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Correlation between vision- and health-related quality of life scores

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ABSTRACT.

Purpose: **To examine the correlation between health-related quality of life (HRQOL) scores [assessed using the generic Short Form Health Survey (SF-36) questionnaire] and vision-related quality of life (VRQOL) scores [assessed using the National Eye Institute Visual Function Questionnaire (NEI-VFQ25)].**

Methods: **Cross-sectional analytic study. All surviving participants of the Blue Mountains Eye Study (n = 1952, aged 60 years and older) were invited to attend comprehensive eye examinations 10 years after baseline examinations and were asked to complete both questionnaires.**

Results: **Complete data were available for 1436 participants. After controlling for age, sex and the presence of either unilateral or bilateral visual impairment, the number of hospital admissions, chronic medical conditions and disabilities, we found that the composite NEI-VFQ score was significantly associated with the two main domains of the SF-36 survey: the summary physical component score ($P < 0.001$) and the mental component score ($P < 0.001$). There was relatively low correlation ($r < 0.3$) between the NEI-VFQ25 subscales and SF-36 subscales including the physical and mental composite scores.**

Conclusion: **VRQOL is influenced by both general health and HRQOL. However, there is a relatively low correlation between the individual subscales of these two quality of life questionnaires.**

Key words: correlation – health – quality of life – vision – vision function questionnaire

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Introduction

Qualitative outcome measures such as quality of life scores are used increasingly in clinical trials of ophthalmic research because traditional clinical outcome measures such as visual acuity alone do not capture the dimensions of satisfaction and functional ability adequately (Massof & Rubin 2001; Odberg et al. 2001; Mamidipudi et al. 2003; Vitale & Schein 2003; Pager 2004; Pager et al. 2004). Health-related quality of life (HRQOL) measures are broadly classified as either generic (i.e. they measure all aspects of health and are applicable across all health conditions) or specific (i.e. they apply only to specific diseases or conditions).

The National Eye Institute Visual Function Questionnaire (NEI-VFQ25) (Mangione et al. 1998) is a specific HRQOL measure that assesses vision-related quality of life (VRQOL) and its various dimensions, and has now been validated across various eye conditions of varying severity, including age-related cataract, macular degeneration, glaucomatous visual field loss and low vision from any cause (Mangione et al. 1998, 2001; Cole et al. 2000; Broman et al. 2001, 2002; Miskala et al. 2003; Scilley et al. 2004; Burstedt et al. 2005). The Short Form Health Survey (SF-36) is a generic quality of life tool that has been validated across a range of populations (Ware & Sherbourne 1992; Chia et al. 2003). As shown previously, visual impairment is associated with poorer SF-36 and NEI-VFQ scores (Chia et al. 2003, 2004). However, few studies have assessed the cross-sectional correlation between these two distinctly different HRQOL measures (Mangione et al. 1998). In this study, we aimed to examine the extent of any correlation between the generic SF-36 and the vision-specific NEI-VFQ25 questionnaires in an older, community-living Australian population.

Materials and Methods

Participants

The Blue Mountains Eye Study (BMES) is a population-based cohort study of common eye diseases in a predominantly White Australian population, aged initially 49+ years, living in two postcode areas west of Sydney. Of 3654 baseline (1992–1994) participants, 2335 (75% of survivors) were re-examined after 5 years (1997–1999); 1952 (76% of survivors) were re-examined after 10 years (2002–2004). The study was conducted in accordance with the recommendations of the Declaration of Helsinki and was approved by the Western Sydney Area Health Service Human Research Ethics Committee. Written consent was obtained from all participants. Data for the current study were collected at the 10 year follow-up examination.

Participants had a comprehensive eye examination that included measurement of distance logMAR visual acuity before and after subjective refraction using the Early Treatment Diabetic Retinopathy Study (ETDRS) method (Attebo et al. 1996), automated perimetry and lens and stereo retinal photographs. Before attending, participants were asked to complete a detailed questionnaire and return it by mail or at examinations. HRQOL and VRQOL questionnaires were included.

HRQOL questionnaire (SF-36)

HRQOL was ascertained using the SF-36 (Ware & Sherbourne 1992). This instrument contains 36 items, measuring eight dimensions of health and wellbeing: 'physical functioning', 'role limitation due to physical problems', 'bodily pain', 'general health perceptions', 'vitality', 'social functioning', 'role limitation due to emotional problems' and 'mental health'. Each dimension was scored from 0 (worst possible health state) to 100 (best possible health state) by coding, summating and transforming relevant item scores. Missing values were substituted by averaging other items when the number of missing items was less than half the total number of items in that dimension. No substitution was used for dimensions with only two items. The eight dimensions comprise two domains – physical and mental – scored as physical component scores (PCS) and mental component scores (MCS). These are summary measures calculated using factor analysis and Australian normalized scores (Australian Bureau of Statistics 1997).

VRQOL questionnaire (NEI-VFQ25)

The 25-item NEI-VFQ is a vision-targeted survey that assesses the influence of visual impairment on HRQOL. The 25-item NEI-VFQ measures 12 domains of VRQOL: general health, general vision, near vision, distance vision, social functioning, dependency, mental health, role difficulties, driving, ocular pain, peripheral vision and colour vision. Each subscale is scored so that 0 represents the lowest and 100 the best possible score. An overall composite score for the NEI-VFQ25 is calculated by averaging the vision-targeted subscale scores, excluding the general health question. A full description of the 25-item field test NEI-VFQ has been reported elsewhere (Mangione et al. 2001).

Vision

Unilateral visual impairment was defined as best-corrected visual acuity (BCVA), i.e. after subjective refraction worse than 6/12 in the worse eye and 6/12 or better in the fellow eye. Bilateral visual impairment was defined as BCVA worse than 6/12 in the better eye.

Medical status

During examinations, participants were asked whether they had a history of any of the following medical conditions: cardiovascular disease (angina, acute myocardial infarction or stroke), cancer, hypertension, hypercholesterolaemia, diabetes, thyroid disease, asthma, arthritis and migraine. A comorbidity index was created by summing the number of medical conditions. This method has been developed by Linn et al. (1968). Participants were also asked about a history of hospital admission during the past 12 months. A disability index was created to include hearing impairment, walking difficulty (use of a walking aid or wheelchair), shortness of breath, language difficulty or speech defect.

Statistical analysis

We used SAS software (V9; SAS Institute, Cary, North Carolina, USA) for data analyses. Univariate analyses were performed to identify factors associated with the composite NEI-VFQ25 score. For univariate analysis of the 25-item composite scale, mean values of the scale for categories of the independent variables were used. Multiple linear regression models were used to analyse the association between composite NEI-VFQ25 scores (dependent variable) and composite SF-36 scores, after adjusting for age, visual acuity, hospital admissions, comorbidity index and disability index. The backward elimination method was used for modelling purposes, with a significance criterion of $P < 0.05$ to be included in the final regression model. The composite NEI-VFQ scale used in analyses was a modified version in which the general health question was the only item excluded. Significant variables in the final multiple linear regression model were examined for non-linear effects. The correlation coefficients (r) between the various NEI-VFQ25 subscales and the SF-36 subscales were obtained from linear regression models.

Results

Participants had a mean age of 73.8 years (range 60–97 years) and 59% were female. Of the 1952 10-year participants, complete data on visual acuity, NEI-VFQ25 and SF-36 questionnaires were available for 1436 (73.6%). Those patients without complete data did not differ in terms of socio-demographic features (data not shown; $P > 0.1$).

Bilateral visual impairment, based on BCVA (1492 had visual acuity data), was present in 42 participants (2.8%); unilateral impairment was present in 162 participants (10.9%); 1288 (86.3%) had no visual impairment. Scores of the NEI-VFQ25 and its subscales for all study participants are presented in Table 1. The NEI-VFQ25 composite and subscale scores were skewed positively. Subscale scores for general vision, ocular pain,

Table 1. National Eye Institute Visual Function Questionnaire (NEI-VFQ25): composite and subscale scores.

	VFQ-25 composite	General vision	Ocular pain	Near vision	Distance vision	Social functioning	Mental health	Role difficulties	Dependency	Driving	Peripheral vision	Colour vision
Mean	90.7	74.8	85.6	86.4	86.8	95.6	88.7	87.6	96.2	88.0	90.9	96.5
SD	9.0	15.7	17.0	17.2	17.7	13.5	16.5	20.2	13.6	18.4	18.2	12.1
Median	93.2	80.0	87.5	91.2	91.7	100	93.8	100	100	90.0	100	100
Minimum	27.4	0	12.5	0	0	0	0	0	0	0	0	0
Maximum	100	100	100	100	100	100	100	100	100	100	100	100
Q1	87.6	60	75	75	83.3	100	87.5	75	100	90	100	100
Q3	96.5	80	100	100	100	100	100	100	100	100	100	100

SD, standard deviation; Q1, 25th percentile; Q3, 75th percentile.

near vision and far vision were lowest, and those for social functioning, colour vision and peripheral vision were highest.

The unadjusted composite NEI-VFQ25 scores were lower in females, older participants and in those with visual impairment, other medical conditions, chronic disabilities or recent hospital admissions. NEI-VFQ25 scores were associated strongly with both the PCS ($P < 0.001$) and MCS ($P < 0.001$) of the SF-36 (Table 2).

BCVA, PCS, MCS, recent hospital admissions in the last 12 months, number of chronic medical conditions and disabilities retained their significant contribution in explaining the variation of NEI-VFQ25 scores. Visual acuity explained 29.5% of the NEI-VFQ25 score variance (R^2). Additional statistically significant factors were age (7.3%), SF-36 PCS (9.1%), SF-36 MCS (5.6%), disabilities (8.6%), chronic medical conditions (2.1%) and hospital admissions (0.6%). In combination, these factors accounted for 40.2% of the NEI-VFQ25 score variance.

In multivariate analyses, while controlling for BCVA, age, recent hospital admissions, chronic medical conditions and disabilities, NEI-VFQ25 scores were associated significantly with both the SF-36 MCS ($P < 0.001$) and PCS ($P < 0.001$) scores. NEI-VFQ25 scores increased by 2.7 and 2.1, respectively, for each 10-point increase in the MCS and PCS. Table 3 shows mean adjusted NEI-VFQ25 scores across different PCS and MCS values.

The correlation between NEI-VFQ25 and SF-36 subscales is presented in Table 4. Both the SF-36 PCS and MCS had relatively low correlations with most NEI-VFQ25 subscales (all $r < 0.3$ for PCS and all $r < 0.26$ for MCS values).

Table 2. Mean National Eye Institute Visual Function Questionnaire (NEI-VFQ25) scores by characteristics.

	Number*	Mean (SD)	*P*-value
Sex			
Female	916	88.5 (12.9)	0.008
Male	647	90.1 (10.4)	
Age			
< 70	521	91.7 (8.0)	< 0.001
70–74	369	90.9 (8.6)	
75–84	561	87.7 (12.8)	
≥ 85	112	78.4 (21.9)	
Visual impairment			
None	1288	91.6 (8.3)	< 0.001
Unilateral	162	81.2 (15.5)	
Bilateral	42	63.4 (26.8)	
Medical conditions			
0	188	91.6 (10.9)	< 0.001
1	422	90.8 (9.2)	
2	426	88.5 (13.6)	
3	331	88.5 (11.6)	
4	166	87.1 (13.6)	
≥ 5	79	84.5 (13.7)	
Recent hospital admissions			
No	1218	89.6 (11.4)	0.003
Yes	361	87.4 (13.5)	
Disability index			
0	1156	90.6 (9.2)	< 0.001
1	105	83.8 (17.0)	
2	69	80.0 (18.1)	
≥ 3	27	69.4 (27.9)	
Physical component score (SF-36)			
< 30	336	84.2 (16.3)	< 0.001
30–40	286	86.6 (12.5)	
40–50	428	89.7 (10.1)	
≥ 50	513	93.2 (7.23)	
Mental component score (SF-36)			
< 40	299	84.7 (15.1)	< 0.001
40–60	289	86.0 (13.8)	
50–60	694	91.2 (9.3)	
≥ 60	281	91.9 (9.7)	

* NEI-VFQ25 data were available for 1563 patients. Total numbers vary depending on data being available for individual characteristic.

SD, standard deviation; SF-36, Short Form Health Survey.

Table 3. Multivariable-adjusted mean National Eye Institute Visual Function Questionnaire (NEI-VFQ25) scores by Short Form Health Survey (SF-36) physical and mental component scores (controlled for best-corrected visual acuity, age, chronic medical conditions, disabilities and hospital admissions).

	Composite NEI-VFQ25 score
Physical component score (SF-36)	
< 30	85.6
30–40	87.2
40–50	89.4
≥ 50	92.1
Mental component score (SF-36)	
< 40	84.6
40–60	87.1
50–60	90.2
≥ 60	92.0

Discussion

In this older Australian population, we found that the NEI-VFQ scores were associated significantly with the PCS and MCS of the SF-36 after adjusting for visual acuity, age, number of chronic medical conditions, chronic disabilities and hospital admissions. These findings suggest that interpreting NEI-VFQ25 scores should take into account both general health and HRQOL.

A previous study indicated that SF-36 composite scores have a relatively low correlation with the NEI-VFQ25 composite and its subscales (Mangione et al. 1998). Our population-based findings are in keeping with this previous report that the correlations between most NEI-VFQ25 subscales and generic composite HRQOL measures were below 0.3. Surprisingly, we also found relatively low correlations between the individual subscales of the SF-36 and the NEI-VFQ25 subscales. There was low correlation between subscales that supposedly measured the same variable. For example, the correlation between the 'social functioning' subscale of the NEI-VFQ25 and the 'social functioning'

Table 4. Correlation coefficient (*r*, parametric) between the National Eye Institute Visual Function Questionnaire (NEI-VFQ25) subscales and the Short Form Health Survey (SF-36) subscales.

SF-36 subscales / NEI VFQ25 subscales	Physical functioning	Role limitation due to physical problems	Bodily pain	General health perceptions	Vitality	Social functioning	Role limitation due to emotional problems	Mental health	Physical component score	Mental component score
General vision	0.27	0.20	0.16	0.26	0.25	0.22	0.17	0.20	0.23	0.19
Ocular pain	0.23	0.23	0.26	0.22	0.26	0.24	0.22	0.23	0.24	0.22
Near vision	0.32	0.26	0.23	0.25	0.27	0.27	0.23	0.22	0.28	0.21
Distance vision	0.38	0.27	0.18	0.21	0.30	0.25	0.23	0.21	0.29	0.19
Social functioning	0.25	0.16	0.06	0.11	0.18	0.22	0.18	0.15	0.16	0.16
Mental health	0.30	0.25	0.18	0.24	0.28	0.29	0.25	0.27	0.24	0.26
Role difficulties	0.32	0.28	0.20	0.23	0.28	0.29	0.24	0.26	0.27	0.23
Dependency	0.25	0.18	0.10	0.17	0.19	0.27	0.19	0.17	0.18	0.19
Driving	0.25	0.22	0.14	0.13	0.18	0.15	0.17	0.14	0.21	0.12
Peripheral vision	0.29	0.23	0.15	0.17	0.22	0.24	0.22	0.19	0.22	0.19
Colour vision	0.17	0.15	0.03	0.08	0.13	0.16	0.13	0.07	0.12	0.10
Composite score	0.37	0.29	0.22	0.26	0.32	0.32	0.27	0.26	0.30	0.26

subscale of the SF-36 was only 0.22. The correlation between the 'mental health' subscale of the NEI-VFQ25 and the 'mental health' subscale of the SF-36 was 0.27. Our findings suggest either that the individual subscales capture different dimensions of the same outcome measure or that the validity of these subscale measures needs to be assessed.

Our analysis also confirms previous findings that the NEI-VFQ25 is a sensitive tool to changes in vision, regardless of the specific eye condition (Mangione et al. 1998, 2001; Cole et al. 2000; Broman et al. 2001, 2002; Miskala et al. 2003; Scilley et al. 2004; Burstedt et al. 2005). Our data showed that BCVA was related strongly to the NEI-VFQ25 scores, after accounting for potential confounders. Participants with both unilateral and bilateral visual impairment scored significantly lower in the NEI-VFQ25 across all subscales. Visual acuity accounted for 29% of the variance in the NEI-VFQ25 composite scores. This confirms that the NEI-VFQ25 is a reliable and valid vision-specific quality of life instrument (Klein et al. 2001; Miskala et al. 2003).

A limitation of our study is that only 74% of study participants completed both the VRQOL and HRQOL questionnaires, which could have introduced bias to our findings.

In summary, although objective measures of visual function are still the primary outcome in many clinical and epidemiological trials related to eye health, these may no longer be sufficient on their own. There is a growing demand for subjective, patient-based visual function assessments, such as VRQOL measures. Our study findings suggest that VRQOL scores are influenced by a person's general health and HRQOL. We recommend the use of both VRQOL and generic HRQOL measures in clinical vision research: these two questionnaire areas capture largely different dimensions of this subjective outcome. Interpreting NEI-VFQ25 scores should take into consideration the correlation with SF-36 scores.

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Contribution of Authors

Design and conduct of the study (P.M., J.J.W.). Collection and management of the data (E.R., E.M.C.). Analysis and interpretation of the data (B.S., E.M.C., E.R., J.J.W.). Preparation of manuscript (B.S.). Review and approval of manuscript (E.M.C., P.M., J.J.W.).

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