Utility values among glaucoma patients: an impact on the quality of life

V Gupta, G Srinivasan, S S Mei, G Gazzard, R Sihota, K S Kapoor

Aim: To ascertain utility values and associated quality of life with different severity and duration of glaucoma among Indian patients.

Methods: Utility values of 105 consecutive patients with primary glaucoma of at least 12 months’ duration were evaluated in a cross sectional study. Utility values were ascertained in five groups using both the time-trade off and standard gamble methods: group 1 (best corrected visual acuity in the better eye of 6/9 or better), group 2 (best corrected visual acuity in the better eye of 6/18 to 6/12), group 3 (best corrected visual acuity in the better eye of 6/36 to 6/24), group 4 (best corrected visual acuity in the better eye of 3/60 to 6/60), and group 5 (best corrected visual acuity in the better eye of 3/60 or worse).

Results: The mean utility value for the glaucoma group as a whole was 0.64 (SD 0.69; 95% confidence interval (CI), 0.58 to 0.70) with the time-trade off method and 0.86 (SD 1.00; 95% CI, 0.81 to 0.90) with the standard gamble method for a gamble of death. The mean utility results by the time-trade off method were as follows: group 1 = 0.66, group 2 = 0.66, group 3 = 0.62, group 4 = 0.55, and group 5 = 0.61. The utility value was much lower in those with no formal education or only primary education compared to those with postgraduate education (0.75) (p = 0.038). Those patients with glaucoma of less than 5 years’ duration had a utility score of 0.62 while those with glaucoma for more than 10 years had a score of 0.74 (p = 0.40).

Conclusions: Visual acuity loss occurring secondary to glaucoma is associated with a substantial decrease in patient utility value (and quality of life) in a developing country like India. The utility value is directly dependent on the degree of visual acuity loss associated with the disease and educational status and not on the duration of disease, the number of medications, or the visual field indices.

Glaucoma is a disease that causes irreversible blindness with the blindness rate for primary angle closure glaucoma (PACG) being three to four times higher than for primary open angle glaucoma (POAG). One Indian study found a prevalence of 2.6% for any glaucoma, with 1.7% for POAG and 0.3% for PACG.¹ These values correspond with the prevalence of glaucoma in the West. The value of health-related quality of life measures and their application in medical research has been shown in various chronic and progressive diseases and also in certain life-threatening diseases. Utility values are a measure of the subjective functional capacity of a patient; how a patient is troubled by his disease in his or her activities of everyday life. It is an indicator of the quality of life of the patient in relation to his disease. By convention, a utility value of 1.0 indicates a state of perfect health, whereas a utility value of 0 indicates death. A disease that affects the quality of life minimally such as systemic hypertension may have a utility score of 0.98 while severe angina may have a score of 0.50.¹ (table 1).

Using utility values to assess the quality of life and thereby health prioritisation of different diseases including glaucoma has been done among populations in developed nations; however, such an assessment has not been made among Indian patients with glaucoma. This study thus aimed to determine how much glaucoma affects the day to day life of our patients and what factors influence utility values.

PATIENTS AND METHODS

The study was carried out using a standard questionnaire for consecutive patients having chronic management for primary glaucoma seen in a tertiary care centre. The study was initiated after approval of the ethics committee. Interviews were conducted by a single examiner. The questions were translated according to the language understood by the patient.

Inclusion criteria were cases of established glaucoma following up for at least 12 months, who were able and willing to answer the questions in the questionnaire. Patients with any other condition that could impair vision, such as cataract, diabetes, and macular degeneration, were excluded from the study. Patients with a recent acute attack of angle closure were also excluded from the study. Patients who did not understand the questions or were not willing to answer them were excluded from the study.

All patients who had been diagnosed with glaucoma underwent a complete ophthalmic examination including a best corrected Snellen visual acuity, gonioscopy, standard achromatic automated perimetry, and Goldmann application tonometry. After the clinical examination, each patient was asked a series of questions according to the questionnaire.

In the time-trade off utility analysis the patients were asked the number of years of their presumed expected remaining years of life that they were willing to trade off for perfect vision. The time-trade off utility values were calculated by dividing the number of years traded by the number of expected remaining years of life and subtracting this proportion from 1.0 (table 2).

In the standard gamble method the patient was told to suppose that there was a technology that offered him perfect vision when the therapy was effective but when not effective the alternative was immediate death (gamble 1) or blindness (gamble 2). The patient was then asked how high a risk of

Abbreviations: PACG, primary angle closure glaucoma; POAG, primary open angle glaucoma
death (%) or blindness, if any, he or she would be willing to accept before refusing treatment that would restore perfect vision in each eye. This percentage was then subtracted from 1.0 to obtain the utility value.

Depending on the best corrected visual acuity in the better eye the patients were grouped as; group 1 (best corrected visual acuity in the better eye of 6/9 or better), group 2 (best corrected visual acuity in the better eye of 6/18 to 6/12), group 3 (best corrected visual acuity in the better eye of 6/36 to 6/24), group 4 (best corrected visual acuity in the better eye of 3/60 to 6/60), and group 5 (best corrected visual acuity in the better eye of 3/60 or worse).

### Statistical analysis

The means, standard deviations (SD), and 95% confidence intervals (CI) were calculated for the utility values measured in the sample subgroups. The means of different sample subgroups were compared using the unpaired, two tailed Student’s t test. Comparison of the means of time-trade off and standard gamble utilities within the visual stratification groups were performed using the paired, two tailed, Student’s t test. Statistical significance was assumed to occur at the 0.05 level. Non-parametric tests, ANOVA, and Kruskal-Wallis tests were used keeping the utility score as the dependent variable.

### RESULTS

The mean utility value for the glaucoma group as a whole was 0.64 (SD 0.69; 95% CI, 0.58 to 0.70) with the time-trade off method and 0.86 (SD 1.00; 95% CI, 0.81 to 0.90) with the standard gamble method for a gamble of death and 0.97(SD 1.00; 95% CI, 0.94 to 0.99) for a gamble of blindness. The mean utility results by the time-trade off method were as follows: 0.66 (SD 0.74), 0.66 (SD 0.69), 0.62 (SD 0.74), 0.55 (SD 0.67), and 0.61 (SD 0.60) for groups 1–5, respectively. The utility values by the standard gamble method for a gamble of death from groups 1–5, respectively were as follows: 0.83 (SD 0.9), 0.84 (SD 0.95), 0.90 (SD 1.00), 0.78 (SD 0.95), 0.92 (SD 1.00) The mean utility values for a gamble of blindness from groups 1–5, respectively, were 0.98, 0.99, 1.00, 0.84, and 0.94.

The utility value was much lower in those with no formal education or only primary education 0.46 (SD 0.50; CI, 0.27 to 0.50) compared to those with postgraduate education 0.75 (SD 0.75; CI, 0.66 to 0.84) (p value 0.038). Those patients with high school education were found to have a utility score of 0.69 (CI, 0.57 to 0.81) and those with graduate education were found to have a score of 0.62 (CI, 0.52 to 0.71). The duration of glaucoma did not make a significant difference in the utility scores. Those patients with glaucoma of less than 5 years’ duration had a utility score of 0.62 (SD 0.67; CI, 0.54 to 0.70) while those with glaucoma for 5–10 years had a score of 0.69 (SD 0.50 CI, 0.42 to 0.75) and those with glaucoma for more than 10 years had a score of 0.74 (SD 0.55 CI, 0.4 to 0.65) (p = 0.40). Females were willing to trade off more years compared to males (p value = 0.04).

The average mean deviation on visual field of the right eye was −14.1 (SD 8.3) while in left eye it was −12.6 (8.3) dB. The level of field loss in the better eye (mean deviation) did not affect the utility score (table 3). Similarly, the number of topical medications did not affect the utility score significantly. The history of previous glaucoma surgeries also did not affect the utility scores. While those who had undergone surgery had a score of 0.66 (SD 0.73; CI, 0.59 to 0.74), the patients who had no surgery had a score of 0.62 (SD 0.68 CI, 0.52–0.79) (p value 0.49). The utility values were not affected by the diagnostic groups of glaucoma or by the age of the patients. Patients aged less than 50 years had a utility value of 0.62 (SD 0.75; CI, 0.48 to 0.75) by the time-trade off method while those patients above 70 years had a utility value of 0.56 (SD 0.67; CI, 0.43 to 0.70) (p value 0.46).

Regression analysis of the variables was done keeping the utility score as the dependent variable (table 4). Variables like age (p value 0.717), visual acuity (p value 0.382), mean deviation (p value 0.317), number of medications (p value 0.164), and duration of the disease (p value 0.60) did not seem to have a significant influence on the utility value. However, the level of education had a significant effect on the utility values (p value 0.004).

In all groups of patients and in all the parameters assessed, the utility scores by the gamble method were significantly higher than with the time-trade off method (table 4).

### DISCUSSION

The utility theory was propounded by Von Neumann and Morgenstern to quantify the uncertainty that existed in various fields of assessing quality of life measures. It is an

---

**Table 1** Utility scores in various health states with regard to glaucoma

<table>
<thead>
<tr>
<th>Disease/health state</th>
<th>Country</th>
<th>Sample size</th>
<th>Utility value</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age related macular degeneration (mild)</td>
<td>USA</td>
<td>115</td>
<td>0.83</td>
<td>Stein</td>
</tr>
<tr>
<td>2 Hypertension</td>
<td>USA</td>
<td>188</td>
<td>1.00</td>
<td>Stein</td>
</tr>
<tr>
<td>3 Bilateral blindness</td>
<td>USA</td>
<td>15</td>
<td>0.26</td>
<td>Brown</td>
</tr>
<tr>
<td>4 Oesophageal cancer</td>
<td>USA</td>
<td>50</td>
<td>0.80</td>
<td>Wildi SM</td>
</tr>
<tr>
<td>Localised</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metastatic</td>
<td></td>
<td></td>
<td>0.52</td>
<td></td>
</tr>
<tr>
<td>5 Dry eye (severe)</td>
<td>USA</td>
<td>56</td>
<td>0.72</td>
<td>Schiffman</td>
</tr>
<tr>
<td>6 Glaucoma</td>
<td>USA</td>
<td>237</td>
<td>0.91</td>
<td>Jampel</td>
</tr>
<tr>
<td>India</td>
<td></td>
<td>105</td>
<td>0.64</td>
<td>Present study</td>
</tr>
</tbody>
</table>

**Table 2** Calculation of utility score

How to calculate a utility score: an example

**Step 1:** Determine the number of additional years the patient expects to live

Age of the subject expects to live 70 years

**Step 2:** Divide the number of years the respondent is willing to give up to spend the rest of his/her living years free of glaucoma from the value obtained in step 1

70–50 = 20 additional years

**Step 3:** Subtract the value obtained in step 2 from 1.0

1.0–0.50 = 0.50

**Interpretation:** The respondent is willing to give up 50% of his/her remaining life years in a trade off for life without glaucoma. The utility value is calculated by subtracting the percentage of remaining years traded (0.50—i.e., 50%) from the state of perfect health 1.0 (100%).
objective evaluation of the patients’ quality of life, which gives an indication as to how much the patient perceives the disease state affects his day to day living—namely his quality of life.

There are various factors that might be expected to affect the impact of a disease state on the quality of life of a patient, such as duration of the disease, the educational qualification, the patient’s age, sex, the socioeconomic condition, whether the disease is acute or chronic, and psychological variations among individuals. This could cause the values to be different for the same disease depending on the population studied. To the best of our knowledge there has not been any study that has reported the utility values in glaucoma among Indian patients. Other studies have assessed utility values among glaucoma patients and have found higher values; these have primarily been done in patients from developed countries where the understanding of the disease among patients is better and there is a better social and medical support system.

Ophthalmic utility values appear to have good test-retest reliability over prolonged periods of time. Among ocular conditions that cause loss of vision it has been reported that the utility values correlate with the amount of visual loss and not the cause of visual loss. While Torrance and Feeny reported a utility value of 0.39 for blindness their study did not define blindness. Whether the visual loss is caused by age-related macular degeneration or cataract or diabetic retinopathy it was not shown to alter the utility value.

In the present study population, the mean utility value for the total group with glaucoma was 0.64 using the time-trade off method. This value is much lower than previously reported from studies of glaucoma patients in developed countries. Jampel et al have reported utility values of 0.91 in glaucoma patients by the time-trade off method. Most of their patients had early glaucoma or were glaucoma suspects while most of our patients had moderate to advanced glaucoma in at least one eye. Another reason for this difference may be the varying impact of this disease on the patients in developing countries with a poorer socioeconomic status, economic burden of lifelong therapy, and lack of social support compared to the impact in developed nations.

In our study females were willing to trade off more years compared to males, which could be because of the lesser understanding of the disease among women and the fact that they have greater dependency on other family members in decision making. It was also found that those patients who were more than 70 years of age were willing to trade off a greater proportion of their remaining years than those less than 70 years, though the value was not statistically significant (p = 0.46).

The level of education also made a difference to the utility values. Those patients with no formal education or primary education were found to trade off significantly more years than those with postgraduate education (p = 0.038). This may be explained by the fact that the knowledge about the disease and the compliance of an educated person to his medication may be better. Also his understanding may be aided by the reasoning that the disease does respond favourably to medical or surgical management.

As expected, the patients with POAG and PACG did not show a significant difference in the utility values, indicating that the patient is primarily concerned with his visual handicap and not the diagnosis.

We also assessed the impact of the duration of the disease on the utility score. The duration of the glaucoma, less than 5 years or more than 10 years, did not significantly change

---

**Table 3** Utility scores in different groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Participants</th>
<th>Utility score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Time-trade off</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>0.64</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>81</td>
<td>0.69</td>
</tr>
<tr>
<td>Female</td>
<td>24</td>
<td>0.48</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 50</td>
<td>21</td>
<td>0.62</td>
</tr>
<tr>
<td>51–60</td>
<td>19</td>
<td>0.69</td>
</tr>
<tr>
<td>61–70</td>
<td>38</td>
<td>0.69</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>27</td>
<td>0.56</td>
</tr>
<tr>
<td>Number of medications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>61</td>
<td>0.63</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>0.66</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>0.74</td>
</tr>
<tr>
<td>Glaucoma surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>44</td>
<td>0.62</td>
</tr>
<tr>
<td>No</td>
<td>61</td>
<td>0.66</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POAG</td>
<td>52</td>
<td>0.66</td>
</tr>
<tr>
<td>PACG</td>
<td>38</td>
<td>0.60</td>
</tr>
<tr>
<td>JOAG</td>
<td>08</td>
<td>0.70</td>
</tr>
<tr>
<td>LTG</td>
<td>07</td>
<td>0.64</td>
</tr>
<tr>
<td>Mean deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 10</td>
<td>25</td>
<td>0.68</td>
</tr>
<tr>
<td>10–15</td>
<td>16</td>
<td>0.63</td>
</tr>
<tr>
<td>&gt; 15</td>
<td>62</td>
<td>0.64</td>
</tr>
</tbody>
</table>

---

**Table 4** Multiple regression analysis of factors affecting utility score

<table>
<thead>
<tr>
<th>Multiple linear regression</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual acuity in the better eye</td>
<td>0.382</td>
</tr>
<tr>
<td>Age</td>
<td>0.717</td>
</tr>
<tr>
<td>Sex</td>
<td>0.769</td>
</tr>
<tr>
<td>Visual field (mean deviation)</td>
<td>0.317</td>
</tr>
<tr>
<td>Number of glaucoma medications</td>
<td>0.164</td>
</tr>
<tr>
<td>Years since diagnosis of glaucoma was made</td>
<td>0.60</td>
</tr>
<tr>
<td>Number of glaucoma surgeries</td>
<td>0.769</td>
</tr>
<tr>
<td>Educational status</td>
<td>0.004</td>
</tr>
<tr>
<td>Income</td>
<td>0.342</td>
</tr>
<tr>
<td>Associated systemic diseases</td>
<td>0.935</td>
</tr>
</tbody>
</table>
the utility values, though it was seen that the patients with
the disease for a period less than 5 years had a utility value of
0.62 compared to patients with the disease for more than
10 years who had a higher utility value of 0.74 (p = 0.4). This
may be an indicator of the increased ability of the patient to
cope with his disease and better understanding of the disease
with time.

The mean deviation was not found to affect the utility
value, again corroborating the fact that it is mainly the visual
acuity that is of concern to the patient and not the status of
his visual field.

Those who had not undergone surgery for glaucoma had
marginally better utility values than those patients who had
undergone surgery (p = 0.49). The number of antiglaucoma
medications used by the patient, surprisingly, did not make a
significant difference in the utility value.

We also tried to assess the impact of an associated systemic
disease on the utility score. Our patients had associated
systemic hypertension, diabetes mellitus, ischaemic heart
disease, bronchial asthma, and other diseases. But the
presence of an associated systemic disease did not signifi-
cantly affect the utility score. The income of the patients also
surprisingly did not affect the utility score significantly.

In the present study, the utility values were significantly
higher with a gamble of death or blindness (0.86 and 0.97
respectively). Though the gold standard for assessment of
utility values is said to be the gamble method, Wakker et al
and Richardson et al have questioned its validity.8,9 The
standard gamble method has been shown to overestimate
risk aversion compared with other methods.6 They also state
that since the main purpose of such studies is to compare the
different disease states and their influence on the quality of
life, the time-trade off method offers a better standardisation
for comparison.

Hence, it is apparent from this study that the utility values
(quality of life) among our glaucoma patients are lower than
those reported from developed countries. Lower socioeco-
nomic states and lower literacy levels are attributed to lack of
knowledge about the disease and thereby greater concern for
it. The economic burden of lifelong therapy is an important
determinant of the quality of life in developing nations.

Authors’ affiliations

V Gupta, G Srinivasan, R Sihota, Dr Rajendra Prasad Centre for
Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi,
India

S S Mei, Department of Community, Occupational and Family Medicine,
Faculty of Medicine, National University of Singapore, Singapore

G Gazzard, Glaucoma Research Unit, Moorfields Eye Hospital and
Institute of Ophthalmology, London, UK

K S Kapoor, Department of Biostatistics, All India Institute of Medical
Sciences, New Delhi, India

REFERENCES

population in southern India: the Aravind comprehensive eye survey.

2 Stein JD, Brown GC, Brown MM, et al. The quality of life of patients with

3 Torrance GW, Feeny D. Utilities and quality-adjusted life years. Int J Technol
Assess Health Care 1995;5:559–75.

4 Weinstein MC, Starren WB. Foundations of cost-effectiveness analysis for

5 Jampel HD. Glaucoma patients’ assessment of their visual function and quality

6 Brown GC, Brown MM, Sharma S. The reproducibility of ophthalmic utility


8 Wakker P, Stiggelbout A. Explaining distortions in utility elicitation
through the rank dependent model for risky choices. Med Decis Making

9 Richardson J. Cost utility analysis: what should be measured. Soc Sci Med

10 Stein JD, Brown MM, Brown GC, et al. Quality of life with macular
degeneration: perception of patients, clinicians and community members.
Br J Ophthalmol 2003;87:8–12.


12 Wildi SM, Cox NH, Clark LL, et al. Assessment of health state utilities and
quality of life in patients with malignant esophageal dysphagia.

Utility values among glaucoma patients: an impact on the quality of life

V Gupta, G Srinivasan, S S Mei, G Gazzard, R Sihota and K S Kapoor

*Br J Ophthalmol* 2005 89: 1241-1244
doi: 10.1136/bjo.2005.068858

Updated information and services can be found at:
http://bjo.bmj.com/content/89/10/1241

These include:

**References**
This article cites 12 articles, 2 of which you can access for free at:
http://bjo.bmj.com/content/89/10/1241#BIBL

**Email alerting service**
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/