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Research Report

The Reading Behavior Inventory: An Outcome Assessment Tool

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Many questionnaires attempt to assess the quality of life of individuals who are visually impaired (that is, those who are blind or have low vision), but few apply to those who are undergoing visual rehabilitation and hence are difficult to adapt as an outcome measure (Massof & Rubin, 2001). For example, Stelmack, Stelmack, and Massof's (2002) study suggested that the majority of items on the National Eye Institute Visual Function Questionnaire were not amenable to testing the outcomes of vision rehabilitation, whereas Szlyk et

al.'s (2004) analysis of the Veterans Affairs Low Vision Visual Functioning Questionnaire was specifically designed to test the outcomes of vision rehabilitation. Examples of other outcome measures include the Functional Independence Measure for Blind Adults (Long, Crews, & Mancil, 2000) and the Blind Rehabilitation Services Functional Outcomes Survey (De l'Aune, Welsh, & Williams, 2000). Most studies have targeted outcomes as a global concept, which leaves the need to evaluate the effectiveness of specific interventions. Such evaluative tools would allow providers of services to examine the outcomes of specific rehabilitation interventions and may allow for the removal of potential confounding factors (that is, negative outcomes that were found because a component intervention lacked effectiveness) in global measures.

The Reading Behavior Inventory (RBI) was developed as a targeted outcome measure of a low vision reading rehabilitation program. The Western Blind Rehabilitation Center (WBRC), located at the Veterans Affairs Palo Alto Health Care System in Palo Alto, California, is an inpatient rehabilitation program that serves veterans who are legally blind. The design criteria that were considered in developing the RBI were that the inventory should measure changes in behaviors that are associated with reading: the types of materials that participants read and the participants' reading performance (speed), satisfaction with reading, reported difficulty reading, and reported duration of

reading. The change in the participants' reading speed from the beginning to the end of the rehabilitation program was included as the effectiveness measure, while the remaining questions probed the participants' reading behaviors and perceptions of their ability.

Participants

The participants were 64 individuals who were consecutively admitted into the visual skills program of the WBRC who met the -inclusion-exclusion criteria of the study. Once these patients were admitted to the WBRC, they were administered a comprehensive dilated fundus examination and a functional vision examination. Those who had sufficient vision to participate in the visual skills program were referred for low vision training, and those who did not were referred for reading machine training or other reading rehabilitation training. The criteria for inclusion in the study were legal blindness, a self-reported desire to read print, the ability to read 1M print (with a device), and sufficient dexterity to use the prescribed reading device (assessed by observation of the person's ability to use the reading device and by an assessment of dexterity with one of the WBRC manual skills tasks, in this case, assembling a leather link belt). The exclusion criteria were the presence of dementia or another like condition or the use of medications that interfered with the person's ability to learn (assessed by a clinical psychologist and a review of the person's electronic medical record).

Data were collected at three discrete points: before and after training and during a two-month follow-up telephone interview. Of the 64 participants, 40 completed the follow-up. The remainder did not because their telephone numbers were incorrect or had changed, the researchers were unable to contact them after three repeated calls, or they had been hospitalized. All the participants were volunteers and signed consent forms that were approved in accordance with the VA Palo Alto Health Care System's procedures for conducting research with human subjects.

The participants ranged in age from 48 to 89, with an average age of 74 years. The average Bailey-Lovie logMAR visual acuity was 1.12 (20/250 or 6/75), and the average Pelli-Robson contrast sensitivity was 0.92 (range 0.15 to 1.5). The participants were predominantly male (97%). A variety of pathologies were represented among the participants, although most participants were diagnosed with age-related macular degeneration (64.1%), diabetic retinopathy (10.9%), or optic neuropathy (4.7%). Central retinal vein occlusion, glaucoma, optic atrophy and retinitis pigmentosa, anterior ischemic optic neuropathy, cone dystrophy, fundus infection, ocular ischemia, and stroke each accounted for less than 3.1% of the cases.

Methods

The WBRC reading rehabilitation program has been described in detail elsewhere (Good-rich & Kirby, 2001; Goodrich et al., 2000; Goodrich et al., 2004), but in essence, it consists of prescribing the best optical reading device, training in the use of the device, and training in the use of a closed-circuit television (CCTV). Reading speeds were measured using single-spaced paragraph-length materials, each consisting of a short story (between 150 and 300 words in 1M print). Comprehension was assessed by the therapist asking five questions about the content of each paragraph.

The RBI (see Box 1) was administered by the therapist after the prescription of the reading device at the completion of the first day's reading training (hereafter the "pretraining" condition) and at the end of the reading training program (hereafter the "posttraining" condition), and training consisted of about 10 40-minute sessions held on successive days. A researcher administered the posttraining RBI by telephone two months after the conclusion of the training. Four of the self-report questions in the RBI seek information on the variety of materials that are read, the time spent reading, and perceived difficulty and satisfaction with reading. The fifth question addresses perceived satisfaction with reading ability compared to the previous two months. This question was included to ascertain if the participants' perception of their reading ability had changed prior to admission and because the two-month period coincided with the follow-up period, and we specifically asked the participants about their

satisfaction with their reading ability compared to their satisfaction at the end of training.

Results

The increase in reading speed from the first training session (an average of 34 words per minute, wpm) to the last training session (an average of 71 wpm) was significant ($t = 7.445$, $p < .000$). All the final reading speeds were taken with the participants using a prescribed CCTV. The effect size (Cohen, 1988) for this increase was ($d = 1.01$), which is considered large and indicates that the intervention had clinical, as well as statistical, significance. Visual acuity, but not contrast sensitivity, was correlated with the beginning reading speed ($r = 0.378$, $p < .002$) and end-of-training reading speed ($r = 0.458$, $p < .000$). Visual acuity was not significantly correlated with the change in reading speed over the course of training ($p = .402$). The reading speed at the beginning of training was correlated with the reading speed at the end of training ($r = 0.571$, $p < .000$) and a change in reading speed ($r = 0.382$, $p < .003$).

At entry 40% of the participants reported that they did not read at all, while 60% reported that they read bills, letters, medicine labels, or other items (see Table 1). By the end of training, all the participants reported reading, and the percentage of those who reported reading all types of material increased. This change was largely maintained at the follow-up, and the

diversity of materials that were read remained high, except for a decrease in those who reported reading novels and recipes and a slight decrease in those who reported reading medicine labels. In addition, more participants reported reading package directions and "other" items at follow-up (see Table 1).

Chi-square tests were used to compare subjective data categories across the three administrations of the questionnaire. The changes in reported satisfaction and difficulty, pre- ($Z = 6.343$, $p < .000$) to posttraining ($Z = 6.240$, $p < .000$), as assessed by Wilcoxon signed rank tests, were significant, but there was no significant change in satisfaction ($p < .221$) or difficulty ($p < .429$) from the posttraining condition to the follow-up (see Table 2).

Satisfaction with reading after training appears to be related to the perceived difficulty of the task and the amount of time spent reading. Participants who reported the greatest satisfaction with reading reported the least difficulty, as analyzed by an analysis of variance ($F = 5.995$, $df = 59$, 95%, CI 4.11-4.46, $p < .017$) and reported spending the most time reading at the end of training ($F = 16.532$, $df = 59$, 95%, CI 6.47-7.63, $p < .000$). There were no significant differences between the participants' ratings at the end of training and at the two-month follow-up.

Discussion

The RBI was found to be a questionnaire that is easy and inexpensive to administer, and it appears to be a valuable outcome measure. The average reading speed for the group (71 wpm) was sufficient to allow the participants to read a wide variety of materials. The participants' self-reports indicated that prior to training, 40% did not read, whereas after training, all reported reading. The variety of materials that the participants reported reading increased after training. At the follow-up, all the participants continued to read, and the variety of materials that they read was similar to what they reported when they completed training.

The RBI results for the participants' satisfaction and difficulty with reading, time spent reading, and reported difficulty reading significantly improved pre- to posttraining and were maintained at the follow-up. A unique question on the RBI, which compared current reading satisfaction to the previous two months, provided a relative measure of change in satisfaction prior to admission and at follow-up. The participants rated their pretraining reading ability as slightly less than it was two months previously. At the follow-up, they rated their ability as better than it had been at the completion of training, which suggests that they consolidated or perhaps improved their perceived gains.

There were limitations to the study. The sample size was relatively small, and over a third of the participants dropped out in the follow-up phase. Although the RBI is similar to other outcome measures

(Szlyk et al., 2004), research is needed to establish its reliability and validity. The results presented here may have some bias in that each participant's therapist administered the pre- and posttraining RBI; however, this bias is partially offset, since the follow-up was administered by a researcher who was unfamiliar with any prior results. The results of the study strongly suggest that the RBI warrants further investigation as a clinical research and outcome tool.

Conclusion

Outcome measures are valuable tools that critically examine the impact of rehabilitation interventions on global scales, such as a -quality--of-life scale. The RBI was developed as a specific outcome measure to examine both the effectiveness and subjective impact of an intervention that targeted reading rehabilitation. This article suggests that it is a useful measure in demonstrating effectiveness (a change in reading performance) and in assessing patients' perceptions of reading rehabilitation. Although we continue to study its reliability and validity, the RBI is now routinely administered pre- and posttraining as part of the WBRC's best-practice patterns.

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