

Management of nut allergy influences quality of life and anxiety in children and their mothers

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Nut allergy is known to impact on the quality of life (QoL) and anxiety of both the allergic child and their parents, but little is known about how the management of food allergy is associated with these variables. To investigate the impact of nut allergy on QoL and anxiety in mothers and children with nut allergy in order to identify management strategies that may influence these factors. Forty-one nut allergic children (age 6–16 yrs) and their mothers completed questionnaires to assess maternal and children's QoL (PedsQL™, WHOQOL-BREF, FAQL-PB), anxiety (SCAS, STAI) and perceived stress scale (PSS). Children also completed a nut allergy specific QoL questionnaire. Demographic data, details of previous reactions, test results and management plans were collected using parent-report questionnaires and hospital notes. Children with nut allergy had poorer emotional ($p = 0.004$), social ($p = 0.043$), and psychological ($p = 0.006$) QoL compared to healthy normative data. Maternal and child QoL and anxiety were not influenced by the severity of previous reactions. Mother and child reported lower anxiety ($p = 0.043$ and $p < 0.001$ respectively) when the child was prescribed an epinephrine auto-injector. Anxiety was not associated with whether the child carried the auto-injector or whether they strictly avoided traces of nuts in foods. Prescribing auto-injectors is associated with reduced anxiety for food allergic children and their mothers, but is not associated with improved adherence with medical management or reduced risk-taking behavior.

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Peanut and tree nut allergy are a major health concern in the developed world. Twenty years ago peanut allergy was considered rare, with only a few case reports, but since then the prevalence of this allergy has risen substantially. Whilst

0.5% of four year olds born on the Isle of Wight in 1989 had suffered an allergic reaction to peanut, 1.6% of 4 year olds born 5 yrs later were diagnosed with peanut allergy(1). Peanut allergy can result in life threatening reactions and there is currently no cure. Current best practice dictates that children with nut allergy should be looked after by a specialist team and should all be given a management plan (2, 3). The treatment for anaphylaxis is prompt intramuscular injection of epinephrine (4). Delayed administration can be associated with death and therefore patients are educated in the use of epinephrine

Abbreviations: FAQL-PB, Food Allergy Quality of Life-Parental Burden Questionnaire; FAQLQ-PF, Food Allergy Quality of Life- Parent Form; PedsQL, Pediatric QoL Inventory 4.0; PSS-14, Perceived Stress Scale-14; QoL, Quality of Life; SCAS, Spence Child Anxiety Scale; SPT, Skin Prick Test; STAI, State- Trait Anxiety Inventory; WHOQOL-BREF, World Health Organization QoL Scale.

auto-injectors which they are required to carry at all times. However, auto-injectors do not always save lives (5) and therefore other measures are equally important: such as strict avoidance of trigger factors and the treatment of risk factors for severe allergic reactions such as asthma. European legislation decrees that all processed food that intentionally contains peanuts or tree nuts is labeled accordingly but does nothing to address the 'may contain traces' warning that is highly frustrating for many allergic patients. The legislation has been met with mixed feelings by patients, health professionals and the food industry (6–8). Given this, it is not surprising that food allergy represents a significant burden for children and their families (9).

A number of studies have found that nut allergy is associated with increased levels of stress and anxiety in both mothers and children (10–14) whereas fathers' anxiety and stress levels are more in line with established population norms (15). It has been suggested that anxieties surrounding food allergy could be perceived as beneficial if they encourage individuals to comply with appropriate management strategies, but detrimental if they result in individuals imposing excessive restrictions upon themselves (16).

This study was designed to investigate the influence of self-management factors on the quality of life and anxiety in children with nut allergy and their mothers using validated questionnaires. We also investigated whether these factors were associated with food avoidance, allergic parameters such as coexisting allergic disease, age, gender and the previous severity of reactions.

Methods

Design

This was a cross-sectional questionnaire study, measuring quality of life, anxiety and stress in nut allergic children aged 6 to 16 yrs and their mothers. The study gained ethical approval from Isle of Wight, Portsmouth and South East Hampshire Local Research Ethics Committee (LREC. 07/H0501/75).

Participants

All participants ($n = 41$ children and 41 paired mothers) were recruited from Southampton University NHS Hospital Pediatric Allergy clinic and had a diagnosis of peanut or tree nut allergy made by a pediatric allergy consultant at the clinic. Diagnosis was based on clinical history

and positive skin prick test (SPT), or in patients without a personal history, based on highly predictive SPTs and specific IgE. Consecutive patients were provided with verbal information by a medical student (AC) and offered written information (October 2007–May 2008). Those who agreed were provided with the relevant questionnaires to complete at home on a 'normal' day.

Following diagnosis by a pediatric allergist, as part of their routine care, patients received an educational package from a multidisciplinary team, including a nurse specialist and dietician. This included one-to-one teaching from the nurse and/or dietician, watching the Anaphylaxis Campaign DVD 'Action for Anaphylaxis 2005' (<http://www.anaphylaxis.org.uk>) and written information including an individualized management plan. Refresher sessions are available on request of parents and at follow-up appointments, which vary from 1 to 4 yearly. Epinephrine auto-injectors are recommended to the vast majority of patients in the clinic, except for those who have had repeated mild reactions following large doses of nuts. Of the participants in this study 36 were prescribed auto-injectors. The consultants and dietician in this clinic advise that patients may react to products that state that they 'may contain traces of nut' and recommend that they are avoided. However, we only stress the absolute necessity of adhering to this instruction in patients who have previously reacted to small doses.

Children were excluded if there was any other major chronic illness affecting the child, mother, or their family (excluding asthma, hayfever or eczema) as they may have affected QoL.

Measures

Questionnaires were used to measure QoL, anxiety and stress in both the child and mother on a 'normal' day at home. Validated questionnaires were utilized where possible but at the time of this study there were no validated disease-specific questionnaires for QoL for children. Validated generic QoL questionnaires, designed to measure QoL in the general population were therefore used alongside the disease specific instrument, although generic instruments are less likely to detect small and clinically relevant differences.

Questionnaires completed by the children

Pediatric QoL Inventory 4.0 (PedsQL™) (17) is a 23-item self-report generic quality of life scale

with developmentally appropriate self-report forms for children (age 8 to 12) and adolescents (age 13 to 18). It measures physical, emotional, social and school functioning and provides a total scale score, a physical health summary score and a psychosocial health summary score. Children rate on a five-point Likert scale (never, almost never, sometimes, often, almost always) how often they experience things. Each sub-scale and composite scale is marked out of 100 with higher scores representing a better quality of life. All scales have good reliability for the total scale score (alphas over 0.85). Normative data for 699 healthy U.S. children aged 5–16 yrs are reported in Table 1 (18).

The QoL questionnaire for children with nut allergy (16) is an unvalidated 25 item self-report measure, developed for children aged 8 yrs and over. Children are asked to rate how often things happen to them using a Likert scale, ranging from never (scored 1) to always (scored 4); scores range from 25 to 100 with a higher score indicating a poorer QoL. For this sample the scale demonstrated good internal consistency with alpha of 0.96.

Spence Child Anxiety Scale (SCAS) (19) is a self-report scale for children aged 8 yrs upwards and provides an overall measure of anxiety together with six sub-scale scores measuring panic attack and agoraphobia, separation anxiety, physical injury fears, social phobia, obsessive compulsive, generalized anxiety disorder/over-anxious disorder; higher scores represent greater anxiety. Using SCAS, children rate on a four-point Likert scale – never, sometimes, often or

always – how often something happens to them. The scale has high internal reliability (alpha = 0.92). Normative data based on a sample of 2052 healthy Australian children age 8–12 are included in Table 1 (20).

Questionnaires completed by the mothers

State-Trait Anxiety Inventory (STAI) (21) is a self-report measure for adults; two sections of 20 questions scored 1–4 measure state (how you feel generally) and trait (how you feel right now) anxiety. The higher the score on the STAI the higher the level of anxiety. Mean normative scores (21) for a healthy adult U.S. population are shown in Table 2. Both sections of the scale have excellent internal consistency (Cronbach's alpha > 0.90, > 0.89 respectively).

Perceived Stress Scale - 14 (PSS-14) (22) is a 14-item self-report measure which asks about thoughts and feelings in the last month. Items are measured on a Likert scale scoring 0 (never) to 4 (always) with a higher score indicating greater perceived stress. In an adult healthy U.S. population scores range between 0 and 45, with a mean of 19.62. This measure has good internal consistency (Cronbach's alpha = 0.84) (23).

The World Health Organization QoL Scale (Brief version) (WHOQOL-BREF) (24) is a 26 item QoL scale, using a 1 to 5 Likert scale, which measures QoL for physical, psychological, social relationships and environment domains. Raw scores are computed into transformed scores with a range of 4 to 20, with a higher score representing better QoL. There are also two

Table 1. Children's allergy specific QoL (Avery), generic QoL (PedsQL) and anxiety (SCAS) mean scores, standard deviations and ranges for child participants, with normative data for healthy children. Differences between study population and normative data are shown. (key (↓ = ✓) = lower score associated with better QoL/less anxiety; (↑ = ✓) = higher score associated with better QoL)

	Study population			Normative data mean (s.d.)	t (df) value	p value
	Mean	s.d.	Range			
Allergy specific QoL (↓ = ✓)	50.61	8.43	35–65	Not available		
Total generic QoL (↑ = ✓)	78.82	11.71	53.26–100	82.79 (15.00)	−2.063 (36)	0.046
Physical health	84.05	10.77	53.13–100	84.37 (17.33)	−.184 (37)	0.855
Emotional	71.18	19.81	30–100	81.04 (19.54)	−3.067 (37)	0.004
Social	81.28	16.53	45–100	86.82 (17.52)	−2.092 (38)	0.043
School	74.62	14.30	45–100	78.19 (20.70)	−1.561 (38)	0.127
Psychosocial	75.70	13.61	46.67–100	82.11 (15.72)	−2.889 (37)	0.006
Overall anxiety (↓ = ✓)	20.67	12.90	4–55	32.08 (18.66)	−5.525 (38)	<0.001
OCD*	3.51	3.28	0–15	6.09 (3.95)	−4.913 (38)	<0.001
Social phobia	4.51	3.50	0–16	6.65 (4.07)	−3.804 (38)	0.001
Panic attack/Agoraphobia	1.92	2.56	0–10	4.42 (4.85)	−6.094 (38)	<0.001
Separation anxiety	2.97	2.30	0–8	4.90 (3.75)	−5.229 (38)	<0.001
Physical injury	2.77	2.18	0–8	3.66 (2.97)	−2.549 (38)	0.015
Generalized anxiety	4.97	3.03	0–15	6.35 (3.76)	−2.835 (38)	0.007

*OCD, obsessive compulsive disorder.

Table 2. Mother's allergy specific QoL (FAQLPB), generic QoL (WHOQOL-BREF), anxiety (STAI) and stress (PSS) mean scores, standard deviations and ranges for mother participants, with normative data for healthy adults. Differences between study population and normative data are shown. [key (↓ = ✓) = lower score associated with better QoL/less anxiety; (↑ = ✓) = higher score associated with better QoL]

	Study population			Normal data	t value (df)	p value
	Mean	s.d.	Range			
Allergy specific QoL (↓ = ✓)	56.27	25.35	24–117	Not available		
Generic QoL (↑ = ✓)	70.33	9.10	48–83	Not available		
Physical health	16.76	2.42	7–19	15.8 (3.8)	2.534 (40)	0.015
Psychological	14.68	2.09	10–19	14.7 (3.4)	−0.052 (40)	0.959
Social relationships	15.18	3.18	8–20	14.2 (3.5)	1.941 (39)	0.060
Environment	16.07	2.30	9–20	14.1 (2.3)	5.504 (40)	<0.001
Overall QoL	4.05	0.63	2–5	Not available		
Overall health QoL	3.63	1.07	1–5	Not available		
Overall anxiety (↓ = ✓)	69.33	17.44	42–109	Not available		
State anxiety	32.78	9.69	20–60	33.3 (9.5)	−0.343 (39)	0.734
Trait anxiety	36.55	9.98	22–56	32.8 (8.3)	2.377 (39)	0.022
Stress (↓ = ✓)	21.15	6.27	9–36	19.62 (7.49)	1.543 (39)	0.131

one-item questions, which look at overall quality of life and satisfaction with health and have a score range of 1 to 5 on each. The scale has good to very good reliability for all domains (alphas range from 0.68 to 0.82). Normative data for a UK adult healthy population adjusted for age and sex are included in Table 2 (24).

The Food Allergy Quality of Life-Parental Burden Questionnaire (FAQL-PB) is a 17-item instrument for parents with food allergic children, which utilizes a 7-point Likert scale ranging from 1 (not troubled) to 7 (extremely troubled) (25). Questions include issues concerning going on vacation, social activities and worries and anxieties over the previous week. Internal validity has been reported as strong (Cronbach alpha of 0.95).

Procedure

Participants were recruited following a clinic appointment and were asked to complete the questionnaires at home, returning it by post. Informed consent and assent was obtained from mothers and children respectively. Children received age appropriate questionnaires (6–7 yrs olds used questionnaires designed for 8 yrs olds where they were not available for younger children) and completed the peanut allergy specific scale used by Avery et al., the PedsQL™ and the SCAS. Mothers were permitted to assist younger children in reading questions but were asked not to influence their response. Mothers completed the PSS, the STAI, the WHOQOL-BREF and the FAQL-PB. Additional demographic data and information specific to participant's nut allergy (e.g. severity of reactions and test results) was

collected by parent-completed questionnaire and from patient hospital notes.

Data analysis

Data entry and statistical analyses were conducted using SPSS version 14.0 (SPSS, Chicago, Illinois, USA). Summary data was compared with available normative population data using one sample *t*-tests. Differences between groups were analysed using independent samples *t*-tests, relationships amongst variables were investigated using Pearson's correlations. All tests were 2-tailed and the significance level was set at $p < 0.05$.

Results

Forty one patients attending the pediatric allergy clinic were recruited. All participants completed all questionnaires and questions. Thirty two (78%) had reacted to nuts in the community and had supportive investigations; the remainder had clinical investigations that a consultant allergist considered highly indicative of allergy. The age range of child respondents was 6–16 yrs, with a mean of 10.95 yrs (s.d. = 3.1) and a median of 10 yrs. 56% of children were males ($n = 23$), 40% ($n = 16$) had peanut allergy, 22.5% ($n = 9$) had tree nut allergy and 37.5% ($n = 15$) had mixed peanut and tree nut allergy. Reported symptoms included rash (38%), angioedema (39%), difficulty breathing and wheeze (15%), cyanosis (11%) and vomiting (11%). Thirty four children had other atopic disease, including 19 (46%) with hayfever, 25 (61%) with asthma and 32 (78%) with eczema. Thirty six children had been prescribed epinephrine autoinjectors.

Quality of life, stress and anxiety of children with nut allergy and their mothers

Children with nut allergy had significantly poorer overall QoL, emotional, social and psychosocial quality of life when compared with normative data from healthy children (Table 1). They reported similar QoL to healthy children in physical health and school domains. Overall anxiety and all anxiety domains were significantly lower in the study population when compared with normative data (Table 1).

Mothers' generic QoL measured on the physical health sub-scale and environmental sub-scale was significantly better in the study population than the normative data (Table 2). For psychological QoL there was no significant difference. Trait anxiety levels were significantly higher in the study population when compared with the normative data, but no significant differences in state anxiety or stress levels were found (Table 2).

Effect of the patient's management of allergy on quality of life

Twenty nine patients reported eating 'may contain' foods, and 11 strictly avoided such products (data missing $n = 1$). Maternal allergy specific QoL (measured using the FAQL-PB) was better for those where the child reported eating 'may contain' foods (mean = 49.28, s.d. = 20.37) compared to mothers whose child did not eat

'may contain' foods (mean = 75.09, s.d. = 29.58), [$t(38) = -3.149$, $p = 0.003$]. The child also reported better allergy specific QoL if they ate 'may contain' foods (mean = 48.04, s.d. = 8.15 vs. mean = 56.64, s.d. = 6.33), [$t(38) = -3.116$, $p = 0.004$]. There were no other significant differences for mother or child in relation to eating may contain foods.

Maternal generic QoL was better if their child was prescribed an auto-injector (mean = 71.51, s.d. = 8.58) compared to mothers whose child had not been prescribed an auto-injector (mean = 62.00, s.d. = 9.06), [$t(38) = 2.306$, $p = 0.027$]. There were no significant differences in child generic QoL or allergy specific QoL in relation to auto-injector prescription. Nor were there any significant differences in any QoL domain regarding whether the child carried the auto-injector or not.

Effect of the patients' allergy management on anxiety and stress

There were no significant differences in maternal and child reported anxiety levels between those who did and did not eat 'may contain nut' products. Maternal and child reported overall anxiety levels were significantly lower (mother $p = 0.043$; child $p < 0.001$) if they were prescribed an auto-injector for their nut allergy (Table 3). Out of the 36 children prescribed and

Table 3. Differences in maternal and child reported anxiety levels between those prescribed an Epinephrine auto-injector and those not prescribed an auto-injector, and differences in maternal and child reported anxiety scores between different degrees of compliance with carrying epinephrine. Figures are mean (s.d.) unless otherwise stated. (key $(\downarrow = \checkmark)$ = lower score associated with better QoL/less anxiety; $(\uparrow = \checkmark)$ = higher score associated with better QoL)

	Yes (n = 35)	No (n = 5)	t value (df)	p
Prescribed epinephrine				
Maternal overall anxiety ($\downarrow = \checkmark$)	67.23 (15.75)	84.00 (23.45)	-2.097 (38)	0.043
Maternal state anxiety	31.91 (9.28)	38.80 (11.48)	-1.511 (38)	0.139
Maternal trait anxiety	35.31 (9.15)	45.20 (12.38)	-2.168 (38)	0.036
Child overall anxiety ($\downarrow = \checkmark$)	17.68 (10.07)	41.00 (12.35)	-4.711 (37)	<0.001
Child OCD	2.88 (2.53)	7.80 (4.76)	-3.592 (37)	0.001
Child social phobia	3.74 (2.40)	9.80 (5.40)	-4.393 (37)	0.065
Child panic attack/agoraphobia	1.47 (2.05)	5.00 (3.74)	-3.214 (37)	0.003
Child separation anxiety	2.62 (2.13)	5.40 (2.07)	-2.732 (37)	0.010
Child physical injury fears	2.50 (1.88)	4.60 (3.36)	-2.097 (37)	0.238
Child generalized anxiety	4.47 (2.89)	8.40 (1.14)	-2.973 (37)	0.005
	Never/Sometimes (n = 8)	Often/Always (n = 25)		
Carry epinephrine				
Maternal overall anxiety ($\downarrow = \checkmark$)	64.38 (19.96)	68.36 (16.03)	-0.577 (31)	0.568
Maternal state anxiety	31.38 (10.27)	32.64 (10.12)	-0.307 (31)	0.761
Maternal trait anxiety	33.00 (10.62)	35.72 (9.01)	-0.713 (31)	0.481
Child overall anxiety ($\downarrow = \checkmark$)	21.50 (16.90)	17.32 (8.37)	0.944 (31)	0.352
Child OCD	3.25 (3.88)	2.68 (1.87)	0.568 (31)	0.574
Child social phobia	3.38 (2.13)	3.96 (2.49)	-0.596 (31)	0.555
Child panic attack/Agoraphobia	2.50 (2.98)	1.40 (1.89)	1.239 (31)	0.225
Child separation anxiety	3.38 (3.20)	2.64 (2.06)	0.765 (31)	0.450
Child physical injury fears	3.13 (2.53)	2.36 (1.75)	0.963 (31)	0.343
Child generalized anxiety	5.88 (4.39)	4.28 (2.35)	1.336 (31)	0.191

trained to use an auto-injector for emergency administration of epinephrine, 25 often or always carried it. There was no difference in maternal overall anxiety or child anxiety (or anxiety domains) between those who were adherent with this component of their management plan and carried their auto-injector, and those who were not (Table 3). Nor were there any significant differences in maternal stress regarding prescription of an auto-injector or carrying one.

Child related factors

As children's age increased they reported better allergy specific QoL ($r = -0.471$; $p = 0.003$) and less separation anxiety ($r = -0.407$; $p = 0.010$). Other measures of QoL, anxiety and stress for mother and child were not associated with age. The age of a child's first known allergic reaction to nuts had no significant association with maternal or child reported QoL, anxiety or stress levels.

Correlations

Girls reported significantly higher anxiety levels (mean = 25.17, s.d. = 13.96) than boys (mean = 16.81, s.d. = 10.81) [$t(37) = -2.106$, $p = 0.042$]. Girls specifically reported higher anxiety over physical injury (mean = 3.83, s.d. = 2.26) than boys (mean = 1.86, s.d. = 1.68) [$t(37) = -3.129$, $p = 0.03$]. Boys reported an overall better physical QoL (mean = 87.35, s.d. = 7.69) than girls (mean = 80.39, s.d. = 12.63) [$t(36) = 2.076$, ($p = 0.045$)]. There was no gender difference in allergy specific QoL, nor in emotional, social, psychosocial QoL or anxiety scores.

Mothers reported significantly higher levels of overall anxiety ($p = 0.03$) and stress ($p < 0.001$)

if their nut allergic child had previously outgrown other food allergies (Table 4). Similarly, maternal generic overall QoL was significantly worse if their child had previously outgrown other food allergies ($p = 0.007$), and was worse in all QoL domains (Table 4). No significant difference was shown for allergy specific QoL. Outgrowing other allergies did not influence the child's quality of life or anxiety apart from obsessive compulsive behaviors where children who had outgrown their food allergies had significantly higher scores (mean = 5.23, s.d. = 3.94) than those children who had not outgrown their allergies (mean = 2.52, s.d. = 2.52), [$t(36) = 2.585$, $p = 0.01$].

Children with co-existent atopic diseases had worse school related QoL (mean = 72.79, s.d. = 14.10) compared to those with no co-morbidity (mean = 90.0, s.d. = 7.07), [$t(36) = -2.384$, $p = 0.02$]. When this was categorized by disease, only children with hayfever reported worse scores (mean = 70.0, s.d. = 14.10 compared to mean = 79.21, s.d. = 11.58), [$t(36) = -2.041$, $p = 0.05$]. The presence of atopic co-morbidities as a group or individually categorized as asthma, eczema, or hayfever, was not associated with any other child or maternal scores.

Twenty three (62%) of children were allergic to more than one food type. The number of food allergies was not related to the child or mothers' QoL or anxiety scores.

The influence of previous experiences

Maternal and child QoL and anxiety and maternal stress were not related to the severity of symptoms during previous reactions. Nor were they related to whether previous allergic reactions to nuts had required administration of epinephrine ($n = 5$), or required a hospital visit

Table 4. Differences in maternal reported scores between those whose child had previously outgrown other food allergies (including other nuts) and those whose child had not. Figures are mean (s.d.) unless otherwise stated. (key ($\downarrow = \checkmark$) = lower score associated with better QoL/less anxiety; ($\uparrow = \checkmark$) = higher score associated with better QoL)

	Outgrown	Not outgrown	t value (df)	p
Allergy specific QoL ($\downarrow = \checkmark$)	66.54 (29.34) $n = 13$	51.78 (22.62) $n = 27$	1.753 (38)	0.088
Generic QoL ($\uparrow = \checkmark$)	63.69 (10.23) $n = 13$	73.35 (6.64) $n = 26$	-3.560 (37)	0.007
Physical health QoL	15.31 (3.33) $n = 13$	17.44 (1.53) $n = 27$	-2.805 (38)	0.044
Psychological QoL	13.23 (1.83) $n = 13$	15.3 (1.88) $n = 27$	-3.284 (38)	0.002
Social relationships QoL	13.92 (3.15) $n = 13$	15.65 (3.06) $n = 26$	-1.650 (37)	0.107
Environment QoL	14.62 (2.5) $n = 13$	16.74 (1.91) $n = 27$	-2.974 (38)	0.005
Overall QoL	3.54 (0.66) $n = 13$	4.30 (0.47) $n = 27$	-4.199 (38)	<0.001
Overall health QoL	3.08 (1.04) $n = 13$	3.89 (1.01) $n = 27$	-2.356 (38)	0.024
Overall anxiety ($\downarrow = \checkmark$)	78.33 (17.43) $n = 12$	65.96 (16.35) $n = 27$	2.138 (37)	0.039
Trait anxiety	44.00 (9.4) $n = 12$	33.70 (8.48) $n = 27$	3.386 (37)	0.020
State anxiety	34.5 (9.3) $n = 12$	32.19 (10.08) $n = 27$	0.677 (37)	0.503
Stress ($\downarrow = \checkmark$)	26.31 (5.87) $n = 13$	18.77 (4.9) $n = 26$	4.241 (37)	<0.001

to manage an acute reaction ($n = 14$). Nine children had never reacted to nuts, but were diagnosed on the basis of highly predictive SPTs or sIgE, either conducted as part of a research study, because of the child's other allergies, or a sibling history of nut allergy. Whether or not a child had previously reacted to nuts was not significantly related to maternal or child reported QoL, anxiety or stress levels.

Discussion

This study confirms previous findings that nut allergy has a significant impact on psychological distress and quality of life in children with nut allergy and their mothers (10–14). This is the first study to show that the clinical management of nut allergy has an impact on these factors. Prescribing epinephrine auto-injectors rather than increasing anxiety, as might be expected, appears to reduce anxiety for food allergic children and their mothers. However, quality of life, anxiety and perceived stress were not associated with the child's adherence to carrying these auto-injectors. In addition, making an effort to avoid consumption of 'may contain' food products was associated with an impaired QoL in mothers and children. The main limitation of the study was the small number of children who were not prescribed auto-injectors. This reflects the prescribing habits of most pediatric allergy clinics. The ideal study design would be a randomized controlled trial, but it would clearly be unethical to withhold epinephrine auto-injectors from most nut allergic children. Given the limited numbers, and the constraints of study design, this study provides supportive data that prescription of an auto-injector does not adversely affect the child's or mother's quality of life.

Children with nut allergy reported lower quality of life, particularly in the domains of social and emotional QoL, than would be expected for healthy children; a finding which is supported by previous research (12, 16, 26). Children with nut allergy rated their anxiety levels for all domains as significantly lower than would be expected for healthy children. This is counterintuitive but has been described (15). Mothers reported significantly higher trait anxiety levels than the normal population but perceived stress levels were not significantly raised. Mothers reported better QoL than the healthy UK population. This may reflect the social advantage of families who get referred to a pediatric allergy clinic in the UK, where specialist allergy services remain hard to access (27). Another explanation could be that childhood

food allergy promotes greater family cohesion and improved relationships (10–13).

Perhaps the most interesting study finding was that high levels of maternal and child anxiety were not associated with 'better' (more adherent) food allergy management. High levels of anxiety have been shown to promote information sourcing and gathering of support, whereas low levels of anxiety were associated with decreased vigilance (28). Although prescription of an epinephrine auto-injector was associated with lower anxiety in children and parents, this was not associated with adherence to carrying it 'at all times'. Nor was anxiety associated with consumption of 'may contain' labeled foods or the number of previous accidental exposures. It has been suggested that high levels of anxiety may be beneficial and constructive, encouraging individuals to adhere to adequate avoidance measures and emergency treatment plans (28). However, our findings suggest that anxiety is not related to vigilance in the avoidance of 'may contain' products or compliance with carrying auto-injectors. It may be that merely prescribing the auto-injector provides a level of security to both mother and child, which in turn decreases their vigilance. Information provided in clinic regarding the importance of always having the auto-injector available may need to be stressed. In contrast to anxiety, food allergy specific QoL in both mother and child was significantly poorer if they avoided 'may contain' foods. This is likely to reflect the time and burden of reading food labels and deciding upon the safety of foods, which is made difficult by inadequate labeling of allergenic foods (29).

A number of demographic factors were associated with QoL and anxiety. Older children had better allergy specific QoL than younger children. Previous literature (11) has highlighted how mothers of food allergic children adjust to living with food allergy over time, gaining control and incorporating the condition into everyday life. In line with recent findings regarding gender differences in food allergic QoL and anxiety (15) nut allergic girls had higher anxiety over physical injury than boys and also reported worse physical QoL. The differences observed between genders may reflect the fact that boys tend to diminish the importance of a condition in an attempt to reduce stigmatization, whereas girls will integrate a condition into part of their social identity (30).

We were surprised to find that maternal reported anxiety, stress and QoL were worse for those mothers whose children had outgrown other food allergies. This may be due to multiple

allergies as an infant or toddler promoting lifelong maternal anxieties that are maintained by the continuing presence of nut allergy. Children reported no effects on QoL or overall anxiety of having previously outgrown other food allergies. This may be because common preschool allergies such as those to milk and egg are often outgrown before an age where children can vividly remember events. Previous literature has suggested that atopic co-morbidities negatively affect overall health perception and physical QoL of children (13), particularly asthma and eczema (13). However, this study found only one association between hay-fever and school related QoL. All other studies have looked at parental perceptions, and children's reports may reflect increased time off school due to other illnesses and hospital visits. Nevertheless hay-fever has previously been shown to cause decreased functioning at school and increased time off school in children with allergies (31).

Our findings show that severity of previous reactions, the dose of allergen eliciting previous reactions, the need for treatment with epinephrine, and previous admission to hospital with a reaction have no significant effect on maternal or child reported QoL or anxiety. Previous studies have similarly concluded that a history of a severe reactions has no deteriorative impact on QoL (32). This may suggest that the impact of taking precautions on a daily basis, and the constant concerns about potential accidental ingestion, have a greater influence on psychological outcomes than the circumstances surrounding previous reactions. A focus group study of food allergic children and teenagers by Dunn Galvin et al. (33) similarly found that the children who were most anxious were not necessarily those with a significant history of frequent or recent reactions. The authors suggested that these children may have been programmed to be anxious by parents and doctors who are seen to only provide them with 'negative' management advice regarding allergen avoidance and the possible need for injections to treat reactions.

This study has its limitations. The lack of contemporary, representative normative data is an issue, and future studies may be advised to collect control data from their background population. Parents were encouraged to aid, but not influence younger children to complete the questionnaire. This may have inadvertently resulted in children's reports being skewed by parental influence. A strength of the study is that patients were recruited from an allergy clinic, with a diagnosis of allergy made by a specialist. However, our clinic population may not reflect the

general allergic population who have not received an educational package and access to advice. At the time of this study, no food allergy specific questionnaire had been validated to study the quality of life of children. Additionally, although the generic SCAS questionnaire evaluates clinical disorders in anxiety, it may not be entirely relevant to everyday 'food anxiety' issues. A multinational study has recently developed and validated a questionnaire (Food Allergy QoL- Parent form FAQLQ-PF) to assess parental perception of QoL in children aged 0–12 yrs with food allergy (34) and this includes a 'food anxiety' scale. FAQLQ-PF will be an important tool for future health related QoL and food-related anxiety studies in allergic children.

In conclusion, children with food allergy and their mothers experience impairment of QoL. Although food allergic patients who successfully avoid allergens are largely asymptomatic, there is an impact on their emotional and psychological wellbeing. Our findings suggest that prescription of rescue medication for treatment of unexpected severe reactions may alleviate some of their anxieties and improve quality of life. However, higher levels of anxiety in the child and mother were not associated with improved adherence to strictly avoid allergen-containing foods, and did not impact on whether they carried their epinephrine at all times. This decreased anxiety may also reduce families' vigilance. Clinics should continue to stress the need for careful avoidance of food triggers and the ready availability of rescue medication.

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