Impact of Impaired Vision and Eye Disease on Quality of Life in Andhra Pradesh

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Purpose. To determine the impact of visual impairment and eye diseases on quality of life (QOL) in an older population of Andhra Pradesh in southern India.

Methods. The World Health Organization (WHO) QOL (WHOQOL) instrument was adapted as a health-related quality of life (HRQOL) instrument for administration to adults participating in the Andhra Pradesh Eye Disease Study. Participants aged 40 years and older (n = 3702), 99.4% of the 3723 eligible, who underwent interview and detailed dilated ocular eye evaluation by trained professionals were included in this study. Psychometric properties of the HRQOL instrument were evaluated among visually impaired people. Relationships among overall QOL scores and presenting visual acuity in the better eye, specific eye diseases, and demographic variables were examined.

Results. Internal consistency was high for the entire questionnaire (α = 0.94). Each item of the QOL scale had an adequate item–total correlation (range, 0.25–0.77) greater than 0.2. After adjusting for demographic variables and ocular disease, Subjects with blindness had significantly lower QOL scores. Subjects with glaucoma or corneal disease independent of visual acuity had lower scores than subjects without those eye diseases. Subjects with cataract or retinal disease had significantly lower scores than those without cataract or retinal disease in the model without visual acuity but not when visual acuity was added to the model.

Conclusions. Decreased QOL was associated with the presence of glaucoma or corneal disease independent of visual acuity and with cataract or retinal disease as a function of visual acuity. Visual impairment from uncorrected refractive errors was not associated with decreased QOL. (*Invest Ophthalmol Vis Sci.* 2006;47:4742–4748) DOI:10.1167/iovs.06-0020

Clinical evaluation can help to quantify the extent of vision loss, but relating vision loss to the impact on one's functional ability and quality of life (QOL) is useful. Assessing the impact of visual impairment on QOL can provide a comprehensive picture of the burden of visual impairment beyond clinical evaluation. Although reports are available on the prevalence of various levels of visual impairment— cataract, glaucoma, age-related macular degeneration, corneal disease, and other eye diseases and risk factors for these diseases[1–5]—in Andhra Pradesh, the impact of these eye diseases on QOL has not been extensively investigated in this population. Given that most leading causes of visual impairment are age related, the expected increase in the number of elderly in this population will aggravate the problem of blindness. Numerous studies in other populations have investigated the impact of bilateral or unilateral visual impairment on health-related QOL.[6–11] Visual impairment has been shown to have negative effects on health-related QOL and a significant impact on daily functioning,[12,13] including social activities[14,15] and emotional functioning.[14,16]

Resource-poor nations need evidence, especially related to long-term impact, to assist them in the prioritization and allocation of scarce resources. Although cost-effectiveness/cost-utility is recognized as a valuable method of identifying which health interventions deserve the highest priority for public health action, societal values and felt needs of the community also have to be taken into account while determining how to allocate resources.[17] As the allocation of healthcare resources becomes more constrained, it is important to develop cost-effective methods that identify disease in persons who may be at increased risk for vision loss and reduced QOL.

In a large population-based, cross-sectional study, we demonstrated the overall impact of vision loss on QOL in Andhra Pradesh using the health-related quality of life (HRQOL) instrument. We evaluated the psychometric properties of this instrument among the visually impaired in this population and examined the associations between visual acuity and major eye diseases— cataract, uncorrected refractive errors, glaucoma, retinal disease, corneal disease—and QOL among older subjects in Andhra Pradesh.

Methods

Instrument

The generic World Health Organization QOL (WHOQOL) instrument was adapted as the HRQOL instrument for administration to adults participating in the Andhra Pradesh Eye Disease Study (APEDS). The items included in the HRQOL instrument are listed in the Appendix. All the domains of the WHOQOL—physical, psychological, environmental, social, religious, and level of independence—were included in the HRQOL instrument. One facet on sexual activity in the social relationships domain was excluded because of the conservative culture of our country, and three facets in the environment domain (home environment, health and social care, physical environment) were excluded because it was felt that subjects in this setting might not be able to relate to them clearly. Response scales were ordered, with 0 the most positive response and 4 the most negative. The QOL instrument was translated to the local language, Telugu. Inter-interviewer and intra-interviewer reproducibility among three interviewers who had undergone extensive training for administering the instrument was assessed,

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Supported in part by the Hyderabad Eye Research Foundation (Hyderabad, India); Christoffel-Blindenmission (Bensheim, Germany); and the Australian federal government through the Cooperative Research Centres Program.

Submitted for publication January 9, 2006; revised June 8 and July 11, 2006; accepted September 13, 2006.

Disclosure: **R. Nutheti**, None; **B.R. Shamanna**, None; **P.K. Nirmalan**, None; **J.E. Keeffe**, None; **S. Krishnaiah**, None; **G.N. Rao**, None; **R. Thomas**, None

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with a gap of at least 3 days after the first administration on 117 and 55 subjects, respectively. Inter-interviewer reproducibility among interviewers was greater than 0.9, and intra-interviewer reproducibility for each interviewer was greater than 0.94. We calculated a total score for each of the questions and expressed this score as a percentage of the total possible obtainable score ranging from 0 to 100, with higher scores indicating better results.

Study Sample

We administered the HRQOL instrument to 7398 of 7431 (99.6%) eligible subjects aged 16 years and older identified from 70 clusters in three rural areas and 24 clusters in one urban area as part of the APEDS. A multistage sampling procedure was used to select the APEDS sample. One urban and three rural areas from different parts of Andhra Pradesh were selected. The sampling strategy for the urban and rural areas of APEDS has been described.[1] APEDS was conducted from October 1996 to February 2000.[1] Trained investigators interviewed the subjects in the study. Information about income was collected based on the socioeconomic status information obtained from the census of India.[18] All interviews were conducted before any clinical examinations, including visual acuity measurements, were performed. Written informed consent was obtained from subjects before the interview and examination. Illiterate subjects gave a thumbprint to indicate their consent after the content of the consent form was explained to them.

Examination

Participating subjects were transported for examination to a clinic especially set up for this study. The examinations were performed by two ophthalmologists and two optometrists who had received special training in the procedures of this study. Distance visual acuity, both presenting (with current refractive correction, if any) and best corrected after refraction, was measured for each eye separately using logMAR (logarithm of minimum angle of resolution) charts[19] at a distance of 3.8 m. The complete eye evaluation procedure in APEDS has already been described in detail.[1] Automated visual fields were examined with the Humphrey Visual Field Analyzer[20] using the threshold central 24-to-2 strategy (stimulus size III) in those subjects assessed to have any suspicion of glaucoma or any other optic nerve disease or higher visual pathway lesion and those with significant macular/retinal disease (such as retinitis pigmentosa). If the visual field was abnormal or unreliable, testing was repeated on another day. A uniform method of scoring visual field constriction with automated perimetry was used.[21] Photographs of any corneal or other anterior segment abnormality were taken with a slit lamp. Stereoscopic photographs of optic disk, macular, or other retinal abnormalities were taken with a fundus camera. Disabled subjects were assessed at home with the use of portable equipment. Gonioscopy, 78-D lens assessment, automated visual field testing, and photography could not be performed in the home.

Research procedures followed the tenets of the Declaration of Helsinki. This study was approved by the ethics committee of LV Prasad Eye Institute in Hyderabad, India.

Definitions and Causes of Visual Impairment

Blindness in India was defined as presenting distance visual acuity less than 6/60 or central visual field loss less than 20° in the better eye.[1] Subjects meeting the above definition because of uncorrected refractive error were included given that they were functionally blind because they were not using spectacles. Visual impairment was defined as presenting visual acuity less than 6/18 to 6/60 or equivalent visual field loss in the better eye. Visual field loss criteria for visual impairment were classified as described earlier.[2] No visual impairment/normal vision was defined as presenting visual acuity 6/18 or greater in the better eye.

Definitions for classifying the cause of visual impairment as cataract, uncorrected refractive error, glaucoma, retinal disease, and corneal disease in APEDS has been detailed.[1] If cataract and a posterior segment lesion of the optic nerve or retina were present and removal of the cataract would not restore vision, we identified the cause of blindness as the posterior segment lesion. If index myopia caused by cataract was present, even if vision improved with refraction, we identified the cause of blindness as cataract and not as refractive error.

Statistical Analysis

Because the prevalence of visual impairment was greater in older persons than in younger persons, we decided to examine the association between visual impairment and QOL in those 40 years and older. We first evaluated the psychometric properties of the HRQOL instrument among visually impaired older persons. Internal consistency reliability of the items was assessed using Cronbach α.[22] The acceptable minimum Cronbach α was 0.70.[23] Homogeneity of the QOL scale was measured by calculating the correlation between each item with the total score after correcting for its overlap (specific item was removed from the scale for its correlation). An item–scale correlation greater than 0.20 was considered adequate.[24] The criterion validity of the items in the questionnaire was evaluated by performing receiver operator characteristic (ROC) analysis[25] on the percentage of total QOL score to determine the instrument's discrimination ability among the visually impaired.

We then analyzed the associations among QOL score, visual impairment, and ocular morbidity variables after adjusting for their sociodemographic and systemic morbidity variables. Sociodemographic variables included age (categorized by decade), sex, area of residence, and socioeconomic status (defined as per capita income in Indian rupees). Systemic morbidity included hypertension, diabetes, and any other major medical or physical illness. Hypertension was deemed to be present if a subject had a history of high blood pressure diagnosed by a physician, was currently using antihypertensive medications, or both. Diabetes was deemed to be present if a subject had a history of diabetes. Ocular morbidity included cataract, glaucoma, retinal disease, uncorrected refractive errors, and corneal disease. Retinal diseases included age-related maculopathy, chorioretinitis scar, retinitis pigmentosa, and myopic degeneration. Visual acuity was categorized as no visual impairment, visual impairment, and blindness. After selecting the sociodemographic and morbidity covariates, we ran models using the logMAR scale, with visual acuity as a continuous variable and with and without VA as an explanatory variable.

Results

Psychometric Properties

Of the 3723 eligible subjects clinically examined, 3702 (99.4%) responded to the HRQOL instrument. Sixteen of 1361 (1.2%) eligible visually impaired and 5 of 2362 (0.2%) eligible non–visually impaired subjects did not respond to the HRQOL instrument. Among the visually impaired subjects, the mean visual acuity of those who did not respond (1.32 ± 0.70, SD) was significantly ($P = 0.015$) worse than that of those who responded (0.84 ± 0.34, SD) to the instrument. The items 10 (driving) and 6 (working) were not applicable to 88.8% and 47.8% of the visually impaired subjects, respectively. These two items were not considered for further analysis.

Internal Consistency and Homogeneity. The internal consistency of the HRQOL scale was 0.937. The item–total correlation ranged from 0.246 to 0.769. All items of the QOL scale had an adequate item–total correlation greater than 0.2.

Criterion Validity. The total QOL score distinguished between those who rated their QOL in general as "satisfied" and those who rated it as "dissatisfied" (area under the curve [AUC], 0.940; $P < 0.0001$) and "neither satisfied nor dissatisfied" (AUC, 0.703; $P < 0.0001$). Similarly, the QOL score distinguished between the "dissatisfied" and "neither satisfied nor dissatisfied" (AUC, 0.823; $P < 0.0001$) response categories.

TABLE 1. QOL Scores by Demographic Factors and Visual Impairment Levels

	Visually Impaired		Non-visually Impaired		Total	
	n	QOL Score*	*n*	QOL Score*	*n*	QOL Score*
All subjects	1345	74.8 ± 0.41	2357	84.1 ± 0.19	3702	80.7 ± 0.20
Age (years)						
40–49	189	81.1 ± 1.10	1234	86.0 ± 0.26	1423	85.3 ± 0.32
50–59	383	79.3 ± 0.78	658	83.5 ± 0.44	1041	82.0 ± 0.37
60–69	513	73.0 ± 0.67	383	81.0 ± 0.53	896	76.4 ± 0.40
70+	260	67.1 ± 0.94	82	76.2 ± 1.03	342	69.3 ± 0.65
Sex						
Male	585	76.5 ± 0.63	152	86.1 ± 0.26	1737	82.8 ± 0.28
Female	760	73.4 ± 0.55	1205	82.3 ± 0.25	1965	78.9 ± 0.26
Area						
Rural	1144	75.1 ± 0.45	1631	84.0 ± 0.22	2775	81.4 ± 0.39
Urban	201	73.1 ± 1.07	726	84.5 ± 0.33	927	80.5 ± 0.23
Socioeconomic status†						
≤200	188	71.2 ± 1.09	222	79.7 ± 0.58	410	76.2 ± 0.57
201–500	709	73.1 ± 0.56	1076	83.1 ± 0.26	1785	79.3 ± 0.27
>500	423	79.3 ± 0.73	1033	86.2 ± 0.27	1456	83.9 ± 0.30
Education						
None	990	73.3 ± 0.47	1172	81.9 ± 0.25	2162	78.4 ± 0.25
Primary	313	79.0 ± 0.84	931	85.8 ± 0.28	1244	83.6 ± 0.33
Secondary/above	27	79.5 ± 2.89	235	89.0 ± 0.56	262	86.7 ± 0.72
Morbidity						
Hypertension	149	72.8 ± 1.25	305	82.9 ± 0.52	454	79.9 ± 0.56
Diabetes	55	75.0 ± 2.05	132	81.8 ± 0.78	187	78.0 ± 0.87
Physical condition	126	69.6 ± 1.28	227	80.5 ± 0.19	353	76.9 ± 0.60
Eye Disease						
Refractive error	527	78.1 ± 0.68	—	—	—	—
Cataract	767	74.4 ± 0.57	—	—	—	—
Retina	84	72.7 ± 1.66	—	—	—	—
Glaucoma	42	62.6 ± 2.33	—	—	—	—
Cornea	61	63.0 ± 1.92	—	—	—	—

* All QOL score values are mean ± SE adjusted for age.
† Socioeconomic status is defined as monthly per capita income in Indian rupees.

Visual Impairment and Quality of Life

The mean age of subjects in our study was 54.2 years ± 10.4 (range, 40–102 years); 1965 (53.1%) were female, and 2775 (75.0%) resided in rural areas. Table 1 presents demographic, ocular morbidity, and systemic morbidity details along with age-adjusted QOL scores. Among visually impaired subjects, the mean presenting visual acuity in the better eye was 0.84 ± 0.3 logMAR units and the mean QOL score was 74.8 ± 15.9 logMAR units. Subjects with glaucoma or corneal disease had the worst presenting visual acuity in the better eye compared with those with cataract, retinal disease, and uncorrected refractive errors (Table 2).

Age, sex, socioeconomic status, education, hypertension, major medical or physical illness, cataract, glaucoma, retinal disease, corneal disease, and visual acuity were all associated with QOL score in multiple linear regression models (Table 3). Area of residence, diabetes, and refractive errors were not associated with QOL score. As expected, QOL scores declined with age and increased with socioeconomic status and education. Scores were lower in women than in men. QOL scores were also lower in those with hypertension and with any other major medical or physical illness in the models than in those without hypertension and without physical illness. Those with impairment caused by cataract, retinal disease, glaucoma, and corneal disease had lower scores than those without impairment in the model without the visual acuity variable. When visual acuity was added to the model either as a categorical or as a continuous exploratory variable, the associations continued to be significant except for cataract and retinal disease. Those with cataract or retinal disease had significantly lower scores than those without cataract or retinal disease in the model without visual acuity; when visual acuity was added to the model, their scores were not significantly lower.

TABLE 2. Presenting logMAR Acuity in the Better Eye

	n	Visual Acuity*
Visually impaired	1345	0.84 ± 0.3
Non-visually impaired	2357	0.16 ± 0.1
With refractive error	527	0.71 ± 0.2
With cataract	767	0.87 ± 0.3
With retinal disease	84	0.96 ± 0.4
With corneal disease	61	1.02 ± 0.6
With glaucoma	42	1.03 ± 0.7

* Values are mean ± SD.

DISCUSSION

Overall, the psychometric performance of the HRQOL instrument used in APEDS in terms of reliable internal consistency and homogeneity was acceptable among visually impaired older adults of Andhra Pradesh in southern India. The criterion validity of the instrument was demonstrated by its ability to make distinctions in subjects' self-reported satisfaction with QOL.

TABLE 3. Differences in the QOL Scores by Sociodemographics, Morbidity, and Visual Acuity*

	Without Visual Acuity	With Visual Acuity
Age (years)		
40–49	82.26	82.99
50–59	−1.58 (−0.68, −2.47)	−1.39 (−0.52, −2.26)
60–69	−5.18 (−4.18, −6.19)	−4.69 (−3.71, −5.67)
70+	−11.15 (−9.68, −12.62)	−10.13 (−8.70, −11.56)
Sex		
Male	79.01	80.07
Female	−2.41 (−1.65, −3.16)	−2.27 (−1.53, −3.01)
Socioeconomic status†		
≤200	75.19	76.73
201–500	2.35 (1.17, 3.52)	1.89 (0.75, 3.02)
>500	5.44 (4.20, 6.68)	4.73 (3.53, 5.92)
Education		
No education	74.87	76.17
Primary/middle	3.48 (2.65, 4.32)	3.27 (2.46, 4.07)
Secondary/above	5.25 (3.71, 6.79)	5.04 (3.55, 6.53)
Morbidity		
No hypertension	78.88	80.06
Hypertension	−2.07 (−0.93, −3.22)	−2.22 (−1.09, −3.35)
No diabetes	79.18	80.30
Diabetes	−2.61 (−0.93, −4.29)	−2.64 (−0.99, −4.29)
No physical illness	80.07	81.19
Major physical illness	−4.62 (−3.46, −5.78)	−4.72 (−3.58, −5.86)
No cataract	80.01	80.16
Cataract	−4.65 (−3.65, −5.66)	−0.63 (−1.83, 0.57)
No retinal disease	80.62	79.79
Retinal disease	−6.04 (−3.64, −8.45)	−2.00 (−4.46, 0.46)
No corneal disease	84.43	84.38
Corneal disease	−13.43 (−10.57, −16.29)	−10.44 (−7.59, −13.68)
No glaucoma	85.57	83.67
Glaucoma	−15.87 (−12.46, −19.27)	−10.92 (−7.48, −14.37)
Visual acuity		
No visual impairment	—	83.74
Visual impairment	—	−0.75 (−1.83, 0.32)
Blind	—	−13.67 (−11.94, −15.39)

* Data are expressed as regression coefficient (95% confidence interval). Adjusted mean scores are given for the reference categories. Mean scores are adjusted for all other variables in the model (age, sex, socioeconomic status, education, hypertension, diabetes, major medical illness, presence of cataract, glaucoma, retinal disease, corneal disease, and visual acuity).

† Socioeconomic status is defined as monthly per capita income in Indian rupees.

Our study demonstrates that visual impairment is associated with a significant decrease in QOL among the older population in Andhra Pradesh. These findings are consistent with reports in other populations.[6–11] Nearly half the visual impairment in this population was caused by cataract, which is easily treatable. The effect of cataract on QOL was found to be dependent on visual acuity, suggesting that cataract extraction may improve QOL by improving visual acuity. Reports demonstrate a range of benefits from cataract surgery, including improvements in subjective visual function and QOL.[26–28] Cataract is one of the focus points chosen by the global initiative, VISION 2020—The Right to Sight, on the basis of its contribution to the burden of blindness.[29] Interventions that aim to improve QOL of those who are blind or have visual impairment may be more successful if they focus on improving the quality of cataract surgery and the numbers of surgeries. Long-term follow-up and postoperative optical correction are essential components and are critical to achieving good visual outcome. Monitoring of visual outcome, manually and through software, according WHO guidelines after cataract surgery for age-related cataract is recommended globally.[30] Providing cataract services at an affordable cost to the population at large should also be an issue for reducing visual impairment from cataract and for improving the QOL in this population. Barriers to eye care should be taken into account while planning the appropriate interventions. Visual impairment from uncorrected or undercorrected refractive errors has no significant effect on QOL, as attested by the evidence that 90% of the subjects with refractive errors had only moderate visual impairment.

Our data suggest that some residual effect of corneal disease and glaucoma independent of visual acuity affects QOL in this population, possibly because persons with these diseases were mostly bilaterally blind. Among those with glaucoma, 52% were bilaterally blind and 88% were blind in at least one eye. Among those with corneal disease, 25% were bilaterally blind and 82% were blind in at least one eye. Fifty-five percent of those with glaucoma and thirty-four percent of those with corneal disease were bilaterally affected. Functional deficits not captured by vision—including depression and difficulty attending social functions, visiting friends or relatives, and getting support—may mediate the association with decrease in QOL. Interventions that would have an impact on the QOL of those with blindness caused by corneal disease or glaucoma must address visual and other functional effects independently. It may be worthwhile to carry out impact assessment studies after interventions (surgical and medical) for glaucoma and among those who have undergone corneal transplant surgery to confirm the role of visual acuity and QOL.

Our results demonstrate that the impact of retinal diseases, predominantly macular degeneration, on QOL was mostly mediated through its effect on visual acuity. Blindness caused by retinal disease is usually not treatable or preventable, but pro-

viding vision rehabilitation may maximize the ability to make use of remaining eyesight to perform near vision tasks and activities of daily living that would improve the ability to maintain independence.[31,32] Hence, further studies are needed in this population to better understand the impact on QOL after rehabilitation and use of services for low vision.

The strengths of our study are its high response rate (99.4%) and its population-based nature. The cross-sectional design is a limitation. Another limitation that should be considered while interpreting the data is that the items "difficulty in driving" and "difficulty in working" were not considered in assessing the impact of QOL because these items were not applicable to most of the visually impaired subjects. Sixty percent of subjects had stopped working, 8% had changed their line of work, and 22% stopped driving because of their vision problems. Hence, the impact of visual impairment on QOL is likely to be greater than our results showed. The level of visual impairment of the nonrespondent subjects was higher than the levels of impairment in the respondent subjects. However, the higher response rate reduces this limitation.

In conclusion, the HRQOL instrument used in this study was reliable and valid as a tool for assessing the older visually impaired population of Andhra Pradesh in southern India. Uncorrected refractive errors were not associated with decreased QOL. Further longitudinal studies on the impact of therapy for glaucoma, corneal disease, and retinal disease on QOL are needed. Our results suggest that improvement in QOL after cataract surgery is a function of visual acuity.

Acknowledgments

The authors thank the study subjects for their participation; Lalit Dandona and Rakhi Dandona for design and execution of the APEDS; Nagaraj V. Naidu, Kovai Vilas, Pyda Giridhar, and Mudigonda N. Prasad for interviewing the subjects; and Marmamula Srinivas for assistance in assessing the visual acuity of the subjects.

References

1. Dandona L, Dandona R, Srinivas M, et al. Blindness in the Indian state of Andhra Pradesh. *Invest Ophthalmol Vis Sc*i. 2001;42:908–916.
2. Dandona R, Dandona L, Srinivas M, et al. Moderate visual impairment in India: the Andhra Pradesh Eye Disease Study. *Br J Ophthalmol*. 2002;86:373–377.
3. Dandona R, Dandona L, Naduvilath TJ, et al. Refractive errors in an urban population in southern India: the Andhra Pradesh Eye Disease Study. *Invest Opthalmol Vis Sci*. 1999;40:2810–2818.
4. Krishnaiah S, Vilas K, Shamanna BR, et al. Smoking and its association with cataract: results of the Andhra Pradesh Eye Disease Study from India. *Invest Ophthalmol Vis Sci*. 2005;46:58–65.
5. Dandona L, Dandona R, Mandal P, et al. Angle-closure glaucoma in an urban population in Southern India: the Andhra Pradesh Eye Disease Study. *Ophthalmology*. 2000;107:1710–1716.
6. Broman AT, Munoz B, Rodriguez J, et al. The impact of visual impairment and eye disease on vision-related quality of life in a Mexican-American Population: Proyecto VER. *Invest Ophthalmol Vis Sci*. 2002;43:3393–3398.
7. Globe DR, Wu J, Azen S, et al. The impact of visual impairment on self-reported visual functioning in Latinos: the Los Angles Latino Eye Study. *Ophthalmology*. 2004;111:1141–1149.
8. Chia EM, Mitchell P, Rochtchina E, et al. Unilateral visual impairment and health related quality of life: the Blue Mountains Eye Study. *Br J Ophthalmol*. 2003;87:392–395.
9. Chia EM, Wang JJ, Rochtchina E, Smith W, Cumming RR, Mitchell P. Impact of bilateral visual impairment on health-related quality of life: the Blue Mountains Eye Study. *Invest Ophthalmol Vis Sci*. 2004;45:71–76.
10. Vu HTV, Keeffe JE, McCarty CA, Taylor HR. Impact of unilateral and bilateral vision loss on quality of life. *Br J Ophthalmol*. 2005; 89:360–363.
11. Nirmalan PK, Tielsch JM, Katz J, et al. Relationship between vision impairment and eye disease to vision-specific quality of life and function in rural India: the Aravind Comprehensive Eye Study. *Invest Ophthalmol Vis Sci*. 2005;46:2308–2312.
12. West SK, Munoz B, Rubin GS, and the SEE Project Team. Function and visual impairment in a population-based study of older adults: the Salisbury Eye Evaluation Project. *Invest Ophthalmol Vis Sci*. 1997;38:72–82.
13. Rubin GS, Munoz B, Bandeen-Roche K, et al. Monocular versus binocular visual acuity as measures of vision impairment and predictors of visual disability. *Invest Ophthalmol Vis Sci*. 2000;41: 3327–3334.
14. Scott IU, Smiddy WE, Schiffman J, et al. Quality of life of low-vision patients and the impact of low vision services. *Am J Ophthalmol*. 1999;128:54–62.
15. Wang JJ, Mitchell P, Smith W, Cumming RG, et al. Impact of visual impairment on use of community support services by elderly persons: the Blue Mountains Eye Study. *Invest Ophthalmol Vis Sci*. 1999;40:12–19.
16. Rovner BW, Zisselman PM, Shumuely-Dulitzki Y. Depression and disability in older people with impaired vision: a follow-up study. *J Am Geriatr Soc*. 1996;44:181–184.
17. Shamanna BR, Dandona L, Rao GN. Economic burden of blindness in India. *Indian J Ophthalmol*. 1998;46:169–172.
18. Registrar General and Census Commissioner, India. *Census of India 1991*. New Delhi: Ministry of Home Affairs, Government of India; 1992.
19. Ferris FL III, Kassoff A, Bresnick GH, Bailey I. New visual acuity charts for clinical research. *Am J Ophthalmol*. 1982;94:91–96.
20. *Humphrey Field Analyser II User's Guide*. San Leandro, CA: Humphrey Instruments Inc.; 1994.
21. Dandona L, Nanda A. A method of scoring automated visual fields to determine field constriction causing blindness. *Indian J Ophthalmol*. 1998;46:93–96.
22. Cronbach LJ. Coefficient of alpha and the internal structure of tests. *Psychometrika*. 1951;16:297–333.
23. Streiner DL, Norman GR. *Health Measurement Scales: A Practical Guide to Their Development and Use*. 2nd ed. New York: Oxford University Press; 1998.
24. Streiner D, Norman G. *Health Measurement Scales*. Oxford, UK: Oxford University Press; 1995.
25. Massof RW, Emmnel TC. Criterion-free parameter-free distribution independent index of diagnostic test performance. *Appl Opt*. 1987;26:1395–1408.
26. Javitt JC, Steinberg E, Sharkey P, et al. Cataract surgery in one eye or both: a billion dollar per year issue. *Ophthalmology*. 1995;102: 1583–1592.
27. Desai P, Reidy A, Minassion DC, et al. Gains from cataract surgery: visual function and quality of life. *Br J Ophthalmol*. 1997;81:889–895.
28. Javitt JC, Brenner MH, Curbow B, et al. Outcomes of cataract surgery: improvement in visual activity and subjective visual function after surgery in the first, second, and both eyes. *Arch Ophthalmol*. 1993;111:686–691.
29. World Health Organization. *Global Initiative for the Elimination of Avoidable Blindness*. Geneva: World Health Organization; 1997. WHO/PBL/97.61.
30. Monitoring cataract outcome with the manual tally sheet system. Available at: http://ftp.who.int. Accessed June 6, 2006.
31. Hinds A, Sinclair A, Park J, et al. Impact of an interdisciplinary low vision service on the quality of life of low vision patients. *Br J Ophthalmol*. 2003;87:1391–1396.
32. Khan SA, Das T, Kumar SM, Nutheti R. Low vision rehabilitation in patients with age-related macular degeneration at a tertiary eye care centre in southern India. *Clin Exp Ophthalmol*. 2002;30:404–410.

APPENDIX

Items Included in the HRQOL Instrument

1. In general how satisfied are you with your quality of life?				
0 Very satisfied	1 Satisfied	2 Neither satisfied nor dissatisfied	3 Dissatisfied	4 Very dissatisfied
2. Do you have difficulty bathing unaided?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
3. Do you have difficulty dressing unaided?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
4. Do you have difficulty eating unaided?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
5. Do you have difficulty using the toilet unaided?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
6. Do you have difficulty sleeping?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
7. Do you have difficulty working?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
8. Do you have difficulty doing your household chores?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
9. Do you have difficulty walking to shops or to your neighbors?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
10. Do you have difficulty using public transport?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
11. Do you have difficulty driving?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
12. How satisfied are you with your relationships with your family members?				
0 Very satisfied	1 Satisfied	2 Neither satisfied nor dissatisfied	3 Dissatisfied	4 Very dissatisfied
13. Do you have difficulty attending social functions or visiting friends and relatives?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
14. To what extent do you get the support you need from your friends?				
0 Extreme amount	1 Very much	2 Moderate amount	3 Little	4 Not at all
15. How safe do you feel in your daily life?				
0 Extremely safe	1 Very safe	2 Moderately safe	3 Slightly safe	4 Not safe at all
16. How much confidence do you have in yourself?				
0 Extreme amount	1 Very much	2 Moderate amount	3 Little	4 Not at all
17. How well are you able to concentrate on whatever you do?				
0 Extreme amount	1 Very much	2 Moderate amount	3 Little	4 Not at all
18. How often do you worry?				
0 Never	1 Seldom	2 Often	3 Very often	4 Always
19. How often do you feel depressed or dejected?				
0 Never	1 Seldom	2 Often	3 Very often	4 Always
20. Do you feel you are a burden on others?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
21. Do you feel that physical pain prevents you from doing what you have to do?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
22. Are you dependent on medications?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
23. How much chance do you have to acquire new skills that you need?				
0 Extreme amount	1 Very much	2 Moderate amount	3 Little	4 Not at all
24. How much chance do you get to relax?				
0 Extreme amount	1 Very much	2 Moderate amount	3 Little	4 Not at all
25. Do you have difficulty participating in religious activities such as visiting temple/mosque/church or reading holy books?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme

(*continues*)

APPENDIX

Items Included in the HRQOL Instrument (*continued*)

26. Do you feel inhibited because of reasons related to your body?				
0 Not at all	1 Slight	2 Moderate	3 Very much	4 Extreme
Follow-up question asked for each item:				
Is your difficulty caused by any of the following?				
1. Eye-related problems		0 No	1 Yes	
2. Health problems other than eyes		0 No	1 Yes	
3. Other reasons		0 No	1 Yes	2 Most important
4. Cannot say		0 No	1 Yes	