

Health-Related Quality of Life and Self-Rated Health in Adults with Low Vision: An EQ-5D and EQ-VAS Assessment

Maja Belevska ^{1*}, Sotir Ropi ¹, Elena Krstevska-Kelepurovska ¹

¹ Higher Medical School University “St. Kliment Ohridski” Bitola, North Macedonia

Corresponding Author: Maja Belevska **E-mail:** maja.belevska@yahoo.com

Abstract

Objective: Low vision affects mobility, autonomy, social participation and work capacity, yet generic health-related quality of life (HRQoL) data in adults with low vision remain limited in South-Eastern Europe. This study assessed HRQoL and self-rated health in adults with low vision and compared ophthalmic subgroups with a control group.

Methods: This cross-sectional analytical study included 600 adults from urban and rural areas of North Macedonia: 450 adults with low vision and 150 controls with preserved vision. Cases comprised 150 participants with glaucoma, 150 with diabetic retinopathy and 150 with refractive anomalies. Participants were distributed across labour, clerical or administrative, agricultural and other occupations. HRQoL was assessed with the Serbian-language EQ-5D-3L and self-rated health with EQ-VAS.

Results: Moderate problems predominated in mobility (288/450, 64.0%), self-care (301/450, 66.9%), usual activities (293/450, 65.1%) and anxiety/depression (245/450, 54.4%) among low-vision cases. Most low-vision participants reported no pain/discomfort (359/450, 79.8%), although glaucoma showed more severe pain/discomfort than diabetic retinopathy ($\chi^2=11.101$, $p=0.0041$) and refractive anomalies ($\chi^2=11.401$, $p=0.0031$). Controls had better EQ-5D profiles than all low-vision groups across all five domains and in aggregate graded EQ-5D levels. Between diagnostic groups, no meaningful differences were observed for mobility, self-care, usual activities, anxiety/depression or aggregate EQ-5D levels. Derived EQ-VAS mean $\pm$ SD values were 62.1 $\pm$ 13.9 in glaucoma, 53.5 $\pm$ 14.8 in diabetic retinopathy, 60.1 $\pm$ 14.2 in refractive anomalies, 58.2 $\pm$ 15.2 in all low-vision cases and 71.3 $\pm$ 12.9 in controls. EQ-VAS distributions differed between glaucoma and diabetic retinopathy and between diabetic retinopathy and refractive anomalies, but not between glaucoma and refractive anomalies.

Conclusion: Adults with low vision had substantially poorer HRQoL and worse self-rated health than controls, with the greatest burden in mobility, self-care, usual activities and emotional wellbeing. These findings support integrated ophthalmic, rehabilitative, psychosocial and workplace-oriented interventions.

Keywords: low vision; visual impairment; health-related quality of life; EQ-5D; EQ-VAS; occupational health; glaucoma; diabetic retinopathy; refractive anomalies

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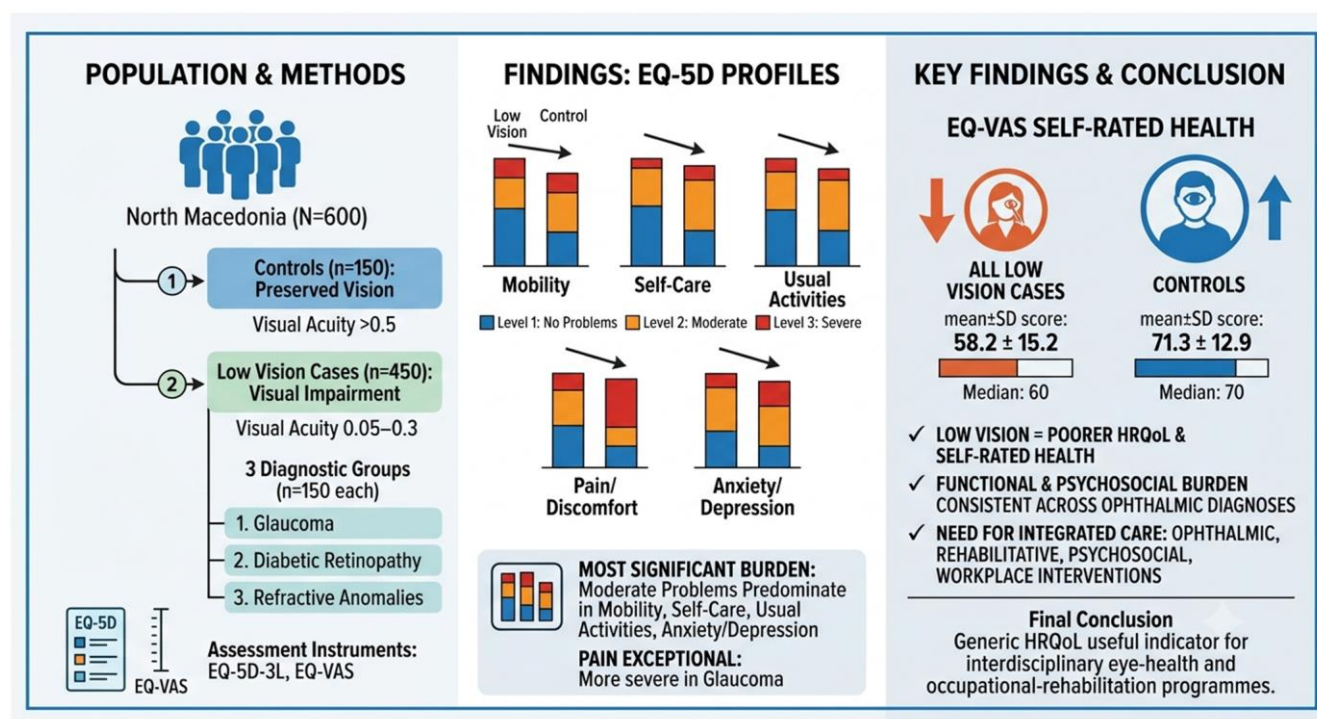
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Graphical Abstract



Highlights

- Significant HRQoL Deficit: Adults with low vision show substantially lower HRQoL and worse self-rated health than fully sighted controls.
- High Functional Burden: Limitations are heavily concentrated in mobility, self-care, and usual activities.
- Severe Psychological Strain: Nearly 30% of all low-vision patients experience severe anxiety or depression.
- Diagnostic Convergence: Functional and emotional burdens remain highly similar across different ophthalmic diagnoses.
- Ocular Pain in Glaucoma: Patients with glaucoma report significantly higher levels of severe pain and discomfort than other subgroups.
- Need for Multidisciplinary Care: Lived health status highlights the urgency for integrated ophthalmic, rehabilitative, and workplace interventions.

INTRODUCTION

Visual impairment remains a major global health and disability challenge. The World Health Organization estimates that at least 2.2 billion people live with near or distance vision impairment worldwide, and that at least 1 billion cases could have been prevented or remain unaddressed [1,2]. Global burden analyses also show persistent long-term burden from avoidable blindness and vision impairment [3,18]. Leading causes include refractive error, cataract, glaucoma, diabetic retinopathy and age-related macular degeneration [2,3].

From a biopsychosocial perspective, the consequences of low vision extend well beyond ophthalmic diagnosis. The International Classification of Functioning, Disability and Health conceptualises disability as an interaction between health condition, activity limitation, participation restriction and contextual factors [4]. For adults with visual impairment, this often translates into difficulties with mobility, self-care, work tasks, household roles and emotional wellbeing. Work participation is particularly important in adulthood because low vision may restrict job opportunities, reduce work ability and deepen social disadvantage [5].

Health-related quality of life provides a useful framework for quantifying these broader effects [6,7]. The EQ-5D is one of the most widely used generic preference-based HRQoL measures and permits comparison across diseases, populations and health-policy settings [8-13,19]. In its 3-level form, EQ-5D evaluates mobility, self-care, usual activities, pain/discomfort and anxiety/depression, while EQ-VAS records overall self-rated health [8-11,19]. Generic measures remain important in visual impairment research because they capture multidimensional burden in a form that is comparable with other chronic conditions and useful for service planning.

Occupational-health research has likewise shown that self-rated health and work ability reflect both disease burden and the interaction between individual capacity and job demands [5,14,15]. However, data from adults with low vision in South-Eastern Europe remain limited, particularly where ophthalmic and occupational contexts intersect. The present study therefore assessed generic HRQoL and self-rated health in adults with low vision using EQ-5D-3L and EQ-VAS, and compared outcomes across three ophthalmic diagnostic groups and a control group. We hypothesised that adults with low vision would report poorer HRQoL and worse self-rated health than controls, while selected domains might vary according to underlying ophthalmic disease.

MATERIAL and METHODS

Study design and setting

This cross-sectional analytical study was conducted in urban and rural areas of North Macedonia. The total sample comprised 600 participants, including 450 adults with low vision and 150 adults with preserved vision as controls. The study included both descriptive and analytical components. Visual function and visual acuity were established by ophthalmological examination using appropriate ophthalmic instrumentation, with classification referenced to ICD-10.

The manuscript was prepared in accordance with the STROBE statement for observational studies [20].

Participants

The low-vision sample consisted of three equally sized diagnostic groups: glaucoma (n=150), diabetic retinopathy (n=150) and refractive anomalies (n=150). The case group had visual acuity 0.05–0.3, whereas the control group had visual acuity >0.5. Participant selection was reported to follow inclusion criteria related to age, sex, profession, degree of visual impairment and ophthalmic diagnosis. Participants were identified through medical documentation and records from regional associations for blind and partially sighted persons and from the National Union of Blind and Partially Sighted Persons.

Occupational, demographic and educational variables

A study-specific questionnaire containing 28 items was used to collect socio-demographic data, social characteristics, lifestyle information and selected disease-history variables. Recorded variables included sex, age, place of residence, education and profession. Occupations were grouped as labourers/workers, clerical/administrative workers, agricultural workers and other occupations. In the low-vision cohort, occupational distribution was labourers 125/450 (27.8%), clerical/administrative 134/450 (29.8%), agricultural 76/450 (16.9%) and other 115/450 (25.6%). Occupational category was collected as a descriptive sociodemographic characteristic to describe the study population and baseline comparability. The original dataset did not include occupation-stratified EQ-5D or EQ-VAS analyses; therefore, occupation was not predefined as an analytical exposure variable in the present study.

HRQoL instruments

HRQoL was assessed with the Serbian-language version of the EQ-5D-3L. The dissertation specified the five EQ-5D dimensions as mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension had three response levels: level 1, no problems; level 2, moderate problems; and level 3, severe problems. Higher levels reflected poorer HRQoL. Self-rated health was assessed using EQ-VAS, scored from 0 to 100, where higher values indicated better self-perceived health [8-11,19]. In the source material, EQ-VAS results were reported in grouped deciles: 30%, 40%, 50%, 60%, 70%, 80% and 90%.

Statistical analysis

The source reported the use of Statistica for Windows 7.0 and SPSS 17.0. Categorical variables were summarised as counts and percentages. Continuous variables were described with means, medians, minima, maxima, interquartile ranges, standard deviations and standard errors, as appropriate. Pearson's chi-square test, Yates-corrected chi-square test and Fisher exact test were used for categorical comparisons. Pearson and Spearman correlation coefficients, Student's t-test, ANOVA and the Mann-Whitney U test were also described in the dissertation's general statistical plan. Statistical significance was set at $p < 0.05$. For the present manuscript, EQ-VAS mean $\pm$ SD values were estimated from grouped frequency distributions by assigning the midpoint value of each reported decile category (30%, 40%, 50%, 60%,

70%, 80% and 90%) to participants within that interval. These estimates are therefore presented explicitly as derived summary values.

Ethics statement

The study was conducted in accordance with the Declaration of Helsinki [16]. Written informed consent was obtained from all participants before inclusion in the study.

RESULTS

Sample characteristics

Of the 600 participants, 450 (75.0%) belonged to the low-vision group and 150 (25.0%) to the control group. The case sample was evenly distributed across glaucoma, diabetic retinopathy and refractive anomalies (150 participants each). Among cases, 240/450 (53.3%) were women and 210/450 (46.7%) were men, whereas controls were evenly divided by sex (75 women and 75 men). Most participants were older than 50 years: 337/450 (74.9%) in the low-vision group and 109/150 (72.7%) in the control group. Participants represented labourers/workers, clerical/administrative workers, agricultural workers and other occupations, reflecting a socioeconomically heterogeneous working-age population. Occupational categories were recorded solely to describe baseline characteristics of the study population and were not analysed as independent determinants of HRQoL outcomes. Sample characteristics are presented in **Table 1**.

EQ-5D domain profiles

Across the low-vision cohort, moderate problems were the most frequent response level in mobility (288/450, 64.0%), self-care (301/450, 66.9%), usual activities (293/450, 65.1%) and anxiety/depression (245/450, 54.4%). By contrast, controls most often reported no problems in mobility (133/150, 88.7%), self-care (133/150, 88.7%) and usual activities (129/150, 86.0%). For anxiety/depression, controls again performed better, with level 1 reported by 111/150 (74.0%) compared with 71/450 (15.8%) among all low-vision cases. Detailed EQ-5D distributions are shown in **Table 2**, and the main intergroup comparisons are shown in **Table 3**.

Mobility did not differ significantly across the three diagnostic groups, but all case groups differed significantly from controls. The same overall pattern was observed for self-care and usual activities. Pain/discomfort was the main exception to the otherwise similar disease-group pattern: glaucoma showed a greater burden of severe pain/discomfort than diabetic retinopathy and refractive anomalies. Anxiety/depression was common across all low-vision groups, with moderate problems predominating and severe problems present in approximately 29%–30% of participants in each disease group. When all EQ-5D responses were pooled across domains, the low-vision cohort showed 898/2250 (39.9%) level-1 responses, 1208/2250 (53.7%) level-2 responses and 144/2250 (6.4%) level-3 responses, compared with 650/750 (86.7%), 97/750 (12.9%) and 3/750 (0.4%) in controls. No significant sex differences were reported for EQ-5D domains within the disease groups or controls.

EQ-VAS self-rated health

According to the grouped EQ-VAS frequencies, low-vision participants rated their health between 30% and 90%, whereas controls rated health between 40% and 90%. In all low-vision cases combined, the most frequent EQ-VAS response was 60% (137/450, 30.4%), followed by 70% (97/450, 21.5%) and 40% (61/450, 13.6%). In controls, the modal value was 70% (42/150, 28.7%), followed by 80% (40/150, 26.7%) and 90% (23/150, 15.4%). Derived EQ-VAS frequencies and summary statistics are shown in **Table 4**; intergroup comparisons are shown in **Table 5**.

Table 1. Sample characteristics of the study population

Characteristic	Low-vision group	Control group	Total / notes
Total participants, n	450	150	600
Visual acuity criterion	0.05–0.3	>0.5	As reported in Methods
Glaucoma, n (%)	150 (33.3 of cases)	–	150
Diabetic retinopathy, n (%)	150 (33.3 of cases)	–	150
Refractive anomalies, n (%)	150 (33.3 of cases)	–	150
Men, n (%)	210 (46.7)	75 (50.0)	285 (47.5)
Women, n (%)	240 (53.3)	75 (50.0)	315 (52.5)
Age 20–50 years, n (%)	113 (25.1)	41 (27.3)	154 (25.7)
Age >50 years, n (%)	337 (74.9)	109 (72.7)	446 (74.3)
Occupation: labourers/workers	125 (27.8)	47 (31.3)	172 (28.7)
Occupation: clerical/administrative	134 (29.8)	39 (26.0)	173 (28.8)
Occupation: agricultural	76 (16.9)	21 (14.0)	97 (16.2)
Occupation: other	115 (25.6)	43 (28.7)	158 (26.3)

Between-group distributions for sex, age and profession were reported as not statistically different at baseline in the dissertation tables.

Table 2. EQ-5D-3L distributions by diagnostic group and controls

Domain	Glaucoma, n (%)	Diabetic retinopathy, n (%)	Refractive anomalies, n (%)	All low-vision cases, n (%)	Controls, n (%)
Mobility	L1 61 (40.7); L2 89 (59.3); L3 0	L1 50 (33.3); L2 100 (66.7); L3 0	L1 52 (34.0); L2 99 (66.0); L3 0	L1 162 (36.0); L2 288 (64.0); L3 0	L1 133 (88.7); L2 17 (11.3); L3 0
Self-care	L1 51 (34.0); L2 99 (66.0); L3 0	L1 49 (32.7); L2 101 (67.3); L3 0	L1 49 (32.7); L2 101 (67.3); L3 0	L1 149 (33.1); L2 301 (66.9); L3 0	L1 133 (88.7); L2 17 (11.3); L3 0
Usual activities	L1 56 (37.3); L2 94 (62.7); L3 0	L1 50 (33.3); L2 100 (66.7); L3 0	L1 51 (34.0); L2 99 (66.0); L3 0	L1 157 (34.9); L2 293 (65.1); L3 0	L1 129 (86.0); L2 21 (14.0); L3 0
Pain/discomfort	L1 110 (73.3); L2 30 (20.0); L3 10 (6.7)	L1 124 (82.7); L2 26 (17.3); L3 0	L1 125 (83.3); L2 25 (16.7); L3 0	L1 359 (79.8); L2 81 (18.0); L3 10 (2.2)	L1 144 (96.0); L2 6 (4.0); L3 0
Anxiety/depression	L1 23 (15.3); L2 82 (54.7); L3 45 (30.0)	L1 24 (16.0); L2 81 (54.0); L3 45 (30.0)	L1 24 (16.0); L2 82 (54.7); L3 44 (29.3)	L1 71 (15.8); L2 245 (54.4); L3 134 (29.8)	L1 111 (74.0); L2 36 (24.0); L3 3 (2.0)

L1 = no problems; L2 = moderate problems; L3 = severe problems. Minor typographical inconsistencies in source percentages were normalised to the printed counts where necessary.

Table 3. Key EQ-5D intergroup comparisons

Domain	Glaucoma vs diabetic retinopathy	Glaucoma vs refractive anomalies	Diabetic retinopathy vs refractive anomalies	Case-control comparisons
Mobility	$\chi^2=1.7303$, $p=0.1884$	$\chi^2=1.2454$, $p=0.2644$	$\chi^2=0.0409$, $p=0.8397$	Glaucoma vs control $\chi^2=75.627$, $p=0.0001$; diabetic retinopathy vs control $\chi^2=96.525$, $p=0.0001$; refractive anomalies vs control $\chi^2=93.428$, $p=0.0001$; all cases vs control $\chi^2=124.855$, $p=0.0001$
Self-care	$\chi^2=0.06$, $p=0.8065$	$\chi^2=0.06$, $p=0.8065$	$\chi^2=0$, $p=1.000$	Glaucoma vs control $\chi^2=94.509$, $p=0.0001$; diabetic retinopathy vs control $\chi^2=98.566$, $p=0.0001$; refractive anomalies vs control $\chi^2=98.566$, $p=0.0001$; all cases vs control $\chi^2=139.391$, $p=0.0001$
Usual activities	$\chi^2=0.525$, $p=0.4686$	$\chi^2=0.363$, $p=0.5467$	$\chi^2=0.015$, $p=0.9028$	Glaucoma vs control $\chi^2=75.144$, $p=0.0001$; diabetic retinopathy vs control $\chi^2=86.444$, $p=0.0001$; refractive anomalies vs control $\chi^2=84.501$, $p=0.0001$; all cases vs control $\chi^2=117.812$, $p=0.0001$
Pain/discomfort	$\chi^2=11.101$, $p=0.0041$	$\chi^2=11.401$, $p=0.0031$	$\chi^2=0.024$, $p=0.8778$	Glaucoma vs control $\chi^2=30.601$, $p=0.00001$; diabetic retinopathy vs control $\chi^2=13.993$, $p=0.0001$; refractive anomalies vs control $\chi^2=12.987$, $p=0.0003$; all cases vs control $\chi^2=22.101$, $p=0.00001$
Anxiety/depression	$\chi^2=0.274$, $p=0.986$	$\chi^2=0.325$, $p=0.984$	$\chi^2=0.174$, $p=0.991$	Glaucoma vs control $\chi^2=112.014$, $p=0.0001$; diabetic retinopathy vs control $\chi^2=110.102$, $p=0.0001$; refractive anomalies vs control $\chi^2=110.211$, $p=0.0001$; all cases vs control $\chi^2=186.302$, $p=0.0001$
Aggregate graded EQ-5D levels	$\chi^2=1.691$, $p=0.430$	$\chi^2=1.773$, $p=0.413$	$\chi^2=0.312$, $p=0.985$	Fisher exact two-tailed: all case-control comparisons $p=0.00001$

Aggregate graded EQ-5D levels pooled all response levels across the five EQ-5D domains.

Table 4. EQ-VAS frequencies and derived summary statistics

Group	30%	40%	50%	60%	70%	80%	90%	Derived mean $\pm$ SD
Glaucoma	4	15	22	46	37	19	7	62.1 $\pm$ 13.9
Diabetic retinopathy	18	32	24	43	23	8	2	53.5 $\pm$ 14.8
Refractive anomalies	10	14	21	48	37	17	3	60.1 $\pm$ 14.2
All low-vision cases	41	61	58	137	97	44	12	58.2 $\pm$ 15.2
Controls	0	6	9	30	42	40	23	71.3 $\pm$ 12.9

Mean $\pm$ SD values were derived from grouped EQ-VAS frequencies reported in the source tables and were not printed directly in that form in the dissertation.

Table 5. EQ-VAS chi-square comparisons

Comparison	χ^2	df	p
Glaucoma vs diabetic retinopathy	25.8	6	0.00001
Glaucoma vs refractive anomalies	4.38	6	0.635
Diabetic retinopathy vs refractive anomalies	16.5	6	0.011
Glaucoma vs controls	33.2	6	0.00001
Diabetic retinopathy vs controls	89.4	6	0.00001
Refractive anomalies vs controls	47.1	6	0.00001
All low-vision cases vs controls	87.9	6	0.00001

No significant sex differences were reported for EQ-VAS distribution within glaucoma, diabetic retinopathy, refractive anomalies or controls.

DISCUSSION

This study shows that adults with low vision had substantially poorer generic HRQoL and worse self-rated health than controls across every EQ-5D domain examined. The pattern was consistent: most participants with low vision reported moderate limitations in mobility, self-care and usual activities, while emotional burden was also prominent, with severe anxiety/depression present in 134/450 (29.8%) of all low-vision cases. These findings are consistent with broader evidence that the impact of visual impairment extends beyond loss of acuity to participation, functioning, psychosocial wellbeing and social inclusion [1-5,17,18].

A notable finding was the relative similarity among the three ophthalmic case groups in most EQ-5D domains. Mobility, self-care, usual activities, anxiety/depression and aggregate graded EQ-5D levels were broadly comparable across glaucoma, diabetic retinopathy and refractive anomalies. This pattern is clinically plausible and consistent with the logic of generic HRQoL measurement, which is designed to capture lived health status rather than disease-specific symptom profiles alone [8-13,19]. Once visual loss reaches the low-vision range used in this study, the functional burden of impairment may converge across different ophthalmic diagnoses.

Pain/discomfort was the main exception. Participants with glaucoma were more likely to report severe pain/discomfort than those with diabetic retinopathy or refractive anomalies. Although EQ-5D is not disease-specific, this domain appeared sufficiently sensitive to capture a clinically relevant distinction that may reflect ocular discomfort, symptom burden, medication burden or recurrent treatment demands. The EQ-VAS findings reinforce the EQ-5D results: self-rated health was markedly lower in all low-vision cases than in controls, and diabetic retinopathy showed the lowest derived mean among the ophthalmic groups.

This may reflect the broader systemic burden of diabetes, which can influence global health perception beyond visual function alone.

The study population included participants from diverse occupational backgrounds, providing a heterogeneous working-age sample. Occupational category was collected to characterise the study population and ensure baseline comparability rather than to evaluate occupation-specific differences in HRQoL. Consequently, the present analyses focused on ophthalmic diagnostic groups rather than occupational subgroup comparisons. Poor HRQoL and reduced self-rated health were consistently observed across this occupationally heterogeneous sample, supporting the broader functional impact of low vision irrespective of occupational background. Future studies should investigate occupation-specific differences in HRQoL and determine whether occupational demands modify the relationship between visual impairment and health-related quality of life [5,14,15].

This study has several strengths. It included a relatively large sample, balanced diagnostic case groups and an internal control group. It used a standardised generic HRQoL instrument and preserved detailed tabulated frequencies and formal intergroup comparisons. Important limitations must also be acknowledged. First, the cross-sectional design precludes causal inference. Second, occupation was described but not fully modelled analytically in relation to HRQoL outcomes. Third, EQ-VAS means and standard deviations were derived from grouped source frequencies rather than printed directly in the source tables. Finally, a small number of source-table percentages appeared typographically inconsistent with the printed counts; in the present manuscript, counts were prioritised where percentages required normalisation. Future longitudinal studies should evaluate

temporal changes in HRQoL following ophthalmological treatment, low-vision rehabilitation and workplace adaptation. In addition, occupation-specific analyses should determine whether different occupational demands modify the relationship between visual impairment and health-related quality of life.

Overall, the findings support a model of care that integrates ophthalmology, low-vision rehabilitation, psychosocial support and workplace adaptation. Screening and treatment alone are insufficient if adults with low vision continue to experience unaddressed limitations in daily activities, mental wellbeing and work participation. Generic HRQoL measures such as EQ-5D and EQ-VAS may therefore be useful outcome indicators for interdisciplinary eye-health and occupational-rehabilitation programmes [17,18].

CONCLUSION

Adults with low vision had significantly poorer HRQoL and self-rated health than controls across all EQ-5D domains and on EQ-VAS. Moderate impairment predominated in mobility, self-care, usual activities and anxiety/depression, while pain/discomfort was particularly worse in glaucoma. Differences between ophthalmic subgroups were generally limited, suggesting that the functional and psychosocial burden of low vision may outweigh disease-specific distinctions in generic HRQoL once impairment is established. These findings support integrated ophthalmic, rehabilitative, psychosocial and workplace-oriented interventions for adults with low vision.

Acknowledgement

None.

Conflicts of Interest

None of the authors have any conflict of interest or financial ties to disclose.

Ethical Considerations

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions.

Authors' Contribution

Conceptualization: MB, SR, EKK

Data curation: MB

Formal analysis: MB, SR, EKK

Funding Acquisition: –

Investigation: MB, SR, EKK

Methodology: MB

Statistics: MB

Project administration: MB

Supervision: MB

Validation: MB, SR, EKK

Visualization: MB

Writing – original draft: MB

Writing – review & editing: MB, SR, EKK

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