Validity of the Visual Function Index (VF-14) in Patients With Retinal Disease

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Objective: To test the validity of the Visual Function Index (VF-14) in patients with retinal disease.

Design: A self-administered questionnaire package in association with clinical examination findings.

Participants: Consecutive patients attending the Vancouver General Hospital Eye Care Centre, Vancouver, British Columbia, retina clinic between May 1 and August 15, 1998.

Main Outcome Measures: Responses to the questionnaire package as they relate to global self-assessment scales and visual acuity. In addition, correlations were calculated between the VF-14, the 36-Item Short-Form Health Survey, a Weighted Comorbidity Scale, and visual acuity scores.

Results: Five hundred forty-seven patients were given the questionnaire package to complete. The VF-14 demonstrated a moderately strong positive association with patient self-rating of amount of trouble, satisfaction, and overall quality of vision. Correlations between the 36-Item Short-Form Health Survey, visual acuity, and the global scales were mild to moderate. The VF-14 was moderately correlated with visual acuity in the better and the worse eyes.

Conclusions: This study provides support for the validity of the VF-14 as a measure of functional impairment in patients with retinal disease. Once responsiveness has been measured and an analysis of disease subtypes has been carried out, the VF-14 will be ready for inclusion in clinical trials to evaluate patients’ functional ability. Further implementation and development of this outcome measure will better our understanding of the utility of the functional assessment format for patients with retinal disease.

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NELLEN VISUAL acuity is the most widely used measure of visual function. Other measures, including contrast sensitivity, visual field, and glare testing, have demonstrated that visual acuity is a descriptor of a single aspect of vision rather than a comprehensive assessment of visual function. An approach that is gaining popularity is the use of standardized vision-related quality-of-life instruments to measure the functional visual status of patients. This variable may be used with other vision descriptors to monitor individual patient progress in clinical settings and clinical trials. Several such instruments have been developed.

Two of these tools, the National Eye Institute Visual Function Questionnaire and the Visual Function Index (VF-14), have gained increasing acceptance in the recent literature. The National Eye Institute Visual Function Questionnaire was designed as a comprehensive functional assessment, applicable to various sight-limiting diseases. It has been used in several patient groups, including individuals with glaucoma, cataract, diabetic retinopathy, age-related macular degeneration, and cytomegalovirus retinitis. The VF-14 was developed by Steinberg et al. It is an index of visual function that was designed to assess patients undergoing cataract surgery. Its usefulness has been demonstrated in patients with cataracts, glaucoma, and corneal disease and it has been translated for use in other languages. The succinct format of the VF-14 has made it a popular choice because of its ease of administration and high rate of patient compliance. This study evaluates the validity of the VF-14 in patients with retinal disease.

RESULTS

The study had an 84.0% participation rate (546/650 patients). Information concerning clinical attributes of the patients may be found in Table 1. Patients’ sex was evenly distributed (48.0% female and 52.0% male). The ethnicity of the patients was as follows: white, 74.0%; Oriental, 20.0%, and East Indian, 6.0%. The mean ± SD age of the sample was 55 ± 18 years (range, 16-95 years).
PATIENTS AND METHODS

The study was approved by the Office of Research Services at the University of British Columbia, Vancouver. Consecutive patients examined by a single retinal surgeon (T.S.C.) at the Vancouver General Hospital, Vancouver, were recruited from May 1 through August 15, 1998. Eligible participants included English-speaking patients aged 16 years or older who were able to give informed consent.

Each survey included the VF-14, the 36-Item Short-Form Health Survey (SF-36), a Weighted Comorbidity Scale (WCS), and 3 global self-assessment questions. The VF-14 contains questions relating to the degree of difficulty experienced by patients in performing 14 vision-related daily activities, such as reading, seeing steps, and watching television. The global assessment questions asked the participants about the amount of trouble and satisfaction they had with their vision and an overall rating of their quality of vision. The interview was administered in the following order: the VF-14, the 3 global questions, the SF-36, and the WCS.

The Medical Outcomes Study SF-36 is a general health-related quality-of-life instrument containing 36 questions and covering 8 domains of health status. Recently, a physical component summary (PCS) and a mental component summary were developed that summarize those questions on the SF-36 related to the physical and mental domains of health. These scores were also used in our analysis. The SF-36 has been tested extensively for reliability and validity in quality-of-life assessment in many different patient groups.

The WCS consists of a checklist of 25 medical conditions. Subjects indicated which of these conditions applied to them (as in a standard comorbidity scale), then specified how much that condition interfered with their daily activities (1 indicated not at all; 2, a little; and 3, a great deal). A cumulative score was recorded, ranging from a minimum of 0 (no comorbidities) to a possible maximum of 75 (hypothetically “a great deal” of interference in daily activities for every condition on the list). This questionnaire was adapted by Scott et al from the National Health and Nutrition Examination Surveys. Completion of the 3 questionnaires required 10 to 12 minutes on average (for self-administered forms). More time was required for interviewer-assisted completion. Completed forms were returned to the research coordinator (M.L.). Clinical data were abstracted from patient medical records using data from the day of questionnaire completion.

Criterion validity was assessed through measurement of the Spearman correlation coefficients between VF-14 score and the global self-ratings of amount of trouble, level of satisfaction, and overall quality of vision experienced by patients. To determine discriminant validity, 2 subscales of the SF-36 (PCS and role limitations due to physical health problems) were used. The Spearman correlations between the global scales and these SF-36 subscales were compared with correlations measured between the VF-14 score and the global scales. Furthermore, the Spearman correlations measured between the VF-14 score and the global scales were compared with the correlation of visual acuity scores with the global scales. The direction (sign) of correlation varied depending on the scales being compared. For the “Trouble With Vision Scale,” the WCS, and the visual acuity scales, higher scores indicated poorer performance.

Visual acuity scores were analyzed through the calculation of weighted average logMAR (WMAR). In this method, the numerator of the Snellen visual acuity score is divided by the denominator, and the base 10 logarithm of the result is calculated. The weighted average gives a 0.75 weighting to the better eye and a 0.25 weighting to the worse eye. Therefore, WMAR summarizes the acuity data from both eyes of the patient in 1 score. Counting fingers was analyzed numerically as a Snellen visual acuity of 20/1000, hand movements as 20/2000, and light perception or no light perception as 20/4000. Internal consistency of the VF-14 was confirmed through the calculation of the Cronbach coefficient α.

VISUAL FUNCTION INDEX (VF-14)

Most (90.0%) of the patients completed the form themselves. The remaining 10.0% were assisted by a trained interviewer (M.L.). The individuals in the latter group were on average older (mean age, 66 years) and had poorer visual acuity (mean ± SD WMAR, −0.60 ± 0.49). Scores on the VF-14 for the study group are given in Table 2. A median of 14 (range, 8-14) questions were considered applicable to the full sample. Of the 546 in the sample, 505 (92.4%) considered 11 or more of the questions to be applicable to them. Table 3 displays VF-14 items in order of impact on the patient. Patients had the most difficulty with reading small print and the least difficulty with recognizing people up close. Of the 546 patients, 143 (26.2%) surveyed did not drive a car. Of the 85 patients who had at one time driven a car, 34 (40%) had stopped driving because of their vision. The Cronbach α coefficient for this sample was .91, indicating high internal consistency (based on patients in the sample finding all 14 items applicable [n = 276]).

36-ITEM SHORT-FORM HEALTH SURVEY

Table 2 summarizes the scores of patients on the 8 domains of the SF-36, as well as the PCS and mental component summary scores. The Spearman correlations between these domains of the SF-36 and the remaining scales are given in Table 4. The PCS and physical functioning subscales demonstrated a weak relation with the VF-14 score (P < .01). The PCS subscale demonstrated a mild relation with the WCS (P < .001) and a weak relation with the global self-assessment scales.

STATISTICAL ANALYSIS

Criterion validity of the VF-14 was determined through calculation of the Spearman correlates of the global self-assessment scales with the VF-14 (Table 5). All 3 global scales demonstrated moderate to strong relations with the VF-14 score. These correlations also showed a higher degree of relatedness (greater magnitude) than any of the global scale correlates with any of the measures of visual acuity.
The Spearman correlation between VF-14 score and worst eye visual acuity was stronger than the correlation between VF-14 score and better eye visual acuity. The correlation between the VF-14 score and the weighted average visual acuity was −0.45 \((P < .001)\). Adjusting for potentially confounding variables did not result in a substantive change to any of the correlations.

Patients were further broken down into subgroups based on WMAR to explore VF-14 changes with visual acuity (Figure 1). The 4 visual acuity subgroups were 20/20 to 20/40 (WMAR, 0 to −0.31), 20/40 to 20/70 (WMAR, −0.32 to −0.55), 20/70 to 20/100 (WMAR, −0.56 to −0.99), and 20/200 or worse (WMAR, −1.00 to −1.80). To provide an alternative method of looking at the function-acuity relation, a second set of acuity subgroups were formed through subdivision into 3 categories: good bilaterally (20/40 or better in both eyes), good unilaterally (20/40 or better in 1 eye), and poor bilaterally (20/40 or worse in both eyes).9 The resulting box plot can be found in Figure 2. In both cases, the scores on the VF-14 decreased with decreasing visual acuity.

Finally, the relation between the better eye visual acuity and VF-14 score was examined as worse eye visual acuity decreased. Worse eye visual acuity was divided into the 4 acuity subgroups previously described, and the correlations were examined. Patients with poorer worse eye acuity displayed a stronger correlation between better eye visual acuity and VF-14 score. (For subgroups 1-4, respectively: 0.26 \([P < .001]\), 0.05 \([P = .68]\), 0.57 \([P < .001]\), and 0.67 \([P < .001]\)).

### Table 1. Major Retinal Disease Subgroups in the Sample of 546 Patients

| Disease Subgroup                  | No. (%)
|-----------------------------------|--------
| Retinal detachment                | 74 (13.6) |
| Age-related macular degeneration  | 71 (13.0) |
| Diabetic retinopathy              | 61 (11.2) |
| Posterior vitreous detachment     | 43 (7.9)  |
| Branch retinal vein occlusion     | 34 (6.2)  |
| Myopia                            | 29 (5.1)  |
| Retinal tear                      | 26 (4.8)  |
| Retinal hole                      | 26 (4.8)  |
| Central serous retinopathy        | 25 (4.6)  |
| Other*                            | 158 (28.9) |

*Subgroups representing less than 5% of cases.

### Table 2. Scale Scores

<table>
<thead>
<tr>
<th>Scale*</th>
<th>No. of Patients</th>
<th>Mean (SD)</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF-14</td>
<td>Full sample</td>
<td>84 (20)</td>
<td>92</td>
<td>2-100</td>
</tr>
<tr>
<td></td>
<td>Self-administered sample</td>
<td>87 (16)</td>
<td>93</td>
<td>27-100</td>
</tr>
<tr>
<td></td>
<td>Interviewed sample</td>
<td>57 (31)</td>
<td>66</td>
<td>2-100</td>
</tr>
<tr>
<td>SF-36</td>
<td>Physical component summary</td>
<td>48 (10)</td>
<td>51</td>
<td>13-70</td>
</tr>
<tr>
<td></td>
<td>Mental component summary</td>
<td>50 (10)</td>
<td>53</td>
<td>7-73</td>
</tr>
<tr>
<td></td>
<td>Physical functioning</td>
<td>81 (25)</td>
<td>90</td>
<td>0-100</td>
</tr>
<tr>
<td></td>
<td>Role limitations due to physical functioning</td>
<td>71 (40)</td>
<td>100</td>
<td>0-100</td>
</tr>
<tr>
<td></td>
<td>Bodily pain</td>
<td>76 (25)</td>
<td>84</td>
<td>0-100</td>
</tr>
<tr>
<td></td>
<td>General health perceptions</td>
<td>70 (21)</td>
<td>72</td>
<td>0-100</td>
</tr>
<tr>
<td></td>
<td>Vitality</td>
<td>59 (20)</td>
<td>60</td>
<td>0-100</td>
</tr>
<tr>
<td></td>
<td>Social functioning</td>
<td>84 (23)</td>
<td>100</td>
<td>0-100</td>
</tr>
<tr>
<td></td>
<td>Role limitations due to emotional problems</td>
<td>71 (40)</td>
<td>100</td>
<td>0-100</td>
</tr>
<tr>
<td></td>
<td>Mental health</td>
<td>75 (18)</td>
<td>80</td>
<td>4-100</td>
</tr>
<tr>
<td>Weighted Comorbidity Scale</td>
<td>6.1 (6.4)</td>
<td>4</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Visual acuity</td>
<td>WMAR</td>
<td>0.22 (0.28)</td>
<td>0.12</td>
<td>0-1.85</td>
</tr>
<tr>
<td></td>
<td>Better eye</td>
<td>0.11 (0.23)</td>
<td>0.00</td>
<td>0-1.70</td>
</tr>
<tr>
<td></td>
<td>Worse eye</td>
<td>0.54 (0.63)</td>
<td>0.30</td>
<td>0-2.30</td>
</tr>
</tbody>
</table>

*VF-14 indicates Visual Function Index-14; SF-36, 36-Item Short-Form Health Survey; and WMAR, weighted average logMAR.

**Comment**

Functional assessment and quality-of-life surveys are gaining acceptance as effective evidence-based methods of measuring patient visual well-being and limitations. The VF-14, an instrument originally developed to test the functional status of patients with cataract, has been used in various different population groups and settings.3,4,6,9,14,27 The utility of an instrument in the measurement of quality-of-life and functional assessment may fluctuate with different study populations.28 Therefore, it is necessary to demonstrate this utility before widespread use of the instrument is made in a particular population. This study tested the validity of the VF-14 in patients with retinal disease. We elected to use this instrument for 2 reasons. First, it is short and easy to complete. Second, the VF-14 has been used in other studies13 at the Department of Ophthalmology, University of British Columbia, giving us greater familiarity with the instrument.

The use of functional outcome assessments on patients with retinal disorders has been studied previously. One particular study20 examined the use of several functional assessment and quality-of-life instruments that predated the VF-14 in examining patients with ophthal-
mologic disorders. The researchers at that time indicated that the length of the existing surveys limited their practical application in clinics. A second limitation identified related to the inability of existing surveys to detect changes in functional status in most patients (with the exception of individuals with high levels of visual impairment).

Several important factors stand out in the identification of an appropriate instrument of this type: ease of...
administration, ease of scoring, and ease of interpretation. In addition, it is important to focus on those activities most important to successful daily function despite the wide array of symptoms that affect the patient group. This careful focus on a particular domain allows for comparison between different patients based on an accepted and important general construct: functional ability in activities of daily living. Ideally, the instrument should also be sensitive to different levels of functional impairment, and be responsive enough to measure any improvement or decline in function as a condition progresses or interventions are used. Steinberg and colleagues subsequently provided the VF-14, which meets most of these criteria. Although Steinberg’s tool was originally designed for patients with cataract, it is possible that its indication of functional scale validity through the measurement of relatedness through correlations. In our study, the relation of the global scale of Trouble With Vision to VF-14 score was moderate ($r = -0.63, P < .001$), and the correlation of the “Satisfaction With Vision Scale” to VF-14 score was mild ($r = 0.43, P < .001$). This exceeds the same correlations measured by Steinberg et al in the 1994 study of -0.45 and 0.34 for the trouble and satisfaction scales, respectively.

Discriminant validity refers to the ability of a scale to demonstrate a higher correlation with its intended study sample than a separate and less specific scale with the same sample. In this case, the SF-36, a generic quality-of-life instrument, would be expected to be less related (have a lower correlation) to the global scales and to visual acuity than would the VF-14 (a disease-specific instrument). Second, the SF-36 would be expected to be a better indicator of the effect of comorbidities on a patient than would the VF-14. As predicted, patients with retinal disease demonstrated only weak correlations between the PCS and the global scales. Correlations between VF-14 score and global scales, by contrast, were far stronger. Conversely, the correlation between the PCS and the WCS was marginally stronger than the VF-14 correlation with the WCS. Therefore, the discriminant validity of the VF-14 is supported by this study group, providing further strength for the utility of this instrument in patients with retinal disease.

One of this study's limitations concerns the 10.0% of patients who were interviewed vs the remaining patients who completed self-administered forms. The scores of these patients were, on average, considerably lower than the scores of the rest of the sample on the VF-14 (Table 2). This result is not unexpected, since the vision of patients in this group was often limited enough that they required assistance. It is highly probable that these lower scores are due to a preselection bias toward patients with poor vision, rather than due to interview technique. Administration of the VF-14 through patient interview has been demonstrated in other studies. A second concern is the suitability of the VF-14 instrument for patients with retinal disease. Since the questions on the VF-14 were originally conceived for patients with cataract, it is possible that
certain ocular complaints experienced by patients with retinal disease may not be addressed by the VF-14. Therefore, more questions may need to be included to produce a more sensitive instrument for these patients.

In this study, visual acuity score in the better eye correlated moderately with the VF-14 score, as has been previously reported. The moderate correlation demonstrates that visual acuity and functionality are separate but related aspects of vision. However, visual acuity did not demonstrate as strong a relation with the global scales as did the VF-14 score. Thus, the VF-14 is more highly related than visual acuity to the global self-assessment scales in our study population and, therefore, more representative of amount of trouble and satisfaction patients have with their vision. The correlation between worse eye visual acuity and VF-14 score was substantially higher than previously reported, suggesting a relation between the condition of the worse eye in patients with retinal disease and their subjective perception of vision quality and functionality. Our data confirm, then, that subjective assessment of functionality of patients with retinal disease must be considered to be based on the per-

The SF-36 measures patient quality of life. In our sample, the general health perceptions, role limitations due to physical functioning, physical functioning, and PCS sub-scales demonstrate mild relations \( r = 0.16 \) to \( 0.25 \), \( P < 0.01 \) with the VF-14 score. This is not unexpected, since most of the patients in this group experienced mild to moderate visual impairment, which would not necessarily be severe enough to seriously impair role functioning or the physical summary score. Musch et al\(^9\) and Gresset et al\(^11\) reported a moderate relation of the VF-14 to role functioning in their sample sets \( r = 0.51 \) and 0.38, respectively. The probable reason for the difference in our sample set is the comparatively younger age of our patients. The average patient age in the study by Musch et al was 72 years and in the study by Gresset et al, 69 years, compared with 55 years in this study. It can be expected that an older age group will have more role limitations caused by physical problems than a sample set of individuals with an average age more than 10 years younger. (Older patients have more comorbidities and a larger number of physical limitations. Therefore, they are more likely to have their “role functioning” impeded.)

Finally, the subscales of the SF-36 and the WCS showed expected moderate relations. The PCS subscale of the SF-36 proved to be the most significantly related subscale to the comorbidity scale, with a correlation of 0.34 \( (P < 0.01) \).

Our study represents the first analysis of validity of the VF-14 across the full spectrum of retinal disease. The results suggest that the VF-14 is a reliable and valid measure of visual function in patients with retinal disease and that individuals living with retinal disease perceive notable functional limitations in their daily activities because of their visual impairment. To effectively include the instrument in clinical trials (as a necessary complement to visual acuity), our group is exploring the validity and responsiveness of the VF-14 in particular subgroups of patients with retinal disease.