Effectiveness of low vision services in improving patient quality of life at Aravind Eye Hospital

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Context: In India, where the heavy burden of visual impairment exists, low vision services are scarce and under-utilized. Aims: Our study was designed to survey the effectiveness of low vision exams and visual aids in improving patient quality of life in southern rural India. Subjects and Methods: The low vision quality of life (LVQOL) questionnaire measures vision-related quality of life through 25 questions on a Likert scale of 0–5 that pertain to (1) mobility, distance vision, and lighting; (2) psychological adjustment; (3) reading and fine work; and (4) activities of daily living. This tool was translated into Tamil and verbally administered to 55 new low vision referral patients before their first visit at the low vision clinic at Aravind Eye Hospital. Low vision aids (LVAs) were prescribed at the discretion of the low vision specialist. 1-month later, the same questionnaire was administered over the phone. Results: About 44 of 55 low vision patients completed baseline and follow-up LVQOL surveys, and 30 normal vision controls matched for age, gender, and education were also surveyed (average 117.34 points). After the low vision clinic visit, the low vision group demonstrated a 4.55-point improvement in quality of life (from 77.77 to 82.33 points, \( P = 0.001 \)). Adjusting for age, gender, and education, the low vision patients who also received LVAs (\( n = 24 \)) experienced an even larger increase than those who did not (\( n = 20 \)) (8.89 points, \( P < 0.001 \)). Conclusion: Low vision services and visual aids can improve the quality of life in South Indian rural population regardless of age, gender, and education level. Thus, all low vision patients who meet the criteria should be referred for evaluation.

Key words: Low vision, low vision aids, quality of life

The World Health Organization defines low vision in regards to low vision care as “visual impairment even after treatment and/or standard refractive correction with visual acuity (VA) of <20/70 to light perception, or a visual field <10° from the point of fixation, in a person who uses or is potentially able to use vision for the planning and/or execution of a task for which vision is essential.”[1] Low vision affects >246 million people worldwide[2] and over 54.5 million in India.[3] Low vision services are scarce, often poorly funded and under-utilized, especially in developing nations. In India, a person with VA <20/200 is considered legally blind and is allowed to receive government services and financial benefits. This acuity cut-off was determined to be an appropriate compromise between balancing the limited government resources and the country’s heavy burden of visual disease.[4] For these patients who cannot be helped with surgical intervention or medical therapy, low vision aids (LVAs) can be a tool to improve the quality of life. However, little is known about how effective the LVAs are in rural Indian population.

At the Aravind Eye Hospital in Madurai, there were 16,737 patients examined in 2011 who met the criteria for low vision; unfortunately only 2471 patients (<15%) were referred and seen at Aravind’s Low Vision clinic that year (Aravind internal data). Based on a brief survey of physicians at Aravind, the reason for the low referral rate was that many physicians perceived low vision services as less beneficial for patients who were illiterate, less educated, and of older age – revealing a potential bias against low vision services. Therefore, this study aims to quantitatively evaluate, using a previously validated low vision quality of life (LVQOL) survey, how effective low vision services are in improving the quality of life in a rural Indian population.

Subjects and Methods

The study was approved by the Medical Ethics Committee of the Stanford University Medical Center and the Research Committee at Aravind Eye Hospital, and conducted according to the principles of the declaration of Helsinki. This study was carried out from June to August 2012 at the Aravind Eye Hospital, a private eye hospital in Madurai, India, which provides low vision eye care to both paying and nonpaying patients.

At the time of study design, the LVQOL questionnaire, originally designed by Wolfsohn and Cochrane in 2000, was selected as the main outcome measure for its simplicity and extensive previous validation. It consists of 25 questions to assess 4 areas of quality of life: (1) Mobility, distance vision, and lighting; (2) adjustment; (3) reading and fine work; and (4) activities of daily living.[5] The questionnaire was translated into Tamil and verified for clarity by 3 different bilingual members of the research team. A pilot study was done with 21 patients using the Tamil questionnaire and question 16 (“How well was your eye condition explained to you?”) was found to be confusing in its translated form, and the patients did not find it relevant to their quality of life. This question was omitted in the questionnaire administered to the patients in the
appropriate, referred them to government benefits or services. Some patients did not receive an LVA because their vision could not afford to pay, these LVAs were provided at low cost or free of charge using financial subsidies from the Govel.

Patients did not improve with any aids, or they refused. A counselor educated patients about their eye condition, and when

In addition to the LVQOL survey, patient demographic and clinical information (including age, gender, literacy, education level, student status, income, diagnosis, VA and visual field) were collected at baseline for all patients. Eligible patients were between 10 and 70 years old, fluent in English or Tamil, with VA <20/70 to light perception in the better eye or visual fields ≤10° from the point of fixation. Patients were excluded if they were mentally disabled, had no way of being contacted later by phone, or had already received low vision services previously. After providing informed consent to participate in the study, patients were interviewed by a Tamil-speaking researcher using the LVQOL questionnaire in a private study room.

In order to establish baseline LVQOL scores of low vision versus normal vision patients, consecutive patients coming to the low vision clinic who met criteria were enrolled along with normal vision control patients who were recruited from the waiting room of the general clinic. Normal vision was defined as best corrected VA ≥20/30 in the better eye and visual fields ≥10° from the point of fixation. 30 low vision patients were compared to 30 normal vision controls matched for age, gender, and education level.

An additional 25 low vision patients were added to the low vision group (total n = 55) to achieve statistical power of 0.80. All patients in the low vision group were assessed at baseline and called for a follow-up LVQOL assessment over the telephone 30 days after their first visit. This 1-month follow-up time point was chosen as long enough so that patients would not be able to recall their initial responses, yet not too long that their eye disease might progress enough to affect their LVQOL score. Additionally, this time would allow patients to try their new LVAs if they had received one. Normal vision patients were not contacted for follow-up. About 80% of the low vision group patients competed the follow-up survey over the phone.

During the low vision visit, an optometrist first assessed the patient’s vision using a logMAR chart. Next, the low vision ophthalmologist specialist examined the patient, explained the prognosis, and prescribed an LVA depending on disease type, acuity level, and mental capacity. LVAs available included hand or stand magnifiers, spectacle magnifiers, telescopes, closed-circuit televisions, and tinted spectacles. If the patient could not afford to pay, these LVAs were provided at low cost or free of charge using financial subsidies from the Gove Trust Mahema Devadoss Endowment established in 2009. Some patients did not receive an LVA because their vision did not improve with any aids, or they refused. A counselor also educated patients about their eye condition, and when appropriate, referred them to government benefits or services.

Statistical analysis
The minimum change in the LVQOL score found to be clinically significant was 5–10 points. This was established in a previously published study of 329 patients in the Netherlands, who were assessed at baseline and 5 months follow-up with the LVQOL and a general transition question. To find if this applied to the Indian population, we conducted a pilot study (n = 20) and found an average 10.0-point increase in score after 1-month (baseline LVQOL score 69 ± 22 points, 30 days follow-up LVQOL score 79 ± 25 points). Based on this pilot data, a sample size of 45 was calculated to be sufficient to detect an improvement of 10 points after 30 days from receiving services at the low vision clinic, using 80% power and 5% level of significance. The patients assessed in the pilot were not included in the final study.

In the current study, 55 patients were chosen to account for the expected loss to follow-up. We calculated the Cronbach’s alpha score of the questionnaire to determine the internal consistency of the questionnaire and ensure that the items are inter-correlated, and scores are reliable.

Continuous variables are expressed as “mean ± standard deviation”. Paired t-test was used to assess the difference between baseline and follow-up LVQOL scores of low vision patients. There was a 20% loss to follow-up when low vision patients were called for a phone interview (after 30 days, patients were called every day for 3 days at a time convenient for them; if they were not able to be reached or if the phone number was incorrect, this was recorded as loss to follow-up). Mann-Whitney U parametric test was used to compare the difference between normal and low vision patient LVQOL scores. Two-tailed Pearson’s product-moment correlation coefficient was used to correlate age and VA with LVQOL scores. P < 0.05 was considered statistically significant. Effect size (change in LVQOL score) was calculated with 95% confidence intervals (95% CI). All statistical analysis was performed using STATA version 11.0 (Texas, USA).

Results
A total of 30 low vision patients had significantly lower LVQOL scores (79.43 ± 18.37 points) compared to 30 normal vision controls (117.34 ± 2.32 points) matched for age, gender, and education level. On average low vision patient LVQOL scores are 37.91 points (32.3%) lower than normal vision patients (Mann-Whitney U parametric test, n = 20, P < 0.0001, two-tailed). Low vision patient scores (79.43 ± 18.37 points) were also more widely distributed than controls with normal vision (117.34 ± 2.32 points) [Fig. 1]. Linear regression was run on 3 variables (age, sex, education) to ensure that they were not confounders, and this effect

![Figure 1: Low vision versus normal vision low vision quality of life score](image-url)
remained unaltered. The questionnaire provided good internal consistency (Cronbach’s alpha = 0.92) in LVQOL scores for low vision patients and demonstrated good reliability.

A total of 44 patients (80%) with low vision completed the 1-month follow-up. There was 20% loss to follow-up due to the difficulty reaching the patient by phone within a time window of 30–33 days. Patients who completed both baseline and follow-up surveys demonstrated an improvement in LVQOL score of + 4.55 points on average (paired t-test, \( P = 0.0013 \), two-tailed), from a baseline of 77.77 ± 19.04 to 82.33 ± 22.52 [Table 1]. The measured effect size overall measured 4.55 points (95% CI 1.06 - 7.14), with very few patients who had a significant decline in LVQOL. Patient scores showed significant improvement in 3 subcategories of the LVQOL on average: mobility (+1.63 points, \( P = 0.01 \), paired t-test, two-tailed), psychological adjustment (+0.84, \( P = 0.01 \), paired t-test, two-tailed), and reading (+1.91, \( P = 0.001 \), Paired t-test, two-tailed). The last area of the LVQOL, activities of daily life, improved in these patients as well, but the change was not significant (+0.18, \( P = 0.543 \), Paired t-test, two-tailed) [Table 1].

Average VA in the better eye of the patients was measured at baseline and was not significantly different between those who did or did not receive an LVA. VA was converted to decimal values and averaged in each group to be compared. Those who did not receive an LVA had a mean VA of 0.17 ± 0.11, and those who received an LVA had a mean VA of 0.16 ± 0.16. Patients who received LVAs (\( n = 24 \)) showed a significant improvement of 8.89 points in LVQOL score after 30 days (Paired t-test, \( P < 0.001 \), two-tailed), their average scores increased from 83.13 ± 13.22 to 92.02 ± 17.35 [Table 2], an improvement of 8.97 points. 6 of these patients received LVAs for free; their LVQOL scores showed significant improvement in 3 subcategories of the LVQOL (mobility, psychological adjustment, reading) and a decrease of 0.65 points in LVQOL score (Paired t-test, \( P = 0.320 \), two-tailed). Their average scores decreased from 71.34 ± 23.00 to 70.70 ± 22.85.

Gender, literacy, student status, and VA in the better eye at baseline were analyzed to identify predictors of benefit from low vision services. There was no correlation between the age and change in LVQOL score (\( r = -0.169, n = 44, P = 0.27 \)) or between VA and change in LVQOL score (\( r = -0.253, n = 44, P = 0.09 \)). Similarly, there was no correlation between change in gender, literacy, student status, and change in LVQOL score [Table 3]. This suggests that of these demographics, there are no significant trends providing a strong basis for predicting who will benefit most from low vision care.

**Discussion**

Our study shows that low vision services can have a quantifiable positive impact on quality of life for many patients living in rural India. Using the LVQOL tool, we were able to measure the reduced quality of life that low vision imposes on patients and how well patients improve after receiving low vision services. Patients showed significant gains in all four categories assessed by the LVQOL except for “activities of daily living.” The population surveyed included many patients whose daily life involved manual labor, fieldwork, or work that requires both hands. LVAs such as telescopes, magnifiers, and other devices are less useful for these activities of daily life. Telescopes are often prescribed for far vision needs, but have a high cost-to-benefit ratio, and many patients find them cumbersome and thus, abandon them in frustration.

Receiving an LVA was a predictor of significant improvement in vision-related quality of life. In this study, the 6 patients who received free LVAs demonstrated an improvement of LVQOL score similar to those who paid for LVAs, and thus providing LVAs for free did not introduce significant bias. Therefore, if the patient is willing to explore low vision services and LVAs, ophthalmologists should definitely refer them for low vision evaluation.

It can be difficult to determine which low vision patients will benefit most from LVAs. When deciding on whether to refer patients to low vision, physicians consider factors including...
patient-specific ocular disease processes, socioeconomic status, individual intrinsic motivation, education level, and activities of daily life. Unfortunately, physician assessments are often limited by time constraints of a busy clinic; in this setting, physicians can easily overlook a referral to low vision services. In this way, the lack of physician referrals can be a barrier for patients who could benefit from low vision services.

An informal survey carried out among 60 ophthalmologists at Aravind Eye Hospital on their views towards low vision services revealed that, in fact, many physicians are unsure which patients would benefit from a referral to low vision. Common perceptions of why physicians do not refer include: the perception that the patient lacks motivation to use LVAs, the patient cannot afford LVAs, or would not benefit from the LVA given his/her education level. Contrary to this, our results establish that indeed patients – regardless of gender, literacy, and education level – can have a significantly improved quality of life with the assistance from low vision services and LVAs.

Functional improvement after low vision rehabilitation has been shown, but vision-related quality of life has not been well-studied and the data is less clear, particularly in the rural Indian population. In more urban settings, low vision rehabilitation services have been shown to improve the clinical outcomes and functional ability outcomes of patients after a spectrum of follow-up surveys ranging from immediately afterwards to 5 years after receiving low vision services. In these studies, a variety of quality of life tools were used including the impact of vision impairment profile, National Eye Institute Visual Function Questionnaire, Visual Function Questionnaire, and the vision quality of life core measure. In India, one study compared different types of low vision rehabilitation by randomizing 436 low vision patients to receive center-based rehabilitation, home-based rehabilitation, a combination of home and center-based rehabilitation, or center-based rehabilitation with non-interventional home visits by trained rehabilitation workers. The outcomes were measured after 9 months using questionnaires to assess adaptation to low vision, quality of life, and effectiveness of rehabilitation training using a newly developed 10-question survey, the effectiveness of low vision rehabilitation training. There was a lower dropout rate with home-based rehabilitation, suggesting a larger benefit with more convenient, individualized vision rehabilitation. However, home-based rehabilitation programs are challenging to implement widely in rural India given issues related to training, human resources, funding, and sustainability. In developing countries, in-home rehabilitation programs such as these may only be as effective as point-of-care rehabilitation at a vision center since many patients are unable to come back for follow-up. With this in mind, our study supports their conclusions and reinforces the importance of low vision referrals so that patients may tap into and benefit from these resources.

In our study, one limitation was that there was no negative control group consisting of low vision patients who were not referred to low vision services. This was intentional, since it would have been unethical to identify and survey these patients at baseline and deny them available services that could potentially help them.

The translated questionnaire was not formally validated previously in this population, however after the adjustments made with the pilot study (eliminating question 16), and based on the Cronbach’s alpha reliability measures, we concluded the survey was relevant to this population and appropriate to use for the purpose of evaluating patient quality of life in this setting. Eliminating one question from the questionnaire also lowered the effect size detectable, relative to the 25-item questionnaire. Thus, our effect size of 4.55 improvement in LVQOL is comparable to what has been reported as a clinically significant improvement in quality of life using the LVQOL in the Dutch population.

The baseline and follow-up survey methods were administered using different methods (in person at baseline and via telephone at follow-up), to minimize loss to follow-up. However, telephone administration of the LVQOL survey has been shown to be as reliable and consistent as in person interview for the LVQOL. Still, 11 patients (20%) were lost to follow-up that may have introduced a response bias. The patients lost to follow-up were not significantly different from those who did follow-up in terms of age, gender, education, VA, or baseline LVQOL score. However, their baseline LVQOL and VA are not indicators of eye disease progression, and these patients may have had a progressively worse course than those who did follow-up and their loss to follow-up may have introduced a response bias.

Admittedly there is a relatively modest improvement overall, patients with severe visual impairments generally do not achieve much visual improvement, even with LVAs. There is a large variability among low vision patients, as seen in our sample; some patients do poorly regardless of rehabilitation efforts. A few patients in this study who experienced rapid decline in LVQOL likely had progressive disease and declining VA, which explains our large amount of variability in effect size. In general, people living with low vision tend to feel frustrated and sad; it becomes difficult for their families and friends as well. Staff members at low vision centers are trained to provide counseling and guidance for rehabilitation. These include practical tips for mobility and activities of daily living (using canes and flashlights to help sense surroundings, enhancing edges of doorways and steps with high contrast tape, enhanced lighting, nonoptical aids such as cardboard notex cards for organizing currency by cut edges matching different sizes of currency notes); vocational/educational rehabilitation (career guidance on vocations that are more practical for people with low vision, advice on using audio books, braille schools); and social rehabilitation (help in gaining government disability financial assistance, subsidies for walking canes, education, travel expenses). With these types of services tailored to each patient’s age, level of vision loss and goals, people can maintain a higher level of independence and quality of life.

Conclusion

Our results demonstrate an improvement in this population of rural India, including less educated, lower income patients – a population often forgotten when it comes to providing low vision services. Many physicians think that low income, rural populations do not benefit from LVAs; however, this study reveals the opposite. Low vision referrals, more specifically LVAs, can help restore a patient’s vision-related quality of life even in rural India. Thus, physicians should remember to refer patients who meet criteria for low vision evaluation.
Efforts should be made in other low resource areas to increase utilization of low vision services that are beneficial for quality of life in low vision patients.

References

1. World Health Organization. Priority eye diseases, refractive errors and low vision definition. Geneva: WHO; c1992. Available from: http://www.who.int/blindness/causes/priority/en/index5.html. Last accessed on 2013 Jun 30.

2. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. Br J Ophthalmol 2012;96:614-8.

3. van Dijk K. Definition: Visual impairment. In: Punani B, Rawal N, editors. Visual Impairment and Blindness. Vol. 1, Ch. 1. Vastrapur, Ahmedabad: Blind People’s Association; 2000. p. 1-10.

4. Wolffsohn JS, Cochrane AL. Design of the low vision quality-of-life questionnaire (LVQOL) and measuring the outcome of low-vision rehabilitation. Am J Ophthalmol 2000;130:793-802.

5. De Boer MR, de Vet HC, Terwee CB, Moll AC, Völker-Dieben HJ, van Rens GH. Changes to the subscales of two vision-related quality of life questionnaires are proposed. J Clin Epidemiol 2005;58:1260-8.

6. Singer MA, Amir N, Herro A, Porbandarwalla SS, Pollard J. Improving quality of life in patients with end-stage age-related macular degeneration: focus on miniature ocular implants. Clin Ophthalmol 2012;6:33-9.

7. McCabe P, Nason F, Demers Tuzco P, Friedman D, Seddon JM. Evaluating the effectiveness of a vision rehabilitation intervention using an objective and subjective measure of functional performance. Ophthalmic Epidemiol 2000;7:259-70.

8. Stelmack JA, Stelmack TR, Massof RW. Measuring low-vision rehabilitation outcomes with the NEI VFQ-25. Invest Ophthalmol Vis Sci 2002;43:2859-68.

9. Ganesh S, Sethi S, Srivastav S, Chaudhary A, Arora P. Impact of low vision rehabilitation on functional vision performance of children with visual impairment. Oman J Ophthalmol 2013;6:170-4.

10. Binns AM, Bunce C, Dickinson C, Harper R, Tudor-Edwards R, Woodhouse M, et al. How effective is low vision service provision? A systematic review. Surv Ophthalmol 2012;57:34-65.

11. Weih LM, Hassell JB, Keeffe J. Assessment of the impact of vision impairment. Invest Ophthalmol Vis Sci 2002;43:927-35.

12. Christy B, Keeffe JE, Nirmalan PK, Rao GN. A randomized controlled trial assessing the effectiveness of strategies delivering low vision rehabilitation: Design and baseline characteristics of study participants. Ophthalmic Epidemiol 2010;17:203-10.

13. Chiang PP, Marella M, Ormsby G, Keeffe J. Critical issues in implementing low vision care in the Asia-Pacific region. Indian J Ophthalmol 2012;60:456-9.

14. Wolffsohn JS, Cochrane AL, Watt NA. Implementation methods for vision related quality of life questionnaires. Br J Ophthalmol 2000;84:1035-40.

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Appendix

Part 1
Mobility, Distance vision and lighting

|   | None | A little | Moderately | Quite a bit | Great | Cannot do this because of vision | Not applicable |
|---|------|----------|------------|-------------|-------|---------------------------------|----------------|
| 1 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 2 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 3 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 4 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 5 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 6 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 7 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 8 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 9 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
|10 | 5    | 4        | 3          | 2           | 1     | 0                               | X              |

Part 2

In this section, I am going to ask you how you feel because of your problem. I will read out a choice of five answers, and you will choose the one you feel describes you best.

|   | None | Rarely | Moderately | Quite a bit | Greatly | Completely because of vision | Not applicable |
|---|------|--------|------------|-------------|---------|-------------------------------|----------------|
|13 | 5    | 4      | 3          | 2           | 1       | 0                            | X              |
|14 | 5    | 4      | 3          | 2           | 1       | 0                            | X              |
|15 | 5    | 4      | 3          | 2           | 1       | 0                            | X              |

Part 3

In this section, I am going to ask you how much your vision problem affects you in doing your reading and fine work. I will read a choice of five answers, and you will choose the one you feel describes you best. You cannot do or don’t do these activities because of your vision or other reasons please tell me.

|   | None | A little | Moderately | Quite a bit | Greatly | Cannot do this because of vision | Not applicable |
|---|------|----------|------------|-------------|---------|-------------------------------|----------------|
|17 | 5    | 4        | 3          | 2           | 1       | 0                            | X              |
|18 | 5    | 4        | 3          | 2           | 1       | 0                            | X              |
|19 | 5    | 4        | 3          | 2           | 1       | 0                            | X              |
|20 | 5    | 4        | 3          | 2           | 1       | 0                            | X              |
|21 | 5    | 4        | 3          | 2           | 1       | 0                            | X              |
Part 4

In this section, I am going to ask you how much your vision problem affects you in doing your Activities of daily living. I will read a choice of five answers, and you will choose the one you feel describes you best. You cannot do or don’t do these activities because of your vision or other reasons please tell me.

| Question                                                                 | None | A little | Moderately | Quite a bit | Great | Cannot do this because of vision | Not applicable |
|-------------------------------------------------------------------------|------|----------|------------|-------------|-------|---------------------------------|----------------|
| 22 How much of a problem do you have finding out the time of yourself? | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 23 How much of a problem do you have writing?                          | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 24 How much of a problem do you have to read your handwriting?         | 5    | 4        | 3          | 2           | 1     | 0                               | X              |
| 25 How much of a problem do you have with your every-day activities?   | 5    | 4        | 3          | 2           | 1     | 0                               | X              |