TEST RETEST RELIABILITY of the COVD-QOL SHORT FORM on ELEMENTARY SCHOOL CHILDREN

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Abstract

Quality of life (QOL) factors have become an area of emphasis for health care and particularly for optometry. The College of Optometrists in Vision Development designed a 30-item checklist (COVD-QOL-30). This was later reduced to 19 items (COVD-QOL-19). The two instruments have been shown to have good test-retest reliabilities and both have been demonstrated to have validity. The reliability of both tools was demonstrated on a group of young adult subjects. The present study was undertaken to investigate if the reliability of the COVD-QOL-19 would approach an acceptable 80% with a younger sample of subjects.

A total of 131 3rd and 4th grade students completed the COVD-QOL-19 on two different occasions, separated by two weeks. Parametric and non-parametric comparisons were made for the two data sets. Test-retest reliability approached 80% acceptability. Four questions were found to have been answered significantly differently on retest. Language and vocabulary are hypothesized to be a problem in the test retest reliability. Recommendations are made for modifying the COVD-QOL-19 to make it more "user-friendly" for elementary school children.

Key Words

College of Optometrists in Vision Development, Quality of Life Outcomes Assessment (COVD-QOL), test-retest reliability, 3rd and 4th grade students, visual symptoms

INTRODUCTION

A patient's quality of life is now considered a significant factor when discussing the appropriateness of health care intervention.[1-3] It is agreed that effective health care should improve a patient's sense of well being by removing symptoms that interfere with daily life activities, and consequently enhance life quality. [4-12] Relief and removal of symptoms is, therefore, a prime consideration in health care therapies, including optometric care.

Validity studies have shown that patient symptoms are linked to the patient's visual performance.[4-8,10-14] Symptomatic subjects performed significantly poorer than asymptomatic subjects on both monocular and binocular accommodative facility tests.[5] McKeon, et al, reported that a quality of life questionnaire addressing symptoms such as headache and diplopia can differentiate between intermittent exotropia and non-intermittent exotropia patients.[6] Various other studies have demonstrated the relationship between symptoms and convergence insufficiency,[7-12] as well as attention deficit.[13]

The College of Optometrists in Vision Development Quality of Life Outcomes Assessment (COVD-QOL) is a clinical survey instrument developed by a task force of the College of Optometrists in Vision Development.[14] The original list consisted of 30 symptoms. It allows for analysis of quality of life symptoms (headache and asthenopia) that are routinely treated with optometric vision therapy.

Test-retest reliability for the 30-item checklist was demonstrated.[15] Use of the checklist showed that children medically diagnosed and then medicated, for at least one year with various amphetamine-like drugs for ADD/ADHD still exhibited twice as many visual symptoms as children who were not diagnosed ADD/ADHD.[13] One of the significant aspects of these findings was that each child had been on the medication for at least one year and the prescribing physician considered the ADD/ADHD to be controlled with these medications; yet, these children still had statistically significantly more vision symptoms than did the non ADD/ADHD children. A conclusion of the paper was that refractive, oculo-motor, binocular, accommodative and perceptual skills might be a significant aspect of the behavioral aspects of these children.

A later study utilizing the 30-item checklist demonstrated that individual patients who completed an optometric vision therapy program showed a statistically significant lowering of post-treatment scores when compared to the pre treatment scores on the COVD-QOL checklist.[16] This decrease in symptoms was true for both the cumulative COVD-QOL score (total score for the checklist) as well as the individual items on the checklist.

One of the problems identified by those using the 30-item checklist in a clinicial environment was that the number of items tended to confuse and overwhelm those who completed the checklist. In an effort to make the checklist more user friendly, a short form was designed.[17] First, items that previously had been most often designated as "never" on the checklist were targeted for exclusion. Clinical judgment was then used to consider if each item was clinically expendable. For instance, "diplopia" was often answered "never" but was considered a significant and was kept in the short form. The resulting short form contained 19 items (COVD-QOL-19). See Appendix A. The short form was shown to have acceptable test-retest reliability with adult subjects.[17]

This COVD-QOL-19 was used to investigate if parent/guardian completion of the short form would agree with the child's completion of the short form.[18] Children were chosen from the 3rd, 5th and 7th grade. The parent/guardian, as well as the child completed the short form, independently. The answers on the COVD-QOL-19 for both the parent/guardian and student were evaluated. The cumulative COVD-QOL-19 scores between the parent/guardian and student were statistically different. The parent/guardian scores were significantly lower (fewer items checked) for 3rd and 5th grade than the children's scores and statistically higher than the children's scores for the 7th grade.

Vaughn et.al., compared the standardized academic achievement scores (Stanford) to the results of the COVD-QOL-19.[18] She found low, but statistically significant, correlations between some of both the parent and student scores, when their scores were compared to the standardized (Stanford IX) academic scores of spelling, math, reading and overall academic performance. As a rule, the parent/guardian COVD-QOL-19 scores predicted academic performance better than the students' scores.

The belief of the optometric profession has increasingly become one that visual screenings are ineffective. The sentiment appears to be that all children should be examined by a trained vision professional before school. Kentucky has led the way in the United States by requiring eye exams for every student entering the first year of school.[19] The COVD-QOL-19 may prove to be a tool that can assist in the identification of students with reduced visual performance in the academic environment. If this short survey could be used as a school screening device to identify visually at risk students in elementary school, it would clearly be very helpful to schools. Current vision screening techniques in schools vary greatly from state to state.[20] The most common vision screening tool presently in use is the Snellen test of visual acuity. Visual acuity alone does not identify many of the visual problems affecting learning and therefore proves ineffective in many cases.

The purpose of this study was to see if test retest reliability could be demonstrated when elementary students (3rd and 4th grade) had completed the COVD-QOL-19 as a group in a classroom setting. If test-retest reliability can be documented, this instrument might become a valuable tool for the classroom teacher to identify visual problems that are interfering with the child's performance in the classroom. A secondary objective of this study was to refine the checklist by further eliminating unreliable questions for this age group.

Table 1. Subjects Who Showed Significant Differences on Test Retest

	T- Test		Wilcoxon Signed Rank Test	
Subject	t Score	Significance	Z Score	Significance
19	2.349	.030	-2.111	.035
21	-2.072	.056*	-2.065	.039
24	2.535	.021	-2.236	.025
28	3.032	.007	-2.550	.011
30	2.111	.049	-1.941	.052*
33	2.306	.033	-2.055	.040
44	2.462	.024	-2.160	.031
57	-2.577	.019	-2.410	.016
65	-3.281	.004	-2.714	.007
73	-2.650	.016	-2.271	.023
81	3.034	.007	-2.56	.010
83	2.445	.025	-2.200	.028
84	4.429	<.001	-3.133	.002
94	2.041	.056*	-2.060	.039
96	2.388	.028	-2.138	.033
103	-4.158	.001	-3.051	.002
109	-2.191	.042	-2.000	.046
111	-2.111	.049	-1.941	.056*
112	3.336	.004	-2.721	.007
115	2.613	.018	-2.226	.026
121	1.991	.062*	-1.968	.049
127	2.625	.017	-2.228	.026
130	2.233	.038	-2.041	.041
133	-2.455	.025	-2.178	.029
142	-6.092	<.001	-3.521	<.001
144	-4.864	<.001	-2.966	.003
147	-3.089	.006	-2.539	.011
152	2.727	.014	-2.436	.015
153	2.388	.028	-2.126	.033

**= approached statistical significance*

METHODS

The office of the Superintendent of Education for the Tahlequah, Oklahoma Public Schools was contacted, and a letter of cooperation was obtained. This letter gave us permission to screen all the 3rd and 4th grade children for vision related symptoms with the COVD-QOL-19. We then applied to, and obtained permission from, the University's Human Experimentation Advisory Committee to conduct the project.

Table 2. Analysis of the COVD-QOL-19 by Item

					t Test		Wilcoxon Signed Rank Test	
Question	X-1	SD-1	X-2	SD-2	t	p	Z	p
1	1.16	1.61	1.11	1.37	0.39	.700	-1.21	.904
2	0.98	1.33	0.86	1.26	0.86	.394	-1.02	.309
3	1.30	1.47	1.29	1.27	0.06	.950	-0.18	.860
4	1.25	1.33	1.55x	1.35	-2.48	.014*	-2.65	.008*
5	0.89	1.34	0.84	1.30	0.00	1.000	-0.28	.783
6	0.74	1.19	0.85	1.21	-1.03	.306	-0.86	.389
7	0.92	1.36	1.03	1.45	-0.68	.498	0.71	.477
8	1.03	1.30	1.02	1.32	0.12	.902	0.43	.666
9	1.14	1.49	1.17	1.34	-0.23	.815	0.37	.714
10	0.82	1.21	0.69	1.09	1.02	.308	-1.10	.270
11	1.50	1.50	1.15	1.33	2.18	.031*	-2.06	.039*
12	0.90	1.35	0.89	1.34	0.06	.949	-1.26	.899
13	1.16	1.40	1.38	1.38	-1.80	.075	1.85	.065
14	1.27	1.39	1.22	1.26	0.41	.682	-0.38	.701
15	0.75	1.13	0.87	1.19	-1.19	.234	-1.26	.207
16	1.04	1.40	0.83	1.19	2.07	.041*	-2.08	.038*
17	1.35	1.54	1.11	1.31	1.49	.139	-1.21	.225
18	1.97	1.48	1.67	1.34	2.52	.013*	-2.50	.013*
19	1.46	1.52	1.40	1.37	0.46	.649	-0.38	.704
Total	14.69	14.69	20.94	14.84	.691	.491	-.945	.345

**=indicates statistical significance*
X1 and SD1= mean and standard deviation of the first administration
X2 and SD2= mean and standard deviation of the second administration

Table 3. Significantly Different Subjects on Test Retest with Four Questions Removed

	T- Test		Wilcoxon Signed Rank Test	
Subject	t Score	Significance	Z Score	Significance
19	2.433	.029	-2.111	.035
24	2.646	.019	-2.236	.025
28	3.166	.007	-2.807	.005
53	2.449	.028	-2.121	.034
57	-2.219	.044	-2.032	.042
60	-2.323	.036	-2.060	.039
65	-3.240	.006	-2.565	.010
81	2.320	.036	-2.077	.038
84	4.895	<.001	-2.992	.003
96	2.779	.015	-2.309	.021
103	-3.674	.003	-2.714	.007
111	-2.432	.029	-2.111	.035
112	3.055	.009	-2.489	.013
115	2.736	.016	-2.226	.026
121	2.449	.028	-2.239	.025
142	-9.431	<.001	-3.475	.001
144	-4.036	.001	-2.569	.010
147	-2.942	.001	-2.388	.017

All the students who were available in the 3rd and 4th grades were administered the COVD-QOL-19 as a group in their classrooms by their individual teacher. Before the administration a scripted explanation was read to each class by one of the present study's investigators. Questions from the students and/or teacher concerning COVD-QOL-19 were then answered.

When the procedure was understood by both the pupils and teachers, each item was read aloud and the students were requested to check the box that most appropriately described their own symptoms. It was emphasized that there were no wrong answers and that the question should be answered as best they understood the question to relate to themselves. After all items had been answered, the questionnaires were collected. The exact procedure was then repeated approximately two weeks later. Scoring for each administration was as follows. Items checked:

never were scored 0;
seldom = 1;
occasional = 2;
frequently = 3;
always = 4.

See Appendix A. Each child's test and retest total scores were then compared and each of the 19 items were analyzed as a group to ascertain if the answers changed significantly from test to retest.

RESULTS

A total of 131 children completed both the test and retest checklist. Analysis of each child's score on test and retest was analyzed parametrically with a student t test, assuming a Likert Scale. In addition, each child's score on test-retest was analyzed non-parametrically by the Wilcoxon Signed-Rank Test. See Table 1. We compared the 3rd year classes to the 4th year classes and found no statistical differences between the performance on either the test or retest data.

Twenty-six students' test-retest results were found to be statistically significantly different (p=.05) by the student t test (80.2% agreement) while 27 were found to be statistically different by the Wilcoxon Signed-Rank Test (79.4 agreement). Twenty-four were found to be statistically different by both methods (81.7% agreement). There were 29 children whose COVD-QOL-19 scores were statistically different when both paramet-

ric and non-parametric analyses were included. See Table 1. This calculates to a 77.8% reliability percentage.

We further examined each item of the COVD-QOL-19. Both the student t test and the Wilcoxon Signed- Rank Test were again utilized to compare the test to the retest. The means, standard deviations, t scores, Z scores and significance values can be found in Table 2. Overall, the 19 items were found not to differ. (t= 0.691, p= .491; Z= -0.945, p= .345) Four of the 19 items (# 4, #11, # 16, #18) were found to be statistically different in scores by both the parametric and non-parametric analysis. The four items were:

4. Skips/repeats lines reading (t= -2.48, p= .014; Z= -2.65, p= .008)
11. Reading comprehension down (t= 2.18, p= .031; Z= -2.06, p= .039)
16. Clumsy, knocks things over (t= 2.07, p= .041; Z= 2.08, p= .038)
18. Loses belongings/things (t= 2.52, p= .013; Z= -2.50, p= .013)

Analysis of the data, as presented in Table 1, was then recalculated without the four questions. These data are found in Table 3. Eighteen children scored significantly different, statistically, on the remaining 15 items. This calculates to a test-retest reliability percentage of 86.3%. The scores for each of these children was found to be significantly different when calculated by both parametric or non-parametric methods.

DISCUSSION

Statistical analysis of the COVD-QOL-19 shows that the survey approaches acceptable repeatability in a 3rd and 4th grade student sample with test and retest results, when the administration is separated by two weeks. When these test-retest results are compared to the results obtained in an adult sample, 77.8% of subjects in the 3rd and 4th grade student sample demonstrated agreement between test and retest, whereas 88.0% of the adult population demonstrated agreement.[17] The test- retest reliability of the COVD-QOL-19 for this student sample approaches the 80% criterion established as acceptable.[15,17] When we removed the four questions that were also found to be statistically different, the reliability of the short form improved to 86.3%, clearly approaching the adult level.

The checklist, with its 77.8% test retest reliability has potential as a screening tool for educators to identify at least third and fourth grade children who may have a vision problem that is interfering with academic performance. Such a tool is easily administered and appears to identify, generally, those children who will not do well academically.

On the basis of the present study we considered changes to the COVD-QOL-19 that could improve its effectiveness. Deletion of items 4, 11, 16 and 18 improved reliability about 10% to 86.3%. This would indicate that deletion of these items would be advisable in the interest of test- retest reliability. Previous research with the original COVD-QOL[15] and the COVD-QOL-19[17] indicated that those subjects who scored 20 or higher with the elimination of these same four items would be at risk for a vision problems that might compromise the child's academic performance. However, there is the possibility that deletion of these four items might actually cause the instrument to be less effective as a screening device; earlier studies have shown some of these items to be statistically important. [13, 16]

A second consideration that became evident during the present study was the degree to which the subjects understood the items and their classification of the COVD-QOL-19. We identified that language and vocabulary were significant challenges for some of the children. It is possible that at least some subjects did not understand every question. Certainly, consideration of the wording of the items, to make the individual inquiry more understandable, could be a helpful first improvement of the checklist, rather than deleting items.

It might also be hypothesized that the more mature (4th grade) students would have a better grasp of the language/vocabulary than the 3rd graders. This was not found to be the case. When the performance of the 3rd grade was compared to the 4th grade, no significant differences were found between the two grades. If language and vocabulary were factors in the students' completion of this instrument, it was not evident in this study.

Adjusting the vocabulary of the questionnaire might improve student understanding at the elementary school level and, consequently, make future responses more consistent. Several words on the COVD-QOL-19 were found to be difficult for some student's to understand. These confusing words existed both in the categories of responses and the individual items. Explanations were required by some of the students during the administration of the survey. Subsequent discussions with the 3rd and 4th grade teachers revealed that frequency category words such as "seldom," "occasionally" and "frequently" caused the most confusion.

We are recommending changing "seldom" to *once in a long time* or "once every now and then and "occasional" to *sometimes* and "frequently" to *a lot*. We believe that these changes might better describe the frequency of the complaint to third and fourth graders. The possible changes for both the categories and items are presented in Appendix B.

Other words in the checklist items also appeared to be confusing to the child. The terms "near work," "avoids," "omits," "runs" and "misaligns" have been changed to better reflect the vocabulary and understanding of the elementary school child. Appendix A and B can be compared to see how we have made these changes.

In spite of these word changes, it may be that vocabulary and language difficulties are inherent for third and fourth grade students. These students may be too young, as a target group, for group administration. We suggest a number of future studies. Administer the unchanged COVD-QOL-19 (Appendix A) randomly in group and individual settings for comparison. The same design should be completed with 5th and 6th grade students to assess older age group's reliability to the original short form checklist. It may be the four items identified in this study would be reliable for the older child. When we considered the four unreliable questions we felt it would be premature to delete them. Skipping and rereading lines (item 4) responds well to vision therapy,[16] and probably relates to an ocular motor problem. Reading comprehension (item 11) is a primary concern with school aged children. Clumsiness (item 16) may relate to poor spatial judgment, and losing things (item 18) might relate to attention deficit. Thus, it may be premature to delete these questions without further review.

Another study should investigate whether the changes indicated in Appendix B have an effect in the level of test-retest reliability in a group setting.

CONCLUSIONS

1. This study demonstrates the adequate test-retest reliability of the COVD-QOL-19 in a sample of 3rd and 4th graders where the instrument was administered in a group setting.
2. It is possible that the instrument can be improved by modifications in the language of both the categories and items.
3. Future research is needed to determine the test-retest reliability of the COVD-QOL-19 with older elementary school children.

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Appendix A
19 Item COVD-QOL Checklist Questionnaire

Check the column which best represents the occurrence of each symptom

	Never	Seldom	Occasional	Frequently	Always
1. Headaches with near work					
2. Words run together reading					
3. Burn, itch, watery eyes					
4. Skips/repeats lines reading					
5. Head tilt/close one eye when reading					
6. Difficulty copying from chalkboard					
7. Avoids near work/reading					
8. Omits small words when reading					
9. Writes up/down hill					
10.Misaligns digits/columns of numbers					
11. Reading comprehension down					
12. Holds reading too close					
13.Trouble keeping attention on reading					
14. Difficulty completing assignments on time					
15. Always says *I can't* before trying					
16. Clumsy, knocks things over					
17. Does not use his/her time well					
18. Loses belongings/things					
19. Forgetful/poor memory					

OTHER COMMENTS:

Appendix B
19 Item COVD-Q53OL Checklist Questionnaire

I.D. NUMBER:_____ DATE: _____ GRADE LEVEL:_____

Check the column which best represents the occurrence of each symptom

Changes in italics	Never	*Once in a Long While*	*Sometimes*	*A Lot*	Always
1. Headaches *reading or writing*					
2. Words *slide together when reading*					
3. Burn, itch, *or* watery eyes					
4. Loses place when reading					
5. *Head tilt or closes* one eye when reading					
6. *Hard to copy* from chalkboard					
7. *Doesn't like reading or writing*					
8. *Leaves out* small words when reading					
9. *Hard to write in a straight line*					
10.*Hard to line up numbers when adding*					
11. *Hard to understand what you've read*					
12. Holds reading *very* close					
13.*Hard to pay attention when reading*					
14. *Hard to finish* assignments on time					
15. *Says "I can't" before trying*					
16. *Bumps into things,* knocks things over					
17. *Runs out of time doing work*					
18. *Loses things*					
19. Forgetful/poor memory					

OTHER COMMENTS: