Acta Biomed 2022; Vol. 93, N. 6: e2022299 DOI: 10.23750/abm.v93i6.13580

Original article

Assessing the quality of life in age-related macular degeneration patients: A cross-sectional study in Kazakhstan

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Abstract. *Aim:* The goal of this study was to assess Vision-Related Quality of Life (VRQoL) in patients with Age-Related Macular Degeneration (AMD) and identify its significant predictors. *Methods*: 458 AMD patients from four eye clinics in three major cities of Kazakhstan were recruited for this study. Data were collected using a structured questionnaire on sociodemographic and visual information and the National Eye Institute-Visual Function Questionnaire-39 (NEI-VFQ-39). *Results:* The study sample included 181 male patients who were 64.9 years on average (SD±8.4), and 277 female patients who were 68.7 years on average (SD±10.7). The majority of patients had stage 2 (43.7%) or stage 3 (40.2%) AMD according to the Age-Related Eye Disease Study (AREDS) classification. The mean (SD) NEI-VFQ-39 total score was 58.0 (23.8), range (9.8 - 100). The multiple linear regression model showed that the VRQoL of AMD patients correlated with the AMD stage according to the AREDS classification, age of the patients, visual acuity, number of years since the AMD diagnosis, and the city of residence. *Conclusions:* AMD causes severe vision impairment and daily functioning problems, reducing the quality of life of patients. To diagnose and treat degenerative eye disorders at an early stage, it is essential to inform patients about regular ophthalmological checkups to diagnose and treat degenerative eye disorders at an early stage. (www.actabiomedica.it)

Key words: macular degeneration; eye diseases; health-related quality of life; perceived social support

Introduction

Age-related macular degeneration (AMD) is a progressive eye disease that primarily affects the central retina, and is one of the leading causes of blindness among adults over the age of 60 (1). The incidence and prevalence of AMD are expected to increase significantly over the next decade as the population ages (2). The situation in the Republic of Kazakhstan may be compared to the general trend of demographic aging. Kazakhstan's population of people 65 and over will nearly double by 2050 (from 1.4 million to 3.4 million people), and their share of the population will rise from 7.5% in 2019 to more than 14% by 2050 (3). AMD is becoming a major public health challenge as life expectancy increases.

The progression of visual impairment caused by AMD may be slow or rapid, depending on the type and stage of the disease (4). Vision loss reduces an individual's ability to perform everyday tasks, increases dependency on others, and results in physical and emotional degeneration (5). The studies have shown that AMD negatively impacts the quality of life (QoL) (6–9). In addition to affecting the patient's QoL, AMD impacts the family members as well since routine tasks are difficult to perform (10). The QoL of patients with

AMD is essential for study and analysis, especially in the context of their place of residence, availability, and reliability of social support.

There are three major cities in Kazakhstan, each with a different level of city development, and culture. Almaty and Shymkent are the hubs of the Southern macro-region, and Nur-Sultan is the hub of the Northern macro-region (11). Nur-Sultan is an expanding young capital of the country, and its population has grown due to internal labor migration since 1998, especially from Almaty and Shymkent (11). Despite extensive research on the QoL of AMD patients in well-developed countries, there is no data exploring the QoL of AMD patients in Kazakhstan, and comparing it between different cities. Social surroundings and influence, everyday activities, and the cultures of different communities may cause patients to experience the same disease differently (12).

In a routine medical appointment, aspects of daily living activities and well-being are rarely discussed (13). In order to measure the impact of eye disorders on health-related QoL (HRQoL) and, vision-related QoL (VRQoL), patient-reported outcomes have been collected through questionnaires (14). The National Eye Institute-Visual Function Questionnaire (NEI-VFQ) was developed to evaluate the QoL of people with eye diseases such as strabismus, keratoconus, cataracts, glaucoma, and AMD (15–19). In a recent study on Chinese patients, NEI-VFQ results showed that AMD patients reported a lower VRQoL compared to other ophthalmological patients with refractive error, keratoconus, and senile cataracts (20).

The goal of this study was to assess VRQoL in patients with AMD and identify its significant predictors.

Materials and methods

Study design and sample

This is a descriptive, cross-sectional study with simple random sampling. We recruited 562 patients with AMD from eye clinics in three major cities of Kazakhstan: Kazakh Research Institute of Eye Diseases (Almaty), Raevskyi Laser Center (Almaty), Mediker Clinic (Shymkent), and the Hospital of the Medical Center of the Administration of the President of the Republic of Kazakhstan (Nur-Sultan). All patients with AMD were randomly invited to participate in the study.

The study recruited patients who consented and met the inclusion criteria. The inclusion criteria: age greater than 30, stage 2-4 AMD according to the Age-Related Eye Disease Study (AREDS) staging (21), ability to speak and understand Russian or Kazakh, absence of any other visual diseases, and willingness to participate.

The study was approved by the Local Ethics Committee of the Kazakh Medical University of Continuing Education, by the Local Ethics Committee of the Asfendiyarov Kazakh National Medical University and followed the Declaration of Helsinki guidelines. Study details were explained to all participants, and they signed an informed consent form.

Assessment instruments

We used a structured questionnaire to collect socio-demographic and visual data. All patients completed the NEI-VFQ questionnaire and answered two yes/no questions regarding social support availability and reliability.

The structured questionnaire had two sections. The first section included individual demographic variables, such as age, gender, race, education level, and city of residence. A second section included visual variables such as visual acuity assessed with a Snellen chart or Sivtsev table, AMD stage according to the AREDS classification, and years from AMD diagnosis. Based on the patient's medical record, the interviewer completed the second section. Using World Health Organization (WHO) guidelines, patients were classified into four groups based on their visual acuity: normal: 0.7-1; mild: 0.4-0.6; moderate: 0.2-0.3; severe: less than or equal to 0.1 (22).

There are two versions of the NEI-VFQ. There is a shorter version (NEI-VFQ-25) and a longer one (NEI-VFQ-39). NEI-VFQ-39 has 39 questions, 25 in the main section and 14 additional questions with multiple choice answers. It took on average 10 minutes to complete in the interviewer format. The scoring of the questionnaire was a two-step process. The first step was to convert each answer to a 0 to 100 scale, with a

higher score indicating better functioning. In step two, the 12 sub-scale scores were calculated by averaging the items from each sub-scale. An overall composite score for the NEI-VFQ-39 was calculated by averaging the vision-targeted subscale scores, excluding the general health rating question.

The NEI-VFQ-39 was translated and cross-culturally adapted in five stages: translation into Kazakh and Russian, synthesis of the translation, back translation, expert committee consensus, and pretest of the final draft. The instrument was translated to Kazakh by two native Kazakh speakers: one is a health professional with experience in ophthalmology, and the other is not a health professional. The instrument was translated to Russian by two native Russian speakers: one is a health professional with experience in ophthalmology, and the other is not a health professional. A draft of each version was produced after the translators and authors discussed the translation outcomes. Two English speakers have translated Kazakh NEI-VFQ-39 back into English, neither of whom had prior knowledge of the original. Two other English speakers translated Russian NEI-VFQ-39 back into English, neither of whom had any prior knowledge of the original. Experts reviewed a report prepared by the researcher's team detailing the differences between the translations, reverse translations, and original versions in order to establish consensus. The second draft of each version was produced after translators and authors discussed translation outcomes. In making its decisions, the committee attempted to ensure semantic, idiomatic, experimental, and conceptual equality between the versions. A final version was tested on 15 Kazakh speakers and 15 Russian speakers to determine if they had any difficulties understanding the items. Following a consensus of 84.9%, the Kazakh NEI-VFQ-39 and Russian NEI-VFQ-39 were developed. These versions of the questionnaire were filled out by participants in the study.

Statistical analyses

Software

IBM SPSS for Windows (version 21.0, SPSS INC., Chicago, IL, USA) statistical software was used to analyze the data.

Independent variables analysis

Descriptive statistics were calculated to present independent variables. For continuous data, mean and standard deviation; for categorical data, frequency and percentage were presented.

Dependent variables analysis

Dependent variables were presented using descriptive statistics, mean and standard deviation. VRQoL of patients assessed by the NEI-VFQ-39 total score and its subscale scores at the recruitment was the primary outcome measure. 12 sub-scale scores were calculated as an average of all answers in each sub-scale section.

Association between the vision-related QoL and other independent variables

In order to identify significant factors associated with VRQoL in AMD patients, a multiple linear regression analysis was conducted. Each linear regression was tested for normality, and robust regression models were used if normality was violated. A cut-off of $p<0.05$ was used to assess statistical significance. Anova analysis was used to compare mean values between the groups.

Results

Sociodemographic and clinical characteristics

Among 562 approached patients, 98 patients did not meet the inclusion criteria. 464 patients met the inclusion criteria, and complete data on 458 patients were included in the final analysis. Eight patients either did not finish the interview or did not answer questions regarding social support and its reliability.

Table 1 presents the descriptive characteristics of the sample. The study sample included 181 male patients who were 64.9 years on average (SD±8.4), and 277 female patients who were 68.7 years on average (SD±10.7).

Table 1. Characteristics of the study participants (n=458).

Variable n (%) / Mean (±SD)	Total Study Population (n=458)	Almaty (n=186 40.6%)	Nursultan (n=121 26.4%)	Shymkent (n=151 33.0%)
Age	9 (2.0)	4 (2.2)	2 (1.7)	3 (2.0)
< 35	20 (4.4)	9 (4.8)	8 (6.6)	3 (2.0)
35-44	53 (11.6)	13 (7.0)	31 (25.6)	9 (6.0)
45-54	112 (24.5)	33 (17.7)	64 (52.9)	15 (9.9)
55-64	128 (27.9)	64 (34.4)	10 (8.3)	54 (35.8)
65-74	108 (23.6)	51 (27.4)	6 (5)	51 (33.8)
75-84	28 (6.1)	12 (6.5)	0 (0)	16 (10.6)
≥85				
Gender	153 (33.4)	54 (29.0)	52 (43.0)	47 (31.1)
Female	305 (66.6)	132 (71.0)	69 (57.0)	104 (68.9)
Race	277 (60.5)	111 (59.7)	84 (69.4)	82 (54.3)
Asian	181 (39.5)	75 (40.3)	37 (30.6)	69 (45.7)
White				
Education Level	47 (10.3)	21 (11.3)	4 (3.3)	22 (14.6)
High school	146 (31.9)	63 (33.9)	32 (26.4)	51 (33.8)
Technical / Special degree or Not completed bachelor's degree	265 (57.9)	102 (54.8)	85 (70.2)	78 (51.7)
Bachelor's degree or Graduate degree				
Social Support	395 (86.2)	173 (93.0)	105 (86.8)	117 (77.5)
Yes	63 (13.8)	13 (7.0)	16 (13.2)	34 (22.5)
No				
Reliability of Social Support	353 (77.1)	156 (83.9)	100 (82.6)	97 (64.2)
Yes	105 (22.9)	30 (16.1)	21 (17.4)	54 (35.8)
No				
AREDS stage	200 (43.7)	60 (32.3)	92 (76.0)	48 (31.8)
2	184 (40.2)	91 (48.9)	22 (18.2)	71 (47.0)
3	74 (16.2)	35 (18.8)	7 (5.8)	32 (21.2)
4				
Years since AMD diagnosis)	2.97 (±1.45)	3.09 (±1.34)	2.56 (±1.34)	3.14 (1.62)
Visual Acuity	6 (1.3)	2 (1.1)	-	4 (2.6)
≤0.1	39 (8.5)	21 (11.3)	2 (1.7)	16 (10.6)
0.2-0.3	221 (48.3)	98 (52.7)	30 (24.8)	93 (61.6)
0.4-0.6	192 (41.9)	65 (34.9)	89 (73.6)	38 (25.2)
0.7-1				

SD – standard deviation; Q1 – quartile 1; Q3 – quartile 3.

VRQoL of AMD patients

The mean (SD) NEI-VFQ-39 total score was 58.0 (23.8), range (9.8 - 100). Mean (SD) subscale scores varied from 39.8 (29.5) for the General Health subscale to 70.4 (26.8) for the Ocular Pain subscale. Table 2 presents a descriptive analysis of the NEI-VFQ-39 total score and subscale scores.

Factors associated with the VRQoL of AMD patients

The multiple linear regression model showed that the VRQoL of AMD patients correlated with the AMD stage according to the AREDS classification, age of the patients, visual acuity, number of years since the AMD diagnosis, and the city of residence. Results of the model are presented in Table 3. This model

Table 2. Descriptive analysis of the NEI-VFQ-39 total score and subscale scores.

Subscales of the NEI-VFQ-39	Mean (SD)	Range	Number of cases analyzed
General Health	39.8 (29.5)	0 - 100	458
General Vision	54.7 (21.9)	10 - 100	458
Ocular pain	70.4 (26.8)	0 - 100	458
Near Activity	52.4 (28.4)	8.3 - 100	458
Distance Activity	55.4 (28.7)	4.2 - 100	458
VS Social Functioning	59.6 (29.0)	0 - 100	458
VS Mental Health	56.7 (26.0)	0 - 100	458
VS Role Difficulties	56.9 (28.9)	0 - 100	458
VS Dependency	58.4 (27.3)	0 - 100	458
Driving	65.8 (37.2)	0 - 100	120
Color Vision	61.2 (31.2)	0 - 100	458
Peripheral Vision	56.7 (30.8)	0 - 100	458
Total Score	**58.0 (23.8)**	**9.8 - 100**	**458**

NEI-VFQ-39 - The National Eye Institute-Visual Function Questionnaire-25; Q1 – 25th percentile; Q3 – 75th percentile; VS – vision specific.

Table 3. Multiple linear regression model between the VRQoL (NEI-VFQ-39 total score) and independent variables.

NEI-VFQ-39	Coefficient	SE	t	p	95% CI	
AREDS stage	-14.55	1.51	-9.65	0.00	-17.51	-11.57
Age group	-3.87	0.81	-4.80	0.00	-5.45	-2.28
City	3.44	0.94	3.68	0.00	1.60	5.28
Visual Acuity	15.36	5.29	2.91	0.04	4.97	25.75
Years since AMD diagnosis	-1.51	0.65	-2.34	0.02	-2.78	-0.24

AMD – age-related macular degeneration; AREDS - Age-Related Eye Disease Study; CI – confidence interval; NEI-VFQ-39 - The National Eye Institute-Visual Function Questionnaire-25; SE – spherical equivalent; VRQoL – vision-related quality of life.

showed that the gender, race, education level, social support, and reliability of social support were not significantly correlated with the VRQoL.

NEI-VFQ-39 total score and subscale scores by AMD stage (AREDS classification)

The mean (SD) NEI-VFQ-39 total scores by AMD stage were 35.1 (15.5) for stage 4 AREDS, 49.1 (17.7) for stage 3 AREDS, and 74.8 (19.2) for stage 2 AREDS patients. The subscale scores varied from 0 (0) (Driving) to 65.0 (30.3) (Ocular Pain) among AMD patients with stage 4 AREDS; from 31.8 (23.5) (General Health) to 65.2 (28.4) (Ocular Pain) among AMD patients with stage 3 AREDS; and from 54.4 (30.7) (General Health) to 81.2 (25.3) (Driving) among AMD patients with stage 2 AREDS. Mean NEI-VFQ-39 scores by AMD stage are presented in Figure 1.

NEI-VFQ-39 total score and subscale scores by age groups

The mean (SD) NEI-VFQ-39 total scores by age groups varied from 29.9 (15.8) among patients that aged 85 and older to 80.3 (19.6) among patients aged 45-54. Among subscales, Driving had the highest range for the mean score from 5.9 (24.2) for patients

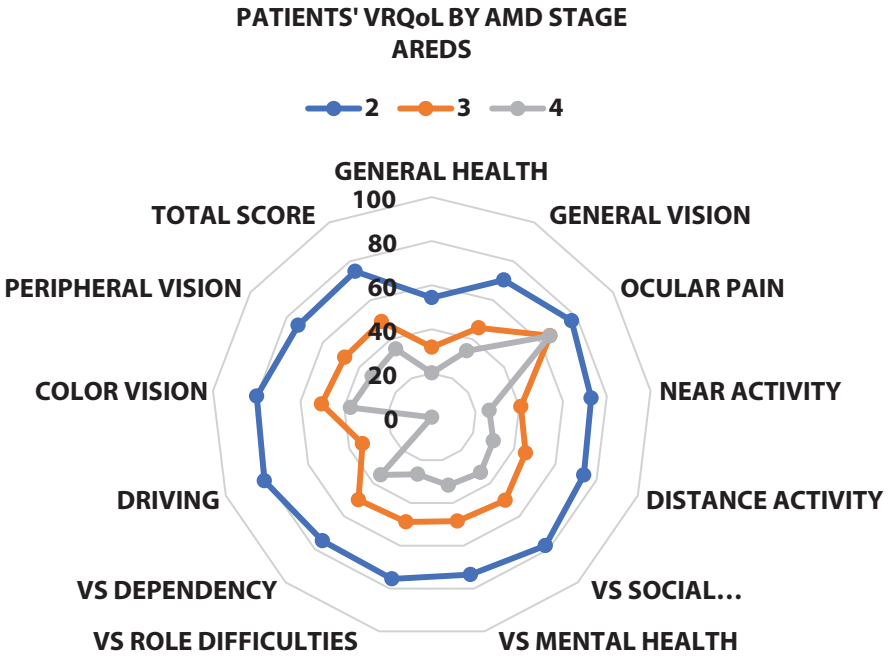

Figure 1. NEI-VFQ-39 total score and subscale scores by AMD stage. Abbreviations: AMD - Age-Related Macular Degeneration; AREDS - Age-Related Eye Disease Study; NEI-VFQ-39 - National Eye Institute-Visual Function Questionnaire-39; VRQoL – vision related quality of life VS – Vision specific;

aged 75 – 84, to 95 (7.5) for patients aged <35. No patients age 85 and older were driving at the recruitment to the study. There were no AMD patients under 45 years of age who had stage 4 AREDS. AMD patients over 85 years of age had stage 3 or stage 4 disease according to the AREDS classification. The mean NEI-VFQ-39 scores by age groups adjusted by AMD stage of patients are presented in Figure 2.

NEI-VFQ-39 total score and subscale scores by the city of residence

The mean (SD) NEI-VFQ-39 total scores by the city of residence were 44.7 (17.5) in Shymkent, 54.4 (20.5) in Almaty, and 80.3 (19.6) in Nur-Sultan. In Shymkent, the mean scores per subscale varied from 26.0 (34.6) (Driving) to 68.5 (29.7) (Ocular Pain). In Almaty, the mean scores per subscales varied from 34.6 (28.7) (General Health) to 67.2 (25.3) (Ocular Pain). In Nur-Sultan, the mean scores per subscale varied from the mean scores per subscale varied from 59.1 (29.9) (General Health) to 86.2 (19.9) (Color Vision).

Figure 3 presents the comparison between the city of residence and the mean NEI-VFQ-39 total score and subscale scores adjusted by visual acuity. Compared to the same group of patients in Almaty with severe visual impairment or blindness, patients with severe visual impairment or blindness in Shymkent scored higher on the mean scores of the following subsclaes: Distance Activity 8.7 (5.3) versus 13.3 (10.8), Vision Specific Social Functioning 4.2 (5.9) versus 16.7 (9.6), Vision Specific Role Difficulties 6.2 (8.8) versus 17.2 (26.7) and Vision Specific Dependency 6.2 (8.8) versus 23.44 (29.9).

Discussion

This study shows that AMD patients have a low quality of life-related to the city of the patient's residence, age, stage, visual acuity, and years since AMD diagnosis. Social support and reliability of social support in the presence of other factors were not statistically significant predictors of the quality of life of AMD patients.

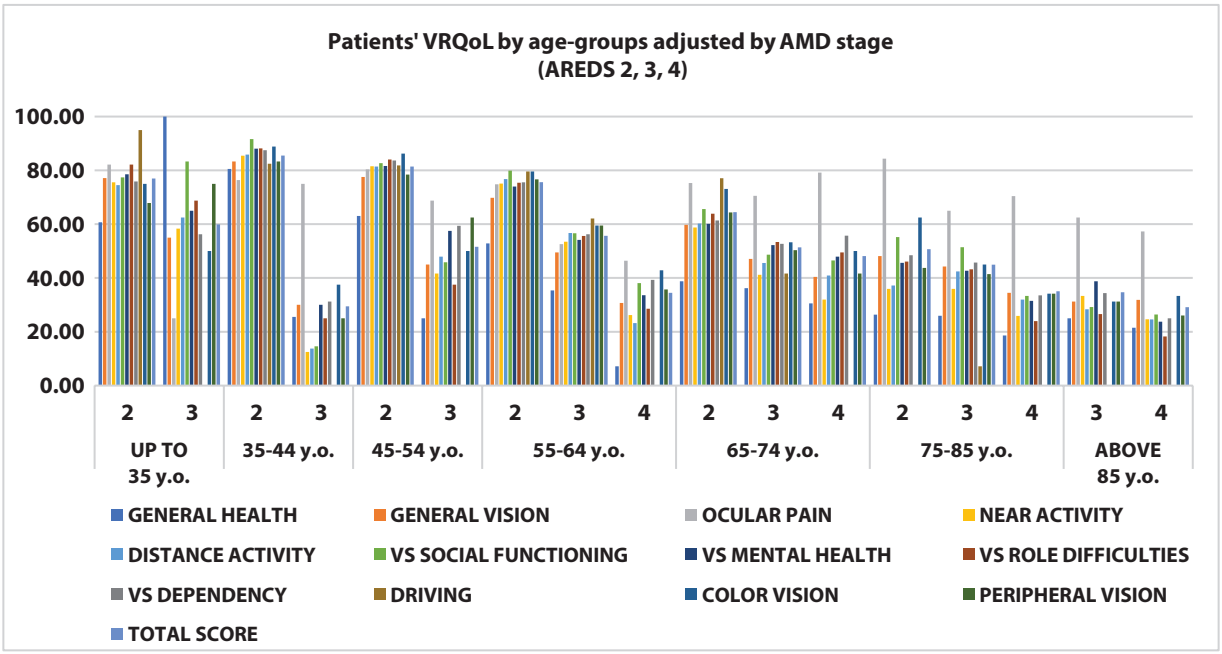

Figure 2. NEI-VFQ-39 total score and subscale scores by age groups adjusted by AMD stage. Abbreviations: AMD - Age-Related Macular Degeneration; AREDS - Age-Related Eye Disease Study; NEI-VFQ-39 - National Eye Institute-Visual Function Questionnaire-39; VRQoL – vision related quality of life; VS – Vision specific; y.o. – years old.

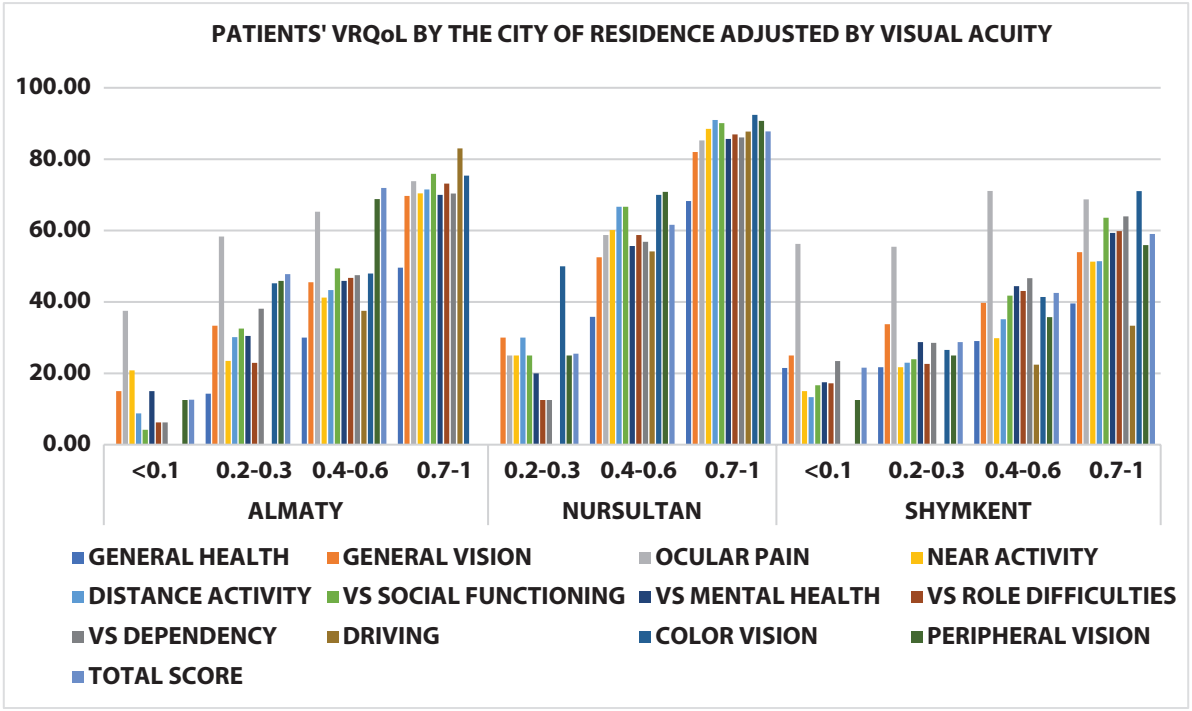

Figure 3. NEI-VFQ-39 total score and subscale scores by the city of residence adjusted by visual acuity. Abbreviations: AMD - Age-Related Macular Degeneration; NEI-VFQ-39 - National Eye Institute-Visual Function Questionnaire-39; VRQoL – vision related quality of life; VS – Vision specific.

We found a significant reduction in QoL of AMD patients in Kazakhstan based on the mean NEI-VFQ total score of 58.0 (23.8). In Kazakhstan, AMD patients have a lower NEI-VFQ total score than patients in Europe, the United States, Canada, or China (7,8,20,23–25). The recent healthcare, economic, political, and social situation, both locally and globally, may have contributed to this finding.

Our results indicate that the mean values of the NEI-VFQ-39 total score were highest in Nur-Sultan, and lowest in Shymkent, and their difference was statistically significant. Furthermore, the city of residence was an influential determinant of the VRQoL of AMD patients, according to the multiple regression analysis. These results confirm that the place of residence is a significant predictor of QoL in patients with AMD, or other chronic diseases (26) (12).

An analysis of 1139 patients from two different randomized clinical trials examined and confirmed the responsiveness of NEI-VFQ-39 scores to vision-related function in AMD patients (27). Our results also confirm that patients with AMD have a higher VRQoL with better visual acuity, and it is a significant predictor. Additionally, patients from Nur-Sultan and Almaty had higher mean values of visual acuity than those from Shymkent.

The number of chronic diseases increases with age, and this lowers QoL, but Sella and co-authors report that QoL doesn't vary with age in healthy elderly people (28). The authors of this study think that it is very important to mention that 6.6% of this study population were under the age of 45, and most of them were residents of Almaty and Nur-Sultan. Ophthalmology visits and regular medical check-ups, which are more common in Nur-Sultan and Almaty, are crucial to early diagnosis and adequate treatment of the degenerative process in the eyes. Nevertheless, our results are similar to previous studies that showed that higher age was a significant predictor of a lower QoL (29).

The wet form of AMD was excluded from other studies that examined the QoL of AMD patients because of the rapid progression (29). We used AREDS classification to determine the stage of AMD progression, including patients with the wet form of AMD (stage 4 AREDS), which may contribute to our finding that the stage is a significant predictor of lower QoL in AMD patients. In our study, a high percentage of AMD patients had stage 4 disease based on AREDS classification (18.8% in Almaty and 21.2% in Shymkent). This may be explained in part by the following factors:

1. In the southern region of the country (Almaty and Shymkent), seeking medical care is usually postponed.

2. Patients from different eye clinics are often referred to the eye clinics included in the study because they offer comprehensive eye examinations and treatment programs. Furthermore, the majority of patients with complex cases all over the country are referred to the Kazakh Research Institute of Eye Diseases in Almaty.

Even though AMD is usually not associated with ocular pain, the mean score on the Ocular Pain subscale was 70.4 (26.8), ranging from 0 to 100. Questions from the Ocular Pain subscale on the NEI-VFQ-39 focused on eye pain and discomfort. Translation and cross-cultural validation of the NEI-VFQ-39 aimed to maintain semantic, idiomatic, experimental, and conceptual equality between original and translated versions. The authors assume that patients responded to discomfort in and around their eyes, which may have been caused by dry eye syndrome.

In this study, the authors aimed to determine whether patients thought they could rely on their social support person/persons and whether this affected their VRQoL. This study did not aim to examine the strength of social support. Regarding social support and reliability of social support, consideration must be given to country-specific factors. Elderly people usually live in a family, with their kids. This cultural aspect might play a role in most patients saying that they have social support (86.2%) and that they could rely on them (77.1%). The results of this study are consistent with previous studies that have supported the main effect hypothesis of social support (30).

Conclusion

AMD causes severe vision impairment and daily functioning problems, reducing the quality of life of patients.

In AMD patients in Kazakhstan, the QoL is dependent on the patient's age, stage, visual acuity, and the city where he or she lives. To diagnose and treat degenerative eye disorders at an early stage, it is essential to inform patients about regular ophthalmological checkups to diagnose and treat degenerative eye disorders at an early stage.

Acknowledgments: The authors would like to thank the group of experts who participated in the data collection: Asel Nuralieva, The Medical Centre Hospital of President's Affairs Administration of the Republic of Kazakhstan (Nur-Sultan); Yrzyk Zharylgassinova, The Medical Centre Hospital of President's Affairs Administration of the Republic of Kazakhstan (Nur-Sultan); Denis Alfereyev, Raevskyi Laser Center (Almaty); Yelena Blum, Mediker Clinic (Shymkent).

Funding Statement: This research received no specific grant from any funding agency.

Conflicts of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Human and Animal Rights: This study followed the Declaration of Helsinki guidelines.

Ethical Declaration: This study was approved by the Local Ethics Committee of the Kazakh Medical University of Continuing Education (study ID: 19-2021; date: 16/03/2021), by the Local Ethics Committee of the Asfendiyarov Kazakh National Medical University (study ID: 1394; date: 30/05/2022).

Authors Contribution: Inara Ismayilova: Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original /draft preparation. Botagoz Turdaliyeva: Resources, Software, Data curation, Supervision. Neilya Aldasheva: Validation, Writing - Review and Editing. Natalia Veselovskaya: Supervision, Project Administration.

Availability of Data: According to the patient consent form data is not available for scientific use by others than the project group members.

Study Registration: The study protocol has been registered with ClinicalTrials.gov Protocol Registration and Results System (Reference: NCT05427994).

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Received: 15 August 2022
Accepted: 13 September 2022
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