

1 The Development of a Nystagmus Specific Quality of Life Questionnaire

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24 This article contains additional online-only material. The following should appear online-
25 only: Appendix 1

26

27 Abstract

28 Purpose: To develop a nystagmus specific quality of life questionnaire derived from patient
29 concerns based on eudemonic aspects of well-being.

30 Design: Cross-sectional study

31 Participants: 206 participants with nystagmus for factor analysis phase and an additional 42
32 participants with nystagmus for construct validity phase

33 Methods: Questionnaire items were written based upon the six domains of everyday living
34 affected by nystagmus that were elicited by previous semi-structured interviews conducted
35 with 21 people with nystagmus (McLean et al. 2012). Following consultation with eight
36 nystagmus experts 37 items were administered to 206 people with nystagmus. Factor
37 analysis was used to identify latent factors among the items and the identify items to
38 propose new nystagmus quality of life scales. Cronbachs alpha was used to assess the
39 internal reliability of the new scales. To assess for discriminate and concurrent validity
40 between the new nystagmus scales and an existing vision related QOL tool, the VFQ-25, was
41 administered to 42 additional participants.

42 Main Outcome Measure: Questionnaire response scores on nystagmus specific quality of life
43 items

44 Results: The factor analysis revealed the retention of 29 items to form a measure
45 comprising two distinct subscales reflecting 'personal and social' and 'physical and
46 environmental' functioning as relates to nystagmus specific quality of life.. The Cronbach's
47 alpha coefficients for the 'personal and social' functioning scale and 'physical and
48 environmental' functioning were 0.95 and 0.93 respectively. Tests for validity of the

measure, consistent with a-priori predictions, when compared to the VFQ-25, revealed the 'physical and environmental' subscale showed concurrent validity (0.88) whilst the 'personal and social' subscale was demonstrated to have discriminative validity (0.81).

Conclusions: We have developed a 29 item, nystagmus specific QOL questionnaire (NYS-29) based on eudemonic aspects of well-being with subscales that address not only physical functioning, but also psycho-social issues. The NYS-29 is grounded in the perspectives and concerns of those who have nystagmus and can be used to determine the impact of nystagmus on daily living in terms of both physical and psychosocial aspects.

68 Health related quality of life (QOL) has, in recent years, become recognised as an important
69 outcome measure for health care. Objective measures alone, such as visual acuity, may not
70 represent clinical outcomes from the patients' perspective.¹ For conditions that affect
71 vision it is now accepted that a combination of visual, functional, psychological, social and
72 economic factors jointly determines an individual experience.² The development of vision
73 specific QOL tools, such as the National Eye Institute Visual Functioning Questionnaire and
74 Low Vision QOL questionnaire,^{3, 4} are documented as being more sensitive to decreased
75 functioning due to vision loss than more generic health related tools, for example the SF-36.
76 Furthermore 'disease-specific' QOL tools have been shown to detect the overall impact that
77 an eye condition has on an individual more so than the generic vision related tools for
78 example in conditions such as amblyopia and strabismus.^{5, 6}

79 Currently there is no disease specific QOL tool available for use in patients with nystagmus.
80 US and European regulatory authorities strongly advise developing HRQOL instruments that
81 are based upon the patients' rather than the clinicians' perspectives.⁷ Data we recently
82 collated, via semi structured interviews, suggests six domains of everyday living as being
83 important to people with nystagmus; relationships (family, friends, education), standing
84 out/being different (being different, particularly when compared to others), feelings about
85 the inner self (self-confidence, self-esteem, inferiority, guilt and distress), daily functioning
86 (discomfort, personal care, deficits), restriction of movement (around opportunities in
87 education, work and leisure, relying on others) and the future (hopelessness, feeling
88 abandoned).⁸ These findings suggest that people with nystagmus are making eudaimonic
89 assessments of well-being that are focussed on longer-term evaluations of one's
90 engagement with life or the extent to which one is able to live their own life well.⁹ This

suggests our research provides a strong narrative basis on which to explore those aspects of QOL that inform one's eudaimonic well-being.

To gain better understanding of the effects of nystagmus for an individual in terms of longer term life engagement there is the need to develop an appropriate tool. In this study we aim to develop a questionnaire to assess QOL among nystagmus patients with an emphasis on measuring those eudaimonic well-being themes previously identified of relationships, standing out/being different, feelings about the inner self, daily functioning, restriction of movement and the future.⁸

Methods

Ethics

This study adhered to the tenets of the Declaration of Helsinki. Ethical approval was received from the Leicestershire, Northamptonshire and Rutland Ethics Committee prior to beginning the study and informed consent was obtained from all participants.

Sample

Two hundred and six respondents (see results for recommended ratio of participants to variables) with nystagmus (97 male and 109 female) who were aged 16 to 83 years (mean = 44.20 years, SD = 16.85) took part in the study. Demographic data collected included ethnicity, level of education, postal code (to assess deprivation level) family history of nystagmus and cause of nystagmus (Table 1). In addition a further 42 participants (31 male and 11 female) aged 16 to 68 years (mean = 42.78, SD = 14.26) with nystagmus were added to the sample to assess for construct validity (Table 1). Participants with infantile and acquired nystagmus were included in the sample as the problematic effects of nystagmus reported in interviews previously conducted were similar for both types.⁸

Initial Item development and administration

A rigorous item selection process was adopted throughout the development of the NYS-29.¹⁰ Items for the questionnaire were created by RJM and JM working with data from the 21 individual interviews previously conducted across several writing sessions, over a six month period. Initial items were written reflecting McLean et al's six domains relationships, standing out/being different, feelings about the inner self, daily functioning, restriction of movement and the future. Some topics that were frequently mentioned during the interviews, for example driving, were not carried through into the questionnaire as the majority of people who have nystagmus are unable to drive. Instead, items were included with regards to limitation in day to day travel and independent travel which were specifically mentioned in the interview extracts and all people could relate to. Sets of these items were given to eight nystagmus experts (four ophthalmologists and four people with nystagmus) to review the items and indicate suitability of items for administration. In particular they were asked to comment if they did not understand an item as well as rate items as not being applicable if this was the case.

After this consultation, thirty seven items were administered to respondents, who all had nystagmus, in the form of a postal questionnaire. Aside from providing demographic information outlined in the sample section, respondents were asked to rate each item in light of the following statement "Please choose the response that best describes you and your feelings". Each response was scored on the following 5-point response scale (1 = 'not at all', 2 = 'a little', 3 = 'somewhat/moderately', 4 = 'quite a lot' and 5 = 'very much so').

Statistical Analysis

Factor analysis was performed to reduce items and determine the subscale that each item belongs to. Meaningful loadings were assessed using the criteria of 0.32 (*Poor*), 0.45 (*Fair*), 0.55 (*Good*), 0.63 (*Very good*) or 0.71 (*Excellent*).^{11, 12} Loadings above .55 (i.e. 'good' or better) were considered useful to the factor and retained for the final questionnaire. Cronbachs alpha was used to assess the internal consistency reliability of remaining items.¹³

To assess the extent any new measure overlapped with previously validated visual functioning questionnaires, the Visual Functioning Questionnaire-25 (VFQ-25) was also additionally administered to 42 individuals to test for construct validity between the VFQ-25 and the new nystagmus scales.¹⁴ Campbell and Fiske's criteria for demonstrating discriminant validity via correlations between two scales being less than .85 was applied, where the statistic is correlation of two scales divided by the square root of the multiplication of both reliability of the scales compared.¹⁵

Results

Factor Analysis

Of the original 206 respondents, 186 respondents provided responses to all 37 items. The number of participants (186) to variables (37) equaled the recommended ratio for exploratory factor analysis (EFA) of at least 5 participants to 1 item, with a minimum number of participants of 150.¹⁶⁻¹⁸ Preliminary analyses of the items before conducting the EFA demonstrated that there were 8 skewness (1.09 and 2.67) and 25 kurtosis (between -1.02 and 6.87) statistics that fell outside the criteria of +/-1 representing "very good" symmetry of a normal univariate distribution.^{19, 20} Consequently, a principal-axis EFA was conducted as the assumption of normality of the data could not assumed.

An EFA was performed on the responses using IBM SPSS Statistics version 22. In determining the number of factors to extract, parallel analysis revealed that the eigenvalues values for the first two factors (16.01, 3.24, 1.58) only exceeded the corresponding criterion eigenvalues (1.97, 1.84, 1.74) for a randomly generated data comprising 37 variables and 186 cases. Subsequently, we forced a 2-factor solution using a promax rotation (Table 2). The first factor comprised 19 items representing '*personal and social*' functioning (e.g. "Having nystagmus does not help me to form close personal relationships", "I am less confident because I have nystagmus"), and are drawn from the relationships, inner, future, standing out domains. The second factor comprised 18 items representing '*physical and environmental*' functioning ("I have difficulty finding or exploring new places because I have nystagmus" and "I have to rely on others because I have nystagmus"), and drawn from the restriction of daily movement, daily functioning and restriction of social movement domains. Removal of redundant items (loadings that did not meet the criteria of good or better [.55]) resulted in a final questionnaire of 29 items; 17 items representing personal and social functioning and 12 items signifying physical and environmental functioning as shown in Appendix 1 (available at <http://www.aaojournal.org>).

The Cronbach's alpha coefficients for the '*personal and social*' functioning ($\alpha = .95$) and '*physical and environmental*' functioning ($\alpha = .93$), exceed the internal reliability criterion of $\alpha > .70$ as "good".¹³ There was a significant correlation between the two subscales ($r = .63$, $p < .01$), with the two subscales sharing just under 40% of the variance, leaving 60% of the variance unexplained, suggesting they are measuring different constructs.

Construct Validity

Given the proposal of the two main dimensions, '*physical and environmental*' and '*personal and social*' functioning, the construct validity of the new scales was assessed by comparing them to scores on the VFQ-25. Among the subsample of 42 participants, the reliabilities of the scales were; VFQ-25, $\alpha = .92$, '*physical and environmental*', $\alpha = .90$, '*personal and social*', $\alpha = .91$, and the correlation between the VFQ-25 and the '*physical and environmental*' scale ($r = .805$) and correlation between the VFQ-25 and the '*personal and social*' ($r = .741$). Campbell and Fiske's formula for assessing discriminant validity produced a correction correlation between the VF-25 and the '*physical and environmental*' scale above the .85 criteria (.88), and a correction correlation between the VF-25 and the '*personal and social*' scale was below the .85 criteria (.81).¹⁵

Discussion

Using six domains of living, previously reported by people with nystagmus as affecting their daily lives, we have developed a 29 item nystagmus specific questionnaire (NYS-29) for use in adults. The 29 items identified are classified into two subscales (personal/social and physical/environmental) and are specific to people who have nystagmus. The items and scales within this study have been developed in the context of eudaimonic well-being, emphasising the measurement of well-being in terms of overall engagement with living one's life well.

Our items were originally based on our previous interview findings in which we had elicited 6 domains of living that were negatively affected by nystagmus.⁸ However, the EFA findings in this current study suggest that respondents' ratings lead to a parsimonious consideration of these 6 domains, focussing on two distinct main areas; personal & social and physical & environmental. We were able to relate the scores on the NYS-29 subscales to the VFQ-25, in

terms of showing concurrent validity for the physical/environmental subscale, and discriminatory validity for the personal-social subscale. Although the VFQ-25 and the new physical and environmental scale may originate from different theoretical perspectives of well-being, the physical and environmental subscale clearly has overlaps in terms of content with the VFQ-25, probably as both scales measure movement and functioning through task related questions. It was therefore anticipated that the physical and environmental subscale would show some concurrent validity with the VFQ-25. However, the personal and social subscale is markedly different from the VFQ-25 as it focusses on social and emotional functioning. These finding suggests that the NYS-29 might be more applicable than the VFQ-25 in measuring well-being in nystagmus as it assesses both similar and additional domains of well-being.

The structure of the NYS-29 is consistent with the structure of other vision based QOL measures. For example our distinction of subscales is also similar to the AS-20.²¹ The AS-20 is a 20 item specific QOL tool derived from patient concerns in relation to strabismus, and consists of two distinct subscales comprising a psychosocial factor and a functioning factor. Interestingly strabismus is an eye condition, like nystagmus, causing not only reduced visual acuity but also causing the eyes to appear cosmetically abnormal. Both the AS-20 and the new NYS-29 comprised of items that capture not only the effect a visual disease can have on visual functioning but also the impact that abnormal cosmetic appearance can have on psycho social domains of life. Cosmetic effects can have detrimental consequences and, both strabismus and nystagmus alike, affect not only self-image but also interpersonal relationships and self-esteem.^{8, 22-24} Social phobia, the fear of being humiliated in social settings, has been documented in various disfiguring or physically disabling diseases,

including strabismus.²⁵ We postulate it is also very possible that social phobia may also be a consequence for people with nystagmus. This emphasizes the need for the personal and social subscale, which does not currently exist in generic vision tools, in order to accurately quantify the overall impact nystagmus, has on well-being.

For this current study all items scoring .55 were considered a good item and retained for the questionnaire, resulting in a tool containing 29 items.^{11, 12} In some cases the number of items would be reduced further so that, for example, the highest scoring top 10 items for each scale were retained in order to make the tool more concise. We opted to retain all 29 items in order to include items that covered all of the domains that were previously reported in the interviews. For example, had the personal/social scale been shortened to just 10 items then many of the items reflecting the domains 'standing out' and 'future with nystagmus' would have been removed even though their loadings for the scale were high.

Although a rigorous process was followed in the development of the questionnaire there are potential weaknesses. Our population is currently limited to a UK sample and it is possible that experiences of nystagmus may differ from country to country. In addition, our sample lacks racial heterogeneity, as is a predominantly white sample, and this may have influenced the final NYS-29 items. In future studies we plan to perform a confirmatory analysis in order to test the structure of the questionnaire with a sample from the USA. Further research is also needed to explore the validity of the NYS-29. Additionally administering the NYS-29 and VFQ-25 to a sample, not only with nystagmus but, to those without nystagmus could show further evidence of construct validity. Also, given that eudaimonic well-being factors are posited to represent indicators of resilience over the life-span, there is opportunity to use the NYS-29 not to just assess current clinical outcomes at

particular time points, but also how well overall personal-social and physical-environmental functioning might be related to other nystagmus related variables.⁹ For example, given that the items have been derived from 6 life domains, how scores on the NYS-29 are related to employment, relationships, access to treatments, daily functioning and well-being in later life.

We have developed a patient derived, disease specific QOL tool for nystagmus that is grounded in the perspectives of those that have the condition and emphasises eudaimonic aspects of well-being. The NYS-29 will help to accurately determine the impact of nystagmus on daily living and also can be used as an outcome measure in the assessment of treatments.

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Demographic	Main Sample (n=206)	Construct Validity Sample (n=42)
Gender		
Male	97	31
Female	109	11
Ethnicity		
White	195	38
Other	11	3
Age		
<20 years	13	1
20-39 years	60	18
40-59 years	71	18
>60 years	35	5
DOB not given	27	0
Deprivation Score		
<10,000	37	6
10,001-20,000	63	12
20,001- 32,844	76	19
Unable to score	30	5
Level of Education		
No Qualifications	11	3
School/college	93	19
Degree/Post graduate	99	20
Education not given	7	0
Type of Nystagmus		
Acquired	18	3
Infantile	184	39
Type not given	4	0
Family History of Nystagmus		
Yes	56	18
No	143	24
History not given	7	0
Driving Status		
Driver	35	9
Non-driver	156	31
Stopped Driving	15	2

314

315 Table 1. Demographic data of participants. Deprivation score taken from Office for National
316 Statistics, based upon postal code each neighbourhood is ranked from 1 (most deprived) to 32,844
317 (least deprived).

318

Questionnaire Item	Interview Domain Item Originated From	Item Loadings	
		Factor 1 Personal & Social	Factor 2 Physical & Environmental
Having nystagmus does not help me to form close personal relationships	Relationships	0.87	-0.14
I am less confident because I have nystagmus	Inner Self	0.87	-0.06
I find it difficult to form new relationships because I have nystagmus	Relationships	0.82	-0.15
I feel self-conscious because I have nystagmus	Inner Self	0.78	-0.02
I find it difficult maintaining friendships because I have nystagmus	Relationships	0.77	-0.17
I find that family relationships are difficult because I have nystagmus	Relationships	0.76	-0.13
I find it difficult to maintain relationships with people at work because I have nystagmus	Relationships	0.75	-0.02
I find meeting new people is difficult because I have nystagmus	Relationships	0.71	0.02
I will be excluded by others because I have nystagmus	The Future	0.69	0.1
I feel less able because I have nystagmus	Inner Self	0.69	0.09
I will always be isolated because I have nystagmus	The Future	0.69	0.09
Nystagmus makes me feel I don't want to try new things	The Future	0.65	0.07
I will always miss out because I have nystagmus	The Future	0.65	0.08
I feel stressed because I have nystagmus	Inner Self	0.63	0.13
Having nystagmus makes me stand out from other people	Standing Out	0.62	0.1
I feel vulnerable because I have nystagmus	Inner Self	0.59	0.2
Having nystagmus makes me different to other people	Standing Out	0.58	0.15
I feel frustrated because I have nystagmus	Inner Self	0.44	0.25
I think that my nystagmus will never change for the better	The Future	0.33	0.09
I have difficulty finding or exploring new places because I have nystagmus	Restriction of Daily Movement	-0.17	0.92
I have to rely on others because I have nystagmus	Restriction of Daily Movement	-0.14	0.89
I struggle in crowded places (football, shopping centres, pubs) because I have nystagmus	Restriction of Daily Movement	-0.07	0.86
I struggle to get to places on my own because I have nystagmus	Restriction of Daily Movement	-0.09	0.79
I am generally limited by day to day travel because I have nystagmus	Restriction of Daily Movement	-0.08	0.77
I have to use things that make me stand out from other people (large print books, monocular) because I have nystagmus	Standing Out	-0.03	0.71
Nystagmus makes it hard for me to read facial expressions	Daily Functioning	-0.01	0.69
I have to ask for additional help because I have nystagmus	Standing Out	0.1	0.68
I am restricted in terms of leisure and social activities because I have nystagmus	Restriction of Social Movement	0.24	0.63
Nystagmus blurs my vision	Daily Functioning	-0.1	0.61
Nystagmus affects what I do in the day	Daily Functioning	0.16	0.58
I was/am restricted in my choice of occupation because I have nystagmus	Restriction of Social Movement	0.18	0.55
I would have progressed further in my career if I didn't have nystagmus	Restriction of Social Movement	0.19	0.53
Nystagmus gets in the way of what I want to do	Daily Functioning	0.19	0.49
I can't do the same things as other people because I have nystagmus	Standing Out	0.28	0.44
Education was/is difficult because of nystagmus because I have nystagmus	Restriction of Social Movement	0.27	0.4

Nystagmus causes me tiredness	Daily Functioning	0.23	0.4
Nystagmus affects my concentration	Daily Functioning	0.29	0.3

319

320 Table 2. Item loadings for the two factor solution: Personal & Social and Physical & Environmental.

321 Interview domain from previous interviews (McLean et al . 2012) that the item was constructed

322 from. Loadings in bold were retained for final questionnaire (NYS-29).

323