

Original article

Health-related quality of life of food allergic patients: comparison with the general population and other diseases

Background: To date no studies have compared generic health-related quality of life (HRQL) of food allergic patients from childhood to adulthood with that of the general population or patients with other chronic diseases. The aim of this study was to compare generic HRQL of food allergic patients with the general population and other diseases.

Methods: Generic HRQL questionnaires (CHQ-CF87 and RAND-36) were completed by 79 children, 74 adolescents and 72 adults with food allergy. The generic HRQL scores were compared with scores from published studies on the general population and patients with asthma, irritable bowel syndrome (IBS), diabetes mellitus (DM) and rheumatoid arthritis (RA).

Results: Food allergic children and adolescents reported fewer limitations in school work due to behavioural problems ($P \leq 0.013$), but food allergic adolescents and adults reported more pain ($P = 0.020$), poorer overall health ($P < 0.001$), more limitations in social activities ($P < 0.001$) and less vitality ($P = 0.002$) than individuals from the general population. Food allergic patients reported poorer generic HRQL than patients with DM, but better generic HRQL than patients with RA, asthma and IBS.

Conclusion: HRQL is impaired in food allergic adolescents and adults, compared to the general population, and it is intermediate in magnitude between DM and RA, asthma and IBS. Children show the least impact on generic HRQL from food allergy.

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Key words: EuroPrevall; food allergy; generic questionnaires; health-related quality of life.

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Accepted for publication 6 May 2009

Currently, there is still no cure available for patients with food allergy. Although food allergic patients may experience symptoms only intermittently, they must maintain a high degree of vigilance to prevent exposure to foods to which they are allergic. This may be a great burden to themselves and their families (1, 2). Despite taking precautions, there is always a chance of accidental exposure and for some patients such exposure may be fatal (3). The knowledge that accidental exposure may result in a (severe) allergic reaction may in turn provoke even more anxiety. This further exacerbates the negative impact on the health-related quality of life (HRQL) of food allergic patients (4).

HRQL may be defined as 'the effects of an illness and its consequent therapy upon a patient, as perceived by the patient' (5). The measurement of HRQL offers the opportunity to study the impact of a disease or the effect

of a treatment from the patient's unique perspective. More importantly, HRQL is the only available measure reflecting the ongoing severity of food allergy, since no objective disease parameters are available (6).

There are two major types of questionnaires to measure HRQL: generic and disease-specific questionnaires. Generic questionnaires can be used to evaluate and compare different diseases. The disadvantages of generic questionnaires are that they may not focus adequately on problems specific to a particular disease and that they simultaneously measure the impact of comorbid diseases. Disease-specific instruments, as their name implies, are targeted to a specific disease. These disease-specific questionnaires are more likely to detect clinically important changes in patients' HRQL. However, disease-specific questionnaires do not allow direct comparison between different diseases (7).

In food allergy research, there are a number of studies that have investigated the impact of food allergy on HRQL (8–20). However, there are no studies that have compared generic HRQL of food allergic patients from childhood to adulthood with that of the general population and patients with other chronic diseases. To our knowledge, there are two previous studies that have compared HRQL of food allergic patients with one other chronic disease (rheumatological disease and diabetes mellitus, respectively) (8, 10). However, the latter study (10) used nonvalidated disease-specific questionnaires, which make a comparison between different diseases problematic. The former study (8) used a single Visual Analogue Scale and the Impact on Family Scale, which only covers a single domain of generic HRQL, and is also the only study in the field of food allergy that investigated the HRQL of food allergic adults. All other studies investigated food allergic children. Of these paediatric studies, there was only one study in which adolescents aged 13–21 years completed a self-administered HRQL questionnaire, while in all other paediatric studies, the HRQL questionnaires were completed by the parents.

The aim of this study was to investigate the impact of food allergy on HRQL measured with self-administered generic HRQL questionnaires in children (8–12 years), adolescents (13–17 years) and adults (≥ 18 years) and to compare the generic HRQL of these food allergic patients with the generic HRQL of the general population and patients with other diseases.

Methods

Participants

The current study is part of a larger survey on the development and validation of food allergy specific HRQL questionnaires and the measurement of the impact of food allergy on HRQL. This larger study was reviewed by the local medical ethics review commission (METc 2005/051) who deemed that the study did not fall under the scope of the Medical Research Involving Human Subjects Act and that therefore approval was not needed. The children (8–12 years), adolescents (13–17 years) and adults (≥ 18 years) who participated in the present study were part of the studies on the cross-sectional validation of the Food Allergy Quality of Life Questionnaire-Child Form, – Teenager Form and – Adult Form (FAQLQ-CF, TF and AF) (18–20). These participants had a physician-diagnosed food allergy for at least one food, and were recruited from our outpatient (paediatric) allergy clinic or were recruited through food allergy support organizations (the Dutch Foundation for Food Allergy and the Dutch Anaphylaxis Network) and by advertisement in local newspapers. Of the patients recruited from our allergy outpatient clinic (60%), about one-third had a food allergy confirmed by a double-blind placebo-controlled food challenge (DBPCFC) and the other patients had a physician-diagnosed food allergy based on history and skin prick test (SPT) and/or blood test. The majority of these patients with a physician-diagnosed food allergy were awaiting a DBPCFC. All patients recruited by advertisement (40%) reported physician-diagnosed food allergies. The most common types of food allergies and different types and severities of symptoms were represented in the study sample.

Procedure

A letter of invitation, the age appropriate generic HRQL questionnaire and descriptive questions on age, sex, type and number of food allergies, type of symptoms and diagnosis were sent by mail to be completed at home. The letter of invitation stressed that participation was completely voluntary. Participants were not paid for their participation. The children (8–12 years) and their parents were instructed that the children should fill out the questionnaires by themselves. Parents were allowed to explain a question when needed, but they were not allowed to tell the child which answer to give. For completing the descriptive questions, parents were allowed to help their child when needed.

Questionnaires

In children and adolescents, the Child Health Questionnaire-Child Form (CHQ-CF87) was administered (21, 22). This questionnaire is self-administered by the child and contains 87 items divided into twelve scales (Table 1). After recoding the raw scores, scale scores were computed and transformed into a 100-point scale. Higher scores indicate better HRQL.

In adults we administered the RAND-36, which is the Dutch translation of the MOS 36-item Short-Form Health Survey (23, 24). The RAND-36 consists of 36 items divided into nine scales (Table 1). After recoding the raw scores, scale scores were computed and transformed into a 100-point scale. Higher scores indicate better HRQL.

Comparative studies

Norm values of the Dutch population were obtained from the validation studies of the generic questionnaires in the Netherlands (22, 23). The original database of the Dutch school population was obtained (22) and used to calculate CHQ-CF87 scores for children and adolescents separately. As comparative diseases, we chose asthma, irritable bowel syndrome (IBS), diabetes mellitus type I (DM) and rheumatoid arthritis (RA), because they have sufficient parallels with food allergy and/or were used as comparative disease in previous studies on HRQL in food allergy (8, 10).

To compare the impact of food allergy on HRQL with the general population and patients with other diseases, we searched PubMed for comparative studies on generic HRQL. Comparative studies were identified through a search from 1998 to 2008 using the search terms 'Child Health Questionnaire Child Form 87' or 'CHQ-CF87' for the children and adolescents and 'RAND-36', 'SF-36' or 'Medical Outcomes Study Short Form 36' for the adults, together with disease-specific terms. Only studies in Dutch populations were included, since the current study of food allergic patients was carried out in the Netherlands. For inclusion in the comparison, the studies had to report the mean (SD) scores for each of the CHQ-CF87 subscales or RAND-36 subscales. Because the focus of the comparison was the effect of disease on HRQL, baseline or pre-treatment scores were required. If multiple studies met the selection criteria, the study with the largest sample size was chosen.

Statistical analysis

One-sample *t*-tests were used to compare the scores of the food allergic patients on the CHQ-CF87 and RAND-36 with Dutch populations and other disease populations previously studied. Because we obtained the original database of the Dutch school-age population (22), we used the Mann–Whitney test to compare the scores of the CHQ-CF87 of the food allergic children and adolescents with the general population (not normally distributed).

Table 1. CHQ-CF87 and RAND-36 scales, items per scale and definition of the scales

Generic HRQL scales	No. of items	Definition of the scales
<i>CHQ-CF87</i>		
Physical functioning (PF)	9	Limitations in physical activities
Role functioning-emotional (RE)	3	Limitations in school work or activities with friends due to emotional problems
Role functioning-behaviour (RB)	3	Limitations in school work or activities with friends due to behavioural problems
Role functioning-physical (RP)	3	Limitations in school work or activities with friends due to physical problems
Bodily pain (BP)	2	Severity, frequency of pain and limitations due to pain
General behaviour (BE)	17	The degree to which the child exhibits aggressive, immature or delinquent behaviour
Mental health (MH)	16	The degree of positive and negative feelings, including anxiety, depression, peacefulness and happiness.
Self-esteem (SE)	14	The degree of satisfaction with abilities, looks, family/peer relationship and life overall
General health (GH)	12	Perceptions of overall health
Change in health*	1	Change in health compared to 1 year ago
Family activities (FA)	6	The degree to which the child's health limits or interrupts family activities or is a source of family tension
Family cohesion (FC)	1	The ability of the family to get along with each other
<i>RAND-36 (SF-36)</i>		
Physical functioning (PF)	10	Limitations in physical activities
Social functioning (SF)	2	Limitations in social activities
Role functioning-physical (RP)	4	Limitations in work or daily activities due to physical problems
Role functioning-emotional (RE)	3	Limitations in work or daily activities due to emotional problems
Mental health (MH)	5	The degree of positive and negative feelings, including anxiety, depression, peacefulness and happiness.
Vitality (VT)	4	The degree of vitality and liveliness
Bodily pain (BP)	2	Severity, frequency of pain and limitations due to pain
General health (GH)	5	Perceptions of overall health
Change in health*	1	Change in health compared to 1 year ago

*This single-item scale was not used in this study.

Statistical analyses were performed with SPSS for Windows 14.0 (SPSS Inc., Chicago, IL, USA).

Results

Participants

The questionnaires were sent to 312 participants divided over the three age groups. Response rates were high: children 84/111 (73%), adolescents 75/98 (77%) and adults 80/100 (80%). A few returned questionnaires were excluded from the analysis because (a) no current food allergies were reported (three children and one adult) or (b) no physician-diagnosed food allergy was reported (seven adults) or (c) the descriptive characteristics were missing (one child and one adolescent) or (d) the generic questionnaire was not completed (one child). Therefore, 225 participants were included in the final analysis. Table 2 shows the descriptive characteristics of these participants.

Comparative studies

The following numbers of articles were reviewed for each generic questionnaire and each disease:

- CHQ-CF87 (children and adolescents): asthma, $n = 3$; IBS, $n = 0$; DM, $n = 5$; RA, $n = 11$;
- RAND-36 (adults): asthma, $n = 7$; IBS, $n = 1$; DM, $n = 19$; RA, $n = 16$;

A summary of the selected articles is shown in Table 3.

CHQ-CF87: food allergy vs population. Food allergic children scored significantly higher on the scale 'role functioning-behaviour' (RB) ($P = 0.005$) than children from the general population (22), indicating better HRQL for the food allergic children on this scale (Fig. 1). Also food allergic adolescents scored significantly higher on the scale RB ($P = 0.013$), but lower on the scales 'bodily pain' (BP) ($P = 0.020$) and 'general health' (GH) ($P < 0.001$) than adolescents from the general population (22), indicating better HRQL on one scale for the food allergic adolescents and poorer HRQL on the other two scales (Fig. 2A).

CHQ-CF87: food allergy vs other diseases. No studies in asthma, IBS, DM or RA were found that examined the CHQ-CF87 in children aged 8–12 years. Only two studies examined the CHQ-CF87 in adolescents with asthma (25) and DM (26). Asthmatic adolescents scored significantly lower on the scales 'physical functioning' (PF) ($P = 0.049$), 'general behaviour' (BE), 'mental health' (MH), 'family activities' (FA) and 'family cohesion' (FC) (all $P < 0.001$) than those with food allergy, indicating better HRQL for food allergic adolescents than asthmatic adolescents. Adolescents with DM scored significantly higher on the scales PF ($P = 0.039$), BP ($P = 0.012$), MH ($P = 0.034$) and 'self-esteem' (SE) ($P = 0.014$) than those with food allergy, indicating poorer HRQL for food allergic adolescents than diabetic adolescents (Fig. 2B).

RAND-36: food allergy vs population. Food allergic adults scored significantly lower on the scales 'social

Table 2. Descriptive characteristics of the food allergic participants ($n = 225$)

	Children	Adolescents	Adults
Number	79	74	72
Sex (m/f)	45/34	34/40	18/54
Age, mean(years)	10.2 (SD 1.3)	14.7 (1.3)	37.2 (14.3)
Age, range (years)	8–12	13–17	18–72
Type of food allergies, n (%)			
Peanut	59 (74%)	57 (77%)	42 (58%)
Tree nut	57 (72%)	56 (76%)	42 (58%)
Egg	29 (37%)	26 (35%)	16 (22%)
Milk	22 (28%)	29 (39%)	19 (26%)
Fish	2 (3%)	13 (18%)	11 (15%)
Shell fish	7 (9%)	12 (16%)	12 (17%)
Wheat	10 (13%)	5 (7%)	12 (17%)
Sesame	14 (18%)	8 (11%)	13 (18%)
Soy	12 (15%)	17 (23%)	13 (18%)
Celery	1 (1%)	3 (4%)	11 (15%)
Fruits	29 (37%)	38 (51%)	35 (49%)
Vegetables	14 (18%)	22 (30%)	27 (38%)
Other*	15 (19%)	20 (27%)	30 (42%)
Number of food allergies, n (%)			
1 food	15 (19%)	9 (16%)	12 (17%)
2 foods	15 (20%)	12 (41%)	14 (19%)
3 foods	16 (20%)	15 (11%)	8 (11%)
>3 foods	32 (41%)	38 (51%)	38 (53%)
Type of symptoms, n (%)			
Cardiovascular symptoms†	28 (35%)	31 (58%)	44 (61%)
Respiratory symptoms‡	56 (71%)	61 (82%)	60 (83%)
Gastrointestinal symptoms§	49 (62%)	47 (64%)	48 (67%)
Skin symptoms¶	69 (87%)	60 (81%)	55 (76%)
Other**	66 (84%)	66 (89%)	62 (86%)

*For example, lupine, kernels and seeds, herbs and spices, meat.

†Dizziness, feeling your heart beat fast, loss of vision, inability to stand, light headedness, collapse, loss of consciousness/passing out.

‡Tightening throat, difficulty swallowing, hoarseness/hoarse voice, difficulty breathing in, shortness of breath, wheezing, cough.

§Nausea, stomach cramps, vomiting, diarrhoea.

¶Itchy skin, red rash, urticaria, worsening eczema, swelling of the skin.

**Oral allergy, swollen tongue or lips, symptoms of the nose or eyes.

functioning' (SF) ($P < 0.001$), 'vitality' (VT) ($P = 0.002$) and GH ($P < 0.001$) than adults from the general population (23), indicating poorer HRQL for food allergic adults (Fig. 3A).

Table 3 Description of studies included in the comparison

Reference	Disease	Patients, n^*	Age, mean (SD)	Age, range	Male, %	Sample source
CHQ-CF87						
(22)	Population	444	12.8 (1.7)	9–17	50.5	School children
(26)	Asthma	72	15 (0.7)	14–17	27.8	School children
(27)	DM	91	14.9 (1.1)	13–16.5	47	Outpatient clinic
RAND-36						
(23)	Population	1063	44.1 (17.5)	18–89	35	Dutch population
(29)	Asthma	27	45.9 (15.9)	NA	33.3	Outpatient clinic
(31)	IBS	169	55.0 (17.1)	NA	22.8	Medical database
(28)	DM	274	38.2 (12.4)	NA	54.4	Outpatient clinic
(30)	RA	679	59.6 (13.8)	NA	29	Diagnostic register

DM, diabetes mellitus type I; RA, rheumatoid arthritis; IBS, irritable bowel syndrome; NA, not available.

*Represents the number of patients included in the analysis of the generic HRQL questionnaire.

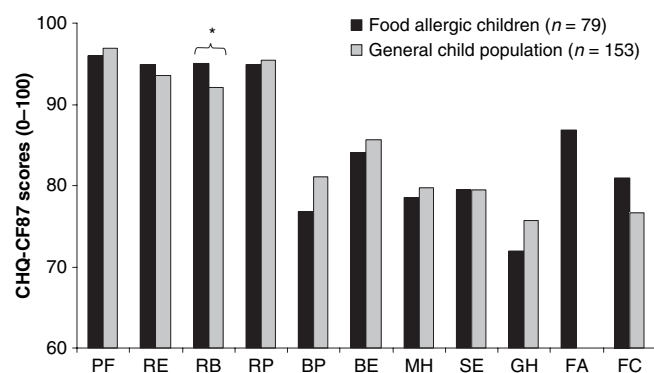


Figure 1. CHQ-CF87 scores of children with food allergy and a sample of children from the general population (22). * $P < 0.01$. Higher scores indicate better HRQL. FA, not available for the sample of children from the general population. See Table 1 for the definition of the scales.

RAND-36: food allergy vs other diseases. Adults with DM (28) scored significantly higher on five scales than those with food allergy (SF, $P < 0.001$; 'role functioning-physical' (RP), $P = 0.014$; VT, $P = 0.002$; BP, $P = 0.001$; GH, $P < 0.001$), indicating poorer HRQL for food allergic adults than diabetic adults. Adults with asthma (28) scored significantly lower on all scales, except one (MH), than those with food allergy (all $P < 0.01$), indicating better HRQL for food allergic adults than asthmatic adults. Also adults with RA (29) scored significantly lower on six scales than those with food allergy (PF, $P < 0.001$; RP, $P < 0.001$; 'role functioning-emotional' (RE), $P = 0.008$; VT, $P = 0.031$; BP, $P < 0.001$; GH, $P = 0.048$), indicating better HRQL for food allergic adults than adults with RA. Finally, adults with IBS (31) scored significantly lower on all scales than those with food allergy (all $P < 0.01$), indicating better HRQL for food allergic adults than adults with IBS (Fig. 3B).

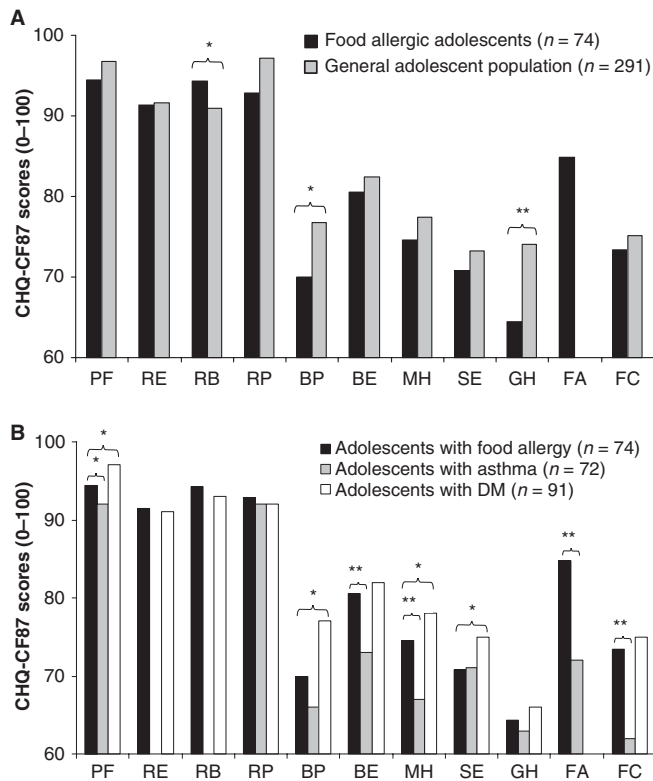


Figure 2. (A) CHQ-CF87 scores of adolescents with food allergy and a sample of adolescents from the general population (22). * $P < 0.05$; ** $P < 0.01$. Higher scores indicate better HRQL. FA, not available for the sample of adolescents from the general population. See Table 1 for the definition of the scales. (B) CHQ-CF87 scores of adolescents with food allergy, asthma (26) and diabetes mellitus type 1 (DM) (26). * $P < 0.05$; ** $P < 0.01$. Higher scores indicate better HRQL. RE and RB not available for asthma, FA not available for DM. See Table 1 for the definition of the scales.

Discussion

In this study we found that, with some exceptions, food allergic patients reported poorer HRQL than the general population and that the generic HRQL impact of food allergy is intermediate in magnitude between DM and RA, asthma and IBS.

One of the advantages of generic HRQL questionnaires is that they can be used to compare patients with a chronic disease with the general population. Overall, we found that food allergic patients reported poorer generic HRQL than the general population. The only significant exception was that food allergic children and adolescents reported fewer limitations in school work or activities with friends due to behavioural problems (RB). This may be explained by the fact that having a food allergy demands that the child be conscious of his or her behaviour, especially regarding to situations involving food, with an emphasis on avoidance of impulsive

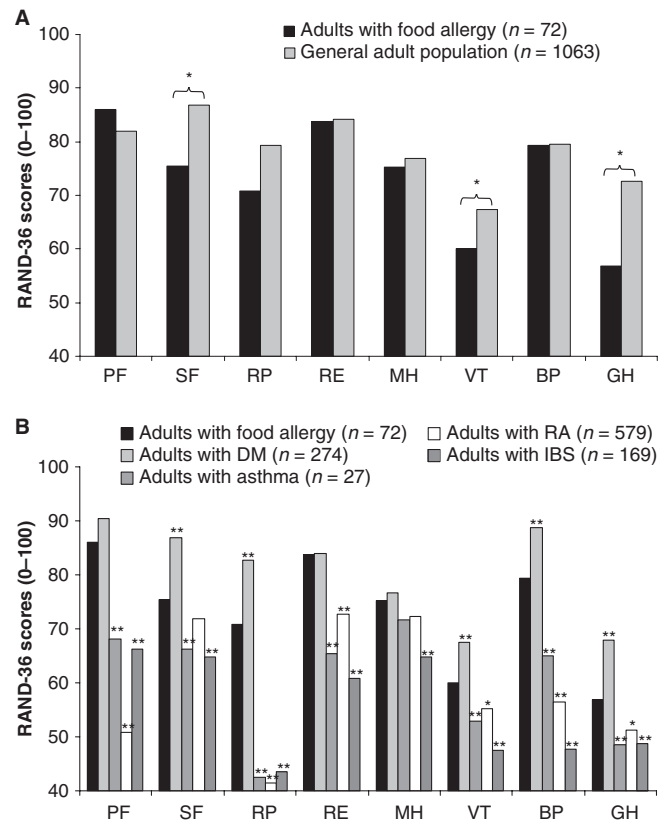


Figure 3. (A) RAND-36 scales scores of food allergic adults and a sample of adults from the general population (23). * $P < 0.01$. Higher scores indicate better HRQL. See Table 1 for the definition of the scales. (B) RAND-36 scales scores of adults with food allergy, diabetes mellitus type 1 (DM) (27), asthma (28), rheumatoid arthritis (RA) (29) and irritable bowel syndrome (IBS) (30). * $P < 0.05$; ** $P < 0.01$. Higher scores indicate better HRQL. See Table 1 for the definition of the scales.

behaviour. These disease managing demands may result in more consciousness about behaviour in other situations as well, resulting in less behavioural problems than in children of the general population.

Food allergic adolescents reported significantly more pain and limitations due to pain (BP) and poorer perceptions of overall health (GH) than adolescents from the general population. It is remarkable that food allergic adolescent reported significantly lower scores on BP than those from the general population, since pain is not a feature of food allergy. However, the questions included in BP ask about bodily pain or symptoms. While symptoms are generally not a feature of food allergy outside of accidental exposures, they are a feature of frequent comorbid conditions such as asthma (31) of which the impact on HRQL is documented (32, 33). Since generic questionnaires do not separate the impact on HRQL of the disease in question from the impact of comorbid diseases, this may have influenced the responses to questions in this domain.

A further advantage of generic HRQL questionnaires is that they can be used to compare different diseases. We compared food allergy with four other chronic diseases and found that food allergic patients reported poorer HRQL than patients with DM, but better HRQL than patients with RA, asthma and IBS. While this may indicate that these diseases differ in their impact on HRQL, other factors may have played a role as well. Firstly, HRQL in adults is age-dependent and it has been found that HRQL as measured with the scales PF, RB, BP and GH decreases with age (23). On average, the food allergic adults in our study were younger than the adult patients with asthma, IBS and RA, which may have led to diminished HRQL being reported by these patient groups. The adults with DM had approximately the same age as the food allergic adults, and thus this comparison is probably not influenced by the described age effect. Another possibility is that generic questionnaires may be biased to being responsive in diseases characterized by daily chronic symptoms such as asthma, IBS and RA. Conversely, generic HRQL questionnaires tend to ignore limitations of lifestyle and psychological burden caused by disease managing activities more characteristic for diseases such as food allergy and DM. This may also have influenced the HRQL reported by these patient groups and could have led to an underestimation of the impact on generic HRQL in DM and food allergy.

Furthermore, no Dutch studies in asthma, IBS, DM or RA were found that examined the CHQ-CF87 in children aged 8–12 years. However, such studies have been done in other countries. For example, in Sweden they found that in children aged 9–16 years the best HRQL was reported by children with short stature, followed by DM and asthma, and the worst HRQL was reported by children with juvenile chronic arthritis (JCA) as measured with the CHQ-CF87 (34). Inasmuch as these results are comparable, the food allergic children and adolescents from our Dutch study reported poorer generic HRQL than the Swedish patients with short stature and DM, but better HRQL than the Swedish patients with asthma and JCA.

The disadvantages of generic questionnaires are that they are by design comprehensive, so they may not focus adequately on problems specific to a particular disease. In addition, generic questionnaires do not separate the impact on HRQL of the disease in question from the impact of comorbid diseases. As asthma is a frequent comorbid condition in food allergy and vice versa (32),

these comorbidities may have influenced the HRQL outcomes to some extent. Therefore, the patient groups with food allergy and asthma in the current comparison may not be totally separate groups.

This study may have some further limitations. We decided to only include comparative studies that were performed in the Netherlands, since the HRQL measurement in food allergic patients was done in the Netherlands. This may decrease the generalizability of the results to other countries and cultures. However, for the comparisons within this study, it was important to include only Dutch studies to prevent bias caused by different languages or cultures. In addition, it should be mentioned that the comparison between the different diseases is restricted to the patients included in the selected studies. Patients within these different studies could not be perfectly matched on demographic variables which might influence the impact of these diseases on HRQL. Finally, for completing the descriptive questions, parents were allowed to help their child when needed. This may have lead to unwanted parental interference with the CHQ-CF. However, we emphatically instructed parents and children that the children should fill out the CHQ-CF by themselves. Moreover, we felt that this method reduced the burden for the children and improved the correctness of the answers.

In conclusion, this study showed that food allergic patients generally reported poorer HRQL than the general population, and the generic HRQL impact of food allergy is intermediate in magnitude between DM and asthma, IBS and RA. Although we found that food allergy has a greater impact on generic HRQL than DM, it is remarkable that this is not reflected in the attitudes of governments, societies and science. For example, if the term 'food allergy' is entered in PubMed 14 394 hits are found and if the term 'diabetes' is entered in PubMed 326 718 hits are found. Although the prevalence of both diseases is in the same range, the societal attention for these diseases does not reflect their HRQL impact. Further comparative studies between food allergy, DM and other chronic diseases will show if similar differences in HRQL impact are seen as in our study.

Acknowledgment

This work was funded by the EU through the EuroPrevall project (FOOD-CT-2005-514000).

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