

The impact of anaphylaxis on the quality of life and mental health of adults

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Abstract

Background. Anaphylaxis is a severe and potentially life-threatening allergic reaction which has a detrimental impact on quality of life (QoL), however little is known about the impact of anaphylaxis, across the various causes, on adults. The aim of this study was to assess the impact of anaphylaxis on QoL and mental health in adults. **Methods.** Participants (n=142; 60% female) were recruited from a regional allergy centre (Birmingham, U.K) following systematic specialist evaluation. They completed measures of generic QoL (WHOQoL BREF), anaphylaxis specific QoL (A-QoL-Adults), anxiety and depression (HADS) and stress (PSS). **Results.** Anaphylaxis triggers were mainly to medication or during general anaesthesia (29.6%), food (29.6%), wasp or bee venom (16.2%), or were spontaneous (21.1%). Adults with anaphylaxis had significantly poorer general QoL and stress than published data from a healthy population. Females had significantly poorer anxiety and depression than norm data (all $p < 0.01$). Poorer anaphylaxis specific QoL was significantly related to greater stress, depression, anxiety, poorer general QoL and demographic and clinical variables such as age, gender, severity of anaphylaxis, presence of other atopic conditions (all $p < 0.05$). Regression analysis showed that anxiety, depression and number of anaphylactic reactions were significant predictors for anaphylaxis specific QoL. **Conclusions.** Anaphylaxis has an adverse impact on QoL and mental health of adults across different triggers. Anxiety, depression and number of reactions in particular seem to be important in explaining the impact on QoL and should be of particular note for clinicians managing adults with this condition, and when considering specialist psychological support.

INTRODUCTION

Anaphylaxis is a severe and potentially fatal allergic reaction to foods such as peanuts, nuts and shellfish, drugs such as penicillin or general anaesthetic agents, latex, bee or wasp venom or can occur spontaneously (idiopathic)¹. It is characterised by cardio-respiratory and muco-cutaneous manifestations and requires prompt administration of epinephrine². The lifetime prevalence of anaphylaxis is approximately 0.05-2.0% in the USA and around 3% in Europe¹ and there is evidence to suggest that prevalence has increased during the last two decades³.

Much of the research investigating the impact of anaphylaxis on people's lives has focused on children and adolescents. During development of food allergy quality of life (QoL) scales for children, it was reported that those with a history of anaphylaxis to food had poorer QoL and greater anxiety than those with no such history⁴. Qualitative research with adolescents at risk of food-related anaphylaxis has noted the worry surrounding such a reaction and the fear of having to use an adrenaline auto-injector (AAI)^{5,6}. Similarly for

anaphylaxis associated with insect venom or drugs, poorer quality of life has been reported in comparison to people without such allergies⁷⁻⁹.

Research on the impact of anaphylaxis on adults is sparse, with studies generally focusing on one particular allergen. No quantitative studies look at the psychological impact of anaphylaxis across its variety of causes, on adults. Two qualitative studies conducted in the UK investigated the impact anaphylaxis has on daily lives of adults^{10,11}. Both studies reported similar important themes, including the fear elicited by having an anaphylactic reaction, followed by the frustration in having to manage the condition at that stage of their lives; the need to have some control over their condition and the important role provided by friends, family and the medical profession in supporting their management.

Anaphylaxis is the most serious type of allergic reaction. Greater understanding of the impact this has on adults across different triggers might improve quality of clinical care and help to direct psychological support where necessary. We recently developed and validated a QoL scale for anaphylaxis in adults¹². The aim of this study was to assess the impact anaphylaxis has on the QoL and mental health of adults, using validated measures.

METHODS

Design

This study employed a cross-sectional survey design. Ethical approval was provided by an NHS Ethics Committee in the UK (reference: 16/SC/0238). All participants gave written informed consent.

Participants and procedure

Adult participants (aged [?]18 years) with a diagnosis of anaphylaxis meeting the World Allergy Organization (WAO) diagnostic criteria² as assessed by a specialist in allergy were recruited from allergy clinics in University Hospitals Birmingham (UHB) NHS Foundation Trust, Birmingham, UK. Patients were excluded if they lacked English language proficiency or if they lacked capacity to provide informed consent. The UHB Allergy service is an accredited centre by The Royal College of Physicians of London under the Improving Quality in Allergy Services (IQAS) program and was designated as a WAO centre of excellence in 2020. The service receives referrals from within Birmingham and beyond including Coventry and Warwickshire, Staffordshire, Shropshire and South Wales.

Patients were systematically assessed by a detailed clinical history and allergy tests as per British Society for Allergy and Clinical Immunology (BSACI) and European Association of Allergy and Clinical Immunology (EAACI) guidelines¹³⁻¹⁹. All eligible participants who attended the clinics were provided with a study participant information sheet by health care professionals at the allergy clinic. If they wanted to take part, they were asked to sign a consent form and complete the questionnaires in clinic or take them home for completion. If they took the questionnaires home, they were provided with an envelope with a stamp and a return address to post back to RK's study team at Aston University, Birmingham. All completed questionnaire packs were separated from consent forms, assigned a study code and analysed anonymously.

Measures

Participants were asked to complete demographic details and information about their anaphylaxis. These data were also extracted from their clinical records and cross-checked with the self-report data. Severity of anaphylaxis was rated by the allergy research nurse using the Brown grading system²⁰. Participants completed four validated scales to assess QoL and mental health. These were the World Health Organisation Quality of Life Scale, Brief version (WHOQoL BREF)²¹ to measure generic QoL, the Anaphylaxis Quality of Life Scale for adults (A-QoL-Adults)¹² to measure anaphylaxis specific QoL, the Hospital Anxiety and Depression Scale (HADS)²² to measure anxiety and depression and the Perceived Stress Scale (PSS)²³ to measure stress. All scales have excellent reliability and validity. Further details of each scale can be found in the online supplement (S1).

Statistical analysis

Data analyses were conducted using SPSS version 26. Differences in mean scores from the study sample and published norm mean scores for the WHOQoL BREF²¹, the PSS²³ and the HADS²⁴ were analysed using one-sample t-tests. Differences across categorical variables and across different anaphylaxis trigger groups were analysed using t-tests and one-way ANOVAs. When analysing across different trigger groups, participants with anaphylaxis to more than one cause (n=2) were excluded to ensure they were not counted more than once in the analysis. Relationships between QoL, anxiety, depression, stress and continuous demographic and clinical variables were analysed using Pearson's correlations. Variables significantly associated with anaphylaxis related QoL (as measured by the A-QoL-Adults) were entered into a regression model to explore significant predictors of QoL in adults. All tests were two-tailed and alpha was set at 0.05. Sensitivity analysis showed that the study was able to detect medium effect sizes with 80% power, with alpha set at 0.05.

RESULTS

Participant characteristics

A total of 142 adults took part (the study recruitment flow diagram is shown in Figure 1). Adults mainly reported anaphylaxis to medication, during general anaesthesia, to food, bee or wasp venom, latex, or had spontaneous or exercise-induced anaphylaxis. A minority of adults (12.7%) self-reported allergies to more than one of these categories and n=2 participants had anaphylaxis to more than one cause (both to food and venom). Demographic and clinical information is summarised in Table 1.

General QoL and mental health compared to published healthy population norms

Mean scores for the validated measures and norm data can be found in Table 2. Reported stress in this sample of adults with anaphylaxis was significantly higher than the norm value, $t=4.98(135)$, $p<0.001$. A total of 23.2% of men (n=13) and 49.4% of women (n=42) reported moderate to severe anxiety. Mean anxiety levels were significantly higher than UK norm values for women, $t=3.27(83)$, $p=0.002$, but not for men. A total of 16.1% of men (n=9) and 12.4% of women (n=19) reported moderate to severe depression. Mean depression levels were also significantly higher than UK norm values for women, $t=2.93(83)$, $p=0.004$, but not for men (Table 2). Adults with anaphylaxis reported significantly better general physical QoL than UK norms ($t=-2.10(133)$, $p=0.03$), but significantly poorer social ($t=3.34(138)$, $p<0.001$) and environmental QoL ($t=-7.68(136)$, $p<0.001$). There was no significant difference for psychological QoL.

Relationships between QoL, mental health, demographic and clinical variables

Poorer anaphylaxis specific QoL (as measured by the A-QoL-Adults) significantly related to greater anxiety, depression, stress and poorer generic physical, psychological, social and environmental QoL (Table 3). Those of a younger age, those who had experienced a greater number of anaphylactic reactions and those who carried their AAI more frequently reported significantly poorer anaphylaxis specific QoL (Table 3).

Females reported significantly poorer anaphylaxis specific QoL (mean=2.50, SD=0.93) compared to males (mean=1.73, SD=0.75), $t=-5.09(123.01)$, $p<0.001$. There were no significant differences for ethnicity between White and Indian/Pakistani ethnic groups (further analysis based on ethnicity was not possible due to the low numbers in other groups).

Severity of anaphylaxis was graded using the Brown grading system²⁰. There was no significant difference in anaphylaxis specific QoL for those with a mild to moderate rating compared to those with a severe rating. Those with other atopic conditions (such as hay-fever or allergies to animals or house dust mite) reported poorer anaphylaxis specific QoL (mean=2.34, SD=.93) than those with no other atopic conditions (mean=1.98, SD=.94), $t=2.14(123)$, $p<0.05$.

QoL and mental health across different causes of anaphylaxis

There were no significant differences across the different causes of anaphylaxis for reported stress or anxiety but there were significant differences for depression across food, venom, medication or spontaneous causes of anaphylaxis, $F(3,134)=3.04$, $p<0.05$. Post hoc tests showed that those with anaphylaxis to medication reported significantly greater depression than those reacting to bee or wasp venom.

There were significant differences across different causes for general physical QoL as measured by the WHO-QoL BREF, $F(3,128)=4.40$, $p<0.01$, but not for social, psychological or environmental QoL. Post hoc tests showed that those with anaphylaxis to medication reported significantly worse physical QoL than those reporting anaphylaxis to venom ($p<0.01$).

For anaphylaxis specific overall QoL, there were significant differences across food, venom, medication or spontaneous causes of anaphylaxis, $F(3,124)=6.50$, $p<0.001$. Post hoc tests showed that those with anaphylaxis to food had significantly poorer QoL than those reacting to bee or wasp venom ($p<0.02$) or medication ($p<0.05$). Those with spontaneous anaphylaxis reported significantly poorer QoL than those with anaphylaxis to venom ($p<0.01$) or medication ($p<0.05$).

For the sub-domains of the A-QoL-Adults scale, there were significant differences across the different causes for Limitations on Life, $F(3,129)=7.34$, $p<0.001$, Social QoL, $F(3,130)=3.83$, $p<0.01$ and Emotional QoL, $F(3,131)=4.49$, $p<0.01$. Post hoc tests showed that those with spontaneous anaphylaxis reported poorer social QoL ($p<0.05$) and emotional QoL ($p=0.01$) than those reacting to venom. Those reacting to food reported poorer emotional QoL ($p<0.01$) than those reacting to venom and greater limitations on life compared to those reacting to venom ($p<0.05$) or medication ($p<0.001$). Finally, those with spontaneous anaphylaxis reported greater limitations on life than those reacting to medication as a cause ($p<0.05$) (Table 4).

Predictors of quality of life for adults with anaphylaxis

A hierarchical multiple regression model was run to explore predictors of anaphylaxis specific QoL. Predictors that significantly related to total QoL as measured by the A-QoL-Adult were entered into the model. Demographic and clinical variables were entered in the first step to explore the unique contribution of these variables and to then control for them; mental health variables were entered in the second step. The model for the first step was significant ($F(4,94) = 6.54$, $p<0.001$) and explained 19.1% of the variance in anaphylaxis specific QoL. A greater number of anaphylactic reactions experienced and being female were significant predictors of poorer anaphylaxis specific QoL. The model for the second step was also significant ($F(8,94) = 18.55$, $p<0.001$) and explained a further 40.9% of the variance, with 60% explained overall. In this model, age became significant, but gender was no longer significant. A greater number of anaphylactic reactions experienced and greater anxiety also significantly predicted poorer anaphylaxis specific QoL, with anxiety the strongest predictor (Table 5).

DISCUSSION

This study aimed to assess the impact anaphylaxis has on the QoL and mental health of adults, using validated measures. A new tool developed and validated by our group for measuring anaphylaxis specific QoL for adults¹² was employed and scores on scales to measure general QoL and mental health were compared to relevant norm data where available. When comparing scores with norm data, adults with anaphylaxis reported greater stress and poorer general QoL in social and environmental domains. It is unsurprising that adults with this condition report high levels of stress and an impact on social and environmental QoL, given the constant vigilance required to avoid their respective triggers, which involves continually assessing risk in their environment. Those with food allergy also need to assess risk every time they eat and this type of allergy has been consistently related to poorer social lives, impacting on activities such as eating out or going on holiday²⁵. On the other hand, adults with anaphylaxis reported a better general physical QoL than norm values. This may be due to particular characteristics of this cohort that might be different to the norm sample. For example, the majority of the participants in this cohort were educated up to at least high-school level which may indicate a better socio-economic status, an established predictor of better quality of life²⁶ and general health²⁷.

Gender differences were found when exploring differences in anxiety and depression compared to norm data, with only females scoring significantly worse. Almost half of the present sample of female adults also reported moderate to severe anxiety levels. Anxiety due to anaphylaxis has been reported in younger age groups in both males and females^{5,6}. It is unclear why females in this sample reported particularly high levels compared to males. It may be due to females being more likely to report mental health issues²⁸ or they may simply

have a greater fear of the consequences of anaphylaxis than men. Exploration of beliefs and understanding of anaphylaxis would be useful, particularly as illness beliefs have been shown to be associated with mental health outcomes and long-term management of allergic conditions such as food allergy²⁹ as well as other conditions such as diabetes³⁰. The findings regarding depression are novel as very little research has measured this in adults with anaphylaxis, although depression is a common co-morbidity with other long-term health conditions³¹.

Poorer anaphylaxis specific QoL was significantly related to greater stress, anxiety, depression and poorer general QoL across all domains, which highlights the impact anaphylaxis has on day-to-day living of adults with this condition. Important demographic and clinical variables were also related to anaphylaxis specific QoL such as gender (with females reporting a greater impact), younger age, other atopic conditions and number of anaphylactic reactions. Clinicians should take particular note of patients with these characteristics, as they may require further support in managing their condition and/or require psychological support to reduce mental distress.

Direct comparisons across the different causes for anaphylaxis was possible due to the newly validated A-QoL-Adults scale. Those with anaphylaxis to food or with spontaneous anaphylaxis reported a bigger impact on their anaphylaxis specific QoL compared to those with medication or venom as a cause. This may be due to the level of risk assessment and daily effort needed to avoid allergen/s for those with food allergy, or the extra vigilance for those who do not know what causes their anaphylaxis. Significant differences across causes were also seen for those with anaphylaxis to medication, who reported greater depression and poorer overall physical QoL in comparison to those with anaphylaxis to venom. Clinicians should therefore be aware of the different aspects of lives that are affected, depending on the cause of anaphylaxis, in order to ensure appropriate support is in place for optimal allergy management.

In regression models, psychological variables explained a significant amount of variance in QoL after demographic and clinical variables had been controlled for. In the final model, younger age, greater number of anaphylactic reactions experienced and greater anxiety significantly predicted poorer anaphylaxis specific QoL. Reducing the number of reactions people experience is therefore key to improving anaphylaxis related QoL and it is likely that this may also reduce anxiety, which was the strongest predictor of QoL. Those with high levels of anxiety may benefit from psychological support.

Some limitations should be taken into account when assessing the results of this study. First, two thirds of participants who expressed an interest in taking part in the study did not return their study packs and these participants may have potentially responded differently to those who took part. Second, the sample is predominantly White British and as mentioned previously almost 60% were educated to at least a post-high school level (A levels in the UK education system). Third, those with suboptimal or no proficiency in English language were excluded as questionnaires were not available in other languages. This may have had an impact on results although we found no differences across ethnicity. However, group numbers for different ethnic minority groups were relatively low and so we were not able to determine if these results would be the same in different socio-economic strata or ethnic groups where we know rates of anaphylaxis and allergic conditions may vary³². Fourth, data was generated from a single centre, although it is a major regional centre with a wide catchment area outside Birmingham city. Nevertheless, this study reports novel findings in a sample of well characterised adult patients with anaphylaxis which could assist in informing clinical and psychological support for allergy management. Patient education and training for allergen avoidance is needed to improve self-management of anaphylaxis. In addition, help in recognising when anaphylaxis is having an impact on mental wellbeing is key to timely referral to for psychological support.

In conclusion, anaphylaxis has an adverse impact on QoL and mental health of adults across different causes. Anxiety, depression and number of reactions seem to be important in explaining the impact on QoL. Those with anaphylaxis to food or spontaneous anaphylaxis in particular may benefit from support to help improve quality of life. Further multi-centre studies including a larger sample of patients from ethnic minority groups may help gain further insight into the impact of anaphylaxis on QoL and facilitate development of novel supportive interventions.

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Figure legend

Figure 1. Flow diagram showing study recruitment

Table 1. Demographic information and anaphylaxis characteristics

		N=142 N (%)
Mean age in years (S.D.)		44.41 (17.30)
Age range in years		18-78
Gender	Male	56 (39.4)
	Female	85 (59.9)
	Prefer not to say	1 (0.7)
	Other	5 (3.5)
Ethnicity	White	117 (82.4)
	Indian/Pakistani	13 (9.2)
	African/Caribbean	4 (2.8)
	Prefer not to say	3 (2.1)
Highest level of education	Vocational qualification	20 (14.1)
	Secondary/High school level	28 (19.7)
	A level/post High school level	30 (21.1)
	University degree	46 (32.4)
	None	8 (5.6)
Mean N of anaphylactic reactions (S.D.)		3.51 (7.48)
Cause of anaphylaxis	Food ⁺	43 (30.2)
	Peri-operative general anaesthesia	27 (19.0)
	Medication/drugs (excluding general anaesthesia)	15 (11.3)
	Spontaneous	30 (21.1)

		N=142 N (%)
Symptoms	Wasp or bee venom	24 (16.9)
	Latex	1 (0.70)
	Exercise induced	1 (0.70)
	Change in temperature	1 (0.70)
	Difficulty breathing	95 (66.9)
	Skin rash	94 (66.2)
	Itchy skin	90 (63.4)
	Vomiting	30 (21.1)
	Swelling of mouth, lips or face	88 (62.0)
	Loss of consciousness	24 (16.9)
	Drop in blood pressure	64 (45.1)
Brown grading	Under general anaesthetic	21 (14.8)
	Mild/Moderate	48 (33.8)
	Severe	91 (64.1)
Prescription of an AAI	Yes	99 (69.7)
How often do you carry your AAI	Never	8 (5.6)
	Rarely	7 (4.9)
	Sometimes	9 (6.3)
	Most of the time	23 (16.2)
	Always	58 (40.8)
Other allergies	Yes	72 (50.7)
	Hayfever	39 (27.46)
	Eczema	25 (17.61)
	Asthma	41 (28.87)
Family history of allergy	Yes	42 (29.6)

Figures represent mean (SD) or number (%). Where totals do not equal 100% there is missing data; where they total more than 100% participants could select more than one option

⁺Food: peanut, tree nut, soya, sesame, lupin, shellfish, fish, eggs, fruit.

Table 2. Means and standard deviations of the A-QOL- Adults, the WHOQOL BREF, the HADS, and the PSS for this sample and published norms where available.

Scale	Adults with anaphylaxis (n=142)	Norm value
A-QOL-A		
Total QoL	2.18 (0.94)	n.a
Emotional	2.54 (1.07)	n.a
Social	1.86 (0.94)	n.a
Limitations	2.24 (1.07)	n.a
WHOQOL BREF		
Physical QoL	15.15 (3.47)*	15.8 (3.8)
Psychological QoL	14.81 (2.87)	14.7 (3.4)
Social QoL	15.26 (3.74)***	14.2 (3.5)
Environmental QOL	15.78 (2.56)***	14.1 (2.3)
HADS		
Anxiety - men	4.87 (4.72)	5.0
Anxiety - women	7.64 (4.61)**	6.0
Depression - men	3.04 (3.62)	3.0
Depression - women	4.37 (4.28)**	3.0

Scale	Adults with anaphylaxis (n=142)	Norm value
Stress (PSS)	23.24 (8.49)***	19.62 (7.49)

*p<0.05; **p<0.01, ***p<0.001; Note: Norm data for HADS are median scores; n.a: not available

Table 3. Correlations between the A-QOL-Adults, the WHOQOL BREF, the HADS, the PSS and clinical and demographic variables

Scale or clinical variables	A-QOL-Adults
Age	-.24**
Number of reactions	.22*
Frequency of AAI carriage	.30**
WHOQOL BREF	
Physical QoL	-.50**
Psychological QoL	-.45**
Social QoL	-.36**
Environmental QOL	-.48**
HADS Anxiety	.69**
HADS Depression	.54**
PSS Stress	.38**

*p<0.05; **p<0.01

Table 4. Means (and standard deviations) for the WHOQOL BREF, HADS, PSS and A-QOL-Adults across different causes of anaphylaxis

Scale	Food	Venom	Medication	Spontaneous
A-QOL-A				
Total QoL***	2.48 (0.92)	1.71 (0.46)	1.87 (0.92)	2.54 (0.94)
Emotional**	2.78 (1.06)	1.89 (0.63)	2.44 (1.17)	2.82 (1.03)
Social**	2.03 (0.95)	1.50 (0.48)	1.64 (0.83)	2.21 (1.17)
Limitations***	2.70 (1.04)	1.90 (0.76)	1.75 (0.96)	2.50 (1.13)
WHOQOL BREF				
Physical QoL**	3.92 (0.85)	4.18 (0.54)	3.41 (0.88)	3.72 (0.88)
Psychological QoL	3.75 (0.77)	3.95 (0.53)	3.57 (0.75)	3.57 (0.70)
Social QoL	3.87 (0.93)	4.10 (0.62)	3.73 (1.09)	3.64 (0.94)
Environmental QOL	3.90 (0.69)	4.19 (0.45)	3.91 (0.53)	3.84 (0.80)
HADS				
Anxiety	7.00 (5.18)	4.32 (3.04)	6.75 (4.86)	7.83 (4.98)
Depression*	3.67 (3.95)	1.73 (2.53)	4.63 (4.45)	4.70 (4.36)
PSS				
Stress	23.86 (8.90)	19.43 (6.92)	24.56 (8.71)	23.44 (8.50)

*p<0.05; **p<0.01; ***p<0.001

Table 5. Multiple regression model for predictors of QoL (A-QOL-Adults) in adults with anaphylaxis

	Unstandardised Beta	Standardised beta	R ² (Adj R ²)	F
Model 1				
Gender	.54	.30**		
Age	-.01	-.17		
N of reactions	.03	.25**		
Other allergies	-.30	-.16	.23 (.19)	6.54***
Model 2				
Gender	.16	.09		
Age	-.01	-.15*		
N of reactions	.03	.24**		
Other allergies	-.09	-.05		
Stress	-.02	-.20		
Anxiety	.12	.62***		
Depression	.05	.21		
Frequency AAI carriage	.10	.13	.63 (.60)	18.55***

*p<0.05; **p<0.01; ***p<0.001

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Knibb_Anaphylaxis QoL mental health_figure.docx available at <https://authorea.com/users/327459/articles/581474-the-impact-of-anaphylaxis-on-the-quality-of-life-and-mental-health-of-adults>