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Evaluation of the Intermittent Exotropia Questionnaire Using Rasch Analysis

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Abstract

IMPORTANCE—The Intermittent Exotropia Questionnaire (IXTQ) is a patient, proxy, and parental report of quality of life specific to children with intermittent exotropia. We refine the IXTQ using Rasch analysis to improve reliability and validity.

OBSERVATION—Rasch analysis was performed on responses of 575 patients with intermittent exotropia enrolled from May 15, 2008, through July 24, 2013, and their parents from each of the 4 IXTQ health-related quality-of-life questionnaires (child 5 through 7 years of age and child 8 through 17 years of age, proxy, and parent questionnaires). Questionnaire performance and structure were confirmed in a separate cohort of 379 patients with intermittent exotropia. One item was removed from the 12-item child and proxy questionnaires, and response options in the 8- to 17-year-old child IXTQ and proxy IXTQ were combined into 3 response options for both questionnaires. Targeting was relatively poor for the child and proxy questionnaires. For the parent questionnaire, 3 subscales (psychosocial, function, and surgery) were evident. One item was removed from the psychosocial subscale. Resulting subscales had appropriate targeting.

CONCLUSIONS AND RELEVANCE—The Rasch-revised IXTQ may be a useful instrument for determining how intermittent exotropia affects health-related quality of life of children with intermittent exotropia and their parents, particularly for cohort studies.

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The Intermittent Exotropia Questionnaire (IXTQ) is a patient-derived, intermittent exotropia-specific instrument designed to evaluate health-related quality of life (HRQOL) in children with intermittent exotropia and their parents.^{1,2} The IXTQ consists of 3 parts: the 12-item child IXTQ (completed by the child to assess the child's HRQOL), the 12-item proxy IXTQ (completed by the parent to assess the child's HRQOL), and the 17-item parent IXTQ (completed by the parent regarding his or her own HRQOL).¹ The child and proxy questionnaires each have a single subscale. The parent questionnaire contains 3 subscales: psychosocial, function, and surgery. The IXTQ is reliable and valid for assessing HRQOL in children with intermittent exotropia.¹⁻³ It is available for download free of charge at <http://pedig.jaeb.org/>.

The IXTQ was originally developed using classical test theory. Rasch analysis may be used to modify and improve existing HRQOL instruments.⁴⁻⁹ In the present study, Rasch analysis was used to refine the existing IXTQ, removing items that do not contribute meaningful information to the instrument and ensuring that response options are properly interpreted.

Methods

Patient Cohort

Parents gave written informed consent, and children gave written assent when required. The protocol was approved by the institutional review boards of the Mayo Clinic, Jaeb Center for Health Research, and other local sites involved in the study. Data were collected and analyzed in accordance with the Health Insurance Portability and Accountability Act guidelines.

The IXTQ was completed by 575 parents of 575 children aged 1 through 16 years with intermittent exotropia at the time of their child's clinic examination, enrolled from May 15, 2008, through July 24, 2013. The 295 children aged 5 years or older completed the age-appropriate child IXTQ. Parents and children completed the IXTQ as part of routine care in the strabismus practice of one of the authors (J.M.H., n = 110) or at the enrollment examination for 1 of 2 ongoing randomized clinical trials being conducted by the Pediatric Eye Disease Investigator Group (NCT 01032603 [n = 69] and NCT 01032330 [n = 396]). Child questionnaires were administered to children aged 5 through 7 years by study personnel. All 8- to 17-year-old child, proxy, and parent questionnaires were self-administered. Patient demographics are reported in eTable 1 in the Supplement.

Statistical Analysis

Before Rasch analysis, items with floor and ceiling effects on the child, proxy, and parent IXTQs were eliminated as described in the eMethods in the Supplement. Rasch analysis was performed on each of the 4 IXTQs using the analytic methods that we have applied previously (eMethods in the Supplement).⁹ The performance and structure of the Rasch-modified IXTQ were confirmed with a separate Rasch analysis using IXTQ data from an additional 379 parents and their children (eTable 1 in the Supplement).

Results

Detailed results are available in the eResults and eTables 2 through 9 in the Supplement. Item 12 was removed from the child and proxy IXTQs because of strong ceiling effects (Table 1). Rasch analysis on the remaining items indicated that performance of the 8- to 17-year-old child IXTQ and proxy IXTQ would be enhanced by reducing the number of response options to 3 categories. Properties of dimensionality, response ordering, local dependence, misfit, and differential item functioning were acceptable (eResults, eFigure 1, and eTables 2, 4, 5, and 6 in the Supplement), although targeting was not ideal (Figure).

For the parent IXTQ, no strong floor or ceiling effects were noted (Table 2). The 3 previously identified subscales for the parent IXTQ (psychosocial, function, and surgery) were confirmed with principal component analyses (eResults and eTables 3 and 4 in the Supplement). For each subscale, properties of dimensionality, response ordering, local dependence, misfit, and differential item functioning were acceptable with the exception of notable misfit for item 17 in the parent psychosocial subscale, which was then removed (eResults, eFigure 2, and eTables 3, 4, 5, and 7 in the Supplement). Targeting of all 3 parent IXTQ subscales was acceptable (Figure).

Applying the Rasch modifications derived in the present study to a separate cohort of 379 patients, the factor structure and evaluative properties of the IXTQ were confirmed (eResults and eTables 8 and 9 in the Supplement).

Discussion

The results of Rasch analysis indicated that the IXTQ would benefit from slight response option restructuring and item removal (removal of item 12 from the child and proxy IXTQs, reducing the number of response options on the 8- to 17-year-old child IXTQ and the proxy IXTQ from 5 to 3 options, removing item 17 from the parent psychosocial subscale, and scoring the 3 parent subscales separately). These modifications were confirmed to yield unidimensional domains in a separate cohort, with relatively poor targeting for the child and proxy questionnaires but good targeting and person separation for the parent function, psychosocial, and surgery subscales.

Because the 8- to 17-year-old child IXTQ response options can be collapsed to 3 from 5, it may be possible to combine the 5- to 7-year-old child IXTQ with the 8- to 17-year-old child IXTQ in future versions of the child IXTQ with 3 response options. Nevertheless, combining the 2 forms of the child IXTQ would require changing the wording of one of the questionnaires from second to first person or vice versa, requiring all children aged 5 through 17 years to complete the questionnaire on their own or to have the questionnaire read to all children regardless of age. Such changes would require additional validation.

The person separation index and reliability of the child and proxy IXTQs are less than ideal. In contrast, the person separation index and reliability for each of the parent IXTQ subscales are appropriate. Despite this limitation, there may be value in using the child and proxy questionnaires in cohort studies because group summary scores are less sensitive to noise.

There was poor targeting for the child and proxy questionnaires. One potential reason for this poor targeting is the low level of expressed concern on the part of the children and, similarly, the low level of concern expressed by the parents as proxy for their children.

We now recommend that the parent IXTQ be Rasch scored and reported only as 3 separate subscale scores rather than a composite as scored previously.^{1,3,10} We have created conversion tools using Excel spreadsheets (Microsoft Inc) to easily convert raw IXTQ responses to Rasch-scaled responses and have made them available online (<http://pedig.jaeb.org/>). In addition to logit values, the lookup tool converts each Rasch person measure from a logit value to a 0 to 100 value (0 indicating worst HRQOL and 100 indicating best HRQOL) through a linear transformation of the person scores. The Rasch-revised IXTQ, in particular the parent IXTQ, provides a valuable tool to measure the effect of intermittent exotropia on children and their parents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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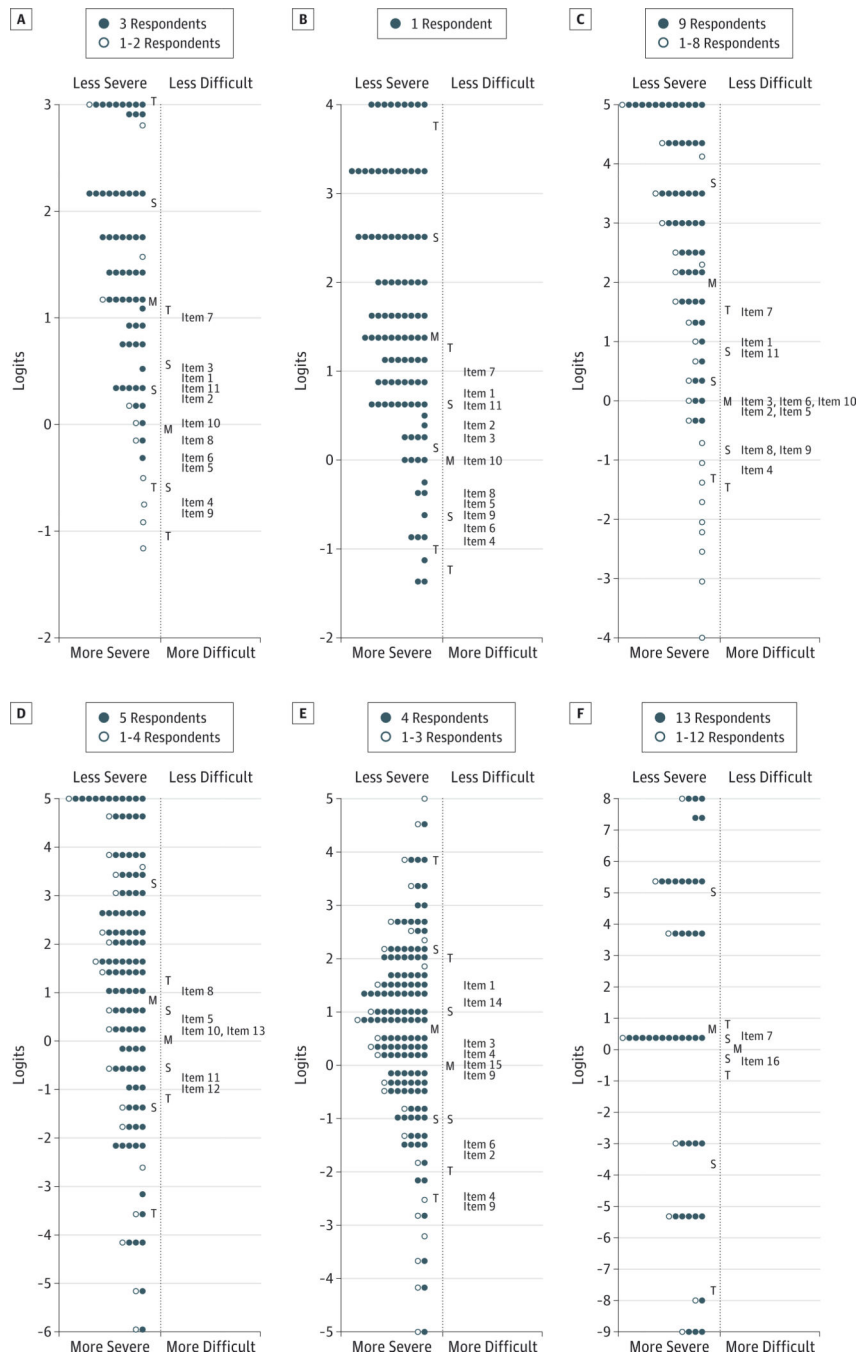


Figure. Targeting for 5- to 7-year-old child IXTQ (A), 8- to 17-year-old child IXTQ (B), proxy IXTQ (C), parent psychosocial subscale of the parent IXTQ (D), parent function subscale of the parent IXTQ (E), and parent surgery subscale of the parent IXTQ (F). M indicates mean; S, SD; and T, 2 SDs.

Table 1

The 12 Items of the Original Child and Proxy XTQ^a

Item	No. (%) of Respondents (N = 575)					
	Responding at Floor (a Lot or Almost Always)			Responding at Ceiling (Not at All or Never) ^b		
	Child 5 to 7 Years Old (n = 192)	Child 8 to 17 Years Old (n = 103)	Proxy (n = 574)	Child 5 to 7 Years Old (n = 192)	Child 8 to 17 Years Old (n = 103)	Proxy (n = 574)
1. I worry about my eyes	21 (10.9)	6 (5.8)	9 (1.6)	108 (56.3)	39 (37.9)	272 (47.4)
2. It bothers me that people wonder what is wrong with my eyes	25 (13.0)	6 (5.8)	7 (1.2)	121 (63.0)	54 (52.4)	378 (65.9)
3. It bothers me because I have to wait for my eyes to clear up	26 (13.5)	3 (2.9)	4 (0.7)	103 (53.6)	59 (57.3)	357 (62.2)
4. Kids tease me because of my eyes	12 (6.3)	2 (1.9)	3 (0.5)	160 (83.3)	80 (77.7)	441 (76.8)
5. I am bothered when grownups say things about my eyes	13 (6.8)	1 (1.0)	5 (0.9)	145 (75.5)	70 (68.0)	369 (64.3)
6. I am bothered when my parents say things about my eyes	12 (6.3)	1 (1.0)	3 (0.5)	141 (73.4)	77 (74.8)	358 (62.4)
7. It bothers me that I have to shut one eye when it is sunny	48 (25.0)	13 (12.6)	23 (4.0)	88 (45.8)	43 (41.7)	269 (46.9)
8. I feel different from other kids because my eyes go in and out	16 (8.3)	4 (3.9)	4 (0.7)	135 (70.3)	74 (71.8)	425 (74.0)
9. I worry about what other people think of me because of my eyes	8 (4.2)	2 (1.9)	3 (0.5)	156 (81.3)	75 (72.8)	425 (74.0)
10. My eyes make it hard to look people in the eye	17 (8.9)	7 (6.8)	10 (1.7)	128 (66.7)	65 (63.1)	367 (63.9)
11. It is hard to concentrate because of my eyes	25 (13.0)	9 (8.7)	4 (0.7)	112 (58.3)	53 (51.5)	291 (50.7)
12. My eyes make it hard for me to make friends	8 (4.2)	1 (1.0)	1 (0.2)	163 (84.9)	94 (91.3)	510 (88.9)

Abbreviation: IXTQ, Intermittent Exotropia Questionnaire.

^aThe 8- to 17-year-old child IXTQ is given. Proxy questions contain the same content but are worded in the third person. Formatted questionnaire is available for download at http://pedig.jaeb.org/ViewPage.aspx?PageName=Home_Page.

^bBold values indicate high ceiling effects (80% of responses).

Table 2The 17 Items of the Original Parent Intermittent Exotropia Questionnaire^a

Item	No. (%) of Respondents (N = 575)	
	Responding at Floor (Almost Always) (n = 574)	Responding at Ceiling (Never) (n = 574)
1. I worry about my child's eyes	78 (13.6)	9 (1.6)
2. I worry that my child will be less independent because of his/her eyes	18 (3.1)	270 (47.0)
3. I worry that my child will have permanent damage to his/her eyes	50 (8.7)	70 (12.2)
4. I worry that my child doesn't see well	37 (6.4)	87 (15.2)
5. I worry about how my child's eyes will affect him/her socially	50 (8.7)	137 (23.9)
6. I worry that my child will get hurt physically because of his/her eyes	19 (3.3)	256 (44.6)
7. I worry about the possibility of surgery	51 (8.9)	61 (10.6)
8. I worry about my child becoming self-conscious because of his/her eyes	52 (9.1)	106 (18.5)
9. I worry that my child will not be able to see the board at school	36 (6.3)	119 (20.7)
10. I worry about other kids teasing my child because of his/her eyes	53 (9.2)	146 (25.4)
11. It worries me what others will think about my child because of his/her eyes	30 (5.2)	226 (39.4)
12. I worry that my child's eye condition will affect his/her personality	29 (5.1)	231 (40.2)
13. I worry that my child's eyes will affect his/her social life if nothing is done	53 (9.2)	165 (28.7)
14. I worry about my child's eyesight long term	80 (13.9)	34 (5.9)
15. I worry about my child's depth perception	48 (8.4)	119 (20.7)
16. I worry about whether or not my child should have surgery	55 (9.6)	73 (12.7)
17. I worry about my child's ability to make friends	12 (2.1)	334 (58.2)

^aFormatted questionnaire is available for download at http://pedig.jaeb.org/ViewPage.aspx?PageName=Home_Page.