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Abstract

**Purpose.** To validate the Impact of Vision Impairment for Children (the IVI_C), a new vision-specific pediatric instrument designed to assess the affect of impaired vision on quality of life (QoL) in children.

**Methods.** The IVI_C was administered to vision-impaired and normally sighted students, 8 to 18 years of age. Reliability and validity were tested, and the IVI_C was subjected to Rasch analysis to assess the scale unidimensionality, measurement characteristics, response options, and targeting.

**Results.** The mean (SD) presenting bilateral distance visual acuity (VA) for the vision-impaired group (n = 122) was 1.10 (0.79) logMAR and 1.15 (0.80) logMAR for near VA. After the initial response categories were collapsed from five to three, content validity was further supported by good person and item fit parameters. The person separation index (PSI) was 0.85, which indicates that the IVI_C can assess QoL across children of several participation levels. The scale was shown to be unidimensional after principal components analysis (PCA) of the residuals (t-test; P = 0.48, P = 0.34).
Vision impairment (visual acuity [VA] <20/60≥20/400) is acknowledged as ranking sixth in global burden of disease impact. While childhood blindness (VA <20/400) accounts for 4% of the world’s blindness, childhood vision impairment is estimated at 12%. A third of the global costs due to vision impairment and blindness are attributable to that occurring in childhood. Despite the low prevalence of childhood blindness and vision impairment, its global impact is high. Childhood blindness is the second most frequent cause of “blind-years,” after adult cataract, which is the leading cause. Furthermore, up to 75% of childhood vision impairment and blindness is caused by nonpreventable and nontreatable conditions in resource-rich countries and an increasingly similar profile is emerging in resource-poor countries. Support needs for vision-impaired children are complex. In addition to clinical and functional vision tests, it is necessary to assess children’s ability to socialize and participate in everyday activities.

Quality of life (QoL) tools ascertain social, emotional, and participation aspects of daily living. Although the Children’s Visual Function Questionnaire (CVFQ), a QoL scale, is available, it uses proxy opinion. Two vision-specific pediatric scales measuring visual functioning are also available: LV Prasad-Functional Vision Questionnaire (LVP-FVQ) and the Cardiff Visual Ability Questionnaire for Children (CVAQC). However, to date no scale has been developed to assess self-reported vision-specific QoL in school-aged children.

Two of the vision-specific pediatric scales developed (the LVP-FVQ and the CVAQC) were validated by Item Response Theory (IRT). Rasch analysis, a form of IRT, complements classic psychometric methods by assessing scale response categories, precision, unidimensionality, and item fit to the measured construct. Rasch analysis helps transform raw questionnaire data, composed of nominal numeric values from response options, into a continuous scale with interval estimates. This transformation can also help to reduce noise and enable the use of valid parametric statistical analyses of the output. These attributes of Rasch analysis have led to its growing recognition and use in the development or revalidation of questionnaires in ophthalmology.

The Impact of Vision Impairment for Children (IVI_C), a vision-specific QoL scale, was developed from focus groups including children, in which themes for guidance were used during the discussions. The items were developed from the children’s focus groups statements and tested for relevance and comprehensibility in a convenience group of children, adolescents, and young adults, with and without vision impairment. We initially showed that the IVI_C has good content and face validity. In this study, we used Rasch analysis to assess its unidimensionality, item fit, person–item targeting, reliability, and internal validity. A secondary objective was to determine the scale reliability and concurrent and discriminant validity.

**Methods**

During 2005, 126 students with vision impairment were recruited through Departments of Education itinerant teacher services in Australia (two states) and in a pediatric low-vision clinic (Vision Australia) in another state. Fifty students without vision impairment were also recruited. The inclusion criteria for the students were (1) aged 8 to 18 years; (2) able to converse in English; (3) no other sensory, physical, and/or intellectual co-morbidity, such as deafness, paraplegia or severe learning disability; and (4) presenting VA worse than 0.3 logMAR (<20/40) and/or a restricted visual field of ≤60°. The lower VA limit was based on the evidence that VA worse than 0.3 logMAR (<20/40) adversely affects lifestyle in adults. A minimum age was specified for two reasons. It is recognized that children as young as 8 years are able to effectively reflect on their QoL. In addition, the questionnaire response format for children ranging in age from 8 to 18 years could remain consistent, allowing comparative longitudinal assessment of individuals. Working with vision-impaired children without other disability,
who are known to demonstrate higher QoL than those with multiple impairments, may limit the generalization of the IVI_C findings. However, by so doing provides a clear platform for assessing the specific impact of vision impairment on children’s QoL. Normally-sighted students were also recruited to determine the scale's discriminant validity, by using the same inclusion criteria, although the required VA was ≤0.2 logMAR (≥20/30). Although it was not possible to recruit buddy-control participants, normally-sighted students were recruited from the same schools that the vision-impaired students attended, on receipt of their verbal permission.

Written informed consent was gained from all participants, guardians, and school principals. The study obtained ethics approval from the Human Research and Ethics Committee of the Royal Victorian Eye and Ear Hospital, the Royal Children's Hospital, four Departments of Education and Vision Australia. This study was conducted in accordance with the Declaration of Helsinki for research involving human subjects.

The IVI_C
Subsequent to item development from focus group data, a 30-item questionnaire (IVI_C, ver. 1.0) was trialed in four Australian states (the pilot phase). The validation phase of the IVI_C (ver. 1.2) followed, using a different sample of children from three Australian states. The IVI_C was developed as an interviewer-administered scale. Unlike most adult vision-related questionnaires and both the LVP-FVQ and the CVAQC which use negative item phrasing, most of the items were positively framed to eliminate negative suggestions about students' circumstances. For example, "When you are in the classroom, are you confident about asking for help you need?" Each page of items was prefaced with the statement, "The questions are all about how things are for you because of your eyesight." All questions had a 5-point scored response, which were, “always,” 5; “almost always,” 4; “sometimes,” 3; “almost never,” 2; and “never,” 1. Six of the items were reverse scored (1, 2, 3, 4, and 5) to prevent response bias. A sixth response, “no, for other reasons,” 8, was also available. As this response was not on the same continuum as the scoring for the scale, it was not scored. However, missing item analysis was conducted, to assess whether the response "no, for other reasons" was informative, to support this decision. During both the pilot and the validation phases, items were eliminated if they were irrelevant for more than 20% of respondents or displayed floor/ceiling effects where end response options 1 and 5, or any individual option response, accounted for >50% of the responses.

The IVI_C was administered to participants face to face, with the exception of one interstate group who answered the questionnaire by telephone. Three subsets of the vision-impaired group answered the questionnaire twice, 3 to 6 weeks apart; the second interview being by the same (temporal stability) or different (inter-observer reliability) interviewers or by different modes (face to face or by telephone).

Assessments
Demographic information on age, sex, support services, type of low-vision devices used, duration and type of ocular condition were provided by participants' families. Distance and near VA were measured using logMAR numeric optotype charts. To classify perception of light (PL) with a logMAR score for analysis, Visual Acuity Rating (VAR) was used and identified PL as 3.0 logMAR. Contrast sensitivity was measured using Lea logMAR contrast charts (cat. no. 2520Precision Vision, LaSalle, IL).

Statistical Analysis
Descriptive statistics were used to characterize the items (SPSS statistical software, ver. 17.0; SPSS Science, Chicago, IL). Temporal stability and reliability between different forms of administration were evaluated by using Guttman split-half correlation. The research design included other functional assessments (not reported here). As it was imperative that the research not be onerous on the children, the time available to use multiple scales to determine discriminant validity was limited. Therefore, another method was used in a group of statistically different children (not vision-impaired) to provide the comparison. Rasch analysis was used to assess the validity and measurement characteristics of the IVI_C using Rasch Unidimensional Measurement Models (RUMM2020 software). As the same response format was used throughout the IVI_C, the Andrich rating scale model was used. The Rasch model assumes that the probability that an individual will respond to an item is a logistic function of the difference between the individual's level of functional ability and the item's level of functional difficulty, and only a function of that difference. The Rasch model thus enables item and person parameter
estimates to be calibrated on the same scale, expressed in logarithm of the odds units (logits). By definition, as this scale is linear, a higher score on the scale represents better QoL and less difficulty with items.

We first assessed the evidence of disordered thresholds that occur when participants have difficulty discriminating between response categories. In other words, a category expected to be harder than an adjacent category may be perceived as easier. Collapsing categories (i.e., giving respondents fewer options) normally resolves the problem of disordered thresholds.

Content validity was evaluated by using person and item fit residual statistics, where it is expected that the mean and SD values approximate 0 and 1, respectively. An overall item–trait interaction score ($\chi^2$) with a statistically nonsignificant Bonferroni-adjusted probability ($P > 0.05/\text{number of scale items}$) was used to indicate overall fit of the data to the model. This method also indicates that the hierarchical ordering of items (i.e., from difficult to easy) is consistent across all levels of participation. An estimate of the internal reliability of the scale based on the person separation index (PSI), which is similar to Cronbach’s $\alpha$, was also reported. PSI $\geq 0.7$ is suitable for group use and PSI $\geq 0.8$ is suitable for clinical use. The PSI is closely linked to the targeting of the scale, as it differentiates the number of statistically distinct groups of respondents that can be identified on the trait.

We also investigated the presence of differential item functioning (DIF), to determine whether different subgroups (e.g., sex or eye diseases), despite equal levels of functioning, respond differently to individual items. Often there is compensatory DIF across a scale. The relevance of uniform DIF is dependent on the use of the scale and the number of items that demonstrate DIF. Finally, principal components analysis (PCA) of the residuals was undertaken, which allows for a test of the local independence of the items. This test allows the pattern of factor loadings on the first residual to determine subsets of items. The assumption of local independence is indicated when the person estimates derived from these subsets do not differ significantly from the estimates derived from the full scale (using Student’s $t$-test). The results of this test indicate whether there are further associations among the items other than random associations, once the Rasch factor has been taken into account.

The absence of such associations, in addition to adequate fit statistics of the data to the Rasch model, would support the validity, reliability, measurement characteristics, and unidimensionality of the IVI_C.

**Results**

**Pilot Phase**

Questionnaires ($n = 100$) were distributed to education services and low-vision centers in four participating Australian states, resulting in 49 returns. Visiting teachers recruited students by invitation if they met the inclusion criteria. The students’ ages were between 8 and 17 years (mean ± SD, 12 ± 2.5). Most of them ($n = 39, 79\%$) had impaired vision (VA $>0.5$ logMAR, or <20/60) since birth, and 41% were boys. There were no reports that the IVI_C questions were misunderstood. Twenty-seven (90\%) of the 30 items were relevant to more than 88\% of the respondents, and responses across the full range of response categories were recorded to 22 (73\%) of the items. Two items had ceiling effects and were removed (“Do you get yourself ready for school” and “Can you recognize coins and notes when paying for things”). The scoring of one item (“Do you want to meet and spend time with other students who have a vision impairment”) proved to be ambiguous, as the highest and lowest scores could either be indicative of more assistance or no assistance required. It was excluded, as it did not add value to the scale. A minimalist approach to item deletion was undertaken during the pilot stage because of the low return and the low representation of boys in this sample group. Of the original 30 items, 27 were retained for the validation phase of the IVI_C.

**Validation Phase**

A total of 176 vision-impaired and sighted students participated between October and December 2005. There were no significant differences between the groups in age and sex ($P > 0.05$; Table 1), despite the difference in secondary and primary school proportions caused by the crossover of 11- and 12-year-old students in both primary (year 6) and secondary (year 7) schools. The median time taken to complete the questionnaire was 6 minutes (range, 2–18 minutes) with 90\% of respondents taking ≤10 minutes. There was no difference between telephone and face-to-face interview times ($P > 0.05$).

**Table 1.**
The causes of vision impairment were grouped according to age at onset, as this can have an impact on early-learning strategies. Age at onset was known for all the Victorian students and for 45% of the interstate students (n = 17/38). Seventy-six percent (n = 77/101) of the vision-impaired group had congenital conditions, and the remainder had juvenile/degenerative conditions. The mean ± SD presenting bilateral distance VA (DVA) for the vision-impaired participants was 1.1 ± 0.80 logMAR, and 85% (n = 104/122) of the group had DVA worse than 0.5 logMAR (<20/60). Four Victorian vision-impaired students were found to have DVA ≤ 0.3 logMAR (≥20/40) without field loss and were excluded from further analysis (Table 1). The vision-impaired sample size of 122 allowed the basic rules of the person-item ratio to be met for questionnaire design. A 5:1 ratio after item reduction (five respondents per item) was achieved.

Twenty-six of the 27 items were considered relevant by more than 80% of the respondents (i.e., did not respond “no, for other reasons”). The one item that was not (“Are you confident to look for part-time work?”) was removed. Two further items were removed at this stage, resulting in 24 items for further analysis. “Do you help in and around the house?” and “Do your classmates want to learn about the equipment/gadgets that you use?” had weak interitem Spearman correlation (<0.2), an indication for removal, as they are likely to be assessing a different construct from the other items of the scale. The remaining 24 items recorded responses across the full range of five response categories. Two items (“…same information as other students?” and “…confident about asking for help you need?”) recorded responses across only four of the five response categories (always to almost never).

**Rasch Analysis**

**Category Thresholds.**

When the remaining 24 items of the IVI_C were initially fitted to the Rasch model, disordered thresholds were evident (a threshold is the intersection of two consecutive categories). As seen in Figure 1A, the IVI_C thresholds demonstrated a disordered arrangement evidenced by response categories 1 and 3 not displaying distinct peaks along the continuum of the latent trait where the category is most likely to be selected. This necessitated that these two categories be collapsed into the extremes, giving categories 0, 0, 1, 2, 2, which resulted in ordered thresholds (Fig. 1B). After the categories were collapsed, all items demonstrated fit residuals <2.5, indicating that there was no significant item misfit to the Rasch model (Table 2). All further results reported relate to the three-level IVI_C.

**Figure 1.**

(A) Category probability curve showing disordered thresholds for item 15, “difficulty to join in.” 0, never; 1, almost never; 2, sometimes; 3, almost always; and 4, always. (B) Category probability curve showing the thresholds for the same item, now ordered after category collapse. 0, almost never; 1 sometimes; 2, almost always.

**Table 2.**
Content Validity and Internal Reliability.

Previously, content validity for the IVI_C was assumed to be satisfactory, as the items were derived from respondent-targeted focus groups. This hypothesis was confirmed where the person and item fit residual statistics (mean and SD values) for the Rasch-adjusted IVI_C, approximated 0 and 1, respectively. The mean ± SD person and item fit residual values for the vision-impaired group were (person) −0.08 ± 0.95 logits, and (item) −0.02 ± 1.04 logits, suggesting the substantial validity of the IVI_C. The overall item–trait interaction scores of $\chi^2 = 65.53 (P = 0.05)$ met the Bonferroni-adjusted criteria of $P > 0.002$. The internal reliability of the scale based on the person separation index (PSI) was 0.85, which indicates that the scale can distinguish between three distinct strata of person ability.

Differential Item Functioning.

There was no notable DIF between any of the measured variables, which were sex, age (0–12 or 13–18 years), level of visual impairment (mild/moderate or severe/profound), use of low-vision aids (all types, optical, non-optical, or none), years of specialist support (0–5, 6–11, or 12–18 years), and cause of vision loss (congenital or degenerative). This result indicates that the IVI_C is a valid scale for assessing vision-specific QoL across the various categories of each of these variables. The substantial lack of DIF also suggests that the items are appropriate for the targeted respondents.

Unidimensionality.

PCA of the residuals loading onto the first factor was undertaken, comparing two subsets with positive and negative loading $>±0.3$. No significant differences were found between the person estimates of the Rasch-scaled IVI_C and the positive and negative subsets, supporting a unidimensional construct. A five-item positive (items 4, 5, 6, 7 and 15; t-test; $P = 0.48$) and six-item negative subset (items 8, 12, 16, 18, 19 and 21; t-test; $P = 0.34$) were identified. This finding provides further support that the instrument is measuring one underlying trait (QoL).

Item Difficulty and Targeting.

The mean overall respondent score of the IVI_C for the vision-impaired group was 1.1 ± 0.98 logits (range, −1.2 to 4.41) suggesting that the respondents’ mean overall level of QoL was higher than the mean required level of difficulty for the items (Table 1). Mobility-related items were found to be the most difficult, followed by items that reflected personal emotive state and community understanding. “Teachers understanding your special needs” (item 19; −0.92 logits) and “difficulty stepping down” (item 2; −0.81 logits) were items that represented least difficulty (Table 2). The person-item map demonstrates that items are not targeted to highly able participants (Fig. 2). Within each item, there are various levels of ability based on the response categories. Participants responding to the category almost never demonstrates less ability or confidence, which is the reference threshold level. The first level of response in the map was sometimes and the second level was almost always. Higher logit values are recorded for the second level of responses for items on the map, as greater ability (confidence) is needed to respond to that level.

Figure 2.

Person-item map showing the targeting of the different response levels of each item to the vision-impaired group. For each item there are three response categories: 0, 1, and 2. The response categories indicate the increasing difficulty level of the item, requiring increasing ability of the individual. The response category 0 is the reference category indicating least difficulty...
level of the item and that the individual requires least ability to attempt the item, thus indicating the greatest impact on QoL. Response category 2 indicates the hardest level of the item requiring the greatest ability of the individual. The items are denoted by their scale number and response level—for example, Q7.2 is item 7, response 2 “almost always” (able/confident) against which six individuals (crosses) are seen as possessing the required level of ability. A further five individuals have greater ability as seen by the crosses above the level of Q7.2.

**Discriminant and Criterion Validity.**

A significant difference between the normally-sighted (mean = 2.7 logits, 95% CI 2.4, 3.06) and vision-impaired (mean = 1.1 logits, 95% CI 0.93, 1.27) groups was found thus supporting discriminant validity of the IVI_C (ANOVA; \( F = 78.75; P < 0.0001 \)). There were also moderate associations between perceived QoL and distance and near VA (Spearman’s \( \rho = -0.26 \), respectively; \( P < 0.01 \)), which substantiates the scale's criterion validity.

**Reliability.**

Only 104 vision-impaired students were available for second interviews. Thirty-three percent (n = 34) participated 3 to 6 weeks apart in reliability parameter assessments. Guttman split-half correlations for temporal, mode (telephone and face), and interobserver reliability parameters were 0.95, 0.90, and 0.86, respectively, indicating that the IVI_C is a stable tool over a short period, between modes and administrators (Table 3).

Table 3.

<table>
<thead>
<tr>
<th>Item number</th>
<th>Item content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you find it difficult to go down stairs or to step off the footpath?</td>
</tr>
<tr>
<td>2</td>
<td>Are you confident to make your own way to school?</td>
</tr>
<tr>
<td>3</td>
<td>Are you confident to use public transport (such as buses, trains, ferries) by yourself?</td>
</tr>
<tr>
<td>4</td>
<td>Are you confident to use public transport (such as buses, trains, ferries) by yourself?</td>
</tr>
<tr>
<td>5</td>
<td>Are you confident to use public transport (such as buses, trains, ferries) by yourself?</td>
</tr>
<tr>
<td>6</td>
<td>Are you confident to use public transport (such as buses, trains, ferries) by yourself?</td>
</tr>
<tr>
<td>7</td>
<td>Are you confident to use public transport (such as buses, trains, ferries) by yourself?</td>
</tr>
<tr>
<td>8</td>
<td>Can you find your friends in the playground at lunch and play time?</td>
</tr>
<tr>
<td>9</td>
<td>When you are in a race, can you recognise people you know before they start?</td>
</tr>
<tr>
<td>10</td>
<td>Can you take part in games or sports that you want to play with your friends?</td>
</tr>
<tr>
<td>11</td>
<td>Do you get the chance to go to activities other than sport (such as social groups)?</td>
</tr>
<tr>
<td>12</td>
<td>Have your eyesight stopped you from doing the things that you want to do?</td>
</tr>
<tr>
<td>13</td>
<td>Do other students help you when you ask them for help?</td>
</tr>
<tr>
<td>14</td>
<td>Do other students help you to join in with them?</td>
</tr>
<tr>
<td>15</td>
<td>Do other students understand your special needs?</td>
</tr>
<tr>
<td>16</td>
<td>Do your teachers understand your special needs?</td>
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<tr>
<td>17</td>
<td>In the classroom, do you get all the same information as other students?</td>
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<td>18</td>
<td>Do you get all the information at the same time as the other students?</td>
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<tr>
<td>19</td>
<td>Do you get enough time in school to complete the work set by the teacher?</td>
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<tr>
<td>20</td>
<td>When you are in the classroom, are you confident about asking for help you need?</td>
</tr>
<tr>
<td>21</td>
<td>When you ask for help, do people understand how much help you need?</td>
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<tr>
<td>22</td>
<td>Do people tell you that you can’t do the things that you want to do?</td>
</tr>
<tr>
<td>23</td>
<td>Do people stop you from doing the things you want to do?</td>
</tr>
</tbody>
</table>

**Discussion**

This study has established that the IVI_C is a suitable and valid instrument for assessing the impact of vision impairment in school-age children in Australia. To our knowledge, this is the first time Rasch analysis has been used to validate a vision-specific QoL in children. Our findings indicate that the Rasch-modified 24-item IVI_C possesses unidimensionality, good person separation, and internal reliability indices. In addition, we demonstrated that the IVI_C is a reliable tool across administration modes, over time, and between observers. It can also effectively discriminate between normally-sighted and vision-impaired groups.

The Rasch-adjusted IVI_C has three response categories from its initial five options. Responses at both extremes were collapsed with adjacent categories providing the suggested responses, almost always, sometimes, and almost never. The category, no, for other reasons, remains (representing missing data) and is not included in scoring. A reduction to a three-category response scale in vision-related measures is consistent with findings from other studies. 53–56

Uniquely, the IVI_C uses positive phrasing for 75% (18/24) of items, which focus on respondents’ confidence to do an activity...
The Baltimore Pediatric Eye Disease Study multimodule QoL scale that caters for both proxy and self-report, allowing for a younger age group to be assessed on the same scale. The current large-scale pediatric eye studies investigating the effect of refractive error and eye disease use health-related, not vision-specific, QoL as an outcome measure. The Multi-ethnic Pediatric Eye Disease Study details the PedsQOL, a multimodule QoL scale that caters for both proxy and self-report, allowing for a younger age group to be assessed on the same scale. The Baltimore Pediatric Eye Disease Study has included the Parent Evaluation of Development Scale. However, the overall positive mean person logit could indicate that the items are targeted to low function or that the group is high-functioning (Fig. 2, as reflected in the item map). This may contribute to the ability of the group to grade their confidence in undertaking a task.

The targeting of the Rasch-adjusted IVI_C suggests that the items are more suited for children of lesser ability, which would make the IVI_C useful for evaluating children who had received little specialist support and to evaluate their changing needs throughout their schooling from age 8 to 18 years. Furthermore, the unidimensionality of the Rasch-adjusted IVI_C indicates that the scale is measuring what it purports to measure, that is, QoL. Future investigation is needed to assess whether specific aspects of QoL (or subscales) can be identified. Subscales would enhance the capacity of the IVI_C to assess the impact of vision loss on specific components of QoL as well as determine the effectiveness of intervention programs.

The Rasch-estimated interval linear score of the IVI_C demonstrated a modest correlation with both distance and near VA, which, combined with the discriminant validity analysis of the scale, supports that the IVI_C is measuring vision-related concepts. The low correlation suggests that factors other than VA alone affect vision-specific QoL. This possibility is exemplified by the International Classification of Functioning, Disability, and Health (ICF) where the interplay between the type of impairment, the activity chosen, and type of participation is affected by contextual factors such as character and culture. The role of other factors has also been commonly demonstrated in studies assessing impact in vision-impaired adults. The ICF and adult studies underpin the necessity of measuring not only VA and functional ability but also of obtaining insight to how individuals are coping with their situations—the rationale behind using QoL instruments.

As opposed to the LVP-FVQ, which was developed in India with several culture-specific items, the items of the IVI_C are more general and potentially more transferable. Consequently, the IVI_C has been used in other pediatric studies in Fiji, India (manuscript submitted), Malawi and the United States. The only item in the LVP-FVQ similar to any in the IVI_C was “walking home at night.” This item was considered as one of the midrange difficulty items of the LVP-FVQ, whereas in the IVI_C moving around at night was an item requiring the greatest level of ability (1.9 logits). Having a low luminance item is important, especially in assessing the effectiveness of training support for students who have degenerative conditions. Even in adult scales with one notable exception, it is rarely addressed appropriately. Being able to assess students’ self-perception of their capability in this activity is highly useful in tailoring specialist intervention programs.

The strengths of this study include the use of focus groups to initially develop the IVI_C. This step is critical in pediatric health care and planning of support services, as there is concern that the needs of pediatric recipients are not being understood. Furthermore, the steps indicative of sound development of a patient-reported outcome measure as articulated by Pesudovs et al. and the U.S. Food and Drug Administration have been met, with few exceptions. The application of Rasch analysis to validate the resultant scale is another strength of this investigation. A limitation of our study is the modest sample size although it met the minimum requirements for validation of a new scale (five respondents per item). Our findings also suggest that the IVI_C currently lacks ability to discriminate change in highly able students (non-ideal targeting of >1.0 logit). Further work with the five-response IVI_C with larger, randomized samples in Australia or countries of similar socioeconomic profile is necessary, to confirm our initial results, followed by studies testing the IVI_C in non-similar countries, to determine transferability. Studies with vision-impaired children with other disabilities would be warranted once the IVI_C has been established, as would studies investigating the effect of refractive error on pediatric QoL.

Current large-scale pediatric eye studies investigating the effect of refractive error and eye disease use health-related, not vision-specific, QoL as an outcome measure. The Multi-ethnic Pediatric Eye Disease Study details the PedsQOL, a multimodule QoL scale that caters for both proxy and self-report, allowing for a younger age group to be assessed on the same scale. The Baltimore Pediatric Eye Disease Study has included the Parent Evaluation of Development Scale.
However, it is questionable that the outcome measures chosen are the most appropriate: Lamoureux et al. have demonstrated using Rasch analysis in a Singaporean population of young children with refractive error that the PedsQOL is not a valid instrument for determining vision-specific QoL. The IVI_C may prove to be more useful in such studies, as it has been developed as a vision-specific tool. However, it has not yet been tested with school children aged 5 to 7 years or in those with refractive error.

In conclusion, our results support the hypothesis that the IVI_C is a psychometrically valid vision-specific QoL measure, which is appropriate for use in vision-impaired children aged 8 to 18 years who have no additional disabilities. It identifies a range of needs that can be compared between administrations for each individual, allowing support requirements to be monitored. Therefore, it can be used with other tools to plan students' support needs and has the potential to provide assessment of interventions. Our results represent an important step toward providing assessment of participation in daily activities and QoL in children with vision impairment.

Footnotes

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