ARTICLE

The College of Optometrists in Vision Development – QOL Questionnaire in a socially at-risk population of youth

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Abstract

Background: The literature reports a high prevalence of visual dysfunction in those populations that are socially at-risk. This research is designed to determine the effectiveness of the College of Optometrists in Vision Development - QOL (COVD-QOL) Questionnaire in this special population.

Methods: Youth enrolled in a special high school (n=123) were given vision screenings followed by comprehensive optometric examinations for those referred (n=55). Twenty-four were placed into a vision therapy group and 31 into a control group for a period of 12 weeks. Prescription lenses were also provided, as needed.

Results: Significant differences were measured on the COVD-QOL between those who passed the screening and those who failed. Also, significant pre-test and post-test differences were found on those subjects within both the vision therapy and control groups. When a cutoff score of 20 was used, the vision therapy group showed greater improvement in symptom scores than the control group.

Conclusions: The COVD-QOL questionnaire differentiated between subjects found to be at visual risk and those not at visual risk when using overall scores and cutoff scores and is better suited to measure pre-test/post-test intervention results rather than as an alternative visual screening battery.

Key Words: At-risk youth, QOL, quality of life, optometric vision therapy

Introduction: The realization that the patient's perception of health related outcomes is of prime importance has received a great deal of attention over the last 10 to 18 years.[1] This time period has been named the Era of Assessment and Accountability, codified in federal-level actions taken in 1989 as evidenced by the passage of P.L. 101-239. This act created the Agency for Health Care Policy and Research (AHCPR), which is an effort by the federal government to determine the effects of health services on patients' survival, functional capacity and quality of life (QOL).[2] Behind all this was the concept of containing health care costs by assessing treatment outcomes using QOL analysis.

Developing standard measures: Developing standardized methods to measure QOL has challenged all health professions, and the challenge is being tackled as evidenced by the volumes of research on the topic. In 1995, Mozlin[3] reported that a 1990 Medline search of all articles pertaining to health-related QOL outcomes revealed 28 citations. The same search for articles published in 1997 yielded 192 citations. Our Medline search, September 2006, uncovered 2700 such references.

Eye care providers and visual researchers recognized the need for QOL data to support vision intervention by creating several questionnaires.[3,4] Hoffman's *"QOL: A Review"* reported several pre/post questionnaires.[1] The Cooper *et al* study measured the degree of asthenopia before and after vision therapy.[5] Another measured daily living activities finding that at least one-third of nursing home residents, given

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appropriate correction, were able to recover sufficient visual acuity to improve mobility and intellectual and physical functioning.[6]

Many QOL assessments focus on one disease, one specific condition or one symptom (i.e. refractive correction).[4,7-9] The 25-Item National Eye Institute Visual Function Questionnaire (*NEI-VFQ-25*), a shortened version of the original fifty-one item form (*NEI-VFQ 51*.),[10] is an example where theses instruments probe for information about multiple conditions and their psychometric and social influence on patients' lives. Both were determined reliable and valid. *NEI-VFQ-25* also analyzed psychometric properties of eye conditions and found vision to have robust impact on QOL.

In 1995, a task force from the College of Optometrists in Vision Development (COVD) developed a multi-domain QOL outcomes assessment consisting of 30 questions (COVD-QOL). Mozlin[3] published the prototype that established the impact of not only vision but also the physical/occupational, psychological and social effects that are generally associated with impaired visual skills and vision perception difficulties.

Studies followed that established the reliability of the COVD-QOL questionnaire.[11-13] Others determined the instrument to be an accurate means of portraying reduced symptoms following vision therapy.[13] Use of the COVD-QOL questionnaire on different population groups followed. One issue has been the ability for younger children to respond accurately to the questions. This was examined by comparing COVD-QOL responses of third, fifth, and seventh grade children to the corresponding responses of the parent or guardian. Visual symptoms were found to be inversely correlated to academic performance, with those symptoms reported by parents and guardians having the closest relationship to academics.[15] Sound reliability was also found with a group of third and fourth graders,[13] however the investigators recommended modifying certain questions to make the language more understandable (i.e. "seldom" became "once every now and then"). Others have looked at a child's ability to report visually related symptoms. Borsting *et al* [4] developed a symptom survey for measuring the presence of convergence insufficiency in children 8 to 13 years of age. He concluded such an instrument can be created and that children in this age group are able to respond to a broad range of symptom questions.

These studies have all established a base of confidence for the COVD-QOL questionnaire. Populations studied have included optometry students[11] those 8-9 years of age,[13] and general clinic populations.[14] This particular study adds yet another dimension to this base with the subjects being 16 to 18 years of age who have dropped out of high school. They are a socially-at-risk population of youth.

Socially at risk populations: Certain at risk populations are of particular interest when discussing QOL and vision. Solan and Mozlin[16] looked at the impact of poverty on health, vision development and school failure. Zaba[17] examined the linkage between children's vision and learning problems, delinquency, illiteracy, social and emotional problems. Duckman and Feslinger[18] made an in-depth effort to deliver vision care to children in foster care, a population plagued with unmet needs in health care.

A series of studies, particularly germane to this project, has been done on the adolescent population. Mozlin[19] describes a project of inner-city adolescents relating the biosocial consequences of poverty to central nervous system maturity and therefore to visual development and school achievement. Visual screening of this group resulted in a 52% referral rate.[20] Johnson *et al*[21] screened academically and behaviorally at-risk middle school and high school students resulting in a 97% referral rate. Another investigation [22] found a 80% referral rate on visual screening of socially-at-risk 17–19 year olds.

Adjudicated adolescents were visually screened to isolate which visual factors are most responsible for the learning difficulties of juvenile offenders. Eye movement and convergence tests were significant predictors of reading and language arts achievement scores in this special population.[23] Maples [24] compared the visual abilities, race and socio-economic factors as predictors of academic achievement and found visual factors to be the most predictive variable. The subjects were in the primary grades and followed for three years.

Others have looked at illiteracy as a QOL issue. It is reported that one in five Americans is unable to read, speak, and/or compute in order to function effectively on the job and in everyday living.[25] Johnson and Zaba[26] examined the link between vision and illiteracy by comparing 54 illiterate adults with 54 graduate students. The illiterate group exhibited a 74 % fail rate on the NYSOA Vision Screening Battery compared to 32% for the graduate students.

Table I. Tests Used in Vision Screening (Modified from NYSOA Battery)

Test	Referral Criterion
Far Visual Acuity	20/40 or worse in either eye
Plus Lens Test (+1.50 D)	Same or better acuity as without lens
Near Visual Acuity	20/40 or worse in either eye
Stereopsis	80 arc seconds or worse
Near Point of Convergence	Break of greater than 4 inches
Fusion at Far	2 or 4 balls
Fusion at Near	2 or 4 balls
Vertical Imbalance	Any response beyond the central circle
King Devick	Beyond 1 SD from norm
Distance (dry) Retinoscopy	Hyperopia of +1.50 D or more Astigmatism of 1.00 D or more Myopia of 1.00 D or more Anisometropia of 1.00 D or more
Beery VMI	Standard Score in the lowest 25P*
COVD-QOL Questionnaire	Administered but not used as referral
	* Not a 'stand alone' referral point

The consistent measure in separating the two groups was the eye-movement test; 61% fail rate with the illiterates and 0% fail rate with the graduate students. Clearly, those 'socially at risk' exhibit a high prevalence of visual dysfunction, with vision playing a major role in the QOL within this population.

Aim of this study: The study reported here derives from data collected in a broader project to examine the feasibility of a vision intervention program within the structural elements of the *Youth ChalleNGe* public high school operated by the National Guard near Bend, Oregon. One of 30 such programs in the United States, these schools were authorized by Congress in 1993 to address the needs of an increasing high school drop out population.

Our goal was to determine the effectiveness of the COVD-QOL questionnaire in a socially at-risk population of youth. We ask the questions: Does the COVD-QOL differentiate subjects found to be at visual risk and those who are not at visual risk (as defined by a standardized vision screening battery) and does it measure significant change as a function of a vision intervention program?

Methods:

Population characteristics: This is a socially at-risk population between 16 to 18 years of age with academic performance typically 4 – 6 grades below expectations. All subjects were high school dropouts and enrolled in the *Youth ChalleNGe* program fromm January through June 2006. Informed consent was arranged through the administrative officers of the *Youth ChalleNGe* high school.

Screening protocol: All students enrolled in the class (n=123) were screened utilizing a modified version of the New York State Optometric Association (NYSOA)[27-29] Vision Screening Battery.[a] Tests omitted were color perception and form perception. Tests added were distance retinoscopy (non-cycloplegic), Beery Visual-Motor-Integration (VMI)[b] and the College of Vision Development-QOL Outcomes (COVD-QOL) questionnaire. (See Table I)

A pilot trial of the COVD-QOL questionnaire was completed on the class that preceded the study sample to uncover any problem areas in administration. Examiners kept a tally of the questions posed by the students as they were completing the questionnaire. This process identified the 'problem' language issue with the form. As a result, a revised COVD-QOL questionnaire was used in the study. (See Appendix A for a sample of the modified form.) Two experienced optometrists performed retinoscopy measurements while other screening stations were staffed by trained volunteers.

Those referred by the screening (n=55[46%]) were given comprehensive optometric examinations by a team of 6 optometrists and technicians within 6 days of the initial screening. Prescription lenses/frames were provided as indicated. Of the 55 examined, 32 students were provided a new lens prescription. An additional 7 were told to continue with their current glasses. Twenty-four of those receiving a comprehensive examination were placed into a vision

therapy intervention group. The remaining 31 were placed into a control group with vision therapy being made available following the study. The vision therapy group and control group were matched on age, gender, and VMI Standard Scores.

Vision therapy consisted of two 1-hour sessions per week for 12 weeks. Half the time the therapy was dedicated to developing basic visual skills such as eye movements, accommodation/vergence ranges and flexibility, fusion and stereopsis. The remaining therapy time was spent on computerized visual perceptual procedures (PTS II).[c] (See Appendix B for the vision therapy treatment plan) The control group spent an equal amount of time in a structured study hall. Here they worked on assignments given in the courses taken at this special high school. The COVD-QOL questionnaire was part of the pre-testing and post-testing for both groups.

Results:

Comparisons were made between the group that passed the vision screening battery (defined as true negatives) and those who failed the screening (defined as true positives) utilizing the COVD-QOL questionnaire. For those who passed the vision screening the mean score was 21.1 (SD 13.6). For those failing the vision screening the mean score was 33.7 (SD 18.5.) The QOL score of those failing the screening is significantly higher than for those who passed. (t=4.32,df=121,p= 0.0001). All who failed the screening were found in need of optometric intervention.

A cutoff value for a test is an arbitrarily selected value that separates the positive (abnormal) from the negative (normal results).[30] Everyday examples are cutoff values for hypertension and intraocular pressure. A common cutoff value for the COVD-QOL questionnaire is to look closely at those subjects with a total score of 20 or greater.[15] When this criterion is applied to the vision screening results it was found the COVD-QOL generated 39 true positives, 31 false positives, 37 true negatives, and 16 false negatives.

By design, the COVD-QOL questionnaire contains items from various domains: physical/occupational function, psychological well-being, social interaction, and somatic sensation. Within the somatic sensation domain are vision specific questions. These center upon the first 10 items found in the questionnaire. Comparisons were made with these vision specific items between those who passed the screening and those who failed. For those who passed the screening the mean was 5.6 (SD 4.92). For those who failed the screening the mean was 9.96 (SD 7.78). These means are significantly different. (t=3.95,df121,p=0.0001).

As described earlier, the individuals who failed the vision screening were given a comprehensive optometric examination and divided into a optometric vision therapy intervention group (n=23) and a control group (n=29) *[Some dropped out of school lowering these figures from 24 and 31.]*. The groups were matched on age, gender, and VMI Standard Scores. Note that both groups were visually at-risk and both received lens prescriptions as needed. They differ in that one was given vision therapy over a period of 12 weeks while the control group was assigned to a structured study hall for the same period. Pre-test and post-test data were pooled and the change between pre-therapy to post-therapy examined. (Two-tailed student t-test.) The pre-test mean for the optometric vision therapy group was 34.8 (SD 19.1); the post-test mean was 20.8 (SD 13.7). This reduction in symptoms was significant. (t=4.37, df=22, p=<0.0001). The pre-test mean for the control group was 30.3 (SD 17.0) while the post-test mean was 22.1 (SD 12.6). This reduction in symptoms was also significant (t=3.59, df=28, p=0.001). Both groups improved, comparing pre-test and post-test QOL scores. (See Table 2)

Discussion:

Various studies[12-14] have examined the test-retest reliability of the COVD-QOL questionnaire. Little has been reported on the validity of the instrument. What does the COVD-QOL measure? 'Does it measure what it is supposed to?'

A panel of experts[3] developed the COVD-QOL instrument, which is a common technique to examine *content* validity. Content validity examines whether an instrument can distinguish a difference in the QOL between groups of sick and healthy patients.[1] Clearly, those who passed the vision screening reported fewer symptoms than those who failed the screening as measured by the COVD-QOL instrument.

Criterion validity refers to how well a measure compares with an existing measure of the same phenomena.[1] This suggests (under ideal circumstances) that we could measure the effectiveness of the COVD-QOL questions against a professional comprehensive optometric examination. This approach has various shortcomings; however, as one test battery includes

Table 2. Comparison of Pre and Post Test QOL Scores for VT Group and Control Group

Vision Therapy Group	Pre Test QOL Score	Post Test QOL Score	Control Group	Pre Test QOL Score	Post Test QOL Score
Subj 1	9	5	Subj 1	**81**	**57**
Subj 2	15	8	Subj 2	**33**	**23**
Subj 3	**41**	**35**	Subj 3	**26**	**36**
Subj 4	**65**	**58**	Subj 4	17	12
Subj 5	**41**	19	Subj 5	19	**21**
Subj 6	**33**	17	Subj 6	16	9
Subj 7	**40**	**28**	Subj 7	13	8
Subj 8	**21**	11	Subj 8	**33**	**28**
Subj 9	**69**	12	Subj 9	**24**	18
Subj 10	**75**	**38**	Subj 10	17	**25**
Subj 11	**21**	18	Subj 11	**21**	**26**
Subj 12	**24**	5	Subj 12	**52**	**32**
Subj 13	**34**	18	Subj 13	**36**	**42**
Subj 14	**65**	**21**	Subj 14	13	11
Subj 15	**36**	14	Subj 15	21	3
Subj 16	**46**	**37**	Subj 16	7	6
Subj 17	18	15	Subj 17	**30**	**30**
Subj 18	10	12	Subj 18	**43**	13
Subj 19	**38**	**33**	Subj 19	16	**25**
Subj 20	**32**	**42**	Subj 20	**25**	15
Subj 21	**33**	8	Subj 21	**49**	**29**
Subj 22	**25**	12	Subj 22	**53**	12
Subj 23	10	11	Subj 23	19	9
			Subj 24	**50**	**29**
			Subj 25	**37**	18
			Subj 26	17	13
			Subj 27	16	15
			Subj 28	**57**	**41**
			Subj 29	**38**	**36**
Mean	34.8	20.8	Mean	30.3	22.1
SD	19.1	13.7	SD	17.0	12.6
		t=4.37			t=3.59
		df=22			df=28
		p=<0.0001			p=<0.001

Bold notes cuttoff scores of 20 or higher

measures of physical/occupational, psychological and social domains while the other test battery is limited to visual measures. Also, we did not have this option as comprehensive examinations were performed only on those who failed the screening. What we did do was to compare the vision screening data to a cutoff score of 20 points for the COVD-QOL questions.

Sensitivity is the accuracy of the procedure (COVD-QOL) to correctly identify all individuals in a given population who have a particular disorder – true positives.[31] In this case the sensitivity computes to 71 percent. *Specificity* is the accuracy of the screening procedure to correctly identify those individuals who do have the disorder.[31] Specificity was 54 percent.

The validity of a test can also be measured by the *predictive value:* the probability that a screening decision was correct or incorrect.[31] The predictive value for positive test results would be the probability that an individual identified as having a particular disorder was in fact ill. The positive predictive value in this case is 56 percent. The predictive value for negative test results would be the probability that an

individual identified by the screening as not having the disorder was, in fact, free of the disorder. The negative predictive value in this case is 70 percent.

Collectively, these results do not support the proposition that there are dependable relationships between the COVD-QOL instrument and the screening battery utilized in this study. Given this conclusion, it is well to remember the COVD-QOL questionnaire was not intended to be a visual screening battery.

QOL instruments were primarily designed to measure life-meaningful outcomes of clinical interventions. Maples and Bither[14] looked at the efficacy of vision therapy as assessed by the COVD-QOL questionnaire. They point out most patients who seek the help of an eye care professional and who need optometric vision therapy have multiple problems, not just visual ones. Multi-factorial dysfunctions make assessment of the therapy much more difficult - a key point in this study. Students enrolled in this special high school arrive with a multitude of problems. They are troubled youth with histories of severe learning disabilities, drug abuse, chronic truancy, and non-supportive home environments. Any QOL instrument that probes domains such as psychological well-being and social interactions will have QOL scores that reflect these areas of function along with the somatic sensations represented by vision specific questions. In short, there is a distinct difference between a vision symptom checklist and a QOL instrument as used in this study.

As reported, both the optometric vision therapy group and the control group showed significant change from the pre-test to post-test scores with both reporting fewer symptoms. The *Youth ChalleNGe* High School program places considerable emphasis upon building a successful image of self-esteem within each student through formal classes, discussion seminars, and structured discipline. In effect, the COVD-QOL instrument total score is likely reflecting enhanced psychological well-being and social interactions, as well as vision specific concerns. Recall that both the control group and the vision therapy group received lens prescriptions as needed. Both groups showed improvement from primary vision care. While one might be tempted to tease out these variables, the relative size of the various sub-groups (spectacles only/VT only/spectacles and VT/no spectacles) do not lend themselves to examining the differences between these various interventions. All this said, it is important to underscore the COVD-QOL instrument demonstrated strong differences in reducing the number of subjects in the danger zone of scores 20 or higher after optometric vision therapy.

A chief remaining question is the effectiveness (sensitivity) of the screening battery used to identify all subjects that could have benefited from optometric intervention. Along with this is the concern the intervention utilized best suited the visual problems prevalent in this particular population. These questions remain unanswered. Judgments are made in accordance with the overall tenant of doing the most you can for most of the population given the infrastructure constraints of this special school setting and limited professional staffing.

The study population at *Youth ChalleNGe* differs from the populations used in earlier COVD-QOL studies. Maples[11,12] utilized first-year optometry students to test reliability. Maples and Bither[14] studied a clinical population of children between ages 7 and 18 who were treated in optometric offices. Gerchak *et a1*[13] studied a group of 3rd and 4th graders in a public school setting. In contrast, our study involves 16-18 year olds who are socially at-risk and have experienced difficulty with academic achievement.

Conclusions:

The COVD-QOL instrument did differentiate between those subjects found to be at visual risk and those who are not at visual risk when compared to a standardized vision screening battery if you utilized overall scores and cutoff scores as measures and is best suited to measure pre-test/post-test results from optometric intervention rather than as an alternative to a vision screening battery.

Future Studies: In this project, the wording was modified on the COVD-QOL questionnaire to make adjustments for those with lower language profiency. It is acknowledged this may have altered the reliability of these questions and sets the stage for a follow up project.

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Resources:

a. NYSOA Test
Bernell Corporation
4016 North Home Street
Mishawaka, IN 46545

b. The Beery-Buktenica Developmental Test of Visual-Motor-Integration
Modern Curriculum Press
Simon & Schuster
299 Jefferson Road
Parsippany, NJ 07054

c. Perceptual Therapy System PTS II
Computerized Perceptual Therapy
PTS/HTS
5301 S. Superstition Mountain Drive
PMB 483 Suite 104
Gold Canyon, AZ 85218

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Appendix A • Modified Sample COVD – QOL Form

	Date:	0	1	2	3	4
		NEVER	SELDOM	OCCASIONALLY	FREQUENTLY	ALWAYS
1	I have blurred vision when looking at near objects.					
2	I have double vision. (Seeing two objects rather than one.)					
3	I have headaches with near work.					
4	Words run together when I read.					
5	My eyes burn, itch and water.					
6	I fall asleep when I read.					
7	I see worse at the end of the day.					
8	I skip or repeat lines when reading.					
9	I feel dizzy or sick to my stomach with near work.					
10	I tilt my head or cover an eye when reading.					
11	I have difficulty copying from the chalkboard.					
12	I avoid reading and near work.					
13	I leave out small words when reading.					
14	I write uphill or downhill (My handwriting tends to slant up or down).					
15	Columns of numbers appear misaligned.					
16	I don't understand what I read.					
17	I am poor in sports.					
18	I hold my reading very close.					
19	I have trouble keeping attention on reading.					
20	I have difficulty completing assignments on time.					
21	I often say, "I can't" before trying.					
22	I avoid sports and games.					
23	I have poor hand/eye coordination					
24	I do not judge distance accurately.					
25	I am clumsy.					
26	I do not use my time well.					
27	I do not do well in figuring out change (money).					
28	I lose papers and belongings.					
29	I have trouble with car/motion sickness.					
30	I am forgetful with a poor memory.					

Appendix B • Vision Therapy Treatment Plan

Procedures over the 12 weeks

- Basic Visual Skills

Visual Skill Areas	1	2	3	4	5	6	7	8	9	10	11	12
Ocular Motility	•	•	•		•	•	•	•	•	•	•	•
Accommodative Facility	•	•	•	•	•							
Hand/Eye Coordination	•	•		•		•						
Ocular Motility / Balance Board			•	•		•						
Cheiroscopic Tracing			•	•								
Fusion/Vergence									•	•	•	•
Stereopsis/Vergence						•	•	•	•	•		

- Perceptual Therapy (Perceptual Therapy System II)[c]

  Procedures for Sequential Processing
  Procedures for Temporal Vision Perception Processing
  Procedures for Speed of Information Processing
  Procedures for Rapid Automatized Naming

COVD Blogs

The following COVD blogs are open to the public:

Vision Developments
http://covd.typepad.com/visiondevelopments

VisionU: The State of the Science of Vision
http://covd.typepad.com/visionu

The following COVD blogs are for members only and are password protected:

Around the World: The COVD International Blog
http://covd.typepad.com/around_the_world

Diamonds & Pearls: Tips to Improve Your Patient Care Today
http://covd.typepad.com/diamonds_and_pearls

The Lighthouse: A Community of Leaders in Vision Development
http://covd.typepad.com/the_lighthouse

VT Economics: Tips from Experts to Build Practice Excellence
http://covd.typepad.com/vt_economics

Statements: The COVD State Coordinators Blog
http://covd.typepad.com/statements

COVD members may contact the international office for passwords.