

Royal Prince Alfred Hospital Allergy Unit

Quality of Life in Adults Following The Royal Prince Alfred Hospital Elimination Diet

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Declaration:

'The candidate, *Kristy-Lee Raso*, hereby declares that none of the work presented in this paper has been submitted to any other University or Institution for a higher degree and that to the best of her knowledge contains no material written or published by another person, except where due reference is made in the text'.

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Abstract

Background/Aim: Food intolerance may negatively impact quality of life (QoL), however the influence of an elimination diet on QoL remains unclear. This study aims to determine QoL of outpatients presenting to the Royal Prince Alfred Hospital (RPAH) Allergy Unit following the Elimination Diet at baseline to on the Elimination Diet, and identify relationships between symptoms, diet and QoL.

Methods: Adults presenting to the RPAH Allergy Unit with suspected food intolerance between March and September 2014 completed The World Health Organization Quality of Life Bref (WHOQoL-Bref) questionnaire, The Food-Related QoL (FRQoL) questionnaire and the RPAH Allergy Unit Assessment Form at their initial appointment and three months after starting the Elimination Diet. The relationship between QoL and symptoms were statistically analysed.

Results: Seventy-four patients completed the questionnaires at their initial appointment and twelve, three months after starting the Elimination Diet. Baseline QoL was low compared to Australian norms. WHOQoL domains (follow-up cohort n=12) displayed small changes at three months; physical and environmental QoL improved from baseline, psychological and social QoL decreased. Two FRQoL subscales: food-related health and emotional impact improved, indicating better QoL. Symptoms were seen to occur across three main body systems (gastrointestinal tract, central nervous system, skin) and patients with higher symptom frequency and severity had lower baseline QoL scores.

Conclusion: QoL is impaired in patients with suspected food intolerance presenting to an outpatient hospital. The Elimination Diet effectively reduces symptoms and improves QoL. Further research is needed over a longer timeframe to determine the suitability of the questionnaires to measure QoL change, and if a symptom-specific QoL is needed.

Key words: *food intolerance, quality of life, QoL, elimination diet, symptom.*

Introduction

Food intolerance is defined as a non-immunological adverse reaction to a wide range of food chemicals, which are naturally occurring such as salicylates, amines and glutamates; or food additives such as preservatives and colours.¹⁻³ While the exact prevalence is unknown, it is estimated that 10-15% of people may have some form of food intolerance with only a few experiencing serious problems severe enough to interfere with their day-to-day life.⁴ The variation in the prevalence rate is likely due to no formal diagnostic tool; with many unaware they are sensitive to certain foods.

The mechanism to which reactions occur is poorly understood, but considered to have a pharmacological basis, triggered by food chemicals irritating the nerve endings in different parts of the body.² Reactions are dose-dependent, and delayed due to the cumulative nature of the chemicals involved, varying from person-to-person, manifesting as symptoms affecting the skin, gastrointestinal tract (GIT), central nervous system (CNS), respiratory tract and genitourinary system.^{1,2} Symptoms are varied and differ in frequency, severity, and onset; and may present as urticaria, angioedema, headache/migraine and bowel irritations including symptoms of nausea, bloating, abdominal pain, constipation and diarrhoea.

A relationship between diet and symptoms may become apparent when the foods that cause the symptoms are identified. Food intolerance is not immune-mediated and currently no blood or skin test will accurately diagnose offending food chemicals, in the same way as a food allergy. Instead, the most effective method of investigation is by dietary elimination and systematic

challenge testing.^{1,2} For over 30 years the Royal Prince Alfred Hospital (RPAH) Elimination Diet and challenge protocol has been used as a diagnostic tool to identify food chemical intolerance in Australia.¹ All suspected foods and food chemicals are removed from the diet, for a period of two to six weeks following one of three dietary restriction levels; 'simple', 'moderate' and 'strict', based on symptoms, suspected dietary triggers and the ability to adhere to dietary restrictions.² Once symptoms have settled, foods or double blind placebo controlled challenges are undertaken, thereby identifying the offending food chemicals to which the individual is sensitive.^{2,5} The results of the challenges enable the prescription of a modified diet and gradual liberalisation of foods, allowing patients to avoid adverse reactions to foods as much as possible, and improve symptoms.

Identification of suspected food chemicals, reduction of symptoms and improved quality of life (QoL), are primary outcomes in the management of food intolerance. Current literature shows that food intolerance negatively impacts QoL, as a result of physical symptoms, psychological problems and social limitations.^{6,7} QoL is defined by The World Health Organisation (WHO) as *'an individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns'*.⁸ Moreover, QoL measures an individual's perception of life's positive and negative aspects, giving an insight into the impact of disease from the patient's perspective.^{9,10}

Given the growing awareness of food intolerance in the population and better understanding of elimination diets; QoL has increasingly been recognised as

an important but rather under-investigated outcome. Current study results have varied in terms of how and to what extent elimination diets influence QoL, due to variations in population samples and questionnaires measuring QoL. However these results have shown symptom reduction and QoL improvements when following an elimination diet including pseudoallergen diets, fermentable, oligosaccharides, disaccharides, monosaccharides and polyols (FODMAPs) diet and a gluten free diet.¹¹⁻¹⁴

No studies to date have investigated the influence of following the Elimination Diet has on QoL. This study aims to determine baseline QoL of outpatients presenting to the RPAH Allergy Unit with suspected food intolerance on their baseline diet, and investigate QoL change in patients '*at their best*' on the Elimination Diet. A secondary aim was to document symptom frequency and severity, and identify relationships between symptoms and QoL. It is predicted that as (at the three month follow-up); symptoms in adults with suspected food intolerance reduce, general QoL outcomes in particular physical domains will improve, and food-related QoL subscales will be more impaired. This study will provide an insight into the QoL among adults following an elimination diet.

Methods

Study design

This cross-sectional study is part of a larger five-year prospective observational study on the nutritional adequacy and dietary compliance of patients with suspected food intolerance, prescribed the RPAH Elimination Diet at the RPAH Allergy Unit. The present study was conducted according to the guidelines laid down in the Declaration of Helsinki, and ethics was approved by the Ethics Review Committee (RPAH Zone) of the Sydney Local Health District. Patient recruitment, data collection and data entry was conducted by student dietitians with the help of research dietitians.

Participants

All adults (18 \geq years of age) with an upcoming initial appointment at the RPAH Allergy Unit between March and September 2014 were contacted by telephone one to two weeks prior to their initial appointment to determine suitability and interest in the study. Patients were included if they had a suspected food intolerance and/or symptoms including urticaria, irritable bowel, headaches/migraines, other food reactions or symptoms suspected to be food related. Patients who had trialed the Elimination Diet prior to their appointment and modified their diet appropriately were not eligible to participate. An information pack outlining study details and instructions to complete a four-day weighed food record to be used in the broader study were provided to eligible patients.

At their initial appointment on their baseline diet, patients seeing a dietitian for the Elimination Diet completed three questionnaires: the RPAH Allergy Unit Initial Assessment Form (Adult); The World Health Organization Quality of Life Bref (WHOQoL-Bref)¹⁵ questionnaire; and Food-Related QoL (FRQoL) questionnaire. Approximately three months after commencing the Elimination Diet, a package mailed to patients still participating in the study contained: the RPAH Allergy Unit 3 month Assessment Form (Adult); the WHOQoL-Bref¹⁹ questionnaire; and the FRQoL questionnaire; along with a return, self-addressed, and stamped envelope.

Measures

Symptoms and Diet

Clinical data including medical, symptom, and dietary information was collected using the in house developed RPAH Allergy Unit Initial Assessment Form (Adult) at the patients initial appointment, and the RPAH Allergy Unit 3 month Assessment Form (Adult) three months after commencing the Elimination Diet.

At the initial appointment on their baseline diet, patients were asked to indicate the presence or absence of symptoms in the last six months, reporting symptom frequency and severity. To assess the effectiveness of the Elimination Diet, at the three month time-point, patients were asked to record baseline symptoms before their initial appointment at the Allergy Unit, and '*at their best*' on the Elimination Diet. Baseline symptom data collected from the 3

month time-point were used to measure the change in symptoms on the Elimination Diet.

Symptom frequency and severity were graded according to the following:

i) Frequency: Recorded as never, occasionally, monthly, weekly or daily.

ii) Severity: Recoded as:

Mild: aware of the symptom but it is easily tolerated.

Mild-Moderate

Moderate: sufficient to cause interference with daily life or usual activity.

Moderate-Severe

Severe: incapacitating, with inability to work or carry on with usual activities.

Information on dietary modifications, withdrawals (temporary flare up of symptoms), response to the Elimination Diet and impact of symptoms on QoL were collected from the RPAH Allergy Unit Initial Assessment Form (Adult), and the RPAH Allergy Unit 3 month Assessment Form (Adult). Medical records and dietetic files were accessed for further symptom information, Elimination Diet prescribed (strict, moderate, simple), Elimination Diet stage (on the Elimination Diet, undergoing challenges, liberalising) and response to the diet.

QoL measure

QoL was measured and assessed using two self-administered questionnaires. The WHOQoL-Bref¹⁵ questionnaire is an abbreviated version of the WHOQoL-100 item questionnaire with good validity and reliability.¹⁶ It is a 26-item generic QoL questionnaire, asking about QoL in the 'last 2 weeks', rated on a 5-point Likert scale ranging from 1-5. The questionnaire measures overall QoL, perception of health, and four QoL domains: physical health, psychological, social relationships and environmental. Domain scores are summed and converted into a score out of 100, following the WHOQoL-Bref guidelines¹⁵, with higher scores representing better QoL.

Food-Related QoL questionnaire (FRQoL) is a questionnaire adapted from the validated Food Allergy QoL questionnaire (FAQLQ).¹⁷ It is a 23-item disease-specific questionnaire measuring the impairment of food on QoL using a 4-point Likert scale ranging from 1 (minimal QoL impairment) to 4 (maximal QoL impairment). Total FRQoL score is calculated by the mean of all items, based on 4 subscales: food avoidance and dietary restriction, risk of accidental exposure, food-related health, and emotional impact. Scores are scaled in a negative direction; thus high scores indicate a poorer food-related QoL.

Data analysis

Questionnaire responses were entered into Microsoft Excel (2011), and analysed using the Statistical Package for Social Sciences version 22, (SPSS Inc., Chicago, IL, USA). All variables were tested for normality using the Shapiro-Wilk test before further analysis. Variables are presented as

mean \pm SD and percentages (%). Independent t-test were used to determine any differences between baseline QoL mean scores and Australian population norms¹⁶; Paired t-test determined the difference between baseline and 3 month QoL scores. One-way ANOVA analysis with a post-hoc test was performed to determine QoL differences between the different stages of the Elimination Diet (currently on the Elimination Diet, undergoing challenges, liberalising). Correlations using Spearman's rho (non-parametric) were used to assess the relationship between QoL and symptom frequency and severity. Statistical significance was set at $p\leq 0.05$.

Results

A total of 672 patients were contacted prior to their initial appointment, of which 241 were eligible. At their initial appointment, 102 patients saw a dietitian and were prescribed the RPAH Elimination Diet, of which 74 patients (total cohort) started the Elimination Diet. Of those patients that started the Elimination Diet, 36 patients received the 3-month follow-up study package, of which only 12 patients (follow-up cohort) completed and returned the questionnaires.

Study Characteristics

The characteristics of the total (n=74) and follow-up cohort (n=12), and key variables are presented in Table 1. A high proportion of the cohort was made up of females (74%). Most patients (76%) had modified their diet prior to their initial appointment; on average 2.3 different diets were trialed. The follow-up cohort (n=12) were found to be representative of the larger total cohort (n=74) in variables including; type of symptoms, symptom frequency and severity, symptom impact on QoL and WHOQoL-Bref QoL and FRQoL scores. Equally, the follow-up cohort (n=12) were representative in age and gender (Table 1). Of the 12 (follow-up cohort), all patients followed the strict Elimination Diet; two were currently on the Elimination Diet, four were undergoing challenges and six were liberalising their diet at the 3 month follow-up (Table 1).

Table 1: Characteristic and key variables of the total cohort (n=74) and follow-up cohort (n=12)

	Study cohort (n=74)	Follow-up (n=12)
Age mean±SD (range)	40.26±13.9 (19-78)	40.1±15.8 (19-63)
Female n (%)	55 (74)	7 (58)
Number of dietary trialed [†]		
mean±SD (range)	2.3±2.7 (0-12)	2.7±2.5 (4-12)
Elimination Diet prescribed n(%)		Elimination Diet followed n(%)
- Strict	53 (72)	Strict 12 (100)
- Moderate	17 (23)	- On the diet 2 (17)
- Simple	4 (5)	- Challenges 4 (33)
		- Liberalising 6 (50)

[†]Diet modifications: Vegetarian/vegan, belief based diet, Mediterranean diet, low cholesterol/low fat, low calorie, diabetic diet, gluten-free diet, wheat-free, milk-free, lactose-free, low-FODMAP diet, an Elimination diet, detox, other

Symptoms

When patient reported symptoms were grouped based by body systems; GIT, CNS and skin symptoms were reported by 70%, 70%, and 52% of patients respectively. Respiratory and genitourinary symptoms were less common, at 35% and 23% respectively. Patients often reported symptoms across three main body systems (GIT, CNS and skin) e.g. nausea, headaches and skin rashes, rather than confined to one body system alone e.g. skin rashes only. 'Presenting' symptoms (main symptom for attending the unit) were more commonly confined to a single system. When grouped by body systems, there was some discordance in the number and type of symptoms reported by the patient compared with those recorded by the doctor/dietitian in the medical notes (Table 2). Patients were more likely to report a higher number of symptoms across the three main body systems. Responses from the 3 month follow-up, showed patients to be more aware of their baseline symptoms when improvements were seen on the Elimination Diet. Baseline symptoms reported by the patient were higher at the 3 month follow-up when compared with the baseline symptoms reported at their initial appointment.

Table 2: Presentation of symptoms; patient reported and Doctor/dietitian recorded symptoms grouped by body systems (n=12)

Body systems	Patient reported (n)	Doctor/dietitian recorded (n)
Skin [†] only	1	2
Skin and GIT	0	1
GIT [‡] only	0	3
GIT and CNS	5	4
CNS [§] only	0	0
CNS and skin	0	1
Skin, GIT and CNS	6	1
Number of symptoms mean±SD (range)	10.8±5.4 (1-18)	5 ±1.9 (1-5)

GIT, gastrointestinal tract; CNS, central nervous system.

[†]Skin symptoms including eczema, hives, swelling, rash.

[‡]GIT symptoms including mouth ulcers, difficulty swallowing, nausea, vomiting, indigestion, reflux, wind/gas, bloating/discomfort, stomach pains/cramps, diarrhoea, constipation.

[§]CNS symptoms including headache/migraine, fatigue, muscle/ joint pains.

For the follow-up cohort (n=12) GIT, CNS and skin systems, frequency and severity change is summarised in Figure 1, on their baseline diet and '*at their best*' on the Elimination Diet. When grouped by body systems, there was a general decrease in symptom frequency and severity for most symptoms from baseline to '*at their best*'. The individual symptoms that did not show improvement were mouth ulcers and difficulty swallowing. Respiratory and genitourinary symptoms showed little change and thus were not included in Figure 1.

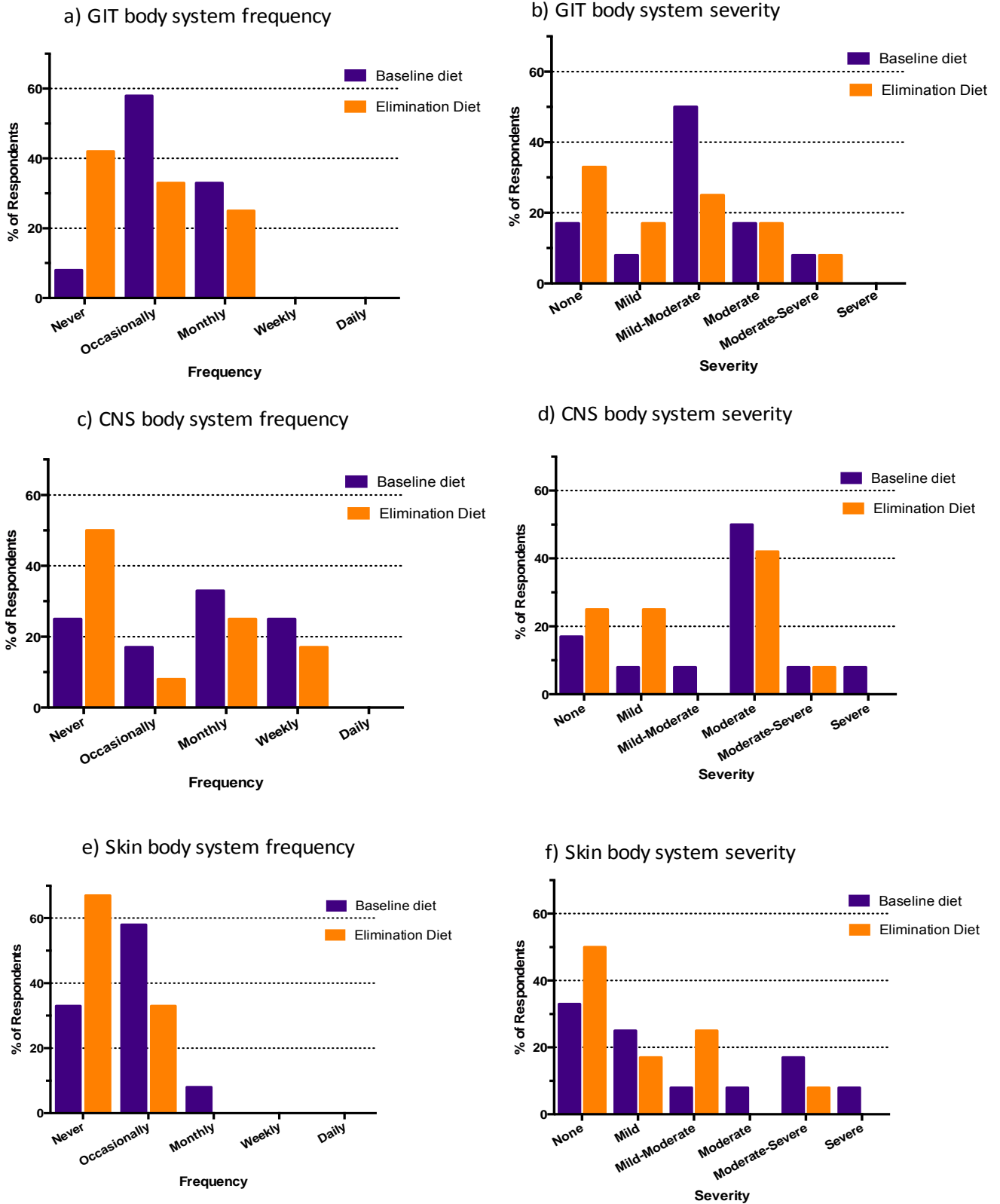


Figure 1 Follow-up cohort (n=12) patient reported symptom frequency and severity change collected from the RPAH Assessment Form grouped by body systems **a)** GIT system frequency; **b)** GIT system severity **c)** CNS frequency; **d)** CNS severity; **e)** Skin organ frequency; **f)** Skin organ severity. Presented as percentages (%) of total respondents. *GIT: Gastrointestinal tract; CNS: Central Nervous System.*

The follow-up cohort (n=12) overall response to the Elimination Diet is displayed in Table 3. All 12 patient's responded to the Elimination Diet; showing an improvement in symptoms, self assessed by patients using the RPAH Allergy Unit 3 month Assessment Form (Adult), and/or recorded by the doctor/dietitian in the medical notes. On average symptom improvement was noticed within the first 15 days. Of the 12, nine reported to suffer from a withdrawal effect, with a temporary flare up of symptoms, which lasted on average for 12 days, with one patient having ongoing symptoms due to other non food related causes.

Table 3: Follow-up cohort (n=12) response to the Elimination Diet

Follow-up cohort (n=12)	
Elimination Diet responder's n (%)	12 (100)
Time-frame to notice symptom improvement (days)	15±9 (5-30)
mean±SD (range)	
Withdrawal effect [‡] n (%)	9 (75)
Duration of withdrawal effect (days)	12.3±8.7 (2-28)
mean±SD (range)	

[†]Responders: patients with clinically significant symptom improvement self assessed and assessed by doctors and/or dietitian's.

[‡]Withdrawal effect: temporary flare-up of symptoms.

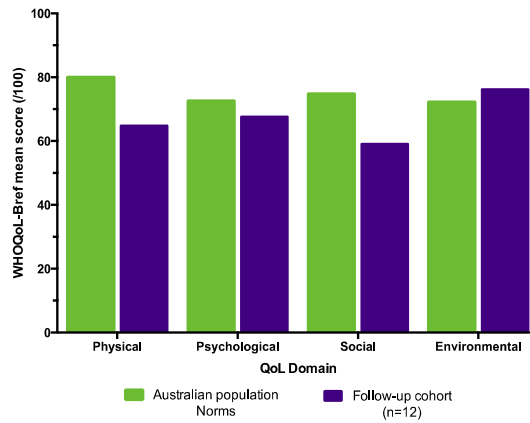
QoL

Comparison of the WHOQoL-Bref domain scores for the follow-up cohort (n=12) compared with Australian population norms¹⁵ is illustrated in Figure 2a. At their initial appointment on their baseline diet, mean environmental QoL score was higher than the population norm. Physical, psychological and social QoL scores were lower. The biggest difference was for physical QoL (1SD below norm).

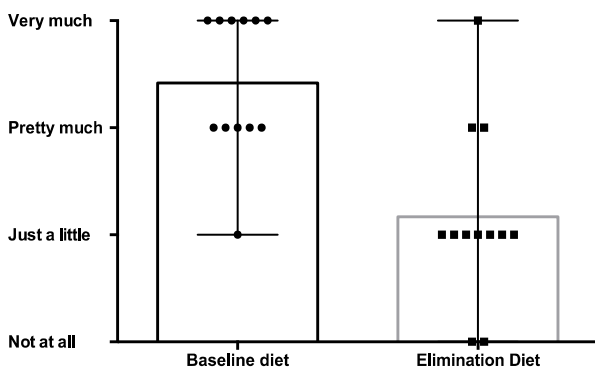
No statistical significant difference was found in QoL scores at the different stages of the Elimination Diet (on the Elimination Diet, challenging, liberalising). The impact of symptoms on QoL for the follow-up cohort (n=12) is illustrated in Figure 2b (as recorded in 3 month RPAH Allergy Unit Assessment Form (Adult)); indicating symptom improvement had a positive effect on QoL. On their baseline diet, 8% reported symptoms to impact their QoL 'just a little', 42% 'pretty much', and 50% 'very much'. '*At their best*' on the Elimination Diet, more patients reported their symptoms had less of an impact on QoL; 58% 'just a little' and 17% 'not at all'.

For the follow-up cohort (n=12), QoL domain scores did not significantly change from on their baseline diet to '*at their best*' on the Elimination Diet (Figure 2c); however physical and environmental QoL scores showed improvement, while psychological and social QoL scores decreased. Of the 12, eight patients showed improvement in physical QoL, four in both psychological and social QoL, and eight in environmental QoL. Self-perception of overall QoL and satisfaction with health remained high (Figure 2d).

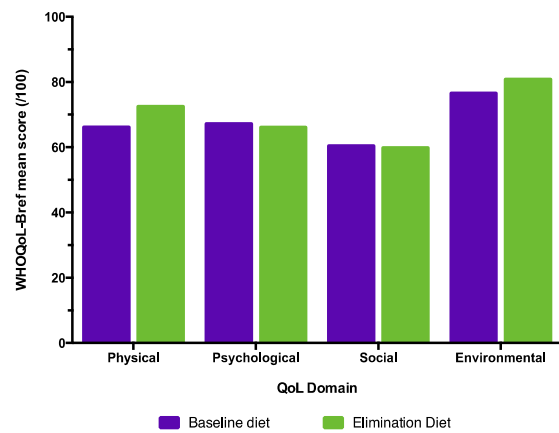
a) WHOQoL scores: Comparison with Australian population norms¹



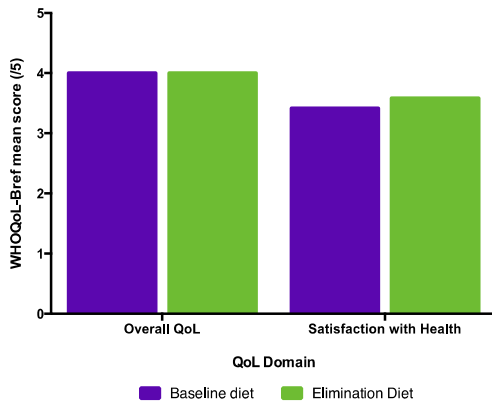
b) The impact of symptoms on QoL: 'at present how much do your symptoms impact on your QoL'



c) WHOQoL change: Baseline diet compared with Elimination Diet



d) WHOQoL self perception change: Baseline diet compared with Elimination Diet



e) FRQoL change: Baseline diet compared with Elimination Diet

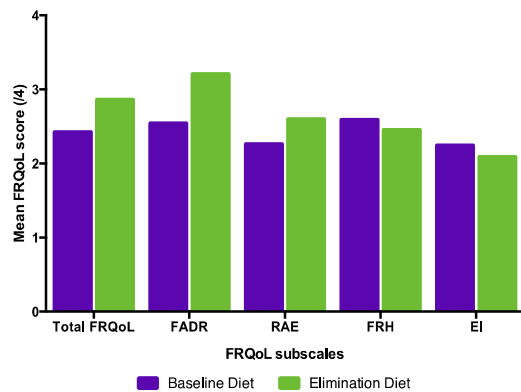


Figure 2 Follow up cohort (n=12) QoL change: Baseline diet (at initial appointment) compared with Elimination Diet (3 month follow-up 'at their best') a) mean WHOQoL scores by domains: Australian norms¹⁶ compared with cohort on baseline diet; b) impact symptoms on QoL assessed by RPAH Allergy Unit Assessment Form. Box showing mean and whiskers showing score range. Individual scores shown by • and ■ c) Mean WHOQoL domains; Higher scores indicate better QoL; d) mean WHOQoL self perception of overall QoL and satisfaction with health; Higher WHOQoL scores indicate better QoL; e) mean FRQoL scores. **FADR**, food avoidance dietary restriction; **RAE**, risk of accidental exposure; **FRH**, food related health; **EI**, emotional impact; Higher FRQoL scores indicate poorer QoL.

Total FRQoL and the four subscales were high at baseline for the follow-up cohort (n=12), indicating poorer FRQoL. Food-related health (FRH) and food avoidance dietary restriction (FADR) subscales, were the highest with a mean of 2.59 and 2.55 out of 4 respectively. FRQoL change was seen in all subscale scores, from on baseline diet to 'at their best' on the Elimination Diet. Food related health (FRH) and emotional impact (EI) subscale scores improved (2.6 vs. 2.5 and 2.3 vs. 2.1 respectively), however this change was not significant. Food avoidance dietary restriction, risk of accidental exposure and Total FRQoL scores increased (2.55 vs. 3.22; 2.23 vs. 2.6 and 2.43 vs. 2.86 respectively).

Correlation of symptoms, diet and QoL

Using Spearman's rho correlation coefficient (q_s), at their initial appointment self-reported from the RPAH Allergy Unit Assessment Form there was a moderately negative correlation between total WHOQoL-Bref scores and the total sum of symptoms ($q_s=-0.3, p=0.01$); symptom frequency (frequency sum of reported symptoms) ($q_s=-0.39, p=0.001$); and severity (severity sum of reported symptoms) ($q_s=-0.3, p=0.01$), for the follow-up cohort. Weak to moderate positive correlations were shown between total FRQoL scores and total symptom number, and symptom frequency and severity, with q_s ranging from 0.26 to 0.37 ($p<0.01$). No significant correlation between total WHOQoL-Bref and FRQoL scores, and other variables including age, gender and number of diets trialed before their initial appointment.

Discussion

This study aimed to determine baseline QoL in adults following the RPAH Elimination Diet and identify changes in QoL following dietary investigation using the Elimination Diet, and was unique in utilising the WHOQoL-Bref and FRQoL questionnaires in patients with food intolerance following an elimination diet. The findings showed that patients with suspected food intolerance had lower QoL scores for physical, psychological and social domains at baseline compared with the general population and following the Elimination Diet improved baseline QoL in physical, environmental, food-related health and emotional impact domains. Secondly, this study aimed to document symptom frequency and severity, and to identify if a relationship exists between symptoms and QoL, it was found that a reduced QoL correlated with number of symptoms, frequency and severity, and a reduction in symptoms had a positive effect on QoL.

The presence of symptoms severe enough to interfere with daily life, negatively impacts QoL.^{6,7,11-14} Some disparity was seen in the symptoms recorded by the doctors/dietitian's in the medical notes and those reported by patients on RPAH Allergy Unit Assessment Form, with on average, patients reporting symptoms to be nearly two times higher. This difference may be accounted for by the variation in how doctors/dietitian's define symptoms compared with the patients.

Many subjectively feel that after experiencing food intolerance symptoms for some time, one feels that the symptoms are interminable and become part of their everyday life, and it is not until their food intolerance is identified and

symptoms improve previously experienced symptoms are acknowledged.^{18,19} This was seen in the patient group, whose awareness of baseline symptoms increased with symptom improvement recorded in the RPAH Allergy Unit 3 month follow up Assessment Form. As this outcome (an increased awareness of symptoms with dietary change) is expected, this change in understanding might be addressed at the initial dietary counselling session to help normalise these perspectives for the patient.

Symptom frequency and severity improved, with the greatest change seen in GIT, CNS and skin body systems, suggestive of the usefulness of the Elimination Diet in this patient group. This improvement correlated with subjective reported impact on QoL, as well symptoms were found to correlate with WHOQoL and FRQoL moderately and weak to moderately respectively. No change in respiratory and genitourinary symptoms occurred, as they were not frequently reported and perceived to be less severe by the patients.

It was found that mouth ulcers and difficulty swallowing symptoms worsened. A number of plausible reasons may explain this observation including in capturing patient symptom improvement '*at their best*' on the Elimination Diet, however as patients were at different stages of the Elimination Diet (e.g. challenges, liberalising) these results may be conflicted. Some patients were undergoing challenges and liberalising their diet and may offer an explanation as to why mouth ulcers and difficulty swallowing worsened, as this could be related to an temporary exacerbation of symptoms when undertaking challenges or liberalising their diet.² This could be further clarified through follow-up at ideal time points of the treatment.

In agreement with the research to date^{6,7,9-14}, the findings from this study suggest patients with food intolerance present with a lower QoL compared with the general population. With regards to the distinct QoL domains measured using the WHOQoL-Bref, environmental QoL were higher in patients with food intolerance compared with the Australian population norms published by Murphy et al 2000.¹⁶ Patients with food intolerance are more likely to seek help and view the access to healthcare as an important part of life.²⁰ General QoL instruments such as the Short-Form 36 Health Survey²⁴ do not commonly cover environmental QoL and thus could not be compared. Patient's physical, psychological and social QoL were lower than the population norms, reflecting the degree to which symptoms interfere with daily life. These baseline QoL results cannot be directly compared to other studies using different QoL tools, however these studies have also documented similar findings with a more pronounced lower QoL in domains relating to physical and social functioning, body pain, mental health and vitality.^{12,21-23}

Physical QoL using the WHOQoL assessed the impact of disease on daily activities, dependence on medication and energy levels. This domain demonstrated the greatest positive change, despite lack of statistical significance and can be explained by a decrease in symptoms, impacting overall QoL 'just a little' or 'not at all' on the Elimination Diet. Environmental QoL assessed the work environment, access to health care and the opportunity to participate in social and leisure activities. The improvement seen in this domain at the 3 month follow up could be explained by the support offered to patients throughout the Elimination Diet and challenge protocol by their doctor/dietitian. Psychological and social domains remained

unchanged. The effect of dietary modification on personal relationships and social support may require prolonged periods of time, as noted in similar studies.^{6,7,9-14,21-23} Furthermore, O'Carroll et al 2000²⁵, found that the sensitivity to change is reduced for the social domain in the WHOQoL-Bref and therefore measuring the social aspects of QoL may be best with the longer WHOQoL-100. Likewise, the burden placed on patient's social networks, particularly where food is involved may increase on the Elimination Diet and thus the value of food intake in the form of social interaction, enjoyment, pleasure and self-esteem may be outweighed.²⁶ In addition to the social burden demonstrated when following a modified diet such as the Elimination Diet, psychological characteristic such as feelings, self-esteem and personal beliefs assessed by the psychological domain may impact QoL. This small change in WHOQoL domains may be attributed to the high overall QoL and satisfaction with health scores reported by patient at baseline, suggesting patients already have a high perception of their QoL, with little room for change.

This is the first time a food-specific QoL had been used to investigate, issues that patients perceive to impact their dietary choices and daily life. The impairment of food on QoL was most pronounced in relation to food-related health (worried about health and food reactions) and avoidance/restriction of foods (had to be alert when eating) at baseline. This impairment (higher QoL score) was found not to correlate with the number of diets trialed even though patients had reported to trial a number of restrictive diets.

Improved FRQoL at 3 months was found in relation to food related health and emotional impact, suggesting patients no longer worry about their health,

have identified trigger foods and/or chemicals causing the adverse reactions, and are no longer concerned reactions will become severe. Yet, food avoidance and dietary restrictions and risk of accidental scores increased (lower QoL) at 3 months as patients became reluctant to eat away from home, try new products as food labels were hard to read and frustrated with explaining their food intolerance to others. In addition limitations as to what foods they could consume means they often refused many things during social activities which like other restrictive diets, are commonly seen on the Elimination diet and challenge protocol and thus negatively impacts QoL.³ Follow-up at 1-year after the effect of a prescribed diet based on identified triggers needs to be assessed to fully ascertain the effect of diet on FRQoL. Also of consideration is that as the questions were presented in a negative context, responses may be inaccurate due to the unnecessary cognitive burden placed on the individual, being slightly biased towards negative responses.²⁷

Although these results extend previous research and provide new clinical insight into the influence of an elimination diet on QoL, the limitations of the study need to be acknowledged. The sample size of the study was small and from a single outpatient hospital, making it difficult to draw any substantial conclusions. Participation was voluntary and likely to favor patients willing to follow the Elimination Diet and challenge protocol or feel symptoms are severe enough to impact life, posing as a potential motivator. It will be of value to follow-up a random selection of the non-responders as to why they did not participate at the 1-year follow-up. Limitations in using these questionnaires are due to their ability to capture QoL change over a short timeframe. As part

of the broader study, QoL change will continue to be assessed yearly for 5 years following completion of the Elimination Diet and challenge protocol. Literature indicates studies commonly utilise the SF-36²⁴ in conjunction with a symptom-specific QoL tools (e.g. IBS-QoL, chronic urticaria QoL (CU-QoL) and Headache-impact statement (HIT-6)), as they have proven to be sensitive in the target population^{7,9-14,21-23}. This may be something to consider in future research when assessing the suitability of the questionnaires to accurately measure QoL and perhaps a symptom-specific QoL questionnaire is needed to capture QoL change more specifically related to the food intolerance population. The small QoL change may be explained by the time-points utilised. QoL change was captured at different stages; patients were either currently on the diet, undergoing challenges or liberalising their diet and this may not reflect when 'at their best' on the Elimination Diet. Future studies will benefit from assessing QoL before challenges, clearly iterating when '*at their best*'.

Conclusion

This study found QoL to be lower in patients with suspected food intolerance presenting to the RPAH Allergy Unit compared with the general population. Symptom frequency and severity correlated negatively with QoL, however clear improvements were seen in symptoms. While QoL changes were not uniform across the domains, the Elimination Diet was useful in improving QoL outcomes. However more time is needed to capture change and will continue to be assessed in the broader study. Further research is needed with a larger study group, using a consistent time-point, with clear instructions to report

when 'at their best'. In addition, the investigation into a symptom-specific QoL may be beneficial to capture QoL change specific to the food intolerance population.

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Conflicts of interest

There is no conflict of interest to report

Authorship

Kristy-Lee was responsible for recruitment, data collection, data analysis and writing the manuscript. Amanda Neubauer, Raso Natalya Lukomskyj, Imogen Hooper and Anna-Jane Debenham contributed to recruitment, data collection and data entry. Dr Anne Swain, Brooke McKinnon, Carling Chan, Kirsty Le Ray and Dr Robert Loblay were responsible for the design and supervision of this study

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Appendix A

RPAH Allergy Unit Assessment Form (Adult)

WHOQoL-Bref Questionnaire

FRQoL Questionnaire

Appendix B

Symptoms

Patient reported symptoms

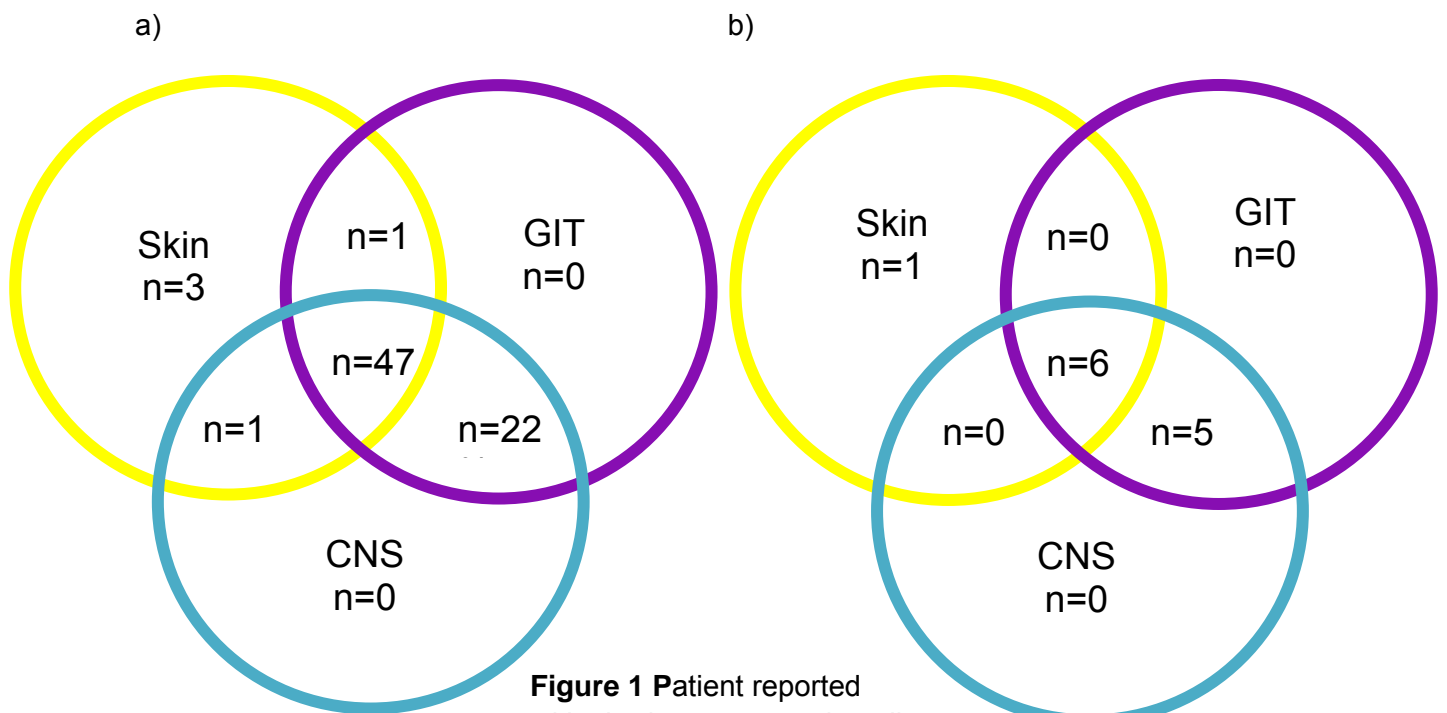


Figure 1 Patient reported symptoms grouped by body systems at baseline on regular diet, total cohort (n=74) compared with follow-up cohort (n=12). **a)** total cohort (n=74) symptoms (GIT, CNS, Skin). **b)** follow-up cohort (n=12) symptoms. *GIT*, gastrointestinal tract; *CNS*, central nervous systems.

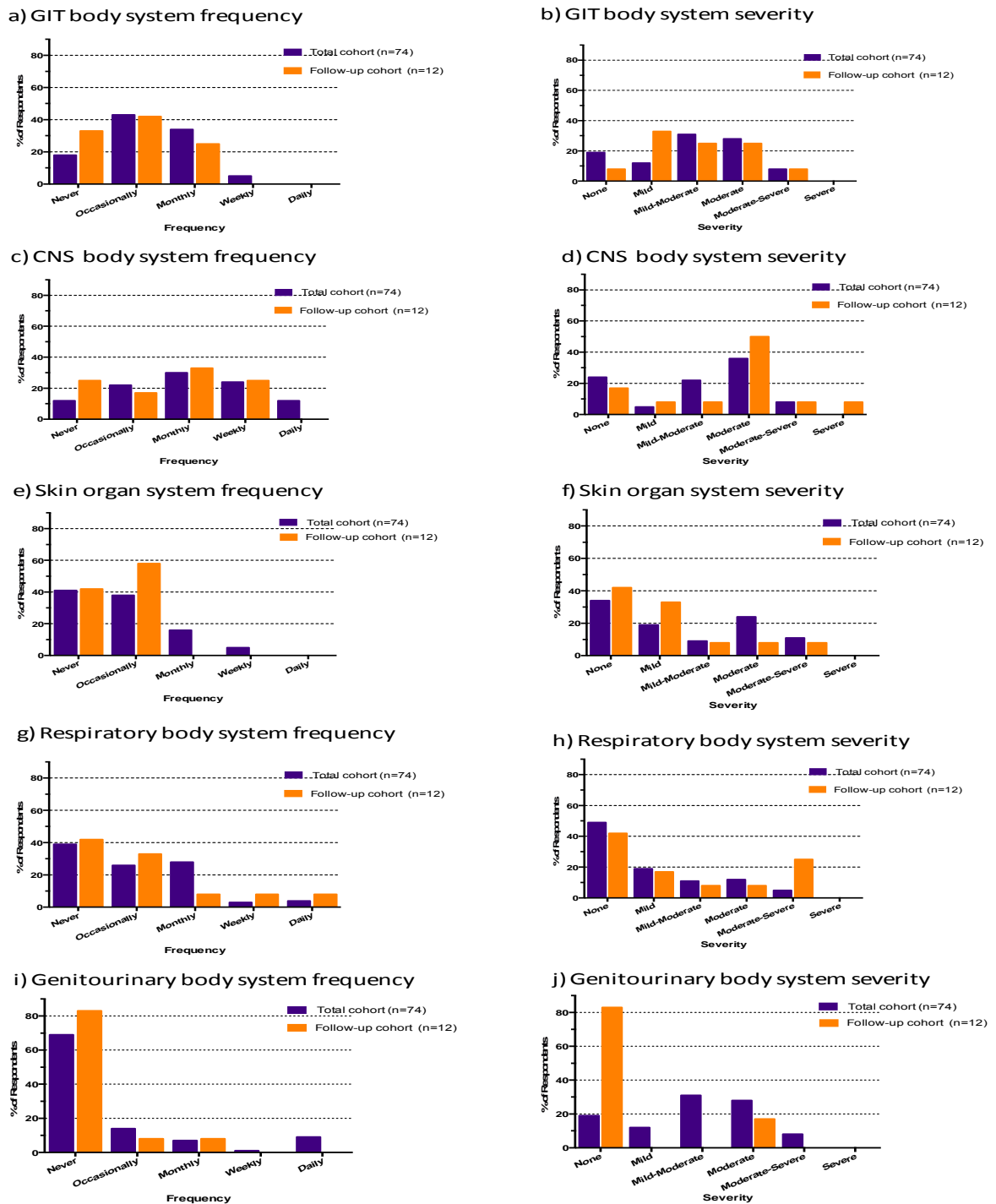


Figure 2: Patient reported symptom frequency and severity grouped by body system, follow-up cohort (n=12) compared with total cohort (n=74) **a)** Gastrointestinal system frequency, **b)** Gastrointestinal system severity, **c)** Central Nervous System frequency, **d)** Central Nervous System severity, **e)** Skin organ system frequency, **f)** Skin organ system severity, **g)** Respiratory system frequency, **h)** Respiratory system severity, **i)** Genitourinary system frequency, **j)** Genitourinary system severity.

† GIT symptoms: mouth ulcers, difficulty swallowing, nausea, vomiting, indigestion, reflux, wind/gas, bloating/discomfort, stomach pains/cramps, diarrhea, and constipation.

‡ CNS symptoms: headache/migraine, fatigue, muscle/ joint pains.

§ Skin symptoms: eczema, hives, swelling, rash.

¶ Respiratory symptoms: nose/sinus, asthma.

∞ Genitourinary symptoms: bladder/vaginal irritation

Presentation of symptoms

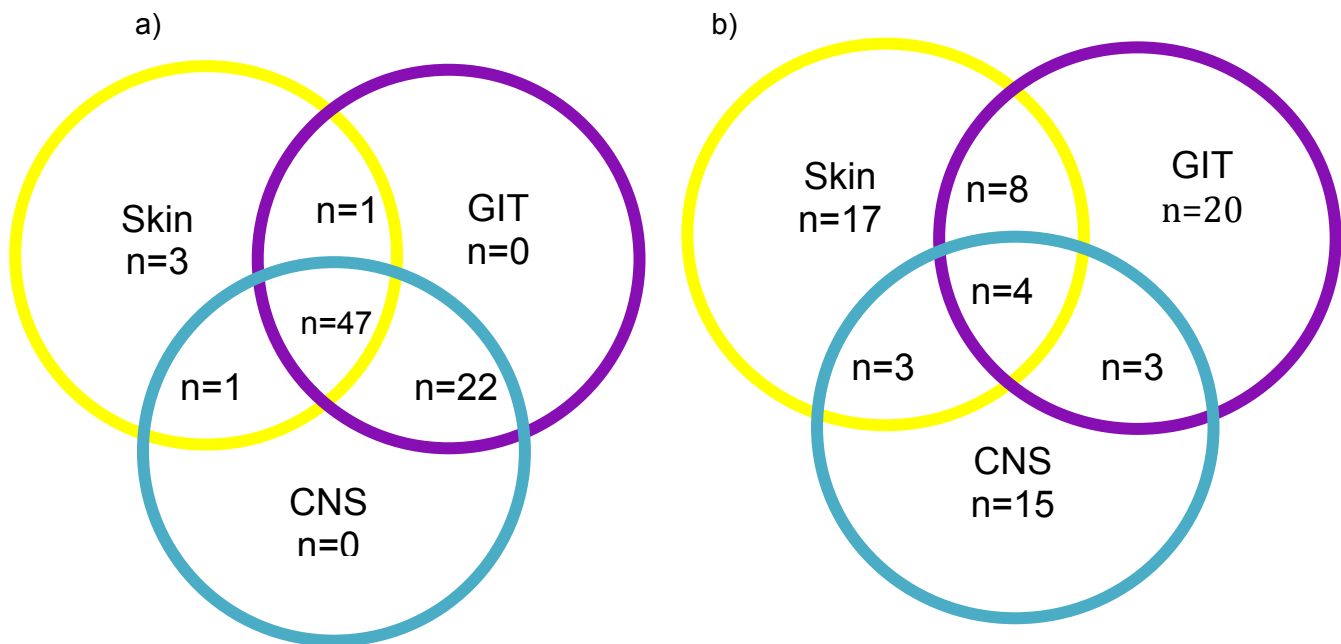


Figure 3 Patient symptoms grouped by main body systems for total cohort (n=74) at baseline. a) presentation of symptoms reported by patients on the RPAH Allergy Unit Initial Assessment Form (Adult) b) presenting symptoms (main reason for attending the unit) record by clinician in medical notes. *GIT*, gastrointestinal tract; *CNS*, central nervous systems.

Difference in baseline symptoms at initial appointment and 3 month follow-up

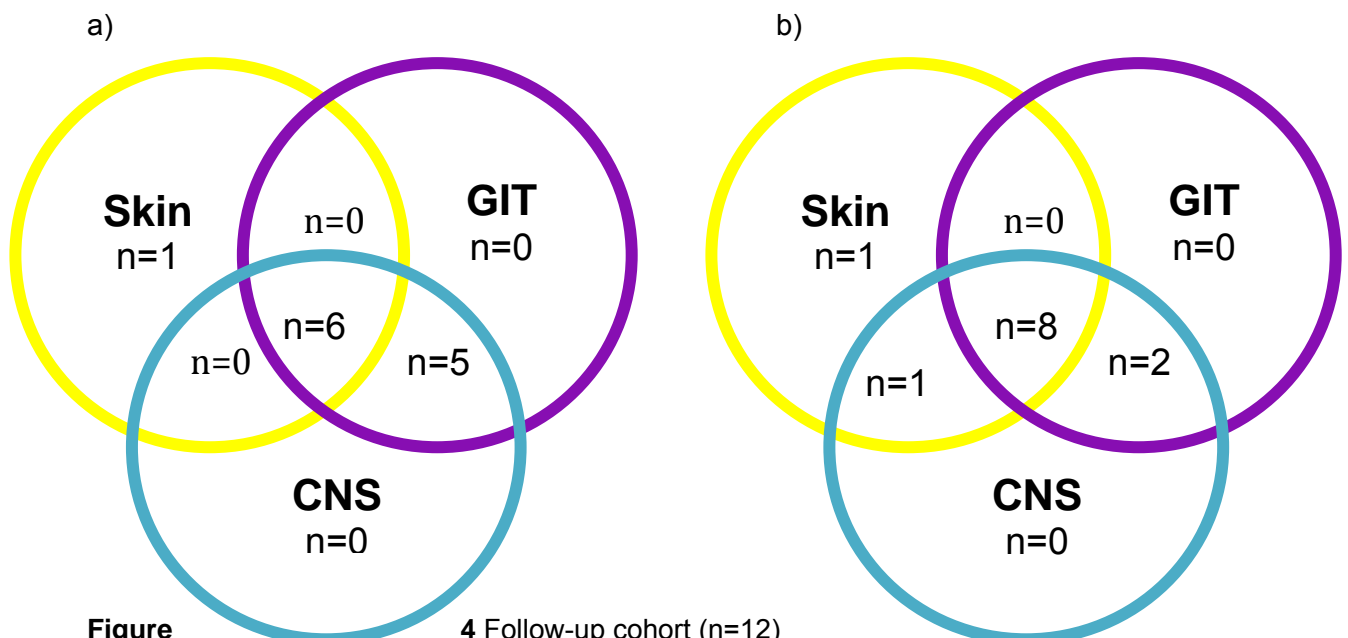
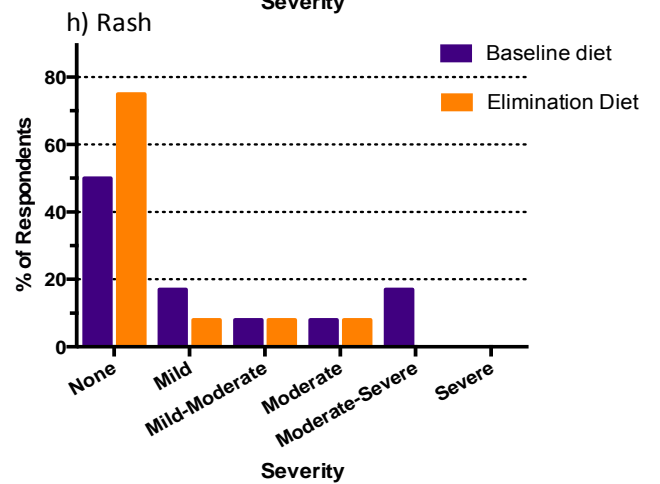
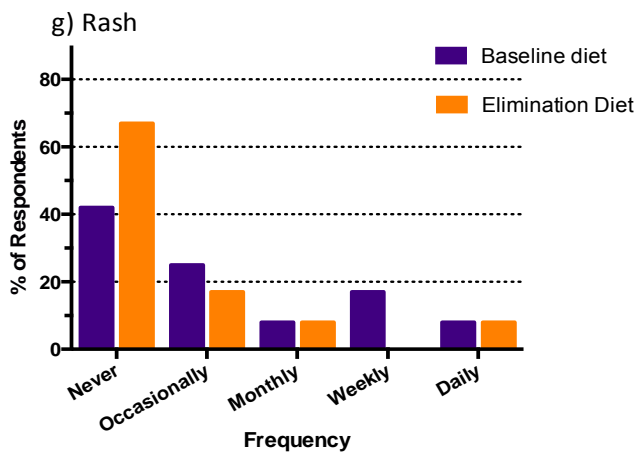
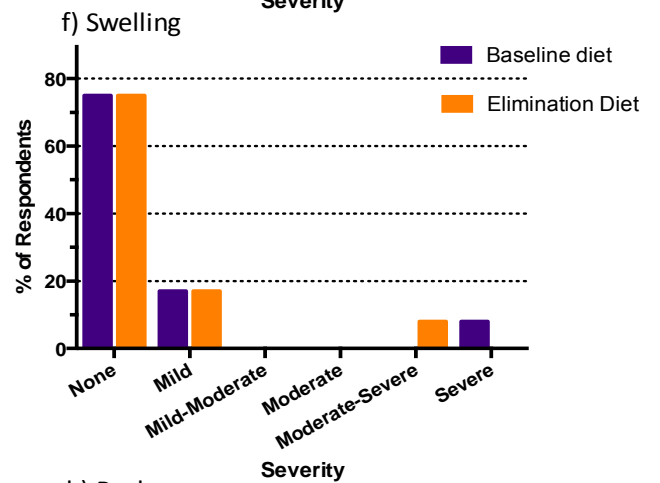
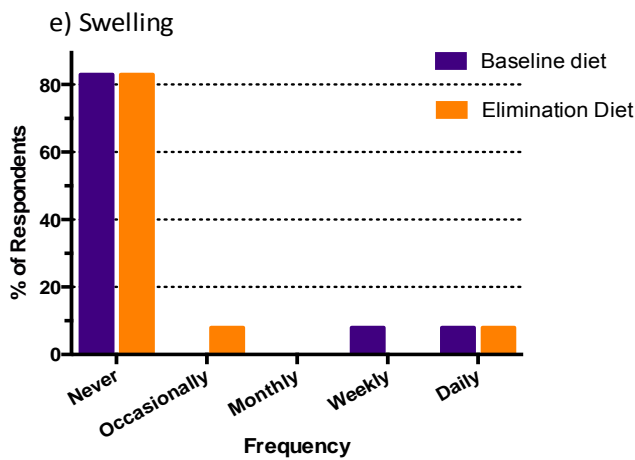
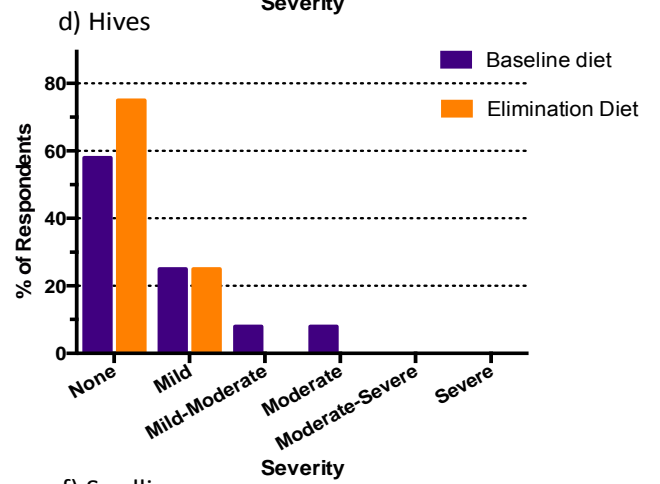
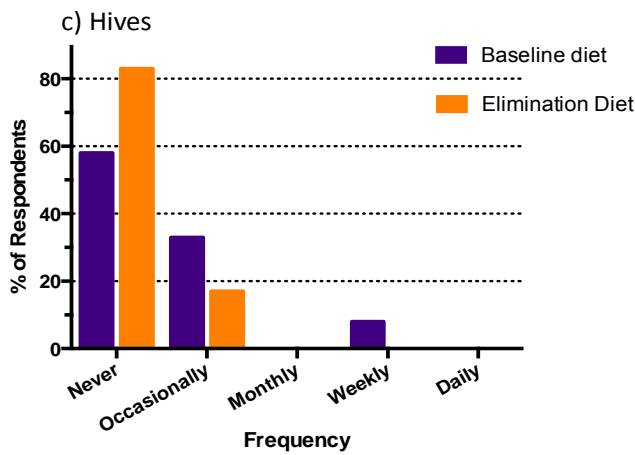
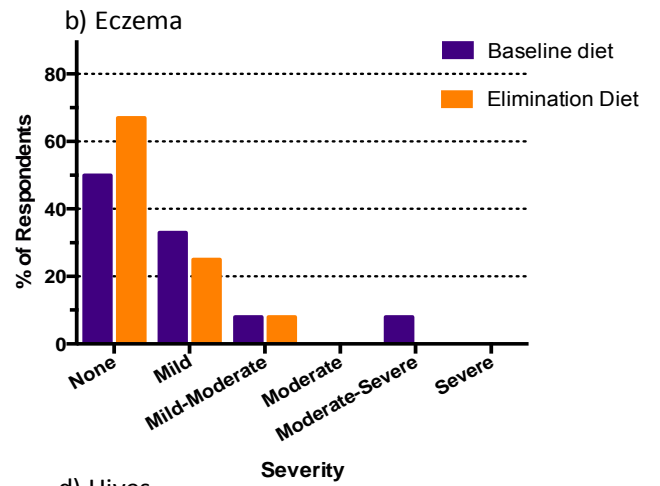
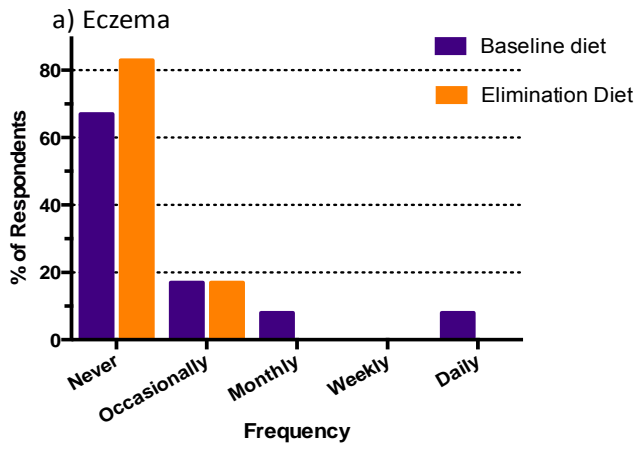
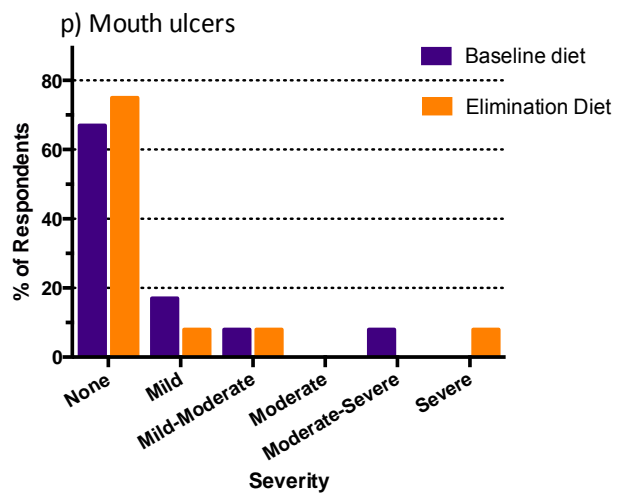
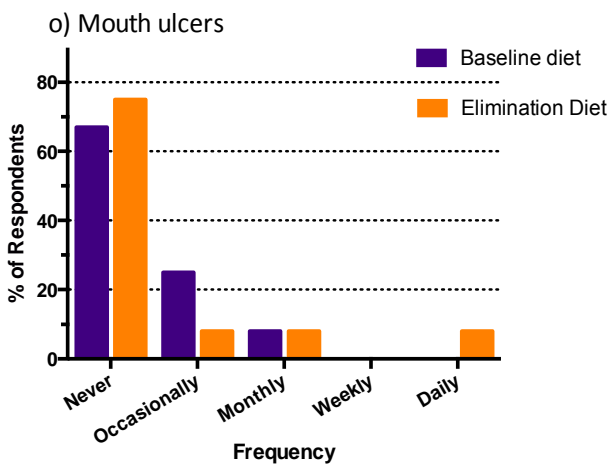
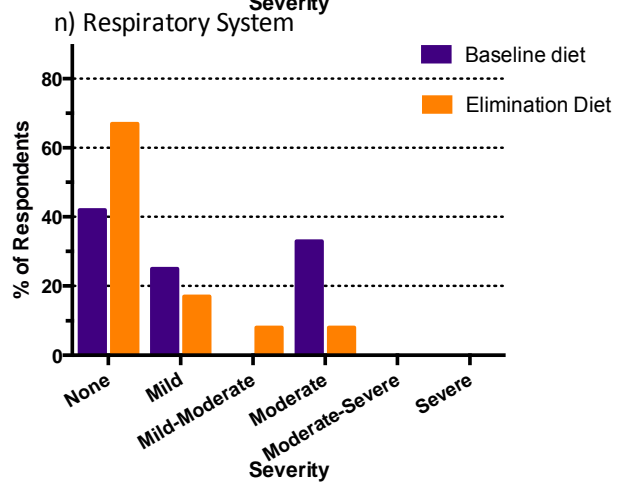
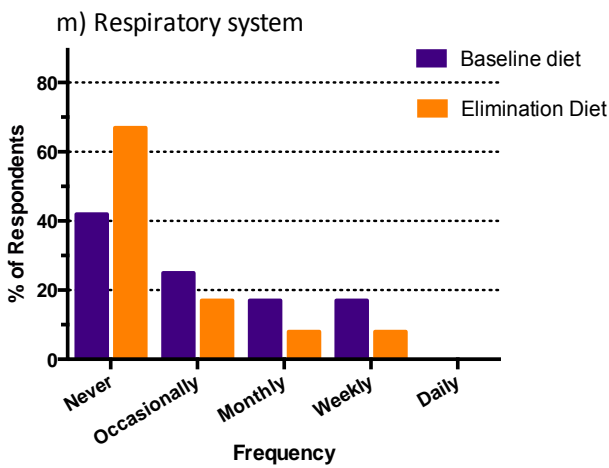
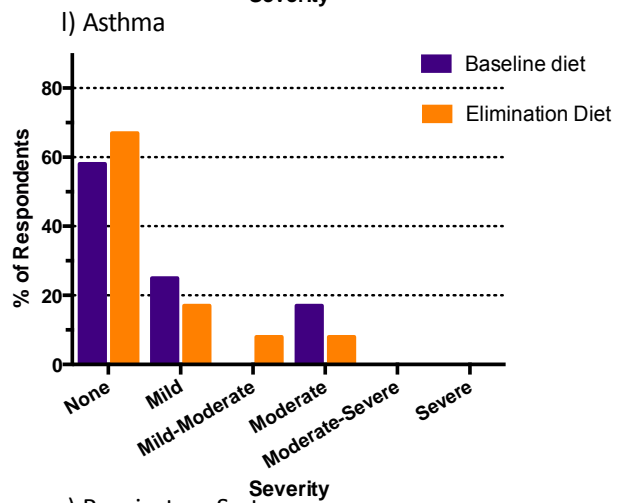
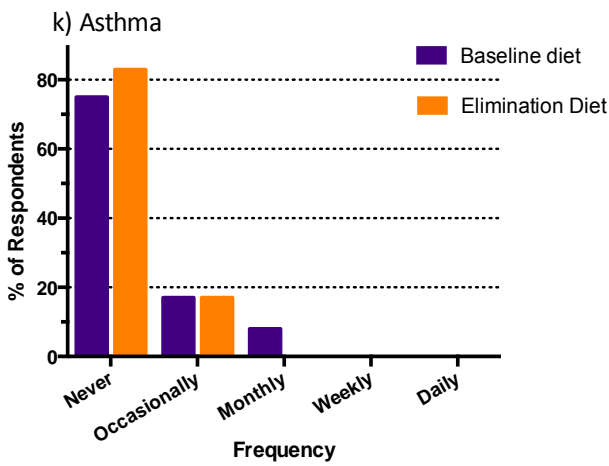
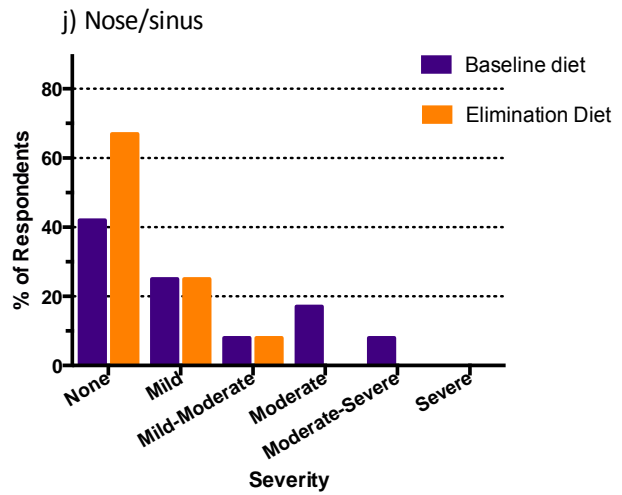
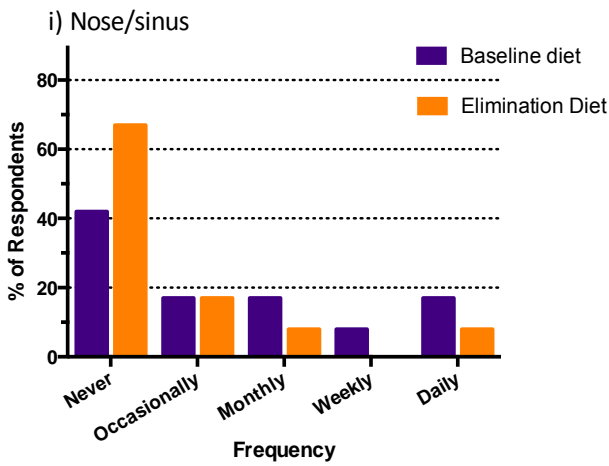
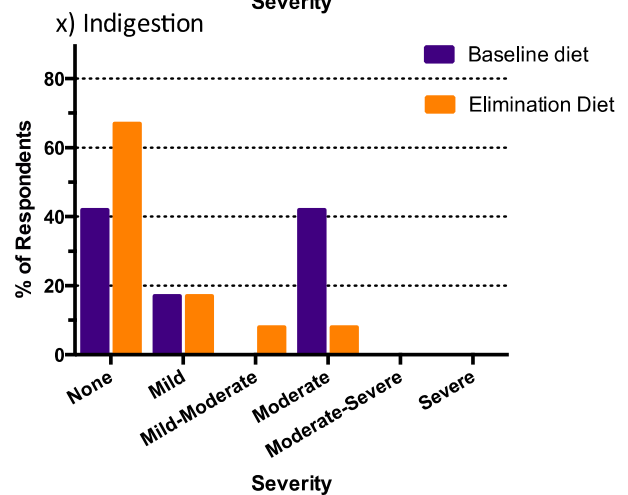
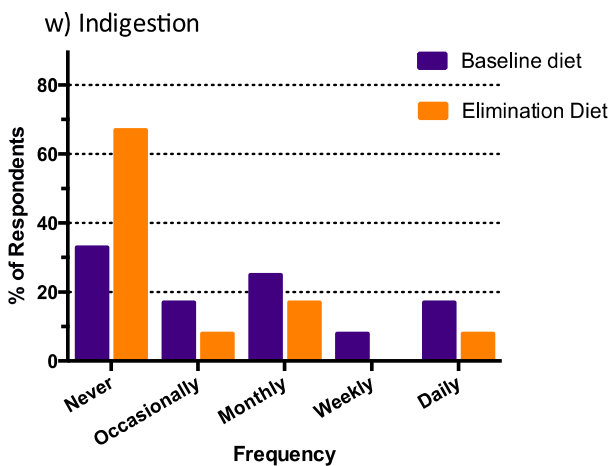
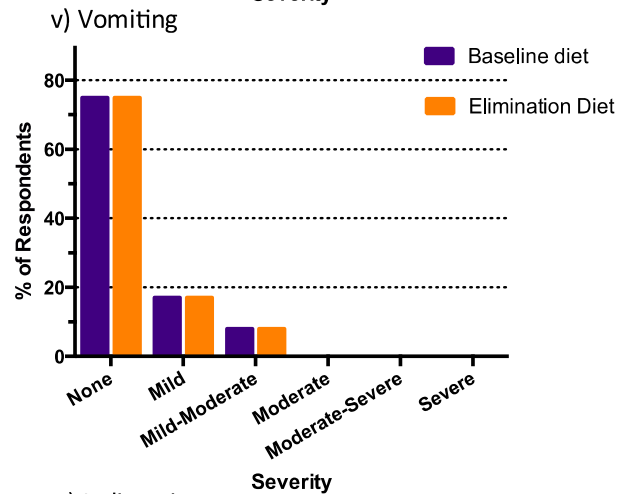
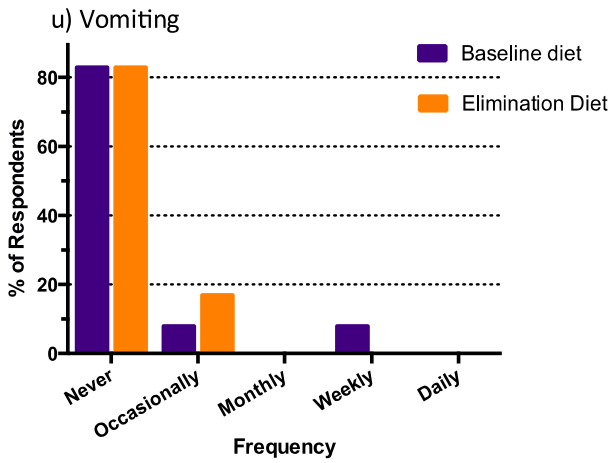
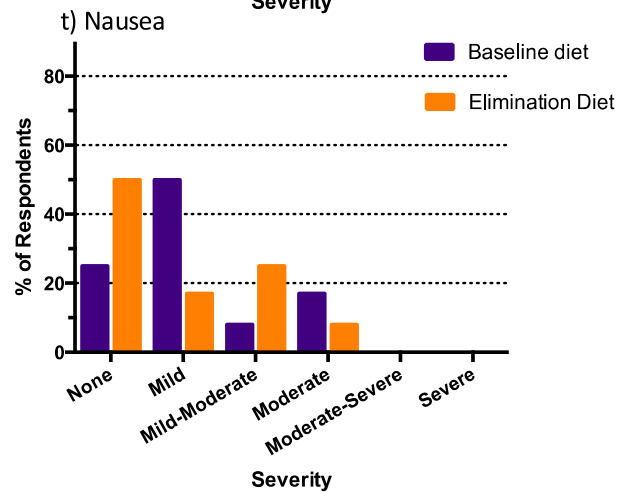
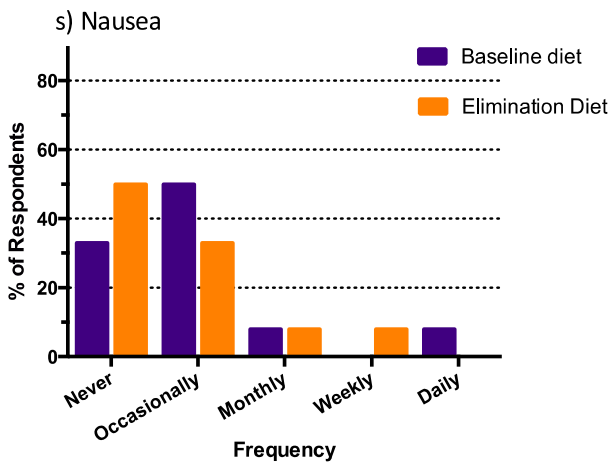
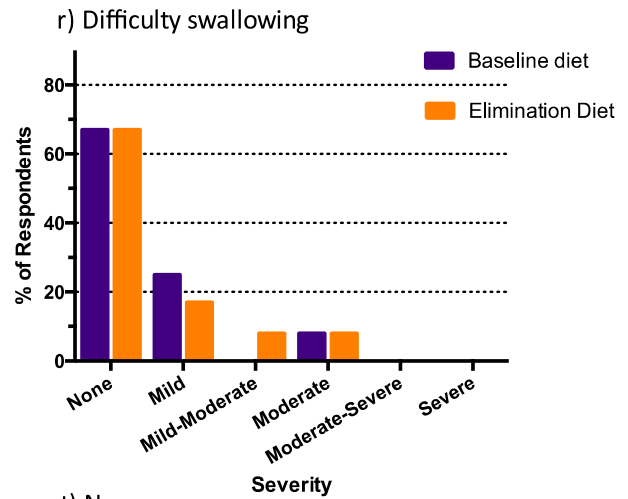
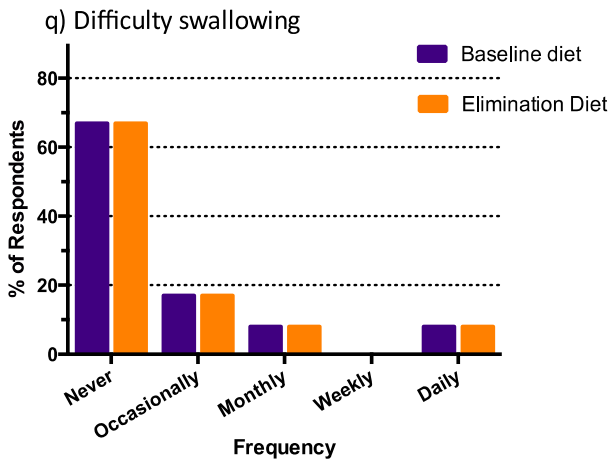
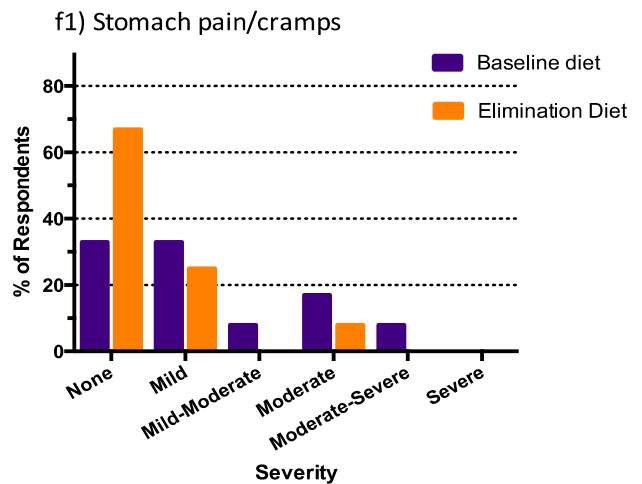
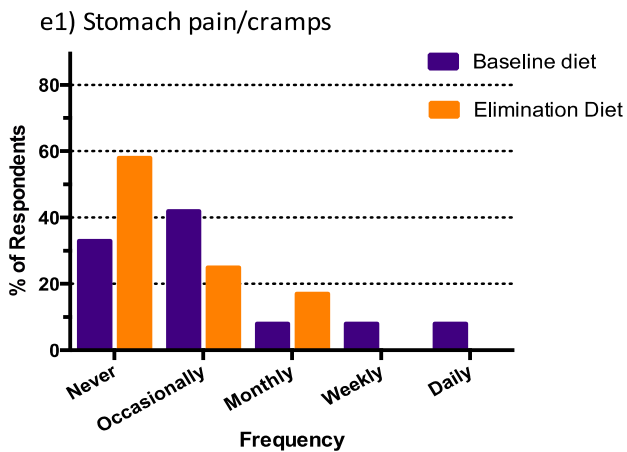
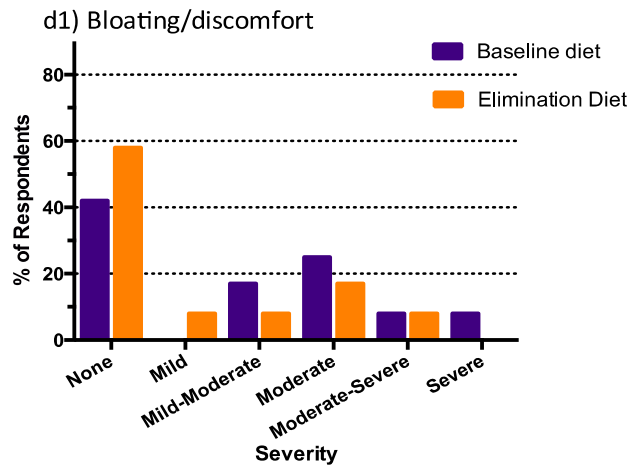
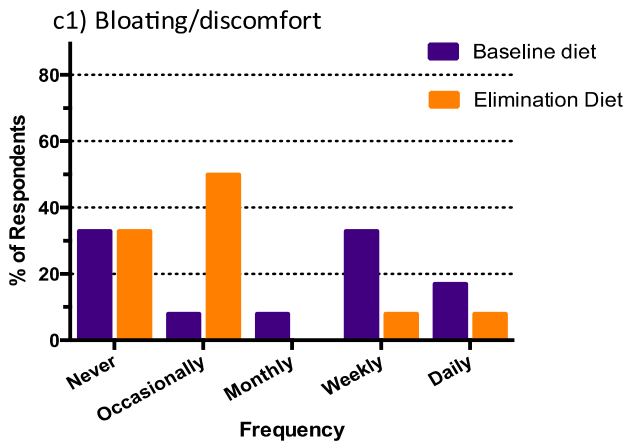
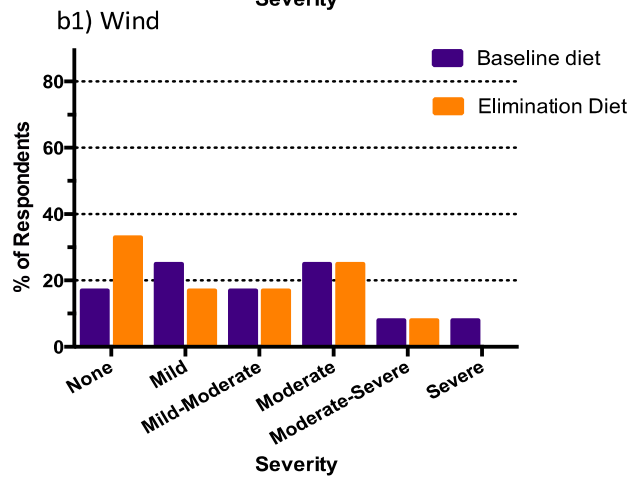
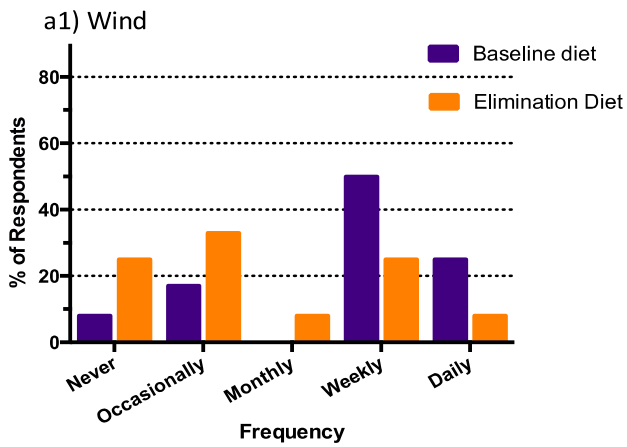
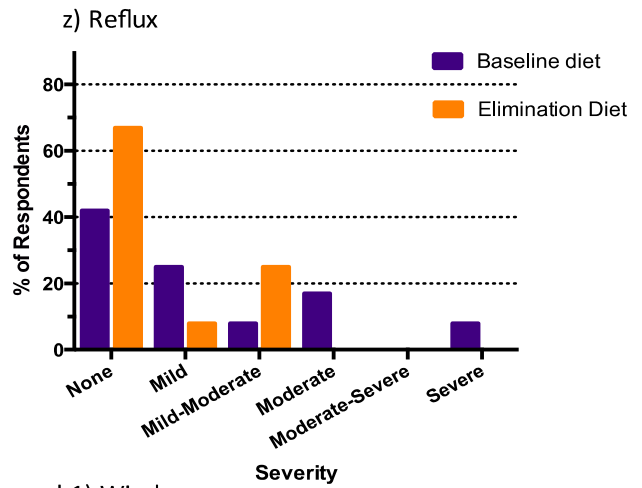
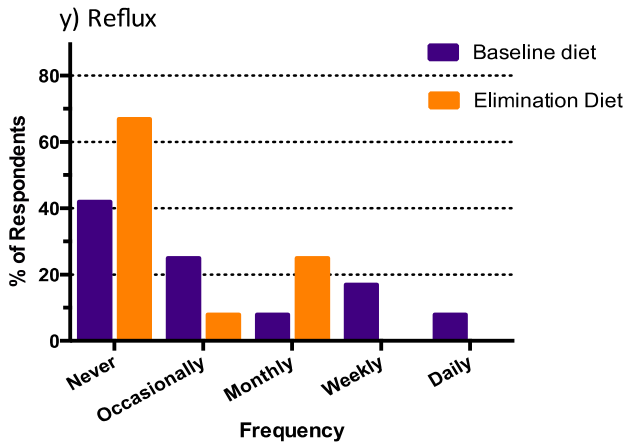


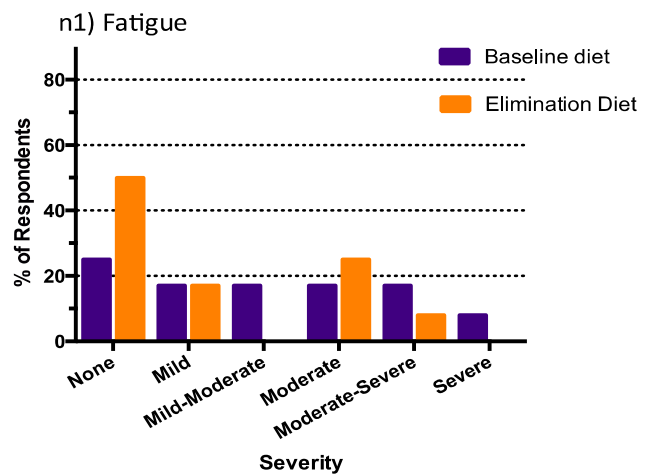
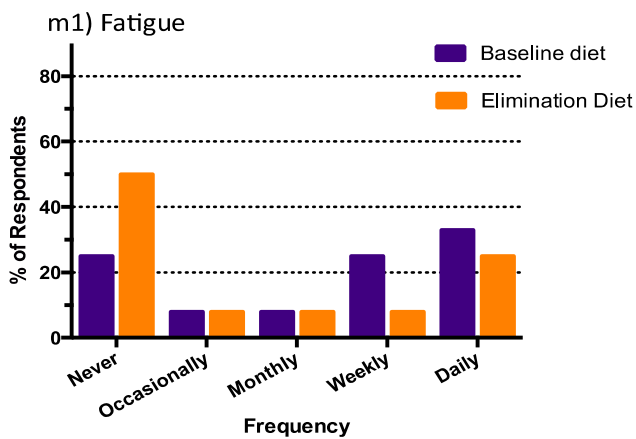
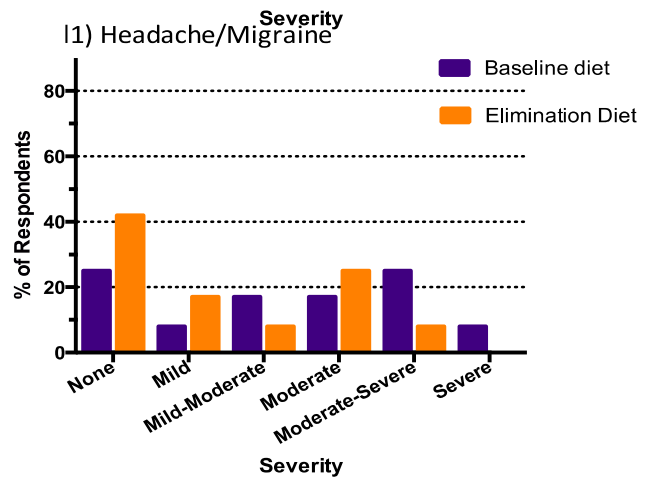
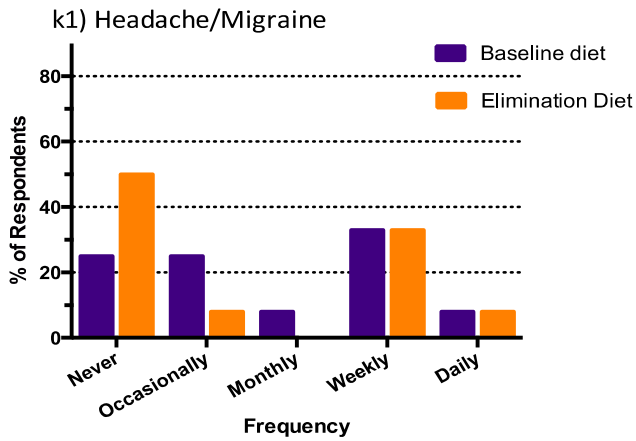
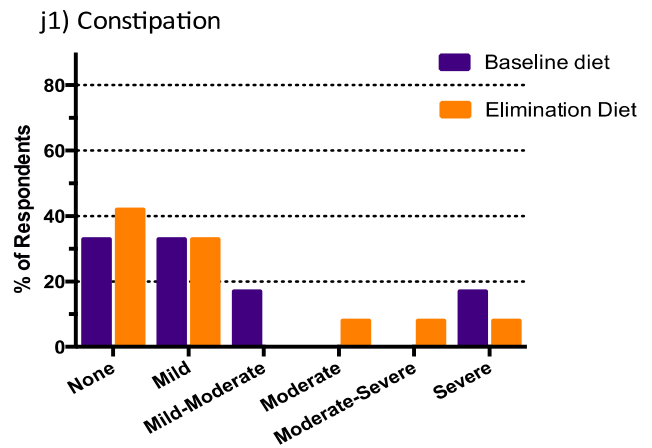
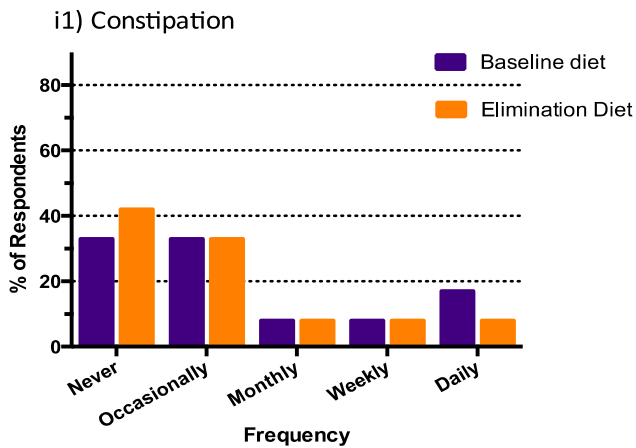
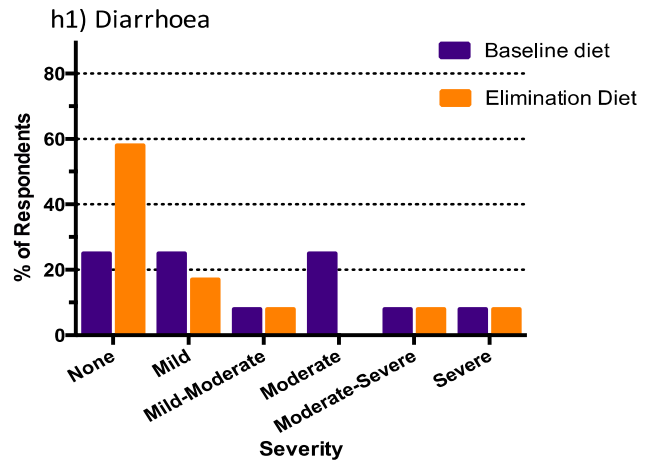
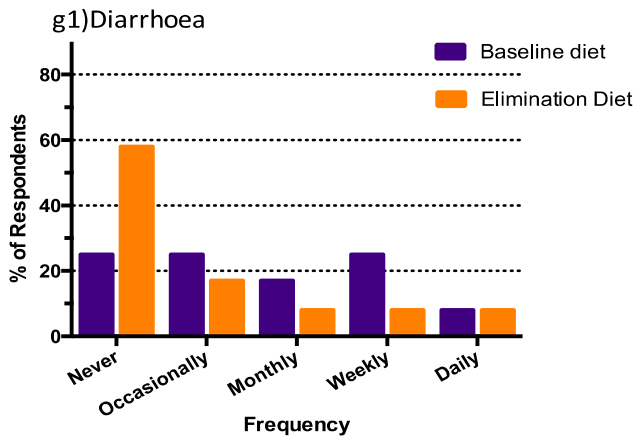
Figure 4 Follow-up cohort (n=12) baseline symptoms reported by patients in the RPAH Allergy Unit Assessment Form grouped by body systems a) baseline symptoms collected at the initial appointment b) baseline symptoms collected at 3 month follow-up. *GIT*, gastrointestinal tract; *CNS*, central nervous systems.











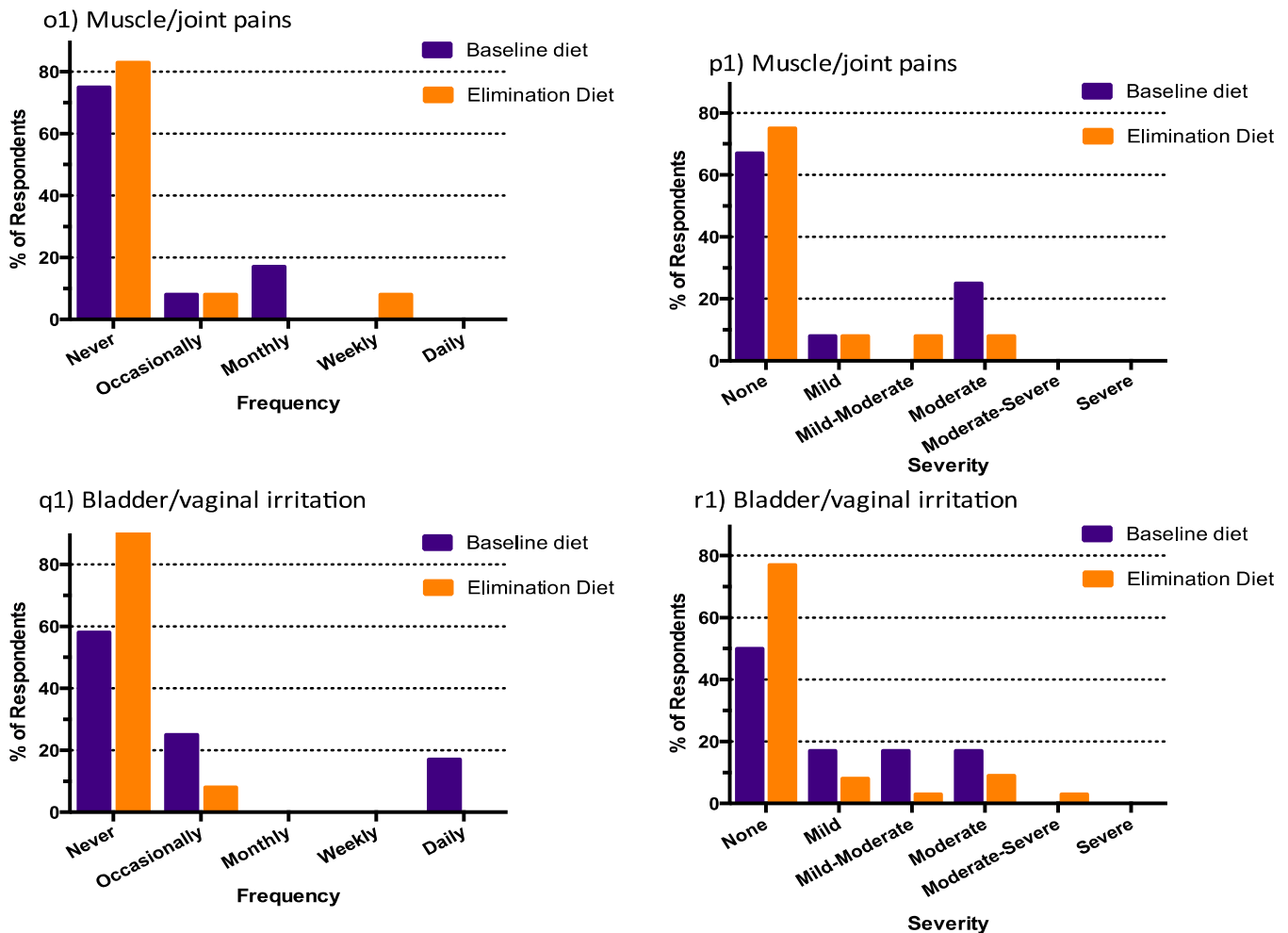
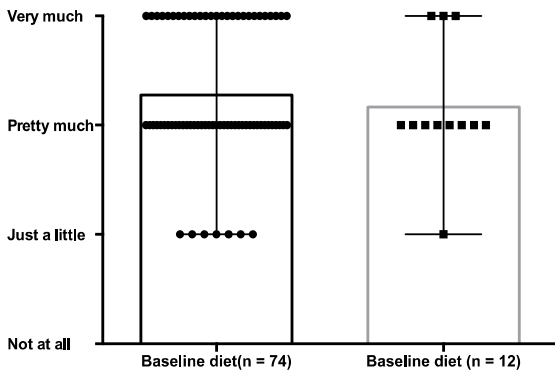


Figure 5 Follow-up cohort (n=12), patient reported symptom frequency and severity on baseline diet compared with Elimination Diet. a) eczema frequency; b) eczema severity; c) hives frequency; d) hives severity; e) swelling frequency; f) swelling severity; g) rash frequency; h) rash severity; i) nose/sinus frequency; j) nose/sinus severity; k) asthma frequency; l) asthma severity; m) mouth ulcers frequency; n) mouth ulcers severity; o) difficulty swallowing frequency; p) difficulty swallowing severity; q) nausea frequency; r) nausea severity; s) vomiting frequency; t) nausea severity; u) vomiting frequency; v) vomiting severity; w) indigestion frequency; x) indigestion severity; y) reflux frequency; z) reflux severity; a1) wind/gas frequency; b1) wind/gas severity; c1) bloating/discomfort frequency; d1) bloating/discomfort severity; e1) stomach pain/cramps frequency; f1) stomach pains/cramps severity; g1) diarrhoea frequency; h1) diarrhoea severity; i1) constipation frequency; j1) constipation severity; k1) headache/migraine frequency; l1) headache/migraine severity; m1) fatigue frequency; n1) fatigue severity; o1) muscle/joint pains frequency; p1) muscle/joint pains; q1) bladder/vaginal irritation frequency; r1) bladder/vaginal irritation severity. Presented as percentage (%) of respondents

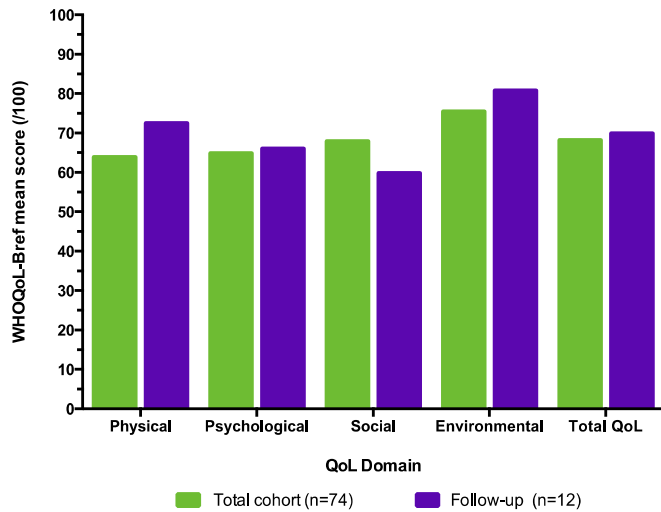
Appendix C

Quality of Life

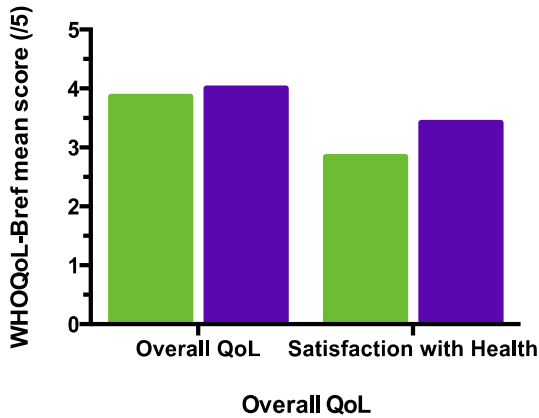
a) The impact of symptoms on QoL 'at present how much do your symptoms impact your QoL'



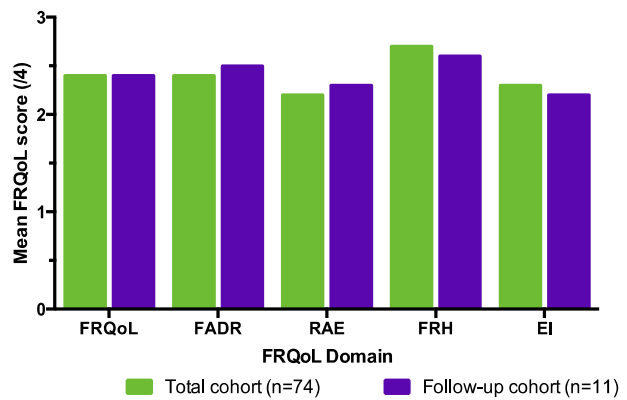
b) WHOQoL comparison at baseline



c) WHOQoL self perception comparison at baseline



d) FRQoL comparison at baseline



Legend: Total cohort (n=74) (green), Follow-up (n=12) (purple)

Figure 1 QoL scores at baseline, Total cohort (n=74) compared with follow-up cohort (n=12) a) impact of symptoms on QoL assessed by RPAH Allergy Unit Initial Assessment Form; b) mean WHOQoL scores by domains; c) mean WHOQoL self perception scores; d) mean FRQoL scores by subscales.

Table 1 : Comparison of follow-up cohort to Australian Population Norm¹⁵ using WHOQoL-BREF instrument.

QoL Measure	Follow-up cohort (n=12)	Australian Population Norm	P Value
WHOQoL-Bref			
Overall QoL (Q1)	4.00±0.739 (2-5)	NA	
Satisfaction with health (Q2)	3.42±0.9 (2-5)	NA	
Physical	66.17±18.5 (31-94)	80.0±17.1	<0.001*
Psychological	67.17±13.18 (50-94)	72.6±14.2	<0.001*
Social	60.42±18.01 (25-75)	74.8±13.7	0.005*
Environmental	76.58±14.36 (50-100)	72.2±18.5	0.020*

Values are mean ± standard deviation and median in parentheses.

Higher scores indicate better QoL.

Abbreviations:WHOQoL-Bref: World Health Organisation Quality of Life Bref Version;
QoL- Quality of life; NA, not available.

* p <0.05

Table 2: Mean QoL change; at their initial appointment on their regular diet compared to “at their best” on the Elimination Diet (n=12)

QoL Measure	Baseline diet	Elimination Diet	p	Improved % (n)	Unchanged % (n)	Deteriorated % (n)
WHOQoL						
Overall QoL	4.00±0.739 (2-5)	4.0±0.85 (2-5)	1.00	16.5 (2)	67 (8)	16.5 (2)
Health assessment	3.42±0.9 (2-5)	3.58±1.08 (2-5)	0.586	33 (4)	50 (6)	17 (2)
Physical	66.17±18.5 (31-94)	72.5±12.4 (56-94)	0.235	67 (8)	8 (1)	25 (3)
Psychological	67.17±13.2 (50-94)	66.1±13.1 (44-81)	0.621	33 (4)	33 (4)	33 (4)
Social	60.42±18.0 (25-75)	59.8±21.5 (31-100)	0.888	33 (4)	33(4)	33 (4)
Environmental	76.58±14.4 (50-100)	80.8±9.48 (69-94)	0.207	50 (6)	25 (3)	25 (3)
Total QoL	68.0±13.46 (41-89)	69.9±11.9 (53-92)	0.511	50 (6)		50 (6)
FRQoL						
Total FRQoL	2.43±0.69 (1.6-4)	2.86±0.63 (1.8-3.9)	0.01 *	18 (2)		82 (9)
FADR	2.55±0.72 (1.5-4)	3.2±0.69 (1.7-4)	0.02*	27 (3)	9 (1)	64 (7)
RAE	2.23±0.79 (1.5-4)	2.6±0.83 (1-4)	0.02*	9 (1)	9 (1)	81 (9)
FRH	2.59±0.79 (1.3-4)	2.5±0.88 (1.3-4)	0.518	45 (5)	27 (3)	27 (3)
EI	2.25±0.85 (1-4)	2.09±0.94 (1-4)	0.477	36 (4)	36 (4)	27 (3)

Values are mean ± standard deviation and range in parentheses.

WHOQoL: higher scores indicate better QoL; FRQoL, FADR, food avoidance dietary restriction; RAE, risk of accidental exposure; FRH, food related health; EI, emotional impact, higher scores indicate greater food impairment and poorer QoL.
p<0.05, **p<0.01.

Table 3: Comparison of QoL scores according to the stage of the Elimination Diet

Elimination Diet Phase				
QoL Measure	On Elimination Diet (n=2)	Challenges (n=4)	Liberalise (=6)	P value
WHOQoL				
Overall QoL	4.5±0.7	4.25±0.5	3.67±1.0	0.416
Health assessment	4.5±	3.255±0.5	3.17±0.98	0.328
Physical	69±0	73.5±17.3	73±14.5	0.934
Psychological	72±4.2	73.3±11.8	59.33±13.5	0.215
Social	62.5±17.7	62.5±21.9	57.2±25.9	0.927
Environmental	84.5±13.4	79.8±8.2	80.8±9.5	0.858
Total QoL	72±0	72.5±12.8	67.5±14.2	0.813
FRQoL				
Total QoL	2.4±0.6	3.0±0.6	2.8±0.8	0.619
FADR	2.6±0.6	3.4±0.4	3.1±0.9	0.428
RAE	2.3±0	2.7±0.5	2.6±1.1	0.879
FRH	2.5±0.3	2.3±0.9	2.6±1.0	0.878
EI	2.5±0.7	2.0±1.4	2.1±0.9	0.806

Values are mean ± standard deviation.

FRQoL, FADR, food avoidance dietary restriction; RAE, risk of accidental exposure;

FRH, food related health; EI, emotional impact

One way ANOVA *p<0.05