



# Assessment of Quality of Life among Moroccan Patients with Glaucoma

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## Abstract

**Introduction:** Glaucoma is the leading cause of irreversible blindness worldwide. It impairs the patient's quality of life. This study aims to measure the quality of life in Moroccan patients with glaucoma and determine associated factors. **Methods:** A cross-sectional study was carried out in the ophthalmology consultation of the Omar Drissi Hospital of the Hassan II University Hospital of Fez between November 2021 and February 2022, including patients followed for glaucoma. The "15-item Glaucoma Quality of Life (GQL-15)" questionnaire was used to measure the quality of life. Multiple linear regression analyses were performed to identify factors associated with Glaucoma Related Quality of Life (GRQoL). **Results:** A total of 170 patients were included. Primary open-angle glaucoma was found in 72.9% of patients. Sixty percent were women, and 60.6% were 60 years of age and older. The mean total score of GQL-15 was  $38.59 \pm 16.71$ . The multiple linear regression model showed a significant association between high GRQoL and early age ( $\beta = -5.81$ , 95% CI:  $-10.46 - -1.16$ ), high study level ( $\beta = -17.05$ , 95% CI:  $-27.50 - -6.60$ ), glaucoma early screening ( $\beta = -9.75$ , 95% CI:  $-16.64 - -2.87$ ), glaucoma moderate stage ( $\beta = -8.08$ , 95% CI:  $-13.82 - -2.35$ ) and with only one eye-drop per day ( $\beta = -6.69$ , 95% CI:  $-11.73 - -1.64$ ). **Conclusion:** Glaucoma-related quality of life was reduced and multifactorial. These findings could serve as a basis for future research into disease burden, including an examination of disease costs.

## Subject Areas

Ophthalmology

## Keywords

Glaucoma, Quality of Life, 15-Item Glaucoma Quality of Life (GQL-15)

## 1. Introduction

Glaucoma is a leading cause of irreversible visual impairment and blindness in adults worldwide [1] [2], with Primary Open-Angle Glaucoma (POAG) being the most common form [3]. It's characterized by the progressive loss of retinal ganglion cells, and high ocular pressure is a primary risk factor [4] [5].

The prevalence of glaucoma in adults aged 40 - 80 years is estimated to be 3.54%, and it is expected to double by 2040 [6]. A survey conducted in Morocco in 1992 by the epidemiological assessment team on blindness showed that glaucoma was the second leading cause of blindness, accounting for 14.3% of cases [7].

Glaucoma is a chronic and progressive condition that can significantly impact the psychosocial well-being of individuals with the disease. They may experience stress, sadness, and decreased quality of life due to the impact on daily activities, independence, and ability to perform routine tasks [8] [9]. People with glaucoma may also feel isolated and may struggle with participating in social activities due to vision loss. Additionally, caregivers and family members may also experience emotional distress while providing support to those with glaucoma [10] [11] [12].

Assessing the quality of life among glaucoma patients is an essential component of comprehensive glaucoma care. Several instruments have been developed and validated to evaluate the impact of glaucoma on patients' quality of life, including generic health-related quality-of-life instruments and glaucoma-specific measures [13]. The most commonly used glaucoma-specific quality of life instrument is the Glaucoma Quality of Life-15 (GQL-15), it is considered more accurate and specific to assess the impact of glaucoma on quality of life and guide interventions to improve the well-being of individuals with glaucoma [14].

Assessing the quality of life among glaucoma patients can provide valuable information to healthcare providers, patients, and their families. It can help healthcare providers tailor treatment plans and interventions to address the specific needs and concerns of individual patients, improve communication with patients, and enhance patient satisfaction with care. For patients and their families, quality of life assessment can provide insight into the impact of the disease on their daily lives, help them make informed decisions about treatment and self-management, and provide a platform for discussing concerns and coping strategies with healthcare providers.

However, to date, no published data are available on the impact of glaucoma on the quality of life of Moroccan patients.

Therefore, this study aims to assess the vision-related quality of life and examine the determinants of quality of life in Moroccan patients with glaucoma.

## 2. Methods

### 2.1. Study Design and Population

A population-based cross-sectional study was carried out among patients in the

ophthalmology department of the Omar Drissi Hospital, Hassan 2 University Hospital in Fes, Morocco between November 2021 and February 2022. Patients over 18 years of age who were diagnosed with glaucoma at least 3 months ago were invited to participate in the study to assess their quality of life. Patients were excluded if they had any of the following: history of optic neuropathy other than glaucoma, retinal pathology, corneal opacity, cataract grade 2, or higher according to the lens opacity classification system II [15] or ocular surgery within the last 3 months, psychiatric disorders including schizophrenia or bipolar disorder, and comprehension or communication difficulties.

## 2.2. Data Collection

Eligible patients received information from their specialist physician, who was part of the research group. The information included the objectives of the study and the implications of participation, as well as a consent form to be filled in if the patients agreed to participate in the study. Once informed consent was obtained, a trained investigator from the research group carried out an interview at the ophthalmic consultation in order to complete a questionnaire with sociodemographic data (age, gender, marital status, life conditions, educational level, employment status, monthly income and health insurance), Clinical data (medical and surgical history, type of glaucoma, onset age, glaucoma early screening, medical and surgical treatments), and Moroccan Arabic dialect version of “Glaucoma Quality of Life-15 (GQL-15)” questionnaire to measure the quality of life [16]. Visual function was measured objectively by clinical examination performed before the interview. When the patient was not attending school, the first item of the GQL-15 questionnaire “reading a newspaper” was replaced by “reading telephone numbers of the same size as in newspapers” since this group of patients can read numbers.

Patients were grouped into three categories based on the degree of central visual field loss: “mild” (defined as unilateral loss of less than 50% of the visual field), “moderate” (defined as unilateral loss of more than 50% of the visual field or bilateral loss with less than 50% loss in each eye), and “severe” (defined as bilateral loss with more than 50% loss in each eye) [17].

## 2.3. The 15-Item Glaucoma Quality of Life Questionnaire (GQL-15)

The GQL-15 questionnaire has been used to assess quality of life in glaucoma patients [14]. It is a specific instrument of 15 items measuring 4 aspects of visual health (subscales): central and near vision; peripheral vision; dark adaptation and glare; and outdoor mobility. With each item rated from 1 (best) to 5 (worst), while 0 is attributed if the participant does not perform the activity in question due to a non-visual cause. The total score was calculated by adding the values of the 15 items.

The scores of each subscale were obtained by calculating the average of the

values of the corresponding items after their transformation into a numerical interval scale ranging from 0 (no difficulty) to 100 (great difficulty).

The items corresponding to the different subscales were:

- Central and near vision: items 1 and 15;
- Peripheral vision: items 4, 8, 9, 11, 12, and 13;
- Glare and dark adaptation: items 2, 3, 5, 6, 7, and 14;
- Outdoor mobility: item 10.

Higher scores indicated greater difficulty in performing vision-related activities and lower Glaucoma-Related Quality of Life (GRQoL) [14].

## 2.4. Data Analysis

Questionnaires with missing data were excluded. The obtained data was entered and processed in Excel 2010. The scores of the four subscales and the total score of the GQL-15 were calculated. Descriptive statistics were used to describe the socio-demographic data, clinical data, and quality of life scores. Quantitative variables were presented as means and standard deviations. Qualitative variables were presented as percentages. Univariate analyses were used to determine the factors associated with quality of life using Analysis of Variance (ANOVA). Then, a multivariate analysis using stepwise multiple linear regressions was performed to determine the factors associated with the GQL-15 total score. The independent variables for the model were selected from the univariate analysis based on a threshold p-value of 0.20. Statistics were performed using the SPSS version 26.0 software package. Statistical significance is defined as  $p < 0.05$ .

## 2.5. Ethical Consideration

The study was approved by the Ethical Committee of Faculty of Medicine, Pharmacy and Dental medicine of Fes.

## 3. Results

### 3.1. Sociodemographic Characteristics

The sociodemographic characteristics of the 170 patients are illustrated in **Table 1**. Of a total of 170 glaucoma patients, sixty percent were women, and 56.5% had never attended school, while only 11.8% had completed secondary educational level. Most of the participants were over 60 years old (60.6%) and 85.3% had a monthly income not exceeding 2000 MAD. In addition, 73.5% had RAMED health insurance.

### 3.2. Clinical Characteristics

The most common glaucoma diagnoses were primary open-angle glaucoma (72.9%) and primary angle-closure glaucoma (17.6%). Patients who underwent early screening were 11.8%. Severe glaucoma was retained in the majority of patients (71.8%). Patients who applied two or more eye drops were the most frequent (63.5%). The full distribution of clinical characteristics in the study sample

**Table 1.** Sociodemographic characteristics of patients with glaucoma.

Variables	Number (%) (N = 170)	GQL-15 total score (Mean ± SD)	p-value
<b>Age, y</b>			<0.001
>60	103 (60.6)	42.20 ± 16.39	
≤60	67 (39.4)	33.08 ± 15.76	
<b>Gender</b>			0.457
Male	68 (40)	39.77 ± 16.86	
Female	102 (60)	37.81 ± 16.65	
<b>Marital status</b>			0.763
Unmarried	38 (22.4)	39.31 ± 16.40	
Married	132 (77.6)	38.38 ± 16.85	
<b>Live conditions</b>			0.693
Alone	7 (4.1)	36.14 ± 21.03	
Family living	163 (95.9)	38.69 ± 16.57	
<b>Educational level</b>			0.001
Illiterate	96 (56.5)	42.67 ± 16.10	
Primary	54 (31.8)	34.50 ± 16.72	
Secondary/University	20 (11.8)	29.57 ± 13.76	
<b>Employment status</b>			0.004
Unemployed	146 (85.9)	40.06 ± 16.44	
Employed	24 (14.1)	29.66 ± 15.84	
<b>Monthly income, MAD</b>			0.179
≤2000	145 (85.3)	39.42 ± 16.90	
2000 - 5000	18 (10.6)	35.05 ± 15.92	
>5000	7 (4.1)	20.50 ± 3.53	
<b>Health insurance</b>			0.012
Not insured	13 (7.6)	40.30 ± 19.06	
RAMED	125 (73.5)	40.40 ± 16.55	
Insured	32 (18.8)	30.58 ± 14.31	

GQL-15: 15-item Glaucoma Quality of Life questionnaire.

is presented in **Table 2**.

### 3.3. Vision-Related Quality of Life

The GQL-15 scores among glaucomatous patients in Fes are listed in **Table 3**. Vision-related QoL scores were lowest (better QoL) for central and near vision ( $36.13 \pm 31.19$ ), outdoor mobility ( $36.14 \pm 36.25$ ) and peripheral vision ( $37.52 \pm 31.33$ ), and highest (worst QoL) for dark and glare adaptation ( $43.03 \pm 27.26$ ).

**Table 2.** Clinical characteristics of patients with glaucoma.

Variables	Number (%) (N = 170)	GQL-15 total score (Mean ± SD)	<i>p</i> -value
<b>Medical and surgical history</b>			0.302
Absent	62 (36.5)	40.33 ± 17.73	
Present	108 (63.5)	37.57 ± 16.09	
<b>Type of glaucoma</b>			0.158
POAG	124 (72.9)	37.29 ± 16.56	
PACG	30 (17.6)	43.83 ± 17.56	
Other types	16 (9.4)	38.75 ± 15.21	
<b>Onset age, y</b>			<b>0.004</b>
<55	67 (39.4)	34.04 ± 15.95	
≥55	103 (60.6)	41.57 ± 16.59	
<b>Glaucoma early screening</b>			<b>0.001</b>
No	150 (88.2)	40.07 ± 16.33	
Yes	20 (11.8)	27.55 ± 15.70	
<b>Reduced visual acuity</b>			<b>0.007</b>
No	82 (48.2)	35.00 ± 16.15	
Yes	88 (51.8)	41.89 ± 16.62	
<b>Mist and halos</b>			0.343
No	119 (70)	37.79 ± 17.32	
Yes	51 (30)	40.48 ± 15.15	
<b>Glaucoma severity stage</b>			<b>&lt;0.001</b>
Mild/moderate	48 (28.2)	31.10 ± 15.53	
Severe	122 (71.8)	41.56 ± 16.28	
<b>Eye drops number/day (N = 156)</b>			<b>0.007</b>
Two drops or more	108 (63.5)	41.05 ± 17.05	
One drops	48 (28.2)	33.08 ± 15.39	
<b>Laser therapy (iridoplasty, trabeculoplasty), N = 157</b>			0.829
No	129 (82.2)	38.57 ± 17.03	
Yes	28 (17.8)	39.32 ± 14.45	

GQL-15: 15-item Glaucoma Quality of Life questionnaire; POAG: Primary Open-Angle Glaucoma; PCAG: Primary Closed-Angle Glaucoma.

### 3.4. Glaucoma-Related Quality of Life Associated Factors

Univariate analysis results revealed four sociodemographic factors associated with a better quality of life (lower GQL-15 total score): early age ( $p < 0.001$ ),

**Table 3.** Subscales and total score of GQL-15.

Score	Min	Max	Mean	SD
Central and near vision	0	100	36.13	31.19
Peripheral vision	0	100	37.52	31.33
Glare and dark adaptation	0	100	43.03	27.26
Outdoor mobility	0	100	36.14	36.25
GQL-15 total score	15	75	38.59	16.71

**Table 4.** Multivariate analysis (forward stepwise) of predictors for quality of life (GQL-15 total score) adjusted  $R^2 = 0.219$ .

Variables	$\beta$ coefficient	95% CI	p-value
<b>Age, y</b>			<b>0.014</b>
≤60	reference	-	-
>60	5.98	1.20 - 10.76	0.014
<b>Educational level</b>			<b>0.003</b>
Illiterate	reference	-	-
Primary	-6.37	-11.41 - -1.33	0.013
Secondary/University	-11.04	-18.31 - -3.78	0.003
<b>Glaucoma early screening</b>			<b>0.002</b>
No	reference	-	-
Yes	-11.31	-18.40 - -4.23	0.002
<b>Glaucoma severity stage</b>			<b>0.014</b>
Mild/Moderate	reference	-	-
Severe	8.09	2.92 - 13.27	0.002
<b>Number of eye-drops/day</b>			<b>0.011</b>
Two or more drops	reference	-	-
One drop	-6.47	-11.50 - -1.45	0.011

advanced educational level ( $p = 0.001$ ), employed patients ( $p = 0.004$ ) and patients with health insurance ( $p = 0.012$ ). In addition, five clinical factors in the univariate analysis were associated with better quality of life, including young age of onset ( $p = 0.004$ ), early detection of glaucoma ( $p = 0.001$ ), preserved visual acuity ( $p = 0.007$ ), mild or moderate glaucoma ( $p < 0.001$ ), and patients who applied single eye drop ( $p = 0.007$ ).

As shown in **Table 4**, multivariate analysis by stepwise multiple linear regression revealed that the items significantly associated with poorer glaucoma-related QoL (higher GQL-15 total score) were, advanced age ( $\beta = 5.98$ ; CI 95%: 1.20 - 10.76) and severe glaucoma ( $\beta = 8.09$ ; CI 95%: 2.92 - 13.27), while the items significantly associated with better glaucoma-related QoL (lower GQL-15 total score) were, advanced educational level (primary education:  $\beta = -6.37$ ; CI 95%: -11.41 -

-1.33 and secondary/university:  $\beta = -11.04$ ; CI 95%: -18.31 - -3.78 comparing with illiterate patients), early glaucoma detection ( $\beta = -11.31$ ; CI 95%: -18.40 - -4.23), and patients who applied single eye drop ( $\beta = -6.47$ ; CI 95%: -11.50 - -1.45), after adjustment for all variables.

#### 4. Discussion

Glaucoma is an ophthalmic disease that can severely affect patients' visual health, limiting their ability to live well, impacting their functionality, productivity, and overall quality of life. Glaucoma is also a chronic disease that progresses asymptotically over an extended period, requiring medical treatment, contributing significantly to healthcare costs [18].

In order to explore the relevant components of glaucoma QoL, this study assessed the QoL of patients with glaucoma in Morocco.

Overall, participants reported a mean total GQL-15 score of  $38.59 \pm 16.71$ . These results are consistent with those of a previous study of glaucoma patients in Manipal, India, where the mean quality of life score (GQL-15 total score) was 33.04 [19]. Slightly better results were found by Goldberg *et al.* [20] in a sample of Australian patients (mean total GQL-15 score of  $30.5 \pm 13.7$ ). Zhou *et al.* [21] and Wang *et al.* [22] in two other studies that reported a better QOL score (the mean total GQL-15 score was 28.79 ( $\pm 12.74$ ) and 29.12 ( $\pm 13.27$ ) respectively. Onakoya *et al.* [23] also reported a better glaucoma-related QOL in Nigerian patients, which had a mean total GQL-15 score of 24.07 ( $\pm 12.4$ ). The higher proportion of patients with severe glaucoma in the present study may explain the variation in Glaucoma related-QOL scores.

Furthermore, our results show that glaucoma patients had the greatest difficulties with the glare and darkness adaptation subscale of the GQL-15. These results are consistent with those of Goldberg *et al.*, Onakoya *et al.*, and Kusumgar *et al.* [19] [20] [23].

According to the study findings, there is a correlation between age and the GQL-15 score for quality of life, where younger patients had a better self-perceived visual ability. This aligns with the results of a previous studies, which also found that age had a negative effect on quality of life assessed by GQL-15 [19] [23]. However, this latter finding contradicts the findings of the Collaborative Initial Glaucoma Treatment Study (CIGTS) [11], which found that older age was associated with reduced functional disability. According to the CIGTS researchers, older patients had lower expectations about their visual health and hence reported fewer complaints than younger patients. But in our Moroccan context, these results can be explained by the over-expression of complaints by elderly patients during consultations in order to obtain better care from their point of view.

Higher level of education was found to have a positive influence on glaucoma-related QOL. This was consistent with the outcome from studies of Omoti *et al.* [24], Olurin *et al.* [25], and Kusumgar *et al.* [19]. Potential explanations for



these discrepancies may lie in several aspects. First, patients with a high education level have an earlier presentation with less severe glaucoma. However, they would have less visual dysfunction and therefore less impact on their QoL. In addition, patients with a high education level could also have a better understanding of the disease and be less anxious.

Early screening for glaucoma, as expected, was inversely associated with a GQL-15 total score (better QoL) in this study. While early screening for glaucoma can be seen as a triumph of medical care, it comes with serious challenges, such as reducing the progression of early asymptomatic glaucoma to complications and, most importantly, blindness. These challenges are not only for the glaucoma patients themselves, but also for society as a whole, which poses a heavy burden on public health. Early screening for glaucoma and reducing its progressive vision loss could explain its positive impact on quality of life [26].

Severity of glaucoma was significantly and positively associated with GQL-15 total scores, indicating that subjects with severe glaucoma reported poorer vision-related QoL than subjects with mild or moderate glaucoma. This latter finding was consistent with the extensive literature [19] [27] [28] [29] [30] showing that the GQL-15 total score generally reflected a trend of poorer G-QoL with increasing disease severity in patients with glaucoma.

The finding of a greater deterioration in glaucoma-related quality of life in patients using two or more eye drops per day compared to those using only one eye drop may be explained by the side effects of eye drops, especially when the number of eye drops used per day is high. Nordman *et al.* [31] showed that poor vision-related quality of life was associated with the presence of local side effects, leading to poor perceived satisfaction with treatment. Dissatisfied patients consult their ophthalmologist more frequently. Emerick *et al.* [32] revealed that difficulty using eye drops was strongly associated with a decrease in quality of life.

Some limitations should be acknowledged. First, only 22% of the variance in QoL could be explained in this study, suggesting either that other factors contributing to an optimal glaucoma-related QoL might be missing. Second, some of the data were self-reported, particularly those on glaucoma-related HRQoL, and therefore subjective, with the potential to be influenced by recall and personality factors. However, the study included objective measures of visual function to which they were compared, which may help to reduce them. Finally, the study participants were recruited from a tertiary health care facility, and their composition according to disease severity was relatively different. But grouping participants with mild glaucoma with those with moderate glaucoma in the statistical analysis increased the statistical power and provided further evidence of the relationship between disease severity and vision-related QoL.

The strengths of this study include a fairly robust sample size. At a sample size of 170 and with 9 variables included in the model of linear regression, the recommended minimum number of subjects per variable is exceeded. Austin *et al.* [33] carried out a series of simulations to identify the minimum number of par-

ticipants per variable required to estimate ordinary least squares linear regression models accurately. In addition, the types of glaucoma were not limited to the most prevalent type, which is Open-Angle Glaucoma (OAG). This led to the inclusion of a large number of patients with different types of visual impairment.

## 5. Conclusions

The study results revealed that the quality of life of glaucoma patients was impaired and that several factors were associated with impaired GRQoL. Older age and severe glaucoma were associated with poorer GRQoL, whereas higher education, early detection of the disease, and fewer eye drops were associated with higher GRQoL.

Early detection of glaucoma is more predictive of better GRQoL through interruption of its progression to more severe stages. This highlights the importance of early detection and treatment of glaucoma to limit its deleterious effects on vision-related quality of life.

## Conflicts of Interest

The authors declare no conflicts of interest.

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