



# Comparison of Quality of Life Questionnaires in Patients with Low Vision

Esra Şahlı, Şefay Aysun İdil

Ankara University Faculty of Medicine, Department of Ophthalmology, Ankara, Turkey

## Abstract

**Objectives:** To compare the quality of life assessed by the Low Vision Quality of Life Questionnaire (LVQOL) and National Eye Institute Visual Function Questionnaire (NEI VFQ-25) in patients with low vision.

**Materials and Methods:** A total of 64 consecutive patients who presented to the Ankara University Low Vision Rehabilitation Department for the first time were included in the study. Patients aged 18 or older who had a best-corrected visual acuity of less than 20/60 or a visual field of equal to or less than 20° from the fixation point in the better eye were included. After examination, the patients were asked to complete the LVQOL and NEI VFQ-25 questionnaires.

**Results:** A very strong correlation was found between the total scores of the two questionnaires. A strong correlation was found between the “distance vision” subscale score of LVQOL and “distance activities” subscale score of NEI VFQ-25. There was also a strong correlation between the “reading and fine work” subscale score of LVQOL and “near activities” subscale score of NEI VFQ-25. There was a weak correlation between the LVQOL total score and visual acuity. There were moderate negative correlations between age at disease onset and the total scores of the two questionnaires.

**Conclusion:** Both the LVQOL and NEI VFQ-25 are able to quantify the quality of life of individuals with low vision and it is possible to compare the studies carried out with these two questionnaires which are validated in Turkish.

**Keywords:** Low vision, quality of life, LVQOL, NEI VFQ-25

## Introduction

The approach to low vision and blindness is very important as it impacts the quality of life, cognitive function, and well-being of the individual as well as society. It is associated with employment, education opportunities, and health economics.<sup>1</sup> According to 2010 statistics from the World Health Organization (WHO), there were an estimated 285 million people with visual impairment worldwide. Of these, 39 million were reported as blind and 246 million as having low vision. The prominent causes of visual impairment (80%)

are uncorrected refractive errors and treatable causes such as cataracts. In developed countries, the most common causes are age-related macular degeneration (AMD), glaucoma, and diabetic retinopathy.<sup>2</sup>

Low vision is defined as a distance visual acuity of less than 20/60 or a visual field of equal to or less than 20° in the better eye after refractive correction and medical or surgical treatment if necessary. Low vision is the main problem targeted by the Vision 2020 program, a global collaborative initiative by the WHO and International Agency for the Prevention of Blindness that aimed to eliminate preventable blindness.<sup>3</sup> It was reported

**Address for Correspondence:** Esra Şahlı, Ankara University Faculty of Medicine, Department of Ophthalmology, Ankara, Turkey

E-mail: esracansizoglu@gmail.com ORCID-ID: orcid.org/0000-0002-1355-7284

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that 65% of people with visual impairment and 82% of those with blindness were aged 50 years or older.<sup>2</sup> In addition, more people will be at risk in the future due to the increasing age of the population worldwide. Visual rehabilitation is an effective method of increasing the quality of life of people with low vision and blindness that cannot be prevented or treated.

Visual impairment is associated with performance and difficulty in everyday tasks related to vision.<sup>4</sup> The effects of visual impairment on an individual include visual, functional, psychological, social, and economic issues. These issues can cause limitations in performing tasks that require vision in educational, occupational, and recreational activities, and these limitations reduce the quality of life of individuals with low vision.<sup>5,6,7,8</sup>

Quality of life means the degree to which a person is independent, productive, healthy, and able to participate in or enjoy life events. The WHO has defined quality of life as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns.<sup>9</sup> Using quality of life questionnaires in patients with low vision may represent a viable option to better understand the impact of low vision on an individual's daily functioning, well-being, needs, and goals. At the same time, quality of life in patients with low vision and the effect of rehabilitation programs on these patients should be measured in order to improve low vision services.<sup>10</sup>

Most studies have focused on objective assessments including visual acuity at near and far distance, reading speed, duration, and fluency, contrast sensitivity, and visual field. But these objective assessments of vision do not cover every aspect of visual function and cannot measure the patient's perception of their disease. Applying quality of life instruments may help the clinician in this regard.

Quality of life instruments consist of a set of questions used to assess daily functioning and health-related quality of life. There are a few quality of life instruments which provide a functional, social, and psychological evaluation and are appropriate for use in the evaluation of low vision services.<sup>10</sup> Two of them, the Low Vision Quality of Life Questionnaire (LVQOL) and the National Eye Institute Visual Function Questionnaire (NEI VFQ-25), have been translated into Turkish and validated.<sup>11,12</sup>

The LVQOL was developed by Wolffsohn and Cochrane<sup>13</sup> specifically for patients with low vision and includes 25 items in 4 dimensions: distance vision, mobility, and lighting; adjustment; reading and fine work; and activities of daily living. This instrument is used in the clinical evaluation of patients with low vision in order to determine the needs of patients in daily life and whether these needs can be met by low vision rehabilitation. Patients are asked to respond on a 5-point scale on which 5 represents no difficulty and 1 great difficulty. The total score ranges from 0 to 125, with higher scores indicating a higher quality of life. The LVQOL was shown to

be a reliable, internally consistent, and sensitive measure of quality of life in patients with low vision.<sup>13</sup>

The LVQOL was adapted into Turkish by Idil et al.<sup>11</sup> One item in the "adjustment" dimension that had a low validity value was excluded from the questionnaire. After removing the item "How well has your eye condition been explained to you", all dimensions of the LVQOL were shown to be reliable, valid, and suitable for use in Turkish patients with low vision. As a result, the Turkish version of the questionnaire consists of 24 items and is evaluated out of a total score of 120.<sup>11</sup>

The NEI VFQ-25 can assess the impact of a wide spectrum of eye diseases on quality of life. It includes 13 subscales (general health, general vision, ocular pain, vision expectations, near activities, distance activities, vision-specific social functioning, vision-specific mental health, vision-specific role difficulties, vision-specific dependency, driving, peripheral vision, and color vision).<sup>14</sup> The 25-item NEI VFQ was translated into Turkish and validated by Toprak et al.<sup>12</sup> and found useful in measuring the impact of visual impairment on affected individuals' quality of life.

The purpose of the present study was to compare quality of life assessed with the LVQOL and NEI VFQ-25 in patients with low vision. Comparing the two questionnaires and evaluating the correlation between them will provide the opportunity to compare the results of studies that used these questionnaires. To our knowledge, there is only one previous study (Chieh JJ, et al. IOVS 2006;47:ARVO E-Abstract 2106) comparing the results obtained from these questionnaires, and it evaluated quality of life in a small group of patients with AMD.

## Materials and Methods

This was a randomized methodological study to evaluate the consistency between the two questionnaires. Ethical approval was obtained from the Ankara University Faculty of Medicine Clinical Trials Ethics Committee (approval number: 15-1022-18). A total of 64 consecutive patients who presented to the Ankara University Low Vision Rehabilitation Department for the first time were included in the study. Patients aged 18 years or older whose better eye had a best-corrected visual acuity (BCVA) of less than 20/60 (0.48 logMAR) or a visual field equal to or less than 20° from the fixation point were included.

All patients underwent a complete ophthalmologic examination including BCVA, near visual acuity, slit lamp biomicroscopy, fundus examination, applanation tonometry, and low vision examination. The patient's visual acuity in the better-seeing eye was recorded as their visual acuity. After the examination, the patients were asked to complete the LVQOL and NEI VFQ-25 questionnaires. The questions were asked to all participants by the same employee (B.S.) due to their inadequate near visual acuity for reading. An informed consent form was signed by each participant before data collection.

The 24 items of the Turkish LVQOL were asked to obtain a total score out of 120 points and 4 subscale scores for each participant. According to the 25 questions and 13 additional questions in the NEI VFQ, 12 subscale scores as well as a combined total score were obtained for each participant. Each subscale was calculated according to the instructions described by the NEI VFQ developers.<sup>15</sup> The scores can range from 0 to 100, where 0 is the worst and 100 shows no disability related to vision. Demographic data including age, sex, diagnosis, and disease duration were also collected. Total scores and related subscale scores of the LVQOL and NEI VFQ-25 were assessed for correlation.

### Statistical Analysis

The total score and the subscale scores of the two questionnaires were compared using the non-parametric Mann-Whitney U test. Correlations between the scores were calculated using Spearman rank analysis.  $P < 0.05$  was considered significant. The strength of correlations was described according to the guide recommended by Evans<sup>16</sup> for the absolute correlation coefficient ( $r$ ): 0.00-0.19 as very weak, 0.20-0.39 as weak, 0.40-0.59 as moderate, 0.60-0.79 as strong, and 0.80-1.00 as very strong.

### Results

There were 31 women (48%) and 33 men (52%). The mean age was 58.7 years (range: 21-87 years). The mean BCVA was 1.3 logMAR (range: 0.3-3.1 logMAR). Thirty percent

of the patients had AMD, 25% of the patients had retinitis pigmentosa. The other diagnoses were diabetic retinopathy (9%), Stargardt disease (9%), hereditary optic neuropathies (6%), glaucoma (5%), albinism (3%), macula dystrophies (5%), and degenerative myopia (3%).

The total score on the LVQOL ranged from 10.6 to 72.0 with a mean of  $42.31 \pm 16.19$ . The mean total score for the NEI VFQ-25 was  $46.45 \pm 24.24$  (range 8 to 97). The Spearman correlation coefficient between the total score of the LVQOL and NEI VFQ-25 was 0.842 ( $p < 0.001$ ), indicating a very strong correlation between the total scores of the two questionnaires. A strong correlation was found between the LVQOL “distance vision” subscale score and the NEI VFQ-25 “distance activities” subscale ( $r = 0.660$ ,  $p < 0.001$ ). There was also a strong correlation between the LVQOL “reading and fine work” subscale score and NEI VFQ-25 “near activities” subscale score ( $r = 0.768$ ,  $p < 0.001$ ). Table 1 shows the total and subscale scores for the two questionnaires and correlations between total scores and related subscale scores.

There was a weak correlation between LVQOL total score and visual acuity ( $r = 0.277$ ,  $p < 0.05$ ) but no relationship between the NEI VFQ-25 total score and visual acuity ( $r = 0.237$ ,  $p = 0.06$ ). A weak correlation was demonstrated between the NEI VFQ-25 “distance activities” subscale score and visual acuity ( $r = 0.261$ ,  $p < 0.05$ ). There were strong correlations between the LVQOL “adjustment” subscale and NEI VFQ-25 “mental health”, “role

**Table 1. NEI VFQ-25 and LVQOL total and subscale scores and correlations between related scores**

NEI VFQ-25 total and subscale scores	Mean $\pm$ SD	LVQOL total and subscale scores	Mean $\pm$ SD	Correlations
Overall score	56.02 $\pm$ 20.23	Overall score (max. 120)	46.45 $\pm$ 24.24	$r = 0.842$ $p < 0.001$
Distance activities	34.25 $\pm$ 22.22	Distance vision, mobility and lighting (max. 60)	25.42 $\pm$ 11.82	$r = 0.660$ $p < 0.001$
Near activities	32.56 $\pm$ 20.20	Reading and fine work (max. 25)	6.98 $\pm$ 5.8	$r = 0.768$ $p < 0.001$
Vision-specific mental health	40.77 $\pm$ 19.28	Adjustment (max. 15)	6.97 $\pm$ 3.78	$r = 0.647$ $p < 0.001$
Vision-specific role difficulties	38.06 $\pm$ 20.85			$r = 0.521$ $p < 0.001$
Vision-specific dependency	52.42 $\pm$ 26.08			$r = 0.665$ $p < 0.001$
Vision-specific social functioning	51.19 $\pm$ 26.38	Activities of daily living (max. 20)	7.55 $\pm$ 6.1	
General health	53.78 $\pm$ 16.41			
General vision	33.12 $\pm$ 14.10			
Ocular pain	61.32 $\pm$ 26.51			
Driving	5.85 $\pm$ 16.96			
Color vision	70.70 $\pm$ 26.73			
Peripheral vision	61.72 $\pm$ 26.34			

NEI VFQ-25: National Eye Institute Visual Function Questionnaire 25, LVQOL: Low Vision Quality of Life Questionnaire, SD: Standard deviation, max: Maximum

limitations due to vision”, and “dependency on others due to vision” subscales ( $r=0.647$ ;  $r=0.521$ ;  $r=0.665$ , respectively,  $p<0.001$ ).

Total LVQOL and NEI VFQ-25 scores showed moderate negative correlation with age at disease onset ( $r=0.370$  and  $r=0.387$ , respectively,  $p<0.05$ ) but not with disease duration. No relationship was found between the total scores of the two questionnaires and age, sex, or diagnosis.

## Discussion

Low vision examination includes many tests to objectively measure visual function, such as visual acuity, reading speed, contrast sensitivity, and visual field, but these measurements do not describe an individual’s visual status exactly. Therefore, there is also a need to assess subjective visual function and outcomes of low vision rehabilitation in patients with low vision.

The success of a low vision service has been defined as reducing the level of difficulty in visual tasks. Stelmack<sup>17</sup> declared that self-reported quality of life is a significant measure of the impact of low vision rehabilitation, and it has long been recognized that visual acuity measurements do not always correlate with the actual daily performance of patients with low vision.<sup>8</sup>

Various questionnaires have been developed and used to assess quality of life in patients with glaucoma, AMD, retinitis pigmentosa, cataract, and optic neuritis, but none of them are specific for patients with untreatable visual impairment. Wolffsohn and Cochrane<sup>13</sup> developed the LVQOL in 2000 to measure the quality of life of those with low vision and determine the effects of low vision rehabilitation. The items of this questionnaire are related to difficulties that people with low vision have in performing daily activities, and it is reported to be one of the best tools for use in low vision patients. LVQOL scores were found to be correlated with visual acuity and other vision-related quality of life questionnaires, and its subscales showed satisfactory construct validity.<sup>18,19</sup> The Turkish version of LVQOL was shown to be internally consistent, reliable, and sensitive in the measurement of quality of life.<sup>11</sup>

The 25-item NEI VFQ was also developed and became one of the most widely used visual function questionnaires.<sup>20</sup> The NEI VFQ-25 has been used in well-known eye surveys including the Age-Related Eye Disease Study, the Wisconsin Epidemiologic Study of Diabetic Retinopathy, and Optic Neuritis Treatment Trial.<sup>21,22,23</sup> It has been translated and validated in several languages. This instrument showed good psychometric properties including reliability and construct validity in a mixed population of patients with various eye diseases and visual impairment.<sup>14</sup> Marella et al.<sup>20</sup> suggest that although the overall scale of NEI VFQ-25 was psychometrically satisfactory, the 12-subscale feature of the NEI VFQ-25 had limited psychometric validity in a low vision population. The items of general health, pain, and driving were found not to fit the overall scale. Sivaprasad et al.<sup>24</sup> demonstrated that the

overall scale and the near and distance activities subscales showed good internal consistency reliability, test-retest reliability, and convergent validity with maximum reading speed and functional reading independency index score in patients with geographic atrophy. Good reliability and construct validity of the NEI VFQ-25 were also demonstrated in patients with AMD in several studies.<sup>25,26</sup> The Turkish version of the NEI VFQ-25 was found to be reliable and valid for the assessment of quality of life in patients with various chronic eye diseases.<sup>14</sup>

Chieh et al. reported a strong correlation (correlation coefficient=0.724) between the LVQOL and NEI VFQ-25 and significant correlations between similar LVQOL and NEI VFQ-25 questions in patients with bilateral severe macular degeneration. They concluded that the LVQOL is a useful additional tool to assess AMD patients with severe vision loss (Chieh JJ, et al. IOVS 2006;47:ARVO E-Abstract 2106). We found a very strong correlation between the total scores of the LVQOL and NEI VFQ-25 in low vision patients. There was a strong correlation between the “distance vision” subscale score of the LVQOL and the “distance activities” subscale score of the NEI VFQ-25. There was also a strong correlation between the “reading and fine work” subscale score of the LVQOL and “near activities” subscale score of the NEI VFQ-25 in our study.

Chieh et al. demonstrated a low correlation between LVQOL composite and subscale scores and visual function including distance and near visual acuity, reading speed, and contrast sensitivity (Chieh JJ, et al. IOVS 2006;47:ARVO E-Abstract 2106). Owen et al.<sup>27</sup> reported that the NEI VFQ-25 subscales for general vision, social functioning, visual dependency, near vision, and color vision were strongly and independently associated with visual impairment in a large group of older people. They demonstrated that although visual acuity was strongly associated with NEI VFQ scores in older adults, it explained less than a fifth of the variation in total score, indicating that visual acuity provides a relatively limited measure of visual performance.

In another study, it was demonstrated that NEI VFQ-25 overall composite score, near activities, distance activities, and vision-specific dependency scores were correlated with BCVA, reading speed, and contrast sensitivity in AMD patients.<sup>25</sup> Although we could not detect a relationship between NEI VFQ-25 and visual acuity, there was a weak correlation between LVQOL total score and visual acuity in low vision patients with several diagnoses. In fact, quality of life instruments provide additional information to visual function measures, so they are not expected to be strongly correlated. The patient’s well-being in visual rehabilitation is a more important indicator than the visual functions measured.

Correlational analysis showed that the total scores and related subscale scores for the two questionnaires were strongly to very strongly correlated. These results suggest that both questionnaires would provide accurate information for assessing quality of life in patients with low vision and evaluating the outcome of low vision rehabilitation.

In our opinion, the NEI VFQ-25 may provide more useful details regarding quality of life than the LVQOL due to the greater number of items in the NEI VFQ-25, but it is more difficult and time-consuming to calculate the total score and subscale scores of NEI VFQ-25, which reduces its practicality. Nevertheless, the LVQOL and NEI VFQ-25 are both useful tools for assessing quality of life.

#### Study limitations

Studies on quality of life questionnaires have mostly focused on older populations because of the increased prevalence of low vision in advanced age. We evaluated people in a wide age group with various chronic eye diseases that cause low vision. To our knowledge, no direct comparison of instruments evaluating quality of life in patients with low vision specifically has been reported in the literature. The inclusion of patients with various diseases that cause low vision can be considered a strength of our study as well as a limitation. The patients we included in our study were not homogeneously distributed according to their diagnoses.

#### Conclusion

We observed a very strong correlation between LVQOL and NEI VFQ-25 total scores and strong correlations between their related subscale scores. They both can provide important information in addition to objective visual measurements when evaluating a patient. Both the LVQOL and NEI VFQ-25 are able to quantify the quality of life of individuals with low vision and will be useful in assessing the effectiveness of low-vision rehabilitation. Therefore, these questionnaires should be combined with objective methods of assessing visual function in a low vision clinic. It is possible to compare studies carried out with these two questionnaires, both of which are validated in Turkish.

#### Ethics

**Ethics Committee Approval:** Ethical approval for the study was received from the Ankara University Faculty of Medicine Clinical Trials Ethics Committee (approval number: 15-1022-18).

**Informed Consent:** Obtained.

**Peer-review:** Externally peer reviewed.

#### Authorship Contributions

Surgical and Medical Practices: E.Ş., Ş.A.İ., Concept: Ş.A.İ., Design: Ş.A.İ., Data Collection or Processing: E.Ş., Analysis or Interpretation: E.Ş., Ş.A.İ., Literature Search: E.Ş., Writing: E.Ş.

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#### References

- Sabel BA, Flammer J, Merabet LB. Residual vision activation and the brain-eye-vascular triad: dysregulation, plasticity and restoration in low vision and blindness - a review. *Restor Neurol Neurosci*. 2018;36:767-791.
- World Health Organization, Global Data on Visual Impairments 2010. <http://www.who.int/blindness/GLOBALDATAFINALforweb.pdf?ua=1>.
- World Health Organization. Vision 2020: The right to sight: Global initiative for the elimination of avoidable blindness. Action Plan 2006 – 2011. Geneva: World Health Organization; 2007.
- Rubin GS, Bandeen-Roche K, Huang GH, Munoz B, Schein OD, Fried LP, West SK. The association of multiple visual impairments with self-reported visual disability: SEE project. *Invest Ophthalmol Vis Sci*. 2001;42:64-72.
- Wang JJ, Mitchell P, Smith W. Vision and low self-rated health: The Blue Mountains Eye Study. *Invest Ophthalmol Vis Sci*. 2000;41:49-54.
- O'Connor P, Keefe J. Focus on low vision. Melbourne: Centre for Eye Research; 2007:16-17.
- McCarthy CA, Nanjan MB, Taylor HR. Vision impairment predicts five-year mortality. *Br J Ophthalmol*. 2001;85:322-326.
- Ovenseri-Ogbomo G, Osafo-Agyei H, Akpalaba REU, Ovenseri EO. Impact of low vision services on the quality of life of low vision patients in Ghana. *Afr Vision Eye Health*. 2016;75:1-5.
- World Health Organization, Health statistics and information systems. WHOQOL: Measuring Quality of Life. [https://www.who.int/health\\_info/survey/whoqol-qualityoflife/en/](https://www.who.int/health_info/survey/whoqol-qualityoflife/en/)
- Jackson AJ. Assessment of functional vision. In: Jackson AJ, Wolffsohn JS, eds. *Low Vision Manual*. 1st ed. Philadelphia: Elsevier Ltd; 2007:167-182.
- İdil A, Ozen M, Atak N, Elhan A, Pehlivan. Validity and reliability study of Turkish version on low vision with Quality of life questionnaire. *Int J Ophthalmol*. 2011;4:546-551.
- Toprak AB, Eser E, Guler C, Baser FE, Mayali H. Cross-validation of the Turkish version of the 25-item National Eye Institute Visual Functioning Questionnaire (NEIU-VFQ 25). *Ophthalmic Epidemiol*. 2005;12:259-269.
- Wolffsohn JS, Cochrane AL. Design of the Low Vision Quality of Life Questionnaire (LVQOL) and measuring the outcome of low-vision rehabilitation. *Am J Ophthalmol*. 2000;130:793-802.
- Mangione CM, Lee PP, Gutierrez PR, Spritzer K, Berry S, Hays RD; National Eye Institute Visual Function Questionnaire Field Test Investigators. Development of the 25-item National Eye Institute Visual Function Questionnaire. *Arch Ophthalmol*. 2001;119:1050-1058.
- Mangione CM. NEI VFQ-25 Scoring Algorithm. Rockville, MD: National Eye Institute; 2000.
- Evans JD. *Straightforward Statistics for the Behavioral Sciences* (1st ed). Pacific Grove, California; Brooks/Cole Publishing; 1996.
- Stelmack JA. Quality of life of low-vision patients and outcomes of low-vision rehabilitation. *Optom Vis Sci*. 2001;128:335-342.
- de Boer MR, Moll AC, de Vet HC, Terwee CB, Völker-Dieben HJ, van Rens GH. Psychometric properties of vision-related quality of life questionnaires: a systematic review. *Ophthalmic Physiol Opt*. 2004;24:257-273.
- de Boer MR, Terwee CB, de Vet HC, Moll AC, Völker-Dieben HJ, van Rens GH. Evaluation of cross-sectional and longitudinal construct validity of two vision-related quality of life questionnaires: The LVQOL and VCM1. *Qual Life Res*. 2006;15:233-248.
- Marella M, Pesudovs K, Keeffe JE, O'Connor PM, Rees G, Lamoureux EL. The psychometric validity of the NEI VFQ-25 for use in a low-vision population. *Invest Ophthalmol Vis Sci*. 2010;51:2878-2884.
- Clemons TE, Chew EY, Bressler SB, McBee W; Age-Related Eye Disease Study Research Group. National Eye Institute Visual Function Questionnaire in the Age-Related Eye Disease Study (AREDS): AREDS Report No. 10. *Arch Ophthalmol*. 2003;121:211-217.
- Klein R, Moss SE, Klein BE, Gutierrez P, Mangione CM. The NEIVFQ-25 in people with long-term type 1 diabetes mellitus: the Wisconsin Epidemiologic Study of Diabetic Retinopathy. *Arch Ophthalmol*. 2001;119:733-740.
- Cole SR, Beck RW, Moke PS, Gal RL, Long DT. The National Eye Institute Visual Function Questionnaire: experience of the ONTT; Optic Neuritis Treatment Trial. *Invest Ophthalmol Vis Sci*. 2000;41:1017-1021.
- Sivaprasad S, Tschosik E, Kapre A, Varma R, Bressler NM, Kimel M, Dolan C, Silverman D. Reliability and construct validity of the NEI VFQ-25 in a subset of patients with geographic atrophy from the Phase 2 Mahalo Study. *Am J Ophthalmol*. 2018;190:1-8.

25. Orr P, Rentz AM, Margolis MK, Revicki DA, Dolan CM, Colman S, Fine JT, Bressler NM. Validation of the National Eye Institute Visual Function Questionnaire-25 (NEI VFQ-25) in age-related macular degeneration. *Invest Ophthalmol Vis Sci.* 2011;52:3354-3359.
26. Revicki DA, Rentz AM, Harnam N, Thomas VS, Lanzetta P. Reliability and validity of the National Eye Institute Visual Function Questionnaire-25 in patients with age-related macular degeneration. *Invest Ophthalmol Vis Sci.* 2010;51:712-717.
27. Owen CG, Rudnicka AR, Smeeth L, Evans JR, Wormald RPL, Fletcher AE. Is the NEI-VFQ-25 a useful tool in identifying visual impairment in an elderly population? *BMC Ophthalmol.* 2006;6:24.