

**Critical Review:**  
**What is the evidence that communication interventions are effective at improving communication outcomes for adolescents with acquired brain injury?\***

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This critical review examines the efficacy of communication interventions for improving communication outcomes in adolescents with acquired brain injury. Five articles were included in this review. Studies included four Level 1 designs (i.e., one randomized controlled trial (RCT), one single subject crossover design, one single subject multiple baseline design, one single subject design), and one Level 3 design (i.e., single group pre-posttest design). Overall, the results of this review revealed suggestive evidence that communication interventions are effective at improving communication outcomes for adolescents with acquired brain injury. Clinical implications and future research recommendations are also discussed.

### ***Introduction***

Acquired brain injury (ABI) is the leading cause of death and disability in adolescents (Keenan & Bratton, 2006; Oberg & Turkstra, 1998). ABI in adolescents is a diverse condition of various etiologies, including but not limited to brain tumours, aneurysms, and traumatic brain injury (TBI) (e.g., falls, motor vehicle accidents, abuse) that can influence brain functioning (Laatsch et al., 2007). In particular, cognitive-communication disorders and psychosocial challenges can result from and persist in ABI in adolescents (Thomas-Stonell, Johnson, Schuller, & Jutai, 1994; Turkstra & Burgess, 2007). Many adolescents with ABI experience subtle difficulties in higher level cognitive-communication abilities such as word retrieval, discourse, comprehension of abstract and figurative language, social skills, memory, organization and executive functioning (Slomine & Locascio, 2009; Thomas-Stonell et al., 1994; Wiseman-Hakes, Stewart, Wasserman, & Schuller, 1998). Given that treating individuals with cognitive-communication disorders is within the speech-language pathologists' (SLPs) scope of practice (CASLPO, 2002), SLPs need to be familiar with effective interventions to assist their adolescent clients with ABI in clinical practice.

### ***Objectives***

The primary objective of this paper is to critically evaluate the existing literature regarding the effectiveness of communication interventions for adolescents with ABI. The secondary objective is to provide SLPs with evidence-based clinical recommendations and future research areas with this population.

*\* This paper was created as a required assignment for the CSD9639 Evidence Based Practice for Clinicians course at Western. While it has been evaluated by course instructors for elements of accuracy and style, it has not undergone formal peer-review.*

### ***Methods***

#### **Search Strategy**

Computerized databases including PubMed, Google Scholar, Scopus, and CINAHL were searched using the following terms: (adolescent OR teen) AND (treatment OR intervention OR therapy) AND (brain injury OR ABI OR TBI OR concussion).

#### **Selection Criteria**

To be included in this critical review, studies had to provide a communication intervention to at least one adolescent with ABI. For the purpose of this review, an adolescent was defined as an individual between the ages of 10-21 years, and communication interventions were defined as various receptive and expressive language and pragmatic interventions that aim to improve communication outcomes for adolescents with ABI. Participants described in each study were required to have communication deficits secondary to ABI, and not related to premorbid conditions such as intellectual disability or specific language impairment. Studies that targeted attention, memory, cognition or behaviour were excluded. Additionally, studies that focused on assessment or literature reviews of communication profiles of adolescents with ABI/TBI were not included in this review. Limitations were not placed on severity of ABI, time since onset of ABI, research design or outcome measures.

#### **Data Collection**

Results of the literature search yielded five studies that met the selection criteria. The studies included four Level 1 designs, i.e., one RCT (Thomas-Stonell et al., 1994), one single subject multiple baseline design (Chapman, Ewing, & Mozzoni, 2005), one single subject crossover design (Franzen, Roberts, Schmits,

Verduyn, & Manshadi, 1996), and one single subject design (Oberge & Turkstra, 1998); and one Level 3 design, i.e., single group pre-posttest design (Wiseman-Hakes et al., 1998).

### **Results**

Thomas-Stonell and colleagues (1994) conducted a randomized controlled experimental design to compare multiple standardized language measure outcomes in two groups of six adolescents with TBI (aged 13-21 years) who received either a computer assisted cognitive-communication remediation program (TEACHWARE) or traditional therapy/community school program (control group). The use of the TEACHWARE screening tool to assess progress of the intervention was also explored. The participants were randomly assigned to each group. Frequency of therapy sessions varied across participants, but overall averaged to be one hour sessions twice per week. Pretest and posttest measures using standardized tests were administered.

Analysis of covariance was used to determine the effectiveness of the remediation modules at improving performance on standardized measures after 8 weeks of therapy. However, the sample size (N=12) may have been too small for ANCOVA. The covariate was the baseline measures from the standardized test scores. The remediation group improved significantly on most of the standardized assessment measures compared to the control group. Within-groups effects were examined using t-tests to determine if there was a significant difference on standardized measures. However, results should be interpreted cautiously as multiple testing of standardized measures compromised the nominal significance level and may be a result of learning the tests rather than improved communication skills.

One strength of this study included anecdotal reports from unblinded teachers suggesting that skill improvements from the remediation programs generalized to classroom tasks.

There are several limitations of this study. First, the authors used standardized language tests to measure the effect of the computer-based intervention on the participants' communication skills. Measuring treatment progress cannot be achieved through norm-referenced measures due to the insufficient number and variety of test items (Kerr, Guildford, & Bird, 2003). Only criterion-referenced assessments can be used to establish baseline function, measure change in intervention and set targets and goals for intervention (Paul & Norbury, 2013). Second, they did not define the dependent variable or the targeted communication

skill for remediation. Third, the clinicians and researchers were not blinded to the groups and goals of the study. Fourth, a description of the implemented remediation program was not provided possibly due to copyright infringement of the TEACHWARE intervention program. This makes it challenging to replicate the study or findings, other than in facilities that have purchased the TEACHWARE remediation modules. Fifth, the test-retest reliability was not evaluated due to significant learning effects. Lastly, although anecdotal teacher reports suggested generalization of skills to classroom settings, no mention of the specific communication skills that improved or generalized from the intervention program were discussed. Due to the statistical and methodological limitations, this study presents equivocal evidence that the computer-based program (TEACHWARE) can improve a broad range of communication skills for adolescents with ABI.

Chapman and colleagues (2005) conducted a single-subject, multiple baseline study examining the effectiveness of precision teaching and fluency training across a range of tasks for five adolescents with ABI (aged 11-19 years). The same individualized intervention was administered throughout the undetermined number of sessions for each participant. Inter-rater reliability was extremely high at 100 percent. However, no randomization or blinding was implemented and treatment length for each participant was variable.

All five participants increased in accuracy and speed in their responses as a result of the fluency and precision training. Appropriate extrapolated acceleration lines from baseline to intervention outcomes were provided for comparison. Although results from the study revealed significant improvement from fluency training intervention for all five participants, the dependent variable for each participant was highly individualized to a specific task (e.g., answering as many self-made autobiographic questions in 60 seconds). Hence, limitations of this study in terms of the clinical relevance are the ability to generalize the skills to other settings and replicate the findings due to the very specific individualized targets. Additionally, the effectiveness of higher level communication outcomes cannot be determined based on increased speed and repetition, which is the sole purpose of fluency training. As a result, this study provides suggestive evidence that fluency and precision training can be applied to improve very specific expressive language and communication outcomes for adolescents with ABI.

Franzen and colleagues (1996) used a single-subject design with a counterbalanced crossover (to control for

the effects of attention) in a study of two boys with TBI (aged 10 years). The participants received the Robinson's elaborative encoding technique (PQRST) to address verbal memory and reading comprehension deficits. Additionally, a metacognition reading comprehension intervention was used as a comparative tool. A normal control without TBI, matched by age and sex of the participants, was used for comparison. He read the same passages as the boys with TBI, but did not receive the interventions. The participants with TBI received 15 intervention sessions: a three session baseline (A), six sessions of PQRST intervention (B) and six sessions of metacognitive intervention (C). Participant 1 received the interventions in the following order: A, B, C; whereas, participant 2 received A, C, B. Interventions did not vary between phases. The interventions were clearly described and implemented consistently over 30-minute sessions on nonconsecutive days, which allows for replication of findings. Reading passages were obtained from grade 4 level reading materials that were assessed by calculating the complexity of words and sentences using the Fry formula (Fry, 1977) which was determined to be a valid and reliable measure of reading complexity.

The appropriate statistical use of a paired difference test revealed that free recall of both boys with TBI significantly improved on standard reading passages during the PQRST intervention; however, free recall performance remained close to baseline during the metacognitive intervention. Moreover, participants with TBI demonstrated improved performance during the PQRST intervention from baseline scores on sentence completion tasks, responding to multiple choice questions and long-term recall on standard reading passages compared to the metacognitive intervention in which results were inconsistent and variable.

One limitation of this study in terms of clinical relevance is the ability to generalize the findings to other reading materials such as classroom materials. Although strategies from the PQRST technique can be used for short narrative genres, they are not easily used for longer instructional materials such as textbooks and novels that adolescents are required to read for curriculum content. This study provides compelling evidence that the PQRST intervention can improve verbal memory and reading comprehension deficits in young adolescents with ABI.

Oberg and Turkstra (1998) investigated the effectiveness of semantic encoding in learning and remembering word definitions based on school curriculums in two single subject designs with adolescents with ABI (aged 18, 19 years). Pre-treatment and two post-treatment tests were collected

immediately at the end of the intervention and one month post intervention. Treatment consisted of ten 30-minute sessions over five weeks. Forty age-appropriate words that were incorrectly defined during the pretreatment test were selected for use during the intervention. Twenty of the forty words were chosen at random and used for the intervention and the other twenty words were used as control stimuli. Responses of word definitions were analyzed based on the protocol of Johnson and Anglin (1995). The systematic rating scale provided clear scoring criteria for defined words. Appropriate statistical analysis of a Fisher's exact test revealed significant improvements in expressed word knowledge compared to control words at the end of treatment and one month post-treatment for both participants.

The strengths of this study include high point-to-point inter-rater reliability on the form, content, and quality of each definition provided by the participants. Treatment and control words were blinded from the second rater. The intervention was described clearly for easy replication. A hierarchy of intervention strategies was also provided. Age-appropriate words were randomly selected for intervention. Moreover, participants were able to provide definitions or words in personally relevant examples to form stronger associations of word meanings in an attempt to generalize usage in naturalistic contexts. Providing personally relevant words that would be applied in classroom settings also assisted with generalization and maintenance of new vocabulary.

One limitation of this study relating to its clinical relevance is that participants with ABI were only able to learn aspects of the words that were explicitly taught during the highly structured and context-dependent intervention. Adolescents with ABI may require continuous support using the semantic encoding technique; therefore, this intervention may not generalize to other settings when adolescents with ABI need to learn new vocabulary. However, some individuals with ABI may have difficulty integrating new information with previous semantically related knowledge (Goldstein, Levin, & Boake, 1989). As a result, the inability to expand word knowledge may be a consequence of the ABI rather than a limitation of the semantic encoding intervention. This study provides compelling evidence that the use of semantic encoding can facilitate improvement in expressive word knowledge of unfamiliar vocabulary for adolescents with ABI.

Wiseman-Hakes and colleagues (1998) used a single group pre-posttest design to evaluate six adolescents with ABI (aged 14-17 years) who received peer group

pragmatic skills training. No control was used for comparison. The Improving Pragmatic Skills in Persons with Head Injury program designed for individual therapy was used and modified for group intervention. An adequate description of the intervention program was provided for possible replication of findings. Only four of the five modules were intensively taught in this study for the duration of 6 weeks, 4 days a week for an hour each day. Pre-treatment, post-treatment and follow-up observation and rating measures of the Rehabilitation Institute of Chicago Rating Scale of Pragmatic Communication Skills (RICE-RSPCS), and Communication Performance Scale (CPS) were collected. Appropriate Statistical analysis of repeated-measures ANOVA was conducted to compare pre and post-treatment measures and post-treatment and follow-up measures. However, the sample size (N=6) may have been insufficient power to conduct a repeated measures ANOVA.

Statistically significant changes were observed during the treatment and were maintained at 6 months post-treatment for the four subtests of the RICE-RSPCS and the CPS. However, analysis of individual items of the RICE-RSPCS indicated that statistically significant changes occurred only on trained communicative functions.

Strengths of this study include the multiple attempts to provide a naturalistic context and promote generalization and maintenance of pragmatic skills. These include collecting measures in the participants' naturalistic environments such as their homes, classrooms, and cafeterias, whereby the participants were unaware of the observer's presence. Additionally, the intensive intervention incorporated self-ratings of the participants' communication performance to improve self-monitoring skills and maintenance of newly acquired skills.

Limitations of this study include possible experimenter bias due to lack of rater blinding. The rater may have been more favorable to the participants post-treatment and at follow-up compared to pre-treatment ratings. Moreover, there was no reliability data available for the RICE-RSPCS or CPS. This study provides suggestive evidence that treating pragmatic deficits in adolescents with ABI can improve psychosocial skills and trained communicative functions.

### *Discussion*

Collectively, the five studies reviewed provide suggestive evidence that support communication interventions for adolescents with ABI. All of the studies demonstrated statistically significant

improvements in various communication outcomes for adolescents with ABI. However, when looking at the results of the studies individually, Franzen and colleagues (1996) and Oberg and Turkstra (1998) provide more compelling evidence than the other studies for the use of the elaborate encoding technique (PQRST) to improve reading comprehension and verbal memory, and the use of semantic encoding to improve expressive word knowledge of new vocabulary items for adolescents with ABI, respectively. Despite the strength of these studies, future research studies need to incorporate older adolescents with ABI to examine the effects of elaborate encoding (PQRST) for populations with higher level reading demands. Moreover, future research can integrate the use of synonyms and antonyms along with the elaborative encoding technique used in the Oberg and Turkstra (1998) study to expand meanings of personal relevant words.

Although standardized speech and language assessments are an excellent tool to assess and compare clients' abilities in relation to the norms of similar aged peers, they are not suitable to determine progress of interventions. While Thomas-Stonell and colleagues (1994) implemented a RCT, their results should be interpreted cautiously. The computer-based program may be an appropriate communication intervention for adolescents with ABI; however, future research should compare to results using a criterion-referenced measure to determine efficacy of the therapy program and screening tool.

The study by Chapman and colleagues (2005) provides a conceptual framework for fluency and precision training rather than a specific intervention that can be replicated. Future studies should implement fluency and precision training while targeting specific communication goals across several participants.

Due to the psychosocial difficulties and social isolation that many adolescents experience after an ABI (Turkstra & Burgess, 2007), interventions that aim to improve pragmatic skills are essential. Wiseman-Hakes and colleagues (1998) provided an intervention that explicitly taught pragmatic skills to adolescents with ABI. Future research in pragmatic interventions should include a control group for comparison and blinding of raters for unbiased results. Considering facilities' scheduling limits and clinicians' increased demands, it is imperative that the effectiveness of non-intensive pragmatic skills' training interventions is also explored. Although the current research demonstrates equivocal to compelling results, limited information was provided about the generalizability of these communication outcomes outside of the clinical research setting. Future research needs to explore how well the communication

skills gained from these interventions generalize to real life contexts of daily living.

It is important to mention that all of the studies in this critical review had limited sample sizes. Although it may be challenging to recruit enough participants especially within a specific population that meets inclusion criteria, it is important that future studies include larger sample sizes to increase the certainty of findings for clinical relevance and usage.

### **Conclusion**

Research has shown that ABI in adolescents can negatively affect brain functioning and communication outcomes. Recovery and rehabilitation can be complex due to the interaction of ongoing social, cognitive and communication challenges. Although there has been limited evidence-based research in this area, the current evidence is suggestive that receptive and expressive language and pragmatic interventions can be effective for improving communication outcomes for adolescents with ABI. Based on the results of this critical review, semantic and elaborate encoding (PQRST) and peer group pragmatic skills' training may be effective therapies for this population. It is essential that SLPs are aware of effective communication therapies to assist with improving functional communication outcomes for their adolescent clients with ABI.

### **Clinical Implications**

These five studies provide preliminary findings regarding the efficacy of communication interventions for adolescents with ABI. Considering the variability of communication outcomes, these findings warrant further investigations regarding the clinical usefulness of these suggestive results. In the meantime, SLPs can select specific communication goals for interventions with their adolescent clients with ABI based on the results of a comprehensive assessment. When goals are well-defined, progress can be easily documented and hierarchies can be developed and changed to meet the individual needs of each client goals and needs. The ultimate goal of therapy is to have the client become their own clinician. Generalization of skills is essential for carryover in meaningful life activities. Using self-monitoring strategies and meaningful, personally relevant materials in therapy is essential to assist with this carryover.

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