–1.2)	0.3	1.1 (0.9–1.2)	0.4	1.2 (1.1–1.4)	0.02	1.3 (1.0–1.6)	0.06
OCIR score	1.0 (0.9–1.0)	0.3	1.0 (1.0–1.0)	0.7	1.0 (0.9–1.1)	0.1	1.1 (1.0–1.2)	0.1

RR = Relative risk; CI = confidence interval; HADS = Hospital Anxiety and Depression Scale; OCIR = Obsessive-Compulsive Inventory-Revised.

*High risk (great, very great, or 100% chance of a future event) compared with lower risk (0%, very small, small, or fair chance of a future event).

#Binary logistic covariant regression analysis with the addition of the variables.

and 48 (24%) had previously been admitted to the hospital because of their asthma.

Parents' Perceived Risk of their Child Experiencing Future Allergic Reactions

Eighty-five percent of the questionnaires were completed by the mothers, 15% by the fathers. Demographic and psychological factors were not associated with the parents' perceived future risk of their child eating food to which they were allergic (Table 2). However, parents of children with a history of an anaphylactic reaction and those who possessed an EAI were 2.6 times more likely to consider their child at a high risk of a future "serious and/or anaphylactic" reaction. Three times as many parents who possessed an EAI (12/70 [18%]) compared with those who did not have an EAI (7/132 [5%]) believed that their child was at

high risk of a future anaphylaxis (Fig. 2). Possessing an EAI was the cofactor associated with the highest perceived risk of death from future allergic reactions (9.9 [95% confidence interval {CI}, 3.3–30]; $p < 0.001$) (Table 2). One percent of the parents without an EAI (2/131) compared with 10% of the parents with an EAI (7/70) believed that their child was at high risk of death from a future allergic reaction (Fig. 2). The parents with higher anxiety scores (1.2 [1.1–1.4]; $p = 0.02$) and parents without a university education (3.7 [1.4–10.1]; $p < 0.01$) perceived that their child was at a higher risk of death (Table 2). Nut allergy was not perceived by their parents as more likely to be associated with a high risk of serious or fatal anaphylaxis than allergies to other foods. Allergies to multiple foods was the only factor associated with parents' perception that they would not be able to manage

Figure 2. Possession of an epinephrine autoinjector (EAI) as a factor that influences parents' perceived risk of their child's having future allergic reactions. The first three panels from left to right show the parents' perception of the chance of their child (1) eating a food to which he or she is allergic, (2) having a serious allergic reaction, and (3) having a fatal allergic reaction. The final panel on the very right of the figure shows the parents' perception that they will be able to manage the future allergic reaction. A "low" score combines never (0% chance), very small chance, or small chance Food Allergy Independent Measure (FAIM) scores; "moderate" is equivalent to fair chance FAIM score; a "high" score combines great chance, very great chance, or always (100% chance) FAIM scores. Comparisons are made by using χ^2 statistics.

AQ: 19 : ** $p < 0.005$ (2-tailed test).

AQ: Future reactions (relative risk [RR] 7.1 [95% CI, 1.6–32]) (Table 2).

Because EAI possession was the main variable associated with a perceived risk of death from future anaphylaxis, further analyses that compared families with and those without EAI were performed (Table 3). Children who possessed EAI were significantly older (RR 1.1 [95% CI, 1.0–1.2]); were more likely to have had an anaphylactic reaction (RR 2.2 [95% CI, 1.1–4.6]), particularly to peanuts or tree nuts (RR 4.2 [95% CI, 1.9–9.1]); and to have allergic rhinitis. There were no significant difference in parents' ethnicity, university education, or affect between the groups.

Psychological Factors and Parents' Perceived Risk of Future Allergic Reactions in Children with Food Allergies

The mothers ($n = 249$) did not differ significantly from the fathers ($n = 44$) in any of the three psychology scores. In addition, these scores were not significantly different in parents of different educational attainment (data not shown). However, the parents who perceived that their child was at a higher risk of future allergic reaction to foods were significantly more anxious (Fig. 3). Those parents who believed that there was a risk of anaphylaxis or death were also more likely to have significantly higher depression and obsessive-compulsive disease scores.

Clinical Features of the Injury Group and Comparison with the Food Allergy Group

Of the 91 children who attended an adjoining pediatric orthopedic clinic for accidental sprains and fractures, 73 (80%) had sustained a fracture, 45% to a bone in their upper limb, 24% to their lower limb, and 2% to their pelvis or rib. Twenty-seven (30%) required an operation for the fracture or dislocation. Thirty-four (37%) had a history of an injury. The characteristics of children and their parents with food allergies and children and their parents with injuries are compared in Table 4. Children who presented with food allergies were significantly younger than those who presented with injuries (median age, 5 versus 10 years; $p > 0.001$) and were more likely to be white European (67% versus 52%; $p < 0.01$). Operative treatment was the only factor associated with a significantly higher perceived risk by the parents of "any" (3.9 [1.4–11.0]; $p = 0.01$) or "serious" future injury (7.6 [1.3–44]; $p = 0.02$). Only 1 of 91 parents (1%) thought that there was a high chance of his or her child dying of a future injury. Parents' perceived impact of their child's allergy or injury on school life was similar, but parents whose children had had injuries believed that the injury had a significantly greater impact on the child's home and extracurricular activities (Fig. 4). In contrast, parents of children with food allergies were more likely to consider their children at risk of future serious or fatal events (Fig. 5). The perceived risk of a serious future adverse event was 13-fold higher in the group with food allergies than in

Table 3 Characteristics of children with food allergies and of their parents based on EAI possession

	No EAI (<i>n</i> = 132)	EAI (<i>n</i> = 70)	<i>p</i> Value*
Age, median (IQR), y	4 (2–8)	8 (4–11)	0.001
Boys, no. (%)	76 (58)	45 (64)	0.3
An only child, no. (%)	76 (58)	45 (64)	0.4
White European origin, no. (%)	89 (67)	47 (67)	1.0
Anaphylactic symptoms, no. (%)	26 (20)	31 (44)	0.001
EAI previous used, no. (%)	0 (0)	8 (11)	0.001
Peanut or tree nut allergy, no. (%)	51 (39)	55 (79)	0.001
Cow's milk protein allergy, no. (%)	53 (24)	23 (33)	0.2
Atopic diseases, no. (%)			
Atopic dermatitis	110 (83)	48 (69)	0.02
Asthma	46 (35)	34 (49)	0.07
Allergic rhinitis	32 (25)	30 (51)	0.001
Questionnaire completed by the mother, no. (%)	109 (83)	66 (94)	0.03
Parents with university education, no. (%)	65 (49)	27 (39)	0.4
Parents' psychological profile, median (IQR)			
HADS depression score	4 (1–7)	3 (1–6)	0.7
HADS anxiety score	5 (2–9)	6 (4–8)	0.3
OCD score	7 (3–15)	6 (4–12)	0.6

EAI = Epinephrine autoinjector; IQR = interquartile range; HADS = Hospital Anxiety and Depression Scale; OCD = Obsessive-compulsive disease.

*Compared patients who had and patients who had not been prescribed an EAI.

#Anaphylaxis is defined as allergic reactions associated with respiratory or circulatory symptoms.

§Statistical analysis was performed by using either the χ^2 test for discrete variables or the Mann-Whitney U test for continuous variables.

those with injuries ($p < 0.001$), independent of the age of the child and the ethnicity of the parent.

DISCUSSION

AQ: 13 To our knowledge, this is the first study to quantify parents' risk perception of their child with serious or fatal allergic reactions to food. Half of the parents in this cohort believed that there was a moderate-to-high risk of their child having future anaphylaxis, and a fifth believed that their child had a moderate-to-high chance of dying from anaphylaxis. Previous anaphylaxis and possession of an EAI were two factors independently associated with a higher perceived risk of future anaphylaxis, after adjusting for confounders, such as the child's age, type of food allergen, parents' affect, and education, by using multivariate analysis. Peanut and/or tree nut allergy and a history of asthma were not associated with a higher perceived risk, even though there is published evidence for a link.^{31,32} The observed differences between the outcomes of our study and previous studies may relate to the measures used. We assessed parental risk perception, whereas others examined parental burden and/or QoL.^{17,19} King *et al.*,³³ examined the impact of peanut allergy on **AQ: 14** QoL and anxiety in 46 families but used SCAS or STAI rather than the Hospital Anxiety and Depression Scale

to assess anxiety and found that the mothers had worse QoL and anxiety scores than the fathers. Although we found no significant difference in anxiety scores of the mothers and fathers, the p value was 0.055, and a larger sample number may have shown a significant trend. Another study, which compared parents in the Netherlands and the United States, showed that, although American parents were more likely to visit a physician for their child's food allergies and had a better knowledge of food avoidance strategies than the Dutch parents, the U.S. parents had lower QoL scores.^{34,35}

Parents who thought that their child was at a high risk of dying from anaphylaxis were less likely to be university educated. They also tended to have higher anxiety scores. A possible explanation for the latter observation is that having a child with food allergies makes parents more anxious. Gillespie *et al.*³⁶ in an interview-based study, indicated that consultation with an allergy specialist may indeed initiate or heighten maternal anxiety about the impact of their child's food allergies. Alternatively, more anxious parents might worry more about the risks of food allergies, but, if this were the case, then one might expect that they might also request and receive EAIs from their child's physician. Our study found that parents in possession of an EAI were not more anxious than those without an autoinjector.

AQ: 15

Figure 3. The association between the parents' affect and obsessive-compulsive disease (OCD) scores and the perceived risk that their child with a food allergy will have a future allergic reaction. The Hospital Anxiety and Depression Scale anxiety and depression scores as well as obsessive-compulsive scores of parents in relation to their perception that the child was at future risk of death (top panels), of a serious adverse event (middle panels), or of eating something to which he or she is allergic (lower panels). Data are shown as box plots (median and interquartile ranges) for low risk, moderate-to-fair risk, and high risk bars. Comparisons were made between median scores of parents who perceived a low and moderate or a high risk of future events for their children by using Kruskal-Wallis tests. * $p < 0.05$, ** $p < 0.005$ (2-tailed test).

EAI is prescribed to treat anaphylaxis that could potentially, albeit rarely, lead to death.^{37,38} Our criteria for EAI prescribing, detailed in the Methods section, are more limited than those indicated in the 2015 U.S. anaphylaxis practice parameter update.³⁹ These practice parameters not only recommend EAI for all patients who have experienced or are at risk for food-induced anaphylaxis (including patients with food allergy and asthma; patients allergic to peanut, tree nuts, fish, and shellfish; and patients with a history of a systemic reaction to food) but also indicated that consideration be given to prescribing EAIs to all patients with immunoglobulin E-mediated food allergy.

Our study indicated that parents who possessed EAI not only perceived that their child was at risk of future anaphylactic reactions but of fatal reactions. This supported those of Pinczower *et al.*⁴⁰ who, in a recent Australia survey of 103 parents of children with food allergies, found that EAI possession was associated with significantly worse food allergy-related QoL scores and contrasted to other reports that indicated that parents with EAI are more confident in managing allergic reactions.¹⁸ Poor confidence may relate to lack of hands-on experience and fear of using EAIs.⁴¹ Fur-

ther studies are required to directly compare EAI competence and confidence in parents who had and parents who had not used an EAI to treat anaphylaxis.

Compared with the injury group, parents of children with food allergies were 13-fold more likely to consider that their child at a high risk of a future serious adverse event and 21-fold more likely to consider that their child may die because of a future adverse event, independent of the child's age, sex, and ethnicity. This was at odds with pediatric morbidity and mortality statistics, in which accidental injuries account for one-third of all emergency department visits and are the most common cause of death in school-age children and young people worldwide,^{42,43} whereas allergic reactions to food accounts for <1% of visits to emergency departments^{44,45} and only one to two childhood deaths in the United Kingdom each year.⁴⁶ The reasons for using a group of children with bony injuries for comparison with children with food allergies deserves further clarification. First, both food-induced anaphylaxis and injuries are accidental. Second, as detailed above, accidental injuries are also potentially life threatening. Third, although not usually leading to chronic disease, injuries are potentially recurrent. The modified Food

Table 4 Characteristics of children and their parents with food allergies and injuries

	Children with Food Allergies (n = 202)	Children with Injuries (n = 91)	p Value*
Age, median (IQR), y	5 (3–9)	10 (7–12)	0.001
Boys, no. (%)	121 (60)	48 (53)	0.3
An only child, no. (%)	54 (27)	23 (25)	1.0
White European, no. (%)	136 (67)	47 (52)	0.01
Severity of allergy or injury, no. (%)			N/A
Anaphylaxis	57 (28)	—	
Fracture	—	73 (80)	
Treatment given, no. (%)			N/A
Epinephrine	8 (4)	—	
Operation	—	27 (30)	
Cast and/or sling	—	51 (56)	
Atopic diseases, no. (%)			
Atopic dermatitis	158 (78)	0	N/A
Asthma	80 (40)	0	N/A
Allergic rhinitis	68 (34)	0	N/A
Questionnaire completed by the mother, no. (%)	249 (85)	74 (81)	0.2
Parents with a university education, no. (%)	118 (40)	26 (29)	0.3
Parents' psychological profile, median (IQR)			
HADS depression score	4 (1–6)	4 (2–7)	0.7
HADS anxiety score	5 (3–8)	5 (2–7)	0.3
OCD score	7 (3–13)	7 (3–11)	0.3

IQR = Interquartile range; N/A = not directly comparable or not applicable; HADS = Hospital Anxiety and Depression Scale; OCD = Obsessive-compulsive disease.

*Compared patients with food allergies and those with injuries.

#Anaphylaxis defined as reactions associated with respiratory or circulatory symptoms.

§Statistical analysis was performed by using either the χ^2 test for discrete variables or the Mann-Whitney U test for continuous variables.

Figure 4. The parents' perceived impact of their child's food allergy or injury on school and extracurricular activities. Assessment was made by using the Food Allergy Independent Measure (FAIM) assessment score (Zea et al., 2002), or modification thereof. A "low" score combines almost none, very small, or little impact FAIM scores; a "moderate" score is equivalent to moderate and/or some impact FAIM scores; a "high" score combines great, very great, or extremely great impact FAIM scores. * $p < 0.05$, χ^2 test.

Allergy Independent Measure questionnaire for perception of the future risk of children with bony injuries has not been previously validated. However, of the observed trends in perceived risk of "any injury" (28%), a "serious injury" (9%), and "death" (1%), the higher perceived impact of injuries on life outside of school compared with within school and the higher

perceived risk in children who require an operation, all provided evidence for the validity of the questions.

CONCLUSION

It is understandable that some parents are unsure, concerned, or even overwhelmed by their child's food

AQ: 21

Figure 5. The parents' perceived risk of any, a serious, fatal future injury or allergic reaction to a food. Assessment was made by using the Food Allergy Independent Measure (FAIM) assessment score (Zea et al., 2002) or modification thereof. A "low" score combines never (0% chance), very small chance, or small chance FAIM scores; "moderate" is equivalent to a fair chance FAIM score; a "high" score combines great chance, very great chance, or always (100% chance) FAIM scores. $**p < 0.001$, χ^2 test.

allergies. This study highlighted the discrepancy between perceived and actual risks that some parents have about their child with food allergies. Parents who are more anxious or have not been to university may need additional support to focus on the evidence, particularly with regard to the actual risk of dying from anaphylaxis and how to manage children with multiple allergies. A prescription of EAI should not only be accompanied by an explanation as to when and how to use the device but a clear explanation of the actual risks that physicians hope to avert by prescribing the device.

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AUTHOR QUERIES

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1

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- 13—Au: Please verify. Okay to add “To our knowledge,” ?
- 14—Au: Please spell out “SCAS” and “STAI”
- 15—Au: Please clarify. Is this “EAI” - “an autoinjector” ?

AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES

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16—Au: Please verify. Okay as spelled out - “IgE” ?

17—Au: Please identify “They”

18—Au: Please note. This reference was not located in PubMed. Please verify/correct all information.

19—Au: Please clarify “Low”

20—Au: Please add a complete citation for “Zoa et al, 2002”

21—Au: Please add a complete citation for “Zoa et al, 2002”

22—Au: Please add department(s) and/or division(s) for affiliations 1 and 2.

23—Author: Please let us know the source of funding for your manuscript. Your article will be supplied to PMC if it’s funded by NIH or any other federal agency.

24—Author: Please verify that this is your correct professional e-mail address.