EXTENDED REPORT

Cataract visual impairment and quality of life in a Kenyan population

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Aims: To evaluate the World Health Organization Prevention of Blindness and Deafness 20-item Visual Functioning Questionnaire (WHO/PBD VF20), a vision-related quality of life scale, and to describe the relationship between cataract visual impairment and vision- and generic health-related quality of life, in people ⩾50 years of age in Nakuru district, Kenya.

Methods: The WHO/PBD VF20 was pilot tested and modified. 196 patients with visual impairment from cataract and 128 population-based controls without visual impairment from cataract were identified through a district-wide survey. Additional cases were identified through case finding. Vision- and health-related quality of life were assessed using the WHO/PBD VF20 scale and EuroQol generic health index (European Quality of Life Questionnaire (EQ-5D)), respectively. WHO/PBD VF20 was evaluated using standard psychometric tests, including factor analysis to determine item grouping for summary scores.

Results: The modified WHO/PBD VF20 demonstrated good psychometric properties. Two subscales (general functioning and psychosocial) and one overall eyesight-rating item were appropriate for these data. Increased severity of visual impairment in cases was associated with worsening general functioning, psychosocial and overall eyesight scores (p for trend <0.001). Cases were more likely to report problems with EQ-5D descriptive dimensions than controls ($p<0.001$), and, among cases, increased severity of visual impairment was associated with worsening self-rated health score.

Conclusion: The modified WHO/PBD VF20 is a valid and reliable scale to assess vision-related quality of life associated with cataract visual impairment in this Kenyan population. The association between health-related quality of life and visual impairment reflects the wider implications of cataract for health and well-being, beyond visual acuity alone.

Cataract is the leading cause of blindness and low vision worldwide, estimated to be responsible for at least 17.7 of the 37 million cases of blindness in the world.[1] Cataract extraction is one of the most cost-effective medical interventions,[2] and yet coverage of cataract surgery in low-income countries remains low.[3]

Visual impairment and outcomes from sight-restoring surgery have traditionally been assessed using objective clinical measures, such as visual acuity (VA). In recent years, however, there has been increasing recognition of the importance of assessing patients' views regarding the impact of medical conditions and interventions, and quality of life assessment has gained increasing interest and acceptance.[4]

Vision-related (disease specific) quality of life (VRQOL) scales assess patients' experiences of visual acuity. By contrast, generic health-related scales are designed to be applicable to a range of conditions, interventions and populations. The majority of studies assessing the association between cataract and quality of life are from high-income countries.[5–9] Many well-validated scales exist for evaluating vision function (VF) and VRQOL in these settings.[10] Fewer scales and studies exist for low-income settings, and in particular for Africa.[11 12] No studies exploring the impact of cataract on wider health-related quality of life in African countries were identified. Recently, the World Health Organization recommended that more attention be given to the assessment of VF and VRQOL in people with visual impairment, and highlighted the need for cross-cultural methods.[13] Based on this, the Indian VF33 questionnaire (INDVFQ33),[14] which was developed through focus group discussion and psychometric evaluation, was reviewed to produce a 20-item visual functioning questionnaire (WHO/PBD VFQ-20). It was recommended that this scale be validated by field testing,[13] but this has not occurred to date.

This study aimed to evaluate the WHO/PBD VFQ20, a new VRQOL instrument, and describe the relationship between cataract visual impairment and vision- and health-related quality of life, in people ⩾50 years of age in Nakuru district, Kenya.

METHODS

Study population

This study was conducted in Nakuru district between February and June 2005 as part of a wider case–control study to evaluate the impact of cataract surgery on quality of life and poverty. To estimate the required number of cases (visually impaired from cataract) and controls (with no visual impairment), sample size calculations were based on previous findings of a difference of at least one-third in mean VRQOL.[14 15] The power to detect this difference required a sample of 133 cases and 133 controls, with an α of 0.01 and 80% power.

Cases were recruited via three methods: a population-based survey of 3500 adults aged ⩾50 years, using systematic cluster sampling with probability proportionate to size (82 cases)[16]; community-based case detection (65 cases) using the same cluster sampling procedure; and the first 50 patients attending the Rift Valley Hospital, Nakuru, Nakuru district, Kenya, who

Abbreviations: EQ-5D, European Quality of Life Questionnaire; EuroQol, European quality of life; HRQOL, health-related quality of life; INDVFQ33, Indian VF33 questionnaire; PCA, principal components analysis; QOL, quality of life; SES, socioeconomic status; VA, visual acuity; VAS, visual analogue scale; VF, vision function; VRQOL, vision-related quality of life; WHO/PBD VFQ20, World Health Organization Prevention of Blindness and Deafness 20-item Visual Functioning Questionnaire

Table 1 Characteristics of cases and controls

	Cases, n (%)	Controls, n (%)	Age- and sex-adjusted OR (95% CI)
Age (years)			
50–59	9 (4.6)	11 (8.6)	Baseline
60–69	34 (17.4)	30 (23.4)	1.3 (0.5 to 3.8)
70–79	66 (33.7)	51 (39.8)	1.6 (0.6 to 4.1)
⩾80	87 (44.4)	36 (28.1)	2.9 (1.1 to 7.8)
Sex			
Male	79 (40.3)	51 (39.8)	Baseline
Female	117 (59.7)	77 (60.2)	1.0 (0.6 to 1.6)
Education			
None	148 (76.7)	74 (58.7)	Baseline
Some	45 (23.3)	52 (41.3)	0.4 (0.2 to 0.7)
Literacy			
Cannot read	148 (75.9)	65 (50.8)	Baseline
Can read	47 (24.1)	63 (49.2)	0.3 (0.1 to 0.5)
Marital status			
Single/widowed	110 (56.7)	59 (46.8)	Baseline
Married	84 (43.3)	67 (53.2)	0.7 (0.4 to 1.2)
Socioeconomic status			
1 (poorest)	57 (29.8)	22 (17.9)	Baseline
2	52 (27.2)	27 (22.0)	0.8 (0.4 to 1.6)
3	46 (24.1)	35 (28.5)	0.5 (0.3 to 1.0)
4 (least poor)	36 (18.9)	39 (31.7)	0.4 (0.2 to 0.8)
Visual acuity			
⩾6/18	0 (0.0)	128 (100.0)	N/A
<6/24, ⩾6/60	78 (39.8)	0 (0.0)	
<6/60, ⩾3/60	41 (20.9)	0 (0.0)	
<3/60, >PL	36 (18.4)	0 (0.0)	
PL	41 (20.9)	0 (0.0)	
	Mean (95% CI)	**Mean (95% CI)**	**p Value**
Vision-related quality of life*			
Overall eyesight	3.9 (3.9 to 4.1)	2.1 (2.0–2.3)	<0.001
General functioning	43.6 (41.5 to 45.8)	17.8 (16.6–19.1)	<0.001
Psychosocial	12.2 (11.4 to 12.9)	5.5 (5.0–6.0)	<0.001
Self-rated health†	47.6 (45.1 to 50.1)	59.4 (56.3–62.5)	<0.001

PL, perception of light.
Some data were missing.
*Higher score denotes poorer quality of life.
†Higher score denotes better self-rated health.

met the case definition. This hospital is the main centre for cataract surgery in Nakuru district and serves people from across the district. Three different methods were employed because of logistical and time constraints. Procedures for ophthalmic examination, case selection criteria and consent were the same in each.

Ophthalmic examination and case definition

The case definition was people aged ⩾50 years with best corrected VA <6/24 in the better eye due to cataract, living in Nakuru district. All clinical examinations and diagnoses were made by ophthalmologists. VA was measured with available correction using a tumbling ''E'' chart. For each case in the survey, one or two age- and sex-matched control subjects (VA ⩾6/18) were randomly selected from the same cluster.

Vision-related quality of life

The WHO/PBD VFQ20[13] was translated into Swahili and two local languages (Kikuyu and Kalenjin), and back-translated by independent translators, who were asked to comment on the appropriateness of language used for the target population. A review was held to discuss differences in the translations and to modify them accordingly. The scale was pilot tested on 20 patients in the eye unit, Nakuru District Hospital, and small modifications to the wording of some items were made to ensure local understanding. One question, ''how much difficulty do you have in seeing because of glare from bright lights?'', caused difficulties for respondents from rural areas where there was a lack of electricity or car lights. Following consultation with an ophthalmologist, this question was removed. For test–retest reliability assessment, the questionnaire was administered to 20 patients at the eye unit, Nakuru Hospital in the afternoon, and again the next morning by the same interviewer.

Health-related quality of life

To assess health-related quality of life, items from the European Quality of Life Questionnaire (EQ-5D) were used. This scale was designed by the European quality of life (EuroQol) group to be brief, simple and practical for use in surveys alongside disease-specific measures.[17] Evidence of validity and reliability in high- and low-income settings has been shown.[18–20] The EQ-5D includes two components. The first consists of five descriptive dimensions: mobility, self-care, usual activity, pain/discomfort and anxiety/depression, each with three response options: no problem, some problem or extreme problem. The second is a visual analogue scale (VAS), with scores ranging from 0 (''worst imaginable health state'') to 100 (''best imaginable health state''). Respondents are asked to indicate on the scale where they rate their ''own health state today''. For all study members this scale was described verbally, enabling those members unable to see the scale to respond. The same translation procedure described above was used to translate the EQ-5D. However, due to time constraints, this was carried out independently from the EuroQol group, and the versions used in this study have therefore not been approved by the EuroQol group.

Interviews

Six interviewers were trained for 1 week, and interviews were observed periodically throughout the study.

Ethical considerations

Informed signed or thumb-printed consent was obtained from all study subjects. All cases were offered free cataract surgery at the district hospital. People with visual impairment, but not eligible to be study cases, were examined and referred to the district hospital accordingly. Ethical approval for this study was obtained from the ethics committees of the London School of Hygiene & Tropical Medicine, London, UK, and the Kenya Medical Research Institute, Nairobi, Kenya.

Statistical analysis

Visual acuity

For analysis, presenting VA in the better eye with available correction was grouped into the following categories: normal vision (⩾6/18, controls only), moderate visual impairment (<6/24, ⩾6/60), severe visual impairment (<6/60, ⩾3/60), blind (<3/60, >PL) and perception of light (PL).

Vision-related quality of life

Validity and reliability of the WHO/PBD VF20 (minus one item) were evaluated by standard psychometric methods, including item acceptability, internal consistency, test–retest reliability, within-scale analyses and analyses against external criteria, and using thresholds specified by Lamping *et al*.[21] Analyses were conducted on data from cases only, except for testing the ability

Table 2 Internal consistency and skewness values for World Health Organization Prevention of Blindness and Deafness 20-item Visual Functioning Questionnaire summary scores

	Interitem range (mean)	Item-total range (mean)	Cronbach α	Skewness
Overall eyesight	–	–	–	−0.59
General functioning	0.33–0.88 (0.70)	0.61–0.93 (0.85)	0.96	−0.15
Psychosocial	0.62–0.80 (0.72)	0.82–0.92 (0.89)	0.91	−0.28
Pain/discomfort in eye	–	–	–	0.21

of the scale to differentiate between groups known to be different, which compared cases and controls. Three subscales were originally proposed: visual symptoms (3 items), general functioning (12 items) and psychosocial (4 items), with one overall eyesight-rating item. As modifications were made, a rotated exploratory factor analysis was conducted to determine how items should be grouped for summary scores. Maximum likelihood estimation was used, and the number of distinct factors in the scale were taken as those with eigenvalues >1.[22]

Covariates

Standard sociodemographic data and indicators of socioeconomic status were collected, as they have been shown to influence QOL.[14] A socioeconomic status (SES) index was calculated for each household using principal components analysis (PCA) to determine weights for a list of assets and wealth indicators using the method of Filmer and Pritchett.[23] Variables entered into the PCA included building materials of the house, ownership of household assets, animal ownership and education of the head of the household. Assets and wealth indicators included in the PCA were selected on the basis of published literature and discussion with local key informants. The index was created using STATA V.9 and was divided into quartiles from poorest (lowest SES index) to least poor (highest SES index).

The associations between QOL measures, VA and socioeconomic variables were assessed initially using analysis of variance (WHO/PBD VF20 subscales and EQ5D VAS score) and χ^2 (EQ5D dimensions). Multivariate linear or logistic (as appropriate) regression analyses were conducted using forward selection of variables, forcing age and gender into the models.

All analyses were conducted using STATA V.9.

Table 3 Forward selection multivariate adjusted linear regression analyses of World Health Organization Prevention of Blindness and Deafness 20-item Visual Functioning Questionnaire scores, presenting visual acuity and sociodemographic variables in cases visually impaired from cataract

	Model 1: overall eyesight	Model 2: general functioning	Model 3: psychosocial
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Presenting visual acuity			
<6/24, ⩾6/60	3.7 (3.6 to 3.9)	36.5 (33.7 to 39.3)	10.7 (9.4 to 11.8)
<6/60, ⩾3/60	3.7 (3.7 to 4.1)	39.2 (33.6 to 39.3)	10.9 (9.3 to 12.6)
<3/60, >PL	4.0 (3.8 to 4.2)	47.2 (43.1 to 51.3)	14.2 (12.4 to 16.1)
PL	4.7 (4.5 to 4.9)	59.2 (55.3 to 63.1)	14.5 (12.9 to 16.1)
p for trend	<0.001	<0.001	<0.001
Age (years)			
50–59	4.2 (3.9 to 4.1)	41 (32.2 to 49.8)	11.5 (7.8 to 15.3)
60–69	3.9 (3.7 to 4.1)	40.5 (36.3 to 44.7)	11.1 (9.3 to 12.9)
70–79	4.0 (3.8 to 4.1)	44.9 (41.8 to 47.9)	13.0 (11.7 to 14.3)
⩾80	4.0 (3.9 to 4.2)	44.4 (41.8 to 47.0)	12.0 (10.9 to 13.2)
p for trend	0.54	0.14	0.47
Sex			
Male	3.9 (3.8 to 4.1)	43.8 (40.9–46.6)	12.3 (11.0 to 13.6)
Female	4.0 (3.9 to 4.1)	43.7 (41.4 to 46.0)	12.1 (11.0 to13.1)
SES			
1 (poorest)	4.2 (4.0 to 4.4)	49.9 (46.6 to53.1)	
2	4.0 (3.8 to 4.2)	43.3 (40.0 to 46.7)	–
3	3.9 (3.8 to 4.2)	39.3 (35.7 to 42.9)	–
4 (least poor)	3.7 (3.5 to 3.9)	40.1 (36.0 to 44.3)	–
p for trend	0.001	<0.001	
Marital status			
Married	–	–	10.6 (9.4 to 11.9)
Widowed/single	–	–	13.3 (12.2 to 14.4)
Amount of variance explained by VA (full model)	23.5% (25.6%)	30.0% (37.6%)	7.8% (12.1%)

PL, perception of light; SES, socioeconomic status; VA, visual acuity.
Age and sex were always kept in the model and adjusted means are presented.
–Did not contribute significantly to the model.
Higher score denotes poorer vision-related quality of life..

Table 4 Response distribution to European Quality of Life Questionnaire domains and adjusted odds ratios in cases and controls

EQ-5D domain	Cases n (%)	Controls n (%)	Adjusted OR* (95% CI)	p Value
Mobility				
No problem	65 (33.2)	93 (72.7)	Baseline	<0.001
Some problem	118 (60.2)	35 (27.3)	5 (3.0 to 8.2)§	
Confined to bed	13 (6.6)	0 (0.0)	–	–
Self-care				
No problems	106 (54.1)	114 (89.1)	Baseline†	<0.001
Some problems	74 (37.8)	14 (10.9)	6.2 (3.3 to 11.7)§	
Unable	16 (8.2)	0 (0.0)	–	–
Usual activities				
No problems	44 (22.5)	93 (72.7)	Baseline	<0.001
Some problems	103 (52.6)	33 (25.8)	8.9 (5.2 to 15.1)§	
Unable	49 (25.0)	2 (1.6)	–	–
Pain/discomfort				
None	30 (15.3)	47 (36.7)	Baseline‡	<0.001
Moderate	131 (66.8)	75 (58.6)	2.7 (1.5 to 4.8)	
Extreme	35 (17.9)	6 (4.7)	6.8 (2.5 to 18.9)	
Anxiety/depression				
None	40 (20.4)	64 (50.0)	Baseline‡	<0.001
Moderate	96 (49.0)	57 (44.5)	2.8 (1.6–4.8)	
Extreme	60 (30.6)	7 (5.5)	13.9 (5.4 to 35.9)	

EQ-5D, European Quality of Life Questionnaire.
*Odds ratios (ORs) from forward selection logistic regression analysis, with age and sex always included in the model.
†Adjusted for age, sex and location.
‡Adjusted for age, sex, literacy and location.
§Owing to small cell sizes ''some problem'' and ''severe problem'' were combined to calculate ORs for ''any problem''.

RESULTS

In all, 196 cases and 128 controls were included. Controls were younger, more likely to have had some education and were in higher socioeconomic groups than cases (table 1).

Table 5 A forward selection multivariate linear regression analysis of self-rated health (from visual analogue scale), visual acuity and sociodemographic variables

	Self-rated health score
	Coefficient (95% CI)
Visual acuity	
<6/24, ⩾6/60	Baseline
<6/60, ⩾3/60	0.5 (−6.2 to 7.2)
<3/60, >PL	−6.2 (−13.2 to 0.8)
PL	−9.6 (−16.3 to 3.0)
p for trend	0.001
Age (years)	
50–59	Baseline
60–69	4.5 (−9.6 to 18.7)
70–79	12.9 (−0.8 to 26.6)
⩾80	7.2 (−6.4 to 20.8)
p for trend	0.66
Sex	
Male	Baseline
Female	1.4 (−4.7 to 7.5)
Socioeconomic status	
1 (poorest)	Baseline
2	8.3 (1.7 to 14.8)
3	8.3 (1.7 to 14.9)
4 (least poor)	10.7 (3.3 to 18.1)
p for trend	0.009
Marital status	
Single/widowed	Baseline
Married	6.7 (0.4 to 12.8)

Vision-related quality of life

The WHO/PBD VF20 fulfilled most standard psychometric criteria. The proportion of missing data for each item was <1%. Floor and ceiling effects were <80% for each item and for summary scores (ie, <80% people endorsed response categories at the top and bottom of the scale for each item and for the summary scores; table 2). Ten items in the general functioning subscale had inter-item correlations (ie, correlations with other items in the same subscale) above the maximum criteria of 0.75, which suggests some item redundancy. Two distinct factors were identified from the factor analysis. All originally proposed general functioning items, with one visual symptom item loaded onto factor 1 and all proposed psychosocial items loaded onto factor 2, suggesting that two subscales, general functioning and psychosocial, are appropriate for these data. One visual symptom item, ''because of your eyesight how much pain and discomfort do you have in your eyes'', did not load well onto either factor. As the pain/discomfort item did not clearly belong to either of the subscales, it was analysed separately. Good subscale internal consistency was demonstrated by high Cronbach α and item-total correlations (table 2). Test–retest correlations were above the acceptable level of 0.80.

Cases had significantly poorer general functioning, psychosocial, overall eyesight and pain/discomfort scores than controls, satisfying the known-group differences criteria (table 1). The scale showed good convergent validity; poorer VA was associated with poorer mean general functioning, psychosocial and overall eyesight rating scores (test for trend $p<0.001$). The exception was the pain/discomfort item, which was not significantly associated with visual acuity. Discriminant validity findings were mixed. Age was not associated with mean VRQOL scores among cases. However, cases in the lower SES group had poorer general functioning (p for trend <0.001) and self-rated eyesight scores ($p = 0.04$). Widowed/single cases had poorer psychosocial scores ($p = 0.004$). Women, widowed/single cases and cases with no formal education reported poorer pain/discomfort scores. In

multivariate analyses (table 3) controlling for visual acuity, overall eyesight and general functioning scores were worse in poorer cases, and widowed/single cases were more likely to have poorer psychosocial scores. There were no significant multivariate predictors of pain/discomfort in the eyes of the cases.

Health-related quality of life

All five EQ-5D dimensions discriminated between cases and controls (table 4). Among cases, adjusting for covariates, poorer VA was associated with higher odds of reporting any problem with mobility (p for trend $= 0.003$), self-care (p for trend <0.001), usual activities (p for trend $= 0.008$) and pain/discomfort (p for trend $= 0.01$). There was no significant association with depression.

Self-rated health score was worse in cases than in controls ($p<0.001$); (table 1), and mean health score worsened with increasing severity of visual impairment in cases (table 5). Widowed/single and cases in the lower SES groups had lower mean health scores.

DISCUSSION

This study evaluated the WHO/PBD VF20, an instrument recommended for measuring VRQOL in low-income settings, in Nakuru district, Kenya. To our knowledge no other studies have explored the association between visual impairment from cataract and quality of life in Kenya.

The results show that the modified WHO/PBD VFQ20, with one overall rating item and two subscales, (general functioning and psychosocial) is a valid and reliable scale in this Kenyan setting. One item about glare from glare from bright lights was removed, but this might have more relevance in other settings. The item about pain in the eye did not correlate well with other items in the scale. Cases reported worse pain scores than controls; however, among the cases, there was no significant variation in pain score with VA. Pain and discomfort are not typical symptoms of cataract, but this item might be more relevant for other ocular morbidities. However, it was not included in the original INDVFQ33 which was developed on the basis of 46 focus group discussions exploring patient's perceptions about their eye conditions and associated impact on daily living.[24] There was some redundancy in items, suggesting that it might be possible to shorten this questionnaire further, although the full questionnaire should be evaluated in other settings to confirm this.

Cases were more likely to report problems with the EQ-5D dimensions than controls. Increasing severity of visual impairment was associated with higher odds of reporting problems with mobility, self-care, usual activities, and pain/discomfort and with mean self-rated health score. These findings correspond to studies from high-income settings,[5] and highlight an impact of visual impairment on wider well-being that is not necessarily reflected by vision related scales.

Sociodemographic and economic variables influenced response independently of VA. This is in accordance with other studies,[5 14] and suggests that experiences of visual impairment may vary according to individual circumstances. In a study in Hong Kong, Lau *et al*[25] comment that, despite comparable VA and using the same scale, mean VRQOL scores were better than those in China and Nepal, and suggest that this may be due to differences in modern household utilities which facilitate self-care activities. A similar reason may explain why cases in the lower SES groups in Nakuru had worse general functioning scores. Promotion of surgical services at early stages of cataract in poor communities should remain a priority. Being widowed/single increased the social and emotional burden of cataract visual impairment, as reflected by poorer psychosocial scores compared with married people. In contrast, but in accordance with findings from the INDVFQ 33 in India,[14] there was no association between VRQOL scores and age or sex.

This study has its limitations. Three different case recruitment methods were used. However, all cases were from the same district and met the same case definition. According to power calculations, 133 controls were required for the study, but only 128 were identified. However, the power calculations were based on very conservative estimates, so the effect of this is probably minimal. The WHO/PBD VF20 was recommended as an instrument to assess all ocular morbidities and we focused only on cataract. Further, we focused only on people aged $\geqslant$50 years, and the scale might perform differently in other age groups. However, the original INDVFQ33 was also developed in people aged $\geqslant$50 years, and, although other eye conditions were included, was largely dominated by cataract, reflecting the relative importance of this condition in the Indian setting. Our results indicated that some items in the Kenyan setting were not relevant or were redundant. Future studies should look at the performance of the full WHO/PBD VF20 scale in other populations or other disease groups. The translation of the EQ-5D questionnaire was not validated by the EuroQol group, although standard translation procedures were followed. Multiple tests of statistical significance for correlated measures were made using these data. However, analyses were repeated using the Bonferroni correction and the multivariate analyses were essentially unchanged.

In this study, evidence of the validity and reliability of a new scale were shown, and the data suggest that this scale would be suitable for assessing the outcome of cataract surgery. The findings add weight to the evidence of disability and poorer self-perception of own health associated with cataract visual impairment among people in an African country.

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