# The Refractive Status and Vision Profile: Rasch Analysis of Subscale Validity

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## ABSTRACT

**PURPOSE:** To determine whether the eight subscales of the Refractive Status and Vision Profile (RSVP) questionnaire provide valid measurement.

**METHODS:** Two hundred patients, recruited from a refractive surgery clinic and general optometric practice, self-administered the 42-item RSVP questionnaire. Psychometric properties investigated included measurement of a single construct (unidimensionality), item fit to construct, measurement precision (represented by person separation), targeting of item difficulty to patient's quality of life (QOL), and differential item functioning.

**RESULTS:** Only two subscales ("concern" and "driving") showed adequate person separation, indicating that they could discriminate patients' QOL. However, both demonstrated poor targeting (7.02 logits for "driving" and 1.11 logits for "concern"). One-third of items in each subscale suffered from differential item functioning.

**CONCLUSIONS:** None of the RSVP subscales are valid for assessment of QOL in patients with refractive error, thereby indicating the RSVP should be considered as a single questionnaire without subscales. [*J Refract Surg.* 2010;26(11):912-915.] doi:10.3928/1081597X-20100512-01

Refractive Status and Vision Profile (RSVP) is one of several questionnaires developed to assess quality of life (QOL) following refractive surgery.[1-5] Previous Rasch analysis of the full 42-item version of the RSVP identified several problems that could be repaired in a 20-item shortened and Rasch-scaled version.[6] However, this analysis only considered the RSVP as a single, overall measurement of QOL; subscales were not assessed. This is an important distinction as validity of an overall scale does not confer validity onto subscales. Owing to a smaller number of items, subscales commonly lack measurement precision.[7] Therefore, subscales must be individually validated with the same rigor as an overall scale.

Given the lack of assessment of subscales in the previous Rasch analysis of the RSVP, the aim of the present study was to use Rasch analysis to determine which, if any, of the native subscales of the RSVP provide valid measurement.

## PATIENTS AND METHODS

### QUESTIONNAIRE

The 42-item RSVP questionnaire contains 8 subscales: concern (6 items), expectations (2 items), physical/social functioning (11 items), driving (3 items), symptoms (5 items), glare (3 items), optical problems (5 items), and problems with corrective lenses (7 items).[4]

### PATIENTS

Two hundred patients were recruited from a refractive surgery clinic and a general optometric practice in Leeds, United Kingdom. Patients completed the RSVP questionnaire by self-administration prior to their consultation.

All patients were aged ≥18 years and had myopia >1.00 diopter (D) along at least one meridian. Patients who had ocular, neurological, or systemic disease and previous ocular surgery or medication that could interfere with visual function were excluded as were patients who were unable to read and/or understand written English.

All patients provided informed consent. The study was conducted in accordance with the tenets of the Declaration of Helsinki. Ethics approval was obtained by the ethical committee at the University of Bradford.

Information on demographics, refractive error, and modality of correction were retrieved either from the response provided on the background information section of the questionnaire or from the patient's medical records. Mean patient age was $38.5 \pm 10.8$ years (range: 18 to 67 years), with a female preponderance of 61%. Slightly over half (52.5%) of the patients wore spectacles with mean spherical equivalent refraction (SE) of $-4.25 \pm 2.50$ D (range: $-0.25$ to $-18.50$ D).

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TABLE

## Performance of the Subscales of the Refractive Status and Vision Profile Questionnaire

| Subscale | No. of Items | Person Separation | Mean Item Location (logits) | Mean Person Location (logits) |
|---|---|---|---|---|
| | | | Parameter | |
| Concern* | 6 | 2.26 | 0 | −1.11 |
| Expectations | 2 | 1.20 | 0 | −0.51 |
| Physical/social functioning | 11 | 1.40 | 0 | −1.92 |
| Driving* | 3 | 2.15 | 0 | −7.02 |
| Symptoms | 5 | 1.40 | 0 | −3.84 |
| Optical problems | 5 | 0.96 | 0 | −3.35 |
| Glare | 3 | 0.69 | 0 | −1.93 |
| Problems with corrective lenses | 7 | 1.02 | 0 | −2.65 |

*Subscale showed adequate person separation >2.00, which warranted further investigation.*

## RASCH ANALYSIS

Rasch analysis was performed using Winsteps Rasch measurement software (version 3.68; winsteps.com, Beaverton, Oregon) with the Andrich rating scale model. We previously reported in detail the application of Rasch analysis to ophthalmic questionnaires.[8,9] In brief, we assessed each subscale for the following: behavior of response categories (using category probability curves), measurement precision (using person separation statistics; minimum acceptable value of 2.00, which indicates three strata of person QOL can be discriminated), dimensionality (using infit mean square [MnSq] statistics with acceptable range 0.70 to 1.30 and principal components analysis of residuals), and targeting and differential item functioning. We included the differential item functioning variables *a priori* in this study; above and below mean age (≥38 years as older and <38 years as younger, respectively), gender, and above and below median refractive error in SE (SE ≥−3.75 D and <−3.75 D, respectively). Differential item functioning was considered to be absent if <0.50 logits, 0.50 to 1.0 logits was considered minimal (but probably inconsequential) differential item functioning, whereas >1.0 logits suggested notable differential item functioning.[7] SPSS software version 15.0 for Windows (SPSS Inc, Chicago, Illinois) was used to examine the descriptive statistics.

## RESULTS

### OVERALL PERFORMANCE

The response categories functioned as intended for all item types. The person separation was inadequate for six of the eight subscales, ranging from 0.69 to 1.40, indicating that the subscales had poor discrimination abilities (Table). This is a fundamental flaw precluding the need for further analysis. Two subscales—concern and driving—showed adequate person separation of 2.26 and 2.15, respectively, which prompted further analyses. These results are presented below.

### CONCERN SUBSCALE

All six items showed infit MnSq values ranging from 0.75 to 1.14, which is within acceptable limits. The targeting of items to patients' QOL was 1.11 logits (Table), indicating mistargeting, which is visible on the person-item map (Fig). Unidimensionality was evidenced by principal components analysis of the residuals that showed the variance explained by the principal component as 64.7% and the unexplained variance explained by the first contrast as 2.0 eigenvalue units. Minimal differential item functioning by age and gender for two items was noted. Males rated the item, "my vision holds me back," of less concern relative to other items by 0.54 logits when compared to their female counterparts. Younger patients rated the item, "my vision makes me less self-sufficient," 0.68 logits less difficult relative to other items when compared to older patients.

### DRIVING SUBSCALE

All three items fit the driving subscale, with infit values ranging between 0.84 and 0.95. However, the targeting was much worse (7.02 logits, Table). The patients' QOL ranged from 14.14 to 16.87 logits, which extended well beyond what the items could capture (range: 1.92 to 1.09 logits). Furthermore, the

**Figure.** Person-item map for concern subscale of the Refractive Status and Vision Profile (RSVP) questionnaire. The participants are located at the left of the dashed line and items are located at the right of the dashed line. Items with most concern are relevant to patients with better quality of life (QOL), which are located towards the bottom of the chart. Conversely, items with least concern are most relevant to those with worse QOL, which are located toward the top of the chart. Each "#" and "." represent two and one to three patients, respectively. The mistargeting of items to persons is evident by the items and persons location on different parts of the scale. M=mean, S=1 standard deviation from the mean, T=2 standard deviations from the mean

QOL showed a skewed distribution with the majority of patients either reporting "no" or "minimum" difficulty with driving. Unidimensionality was established by principal components analysis of the residuals that showed the variance explained by the measures as 79.6% and unexplained variance explained by the first contrast as 1.5 eigenvalue units. Minimal differential item functioning by age for one item was noted. Older patients rated the item "driving when it is raining" 0.82 logits less difficult relative to other items when compared to younger patients.

## DISCUSSION

Our results indicated that only two (concern and driving) of the eight RSVP questionnaire subscales possessed adequate measurement precision (ie, person separation) to distinguish three strata of patients' QOL. The remaining subscales failed on this fundamental aspect of measurement.

Two of the dysfunctional subscales (physical/social

functioning and problem with corrective lenses) had more items than the functioning subscale (concern), yet they had inadequate person separation. This underscores the need to consider the nature of items (ie, how relevant they are to patients) in addition to their number during questionnaire design so as to ensure adequate measurement precision. Critically, item difficulty needs to match patients' abilities (ie, targeting).[10] However, as most items were either too easy or did not concern the patients, targeting was uniformly poor for all subscales except the "expectation" subscale, which was limited by poor person separation. The two subscales with adequate precision suffered from poor targeting and were also hampered by one-third of items in each, demonstrating differential item functioning. This is a problem because it indicates that people of different age and gender use these questions differently.

Consistent with the present study, the previous Rasch analysis of the RSVP also found poor targeting.[6] Thus, the central problem with the RSVP and its subscales is a lack of sufficient and well-targeted items (ie, those that are more concerning or difficult) to assess persons with higher QOL. Other QOL instruments, such as the Quality of Life Impact of Refractive Correction (QIRC) questionnaire, do not have this problem.[1]

The present study has revealed that none of the subscales of RSVP satisfy all the requirements of the Rasch measurement model. These subscales lack appropriate and adequate items to address the individual concepts believed to be captured by these subscales. Therefore, the only justified use of the RSVP is as a single questionnaire. Other questionnaires, such as the QIRC, appear to be a better option.[1]

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