

ERABI

EVIDENCE-BASED REVIEW
of moderate to severe
ACQUIRED BRAIN INJURY

7. Cognitive-Communication Treatments Post Acquired Brain Injury

Penny Welch-West (M.Cl.Sc. SLP), Connie Ferri (MSc. SLP), Leanne Togher PhD,
Shannon Janzen MSc, Brooke Benton BSc RDH, Joshua Wiener BSc, Robert Teasell MD, FRCPC

ERABI
Parkwood Institute
550 Wellington Rd, London ON

Table of Contents

7.1 Introduction 7

7.2 Communication..... 8

- **7.2.1 Communication Remediation9**
- **7.2.2 Social Communication Training13**
- **7.2.3 Training Communication Partners16**

7.3 Non-Verbal Communication..... 19

- **7.3.1 Emotional Intelligence20**

7.4 Alternative Communication Strategies..... 23

- 7.8.1.1 Organizational Word Retrieval Strategies:..... 24*
- 7.8.1.2 Non-Electronic Communication Board: 25*
- 7.8.1.3 Eye-Gaze Communication Board:..... 25*
- 7.8.1.4 Bliss Symbols: 25*
- 7.8.1.5 Pictograms: 25*
- 7.8.1.6 Picture/Symbol Based Boards: 25*
- 7.8.1.7 Alphabet Boards:..... 26*
- 7.8.1.8 Memory Aids 26*
- 7.8.1.9 Synthetic Voice:..... 26*
- 7.8.1.10 Sign Language:..... 26*

7.5 Conclusion 27

7.6 Summary..... 28

7.7 References 29

Table Directory

Table 7.1 Interventions for Improving Communication

Table 7.2 Effectiveness of Social Communication Skills Training

Table 7.3 Training Communication Partners

Table 7.4 Effectiveness of Pragmatic and Emotional Intelligence Interventions

Figure Directory

Figure 1: Picture/Symbols

Abbreviations

AAC	Augmentative or Alternative Communication
ABI	Acquired Brain Injury
PCT	Prospective Controlled Trial
RCT	Randomized Controlled Trial
SLP	Speech Language Pathologist

Key Points

Communicating “yes/no” responses with consistent training and environmental enrichments does not improve communication responses in individuals post ABI.

Retrieval practice is effective for improving memory recall in individuals with an ABI.

Targeted figurative language therapy improves communication in individuals with chronic TBI.

Text-to-speech technology improves reading rates in individuals with TBI.

Memory group interventions improve memory function post ABI.

Training in social skills, social communication or pragmatics is effective in improving communication following brain injury.

Goal-driven interventions may be effective in improving social communication skills and goals following TBI.

Conversation group therapy appears to have a beneficial effect on pragmatic and quality of life concerns following brain injury.

Providing communication training to individuals who interact with people with TBI is effective and encourages two-way dialogue.

Providing training to the communication partner and the individual with TBI together is more effective than training the individual with TBI alone.

Facial affect recognition training improves emotional perception post ABI.

Short intervention designed to improve emotional prosody is not effective post ABI.

Cognitive Pragmatic Treatment (CPT) program is effective at improving comprehension and production of a communication act.

Augmentative and alternative communication interventions designed to assist with organization, access, and efficiency of communication may be beneficial for individuals with severe ABI.

7. Cognitive Communication Treatments Post Acquired Brain Injury

7.1 Introduction

A common sequela after a brain injury is cognitive impairment, which we know largely predicts rehabilitation outcomes. The primary purpose of this chapter is to review the evidence concerning cognitive-communication disorders and their treatments following moderate to severe acquired brain injury (ABI). For more information regarding cognitive impairments that do not stem from communication deficits, such as memory, attention, and executive functioning, please refer to ERABI Module 6 Cognition.

Prior to 1980, Speech-Language Pathologists (SLPs) working in the area of ABI were uncommon; while there has been a significant expansion in the outcome research and clinical services over the past 15 years, it is apparent from this review that evidence-based research into therapeutic interventions is lagging. This review focuses on communication interventions provided to individuals with brain injury. There is a limited number of high quality randomized controlled trials (RCTs) within the literature dedicated to cognitive-communication impairments and the therapies performed to assist with the improvement of these deficits. This is especially true for impairments related to linguistic organization, reading comprehension, written expression and information processing. In a review conducted by Perdices et al. (2006) on brain injury, it was found that the majority of studies (39%) were single subject designs, and only 21% were RCTs. Difficulties conducting RCTs with individuals who have sustained an ABI include the complexity of the disorder, the confounding effects of spontaneous recovery, the heterogeneity of this population, costs, specificity of treatment, the need for multifaceted integrated rehabilitation, and the informed consent procedure (Struchen, 2005; Wiseman-Hakes et al., 2010). Further, blinding participants to their treatment group, and team members who are responsible for providing the treatment is “*nearly impossible*” (Kennedy & Turkstra, 2006).

Bloom and Lahey (1978) define language as, “*knowledge of a code for representing ideas about the world through a conventional system of arbitrary signals for communication.*” Language is comprised of some aspect of content or meaning that is coded or represented in a linguistic manner for the purpose of use in a particular context (Bloom & Lahey, 1978). Every aspect of language (content, form and use) includes cognitive processing. Impairment of any cognitive process may affect any or all components of language. It is the mutually dependent relationship between cognition and language that gives individuals the ability to generate, assimilate, retain, retrieve, organize, monitor, respond to and learn from the environment (Kennedy & Deruyter, 1991).

Traditionally, descriptions of communication disorders that exist within populations of individuals with ABI fall into four main groups: apraxia, aphasia, dysarthria and cognitive-communication. The term cognitive-communication disorder was adopted by the American Speech-Language-Hearing Association (American Speech-Language-Hearing Association, 1987) to distinguish the unique characteristics of communication post ABI from those of aphasia following stroke. The College of Audiologists and Speech-Language Pathologists of Ontario defines cognitive-communication disorders as: “...communication impairments resulting from underlying cognitive deficits due to neurological impairment. These are difficulties in communicative competence (listening, speaking, reading, writing, conversation, and social interaction) that result from underlying cognitive impairments (attention, memory, organization,

information processing, problem solving and executive functions)” (p.4) (College of Audiologists and Speech Language Pathologists of Ontario, 2002). The study of language disorders following ABI has been challenging; conceivably more than any other area of communication disorders. Clinicians are required to deal with issues of language use or pragmatics to a greater extent than for other acquired neurological communication disorders. In some instances, the language disorders found among individuals with ABI are more than just a reflection of underlying cognitive deficits. At other times, precise language processing deficits occur in conjunction with cognitively associated communication disorders (Kennedy & Deruyter, 1991).

Many individuals with an ABI, unlike individuals with developmental communication disorders, have a history of normal learning, language and speech. Typically, they are younger than stroke survivors, and have greater concerns regarding transitions back to school and work. The mechanism of injury is unique, and is related to a collection of cognitive-communication disorders. Therefore, it is important to regard individuals with ABI as a distinct group (Turkstra, 1998).

Communication impairments among this group are generally described as non-aphasic in nature (Ylvisaker M & SF, 1994). This is a different type of communication impairment than that seen following stroke, and this distinction is an important one. Communication deficits in individuals with ABI may also include aphasic-like symptoms such as naming errors and word-finding problems, impaired self-monitoring, and auditory recognition impairments. These constraints may also be coupled with other cognitive-communication impairments, such as attention and perception difficulties, impaired memory, impulsivity, and severe impairment of the individual’s overall communicative proficiency within functional situations. These constraints can prevent individuals with ABI from exhibiting even simple communication skills (Lennox & Brune, 1993).

In ABI, communication challenges are often observed along with otherwise intact speech, fluency, comprehension and grammar (Ylvisaker M & SF, 1994). The communication style of those with an ABI has been described as “the language of confusion” (Halpern et al., 1973). In an older study, dysarthria was the most commonly diagnosed communication disorder (54%), followed by other cognitive communication deficits (16%), aphasia (4%) and apraxia of speech (4%) (Duffy, 2005).

Inappropriate/unconventional social behaviour or impaired executive functions (self-awareness of strengths and weaknesses, goal setting, planning, self-initiating, self-inhibiting, self-monitoring, self-evaluating) are also common areas affected (American Speech-Language-Hearing Association, 1987).

7.2 Communication

There are a number of challenges and difficulties with communication post ABI, some of which include participating in a conversation (retrieving or finding the right word to express oneself), or talking at length about any given topic, formulating sentences, and naming objects or people (Wiseman-Hakes et al., 2010). Despite the variety and availability of treatment materials and strategies aimed at addressing anomia, there is unfortunately a real paucity of studies with strong evidence that meet the inclusion criteria for the ERABI project.

Due to impairments in cognitive abilities following an ABI, difficulties in producing proficient discourse is commonplace. Previous treatments have focused on improving narrative and structured conversations post injury (Kilov et al., 2009). Established treatments often focus on the individual’s ability to communicate with a clinician or researcher but not in the presence of a friend or family member

(Jorgensen & Togher, 2009). Whether an individual communicates with a friend, a family member or community member, rather than a trained clinician post brain injury, has had an effect on the language choices made by both partners (Jorgensen & Togher, 2009).

Group treatment may be an effective intervention for individuals post ABI with cognitive-communication deficits, and may be used to target more complex and higher-level skills within the communication domain and with a wide array of communication partners. Within a group treatment setting, patients with ABI gain support and benefit from the experience of their peers within a non-judgmental environment to experiment with compensatory strategies and acquisition of appropriate interaction skills (College of Audiologists and Speech Language Pathologists of Ontario, 2002).

Some specific goals of group treatment post ABI include having individuals focus on having their basic needs met, to improve word fluency, word usage and word finding, and, to have tools to help better organize ideas in conversation. Strategies to ensure meeting these goals is possible would be to implement the use of a yes/no response system, as well as encouraging individuals to speak clearly, with vocal effort and with proper breath support. For clinical use, the Lee Silverman Voice treatment (LSVT®) would be the primary tool when addressing these issues.

7.2.1 Communication Remediation

The terms rehabilitation and remediation can often be misused interchangeably; rehabilitation aims at compensatory changes, whereas the goal of remediation is to return to original function. In reviewing the literature with regards to cognitive-communication interventions in ABI, cognitive retaining approaches have been described as “mental muscle building designed to improve aspects of cognition through repetition” (Ylvisaker & Urbanczyk, 1990). While a number of studies have demonstrated statistically significant improvements after intensive cognitive retraining, there have been concerns that the improvements did not translate to functional improvements in daily communication (Ylvisaker & Urbanczyk, 1990). It is important that such interventions translate outside of research studies and make a difference during everyday tasks, and generalize to everyday settings where the individual communicates on a daily basis.

Several authors have reviewed a variety of studies focusing on cognitive-communication therapies used to assist those post ABI (Coelho et al., 1996; Kennedy et al., 2008; MacDonald & Wiseman-Hakes, 2010). In an earlier review conducted by Coelho et al. (1996), the concluding findings suggest that those who sustain an ABI benefit from the work of a SLP. Study authors found evidence to suggest that individuals undergoing therapy showed gains in receptive and expressive language, speech production, reading, writing, and cognition. Further they noted that patients with more severe cognitive-communication deficits are more effectively remediated when treatment is directed toward the development of compensatory rehabilitation strategies such as the use of memory aids (Coelho et al., 1996). Additionally, Coelho and colleagues (1996) reported that although interventions directed at particular cognitive deficits are important, clinicians must attend to broader issues of social skills retraining, timing of treatment during recovery, treatment location and its effectiveness (e.g. hospital, home, school, work). Study results from Mackay et al. (1992) suggest that intervention programs offered earlier post injury result in shorter rehabilitation stays. Further, for individuals with comparable disabilities, those who receive rehabilitation have better than average cost outcomes compared to those not receiving these services (Aronow, 1987). For individuals with profound deficits following their ABI, treatment focusing on environmental modification or the arrangement of permanent support systems may be

most effective (e.g. training family members/ significant others to encourage patient/client during activities of daily living) (DePompei & Williams, 1994; Story, 1991).

Table 7.1 Interventions for Improving Communication

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
<p>Sumowski et al. (2014) USA Pre-Post N=10</p>	<p>Population: Severe TBI=10; Mean Age=42.8 yr; Gender: Male=6, Female=4; Mean Time Post Injury=8.4 yr. Intervention: Participants studied 48 verbal paired associates (VPAs) divided into 3 learning conditions: massed restudy (MR), spaced restudy (SR), and retrieval practice (RP). MR is similar to cramming, whereas SR is distributed learning. RP was similar to SR; however, re-exposure trials were framed as cued recall tests. Recall of VPAs was done at 30 min post intervention, and at 1 wk. Participants performed all 3 methods of learning. Outcome Measure: Recall of VPAs.</p>	<ol style="list-style-type: none"> Participants recalled 46.3% of VPAs learned through RP compared with 12.5% through MR ($p<0.0001$), and 15% through SR ($p=0.002$). SR did not result in better memory than MR ($p=0.0555$). At 1wk, participants recalled 11.3% in the RP group compared to 0.0% in the MR ($p=0.004$), and 1.3% in SR ($p=0.011$). Again, SR and MR did not differ from each other ($p=0.343$).
<p>Barreca et al. (2003) Canada RCT PEDro=6 N=13</p>	<p>Population: ABI; Mean Age: 41.3 yr; Gender: Male= 10, Female= 3; Mean Time Post Injury=33 mo; Mean GCS=4.8. Treatment: Patients were assigned to an ABAB (n=7) or BABA (n=6) treatment sequence. Group A received an enriched stimulus environment, collaborative multi-disciplinary intervention, and additional yes/no response training (30 min, 3x/wk). Group B received standard intervention within a hospital environment. This took place over 8 wk, each interval being 2 wk. Outcome Measure: Western Aphasia Battery.</p>	<ol style="list-style-type: none"> No order effect (AB vs BA; $F=0.29$; $p=0.06$) but a treatment trend was found for the effectiveness of group A over group B (A vs B; $F=3.84$; $p=0.07$). No significant differences in Western Aphasia Battery scores between treatments at admission or 6 mo later ($p>0.05$).
<p>Harvey et al. (2013) USA Pre-Post N=9</p>	<p>Population: Severe TBI=9; Mean Age=35.78 yr; Gender: Male=8, Female=1; Mean Time Post Injury=10.89 yr. Intervention: Participants read 24 passages in two different scenarios, once without any training and once after receiving 6 sessions of computerized text-to-speech training. Outcome Measure: Reading rate, comprehension accuracy.</p>	<ol style="list-style-type: none"> Reading rates were significantly faster after receiving training ($p=0.036$). No significant difference between text-to-speech and no text-to-speech conditions were noted for comprehension accuracy ($p=0.950$).
<p>Brownell et al. (2013) USA Pre-Post N=8</p>	<p>Population: TBI=8; Mean Age=43 yr; Gender: Male=5, Female=3; Mean Time Post Injury=8.5 yr; Severity: Moderate to severe. Intervention: Therapy targeting difficulties interpreting figurative language. Participants were assessed at baseline and then performed metaphor interpretation probes and untrained line orientation tasks during the three study phases: (1) baseline phase (10 session, 2x/wk); (2) training phase with word tasks ranging in difficulty (2x/wk); and (3) post training phase (10 sessions, 2x/wk). The exact number of</p>	<ol style="list-style-type: none"> As a whole, the group significantly improved on the Oral Metaphor Interpretation following treatment compared to baseline (Mean difference score=5.9, $p<0.001$). Scores on the Benton line Orientation task did not improve significantly (Mean difference score=-0.2, $p=0.585$) from pre to post training. 6 of 8 participants improved significantly on metaphor interpretation following training, 3 of which maintained these improvements at follow-up.

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
	sessions varied (total 23 to 34). Follow-up conducted at 3 to 4 mo post training. Outcome Measure: Oral Metaphor interpretation, Benton Line Orientation-Judgment Task Short Form Q.	
O'Neil-Pirozzi et al. (2010) USA Prospective Control Trial N=94	Population: TBI; <i>Experimental Group:</i> Mean Age=47.3 yr; Mean Time Post-Injury=11.8 yr; <i>Control Group:</i> Mean Age=47.0 yr; Mean Time Post-Injury=13.4 yr Treatment: In a non-randomized pre-post study group comparison, participants in the experimental group were trained to use Internal Memory Strategies (I-MEMS; n=54); the intervention consisted of 12 90-min sessions, held 2x/wk for 6 wk. It included memory education and emphasized internal strategy acquisition to improve memory function from encoding, storage and retrieval perspectives; the control group (n=40) consisted of a convenience sample. Outcome Measure: Hopkins Verbal Learning Test-Revised (HVLTR), Rivermead Behavioural Memory Test II (RBMT II). Patients were assessed on Week 1 (pretest), Week 7 (post-test 1), and Week 11 (post-test 2).	<ol style="list-style-type: none"> 1. Pretesting revealed a significant difference between experimental and control groups on the HVLTR only (p=0.02). 2. Individuals who had had a severe TBI performed more poorly on the HVLTR than those with moderate injuries. 3. Although those with a severe injury did not improve as much as those with a mild or moderate injury, they did improve more than those in the control group at both post-test 1 (p=0.0002) and post-test 2 (p<0.0001). 4. Similar to what was found with HVLTR assessments, severe injury predicted worse RBMT II scores than moderate injury. 5. RBMT II scores in the I-MEMS groups revealed significant improvements at both post-test 1 (p=0.045) and post-test 2 (p=0.0013) relative to control. 6. Overall memory performance was improved for all those in the experimental group compared to the control group.

Discussion

Barreca et al. (2003) compared two rehabilitation approaches that attempted to establish correct responses to yes/no questions. In addition to providing an enriched environment to the first group, a communicative disorders assistant provided yes/no training to the individuals. In addition, the assistant trained healthcare team members and families to follow scripted procedures to increase arousal/attention and to elicit yes/no responses. This was compared against standard care. A trend towards statistical significance for the first group (yes/no training) was found over the second. These findings offer evidence that some patients with severe head injuries improve their ability to communicate “yes/no” responses when undergoing consistent training and environmental enrichments. Increased interactions between patients and nursing were informally observed. As well, families reported on a satisfaction questionnaire that they were better able to communication with their loved one (Barreca et al., 2003).

Another study examined retrieval practice, administered in person, compared to massed restudy and spaced restudy (Sumowski et al., 2014). In the retrieval practice intervention, the participants were first exposed to a verbal paired associate; the subsequent trials for that verbal paired associate were structured as cued recall tests. For individuals with severe TBI and memory-impairments, this retrieval practice was significantly more effective for memory recall than the massed restudy and spaced restudy interventions both immediately following the intervention and at 1 week post (Sumowski et al., 2014).

Technology interventions have also been used to improve communication post TBI. In a study conducted by Harvey et al. (2013) participants completed six sessions of computerized text-to-speech training. Results showed a significant improvement in reading rates during the text-to-speech conditions compared to the no text-to-speech conditions (Harvey et al., 2013). These findings suggest that text-to-speech technology is a useful tool in improving reading rates among individuals with a TBI. However, the authors note that while reading rates improved, comprehension of the written material was not affected.

Brownell et al. (2013) utilized therapy targeting deficiencies in figurative language. All participants completed 10 sessions of word task training resulting in significant improvements in oral metaphor interpretation (Brownell et al., 2013). Participants in the study were approximately eight years post injury suggesting that post TBI individuals are capable of advanced improvements in non-literal language even after the period of rapid and pronounced spontaneous recovery.

In a study by O'Neil-Pirozzi et al. (2010), individuals with ABI participated in twelve 90-minute sessions which were held twice a week. The intervention included memory education, and to improve memory function the study emphasized internal strategy acquisition. Primary emphasis was placed on semantic association followed by semantic elaboration/chaining and imagery. Results from the Hopkins Verbal Learning Test (HVLT) indicated significant differences between the groups and those with a severe ABI performed more poorly than those with a moderate injury. Despite this finding, those with severe ABIs did perform better than those in the control group. In all, memory performance was seen to improve for all in the intervention group compared to the control group.

Conclusions

There is level 1b evidence that yes/no training and an enriched environment does not significantly improve communication responses in individuals with an ABI.

There is level 4 evidence that retrieval practice is more effective for memory recall in individuals with an ABI than massed restudy (i.e., cramming) and spaced restudy (i.e., distributed learning).

There is level 4 evidence that targeted therapy towards figurative language improves communication in chronic TBI individuals.

There is level 4 evidence that text-to-speech technology improves reading rates post ABI.

There is level 2 evidence suggesting memory group interventions can improve everyday memory functioning post ABI.

Communicating “yes/no” responses with consistent training and environmental enrichments does not improve communication responses in individuals post ABI.

Retrieval practice is effective for improving memory recall in individuals with an ABI.

Targeted figurative language therapy improves communication in individuals with chronic TBI.

Text-to-speech technology improves reading rates in individuals with TBI.

Memory group interventions improve memory function post ABI.

7.2.2 Social Communication Training

ABI can influence every aspect of life including physicality, cognitive function, emotional responses, and social functioning. Communication remediation focuses on one’s ability to improve expressive language, speech production, reading, writing, and cognition. Social communication training more specifically addresses social competence and removing barriers to returning to a meaningful and productive life, which includes having the ability to sustain interpersonal relationships (Braden et al., 2010).

Table 7.2 Effectiveness of Social Communication Skills Training

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
<p>Westerhof-Evers et al. (2017) Netherlands RCT PEDro=7 N_{Initial}=61, N_{Final}=56</p>	<p>Population: TBI; Mean Age=43.2 yr; Gender: Male=83, Female=17; Severity: Moderate to severe. Treatment: Participants were randomly assigned to receive Treatment for Impairments in Social Cognition and Emotion Regulation (T-ScEmo, n=30) protocol or Cogniplus (n=29) training. The TScEmo protocol is aimed at enhancing emotion perception, perspective taking, theory of mind, goal-directed social behaviour through 20 individual treatment sessions offered 1-2x/wk by neuropsychologists. Cogniplus is an individually administered computerized attention training aimed at improving general cognition. Outcomes were assessed baseline (T0), post-intervention (T1), and 3-5 mo follow-up (T2). Outcome Measure: The Awareness of Social Inferences Test (TASIT-short), Sixty faces test (FEEST), Cartoon test, Faux Pas test (FP), Wechsler Adult Intelligence Scale (WAIS-III digit span), Trail Making Test (TMT A and B/A), Test of Everyday Attention Lottery (TEA lottery), Dysexecutive Questionnaire-Social scales (DEX-Soc-self, DEX-Soc-proxy), Brock’s Adaptive Functioning Questionnaire-Social monitoring scale (BAFQ-SM-self, BAFQ-SM-proxy), BAFQ empathy scale (BAFQ-Emp-self, BAFQ-Emp-proxy), Role Resumption List (RRL), Quality of Life after Brain Injury (QOLIBRI satisfaction, QOLIBRI burden), Treatment Goal Attainment (TGA), Relationship Quality Scale (RQS-self, RQS-life partner).</p>	<ol style="list-style-type: none"> For the primary outcome of TASIT-short, there was no significant improvements over time in either group and no significant differences between groups. Significant Time x Group interactions from T0 to T1 were observed for FEEST (p=0.01), CT (p=0.02), RRL (p<0.01), and TGA (p<0.01). No significant interactions from T0 to T1 were observed for FP, DEX-Soc-self, DEX-Soc-proxy, BAFQ-SM-self, BAFQ-SM-proxy, BAFQ-Emp-self, BAFQ-Emp-proxy, QOLIBRI satisfaction, QOLIBRI burden, RQS-self, RQS-life partner, WAIS-III digit span, TMT A, TMT B/A, or TEA lottery. Significant Time x Group interactions from T0 to T2 were observed for FEEST (p<0.01), CT (p=0.02), BAFQ-Emp-proxy (p=0.02), RRL (p<0.01), QOLIBRI burden (p=0.04), RQS-life partner (p=0.02), and TGA (p<0.01). No significant interactions from T0 to T2 were observed for FP, DEX-Soc-self, DEX-Soc-proxy, BAFQ-SM-self, BAFQ-SM-proxy, BAFQ-Emp-self, QOLIBRI satisfaction, RQS-self, WAIS-III digit span, TMT A, TMT B/A, or TEA lottery.
<p>Dahlberg et al. (2007) USA RCT</p>	<p>Population: TBI; Mean Age=41.17 yr; Gender: Male=44, Female=8; Mean Time Post Injury=9.67 yr; Severity: Severe=40, Moderate to mild=12. Treatment: Patients were randomly assigned to</p>	<ol style="list-style-type: none"> Results of the PFIC rating scale showed significantly greater improvements on 7 of the subscales included on the PFIC: general participation (p=0.001), quantity

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
<p>PEDro=6 N=52</p>	<p>either the experimental (n=26) group or the control group (n=26). Individuals receiving the training focused on listening to others, communicating needs, and regulating their emotions during social interactions. There were 12 sessions each lasting 1.5 hr. The control group waited 3 mo before undergoing treatment. Patients were assessed 5 times: baseline (wk 0), end of treatment (wk 12), at wk 24, 36 and 48.</p> <p>Outcome Measure: Profile of Functional Impairment in Communication (PFIC), Social Communication Skills Questionnaire-Adapted (SCSQ-A), Goal Attainment Scale (GAS).</p>	<p>(p=0.024), internal relation (p=0.009), external relation (p=0.005), clarity of experience (p=0.024), social style (p<0.001) and aesthetics (p=0.014).</p> <ol style="list-style-type: none"> The SCSQ-A showed significant improvement (p=0.005) for the treatment group compared to the control, pre- and post-intervention. Over time significant improvement were noted between baseline scores and post-treatment scores for all participants receiving training on the PFIC (21 of the 30 subscales: p<0.001). Significant improvement was noted on the SCSQ-A (p<0.001) as well. Significant improvements were made on the GAS from baseline to all post-treatment evaluations (p<0.001).
<p>Finch et al. (2017) Australia Pre-Post N=8</p>	<p>Population: TBI; Mean Age=36.25 yr; Gender: Male=4, Female=4; Mean Time Post Injury=24.6 mo; Mean GCS=8.25; Severity: moderate=1, severe=7.</p> <p>Treatment: Participants received one 1 hr group and one 1 hr individual therapy session per wk for 8 wk. Therapy sessions were led by a speech-language pathologist and focussed on remediating impaired social communication skills using metacognitive strategy instruction training and goal-based therapy. Outcomes were assessed at baseline (4 wk baseline prior to intervention, pre-intervention, post-intervention, and 4 wk follow-up.</p> <p>Outcome Measure: Profile of Pragmatic Impairment in Communication (PPIC), LaTrobe Communication Questionnaire (LCQ), Goal Attainment Scaling (GAS).</p>	<ol style="list-style-type: none"> For PPIC, only the literal content (p=0.005), general participation (p=0.02), internal relation (p=0.008), clarity of expression (p=0.026), and aesthetics (p=0.016) subscales showed significant improvement from baseline to 4 wk follow-up. No significant differences were observed for the quantity, quality, external relation, social style, or subject style subscores. For PPIC, only the aesthetics subscale was significantly improved (p=0.039) comparing post-intervention to pre-intervention. No significant differences for LCQ were observed when comparing baseline to 4 wk follow-up or pre- to post-intervention. During the intervention, participants identified between three and six goals each. Following the intervention, there was a significant increase in GAS goal T-scores (p=0.012).
<p>Braden et al. (2010) UK Cohort N_{initial}=30, N_{final}=17</p>	<p>Population: TBI; Mean Age=42.11 yr; Gender: Male=21, Female=9; Mean Time Post Injury=7.85 yr.</p> <p>Treatment: Participants received Group Interactive Structured Treatment (GIST) for social competence. This program was provided in a rehabilitation facility or in the community. A treatment workbook, developed specifically for GIST, was given to each participant. Each group member was asked to attend 13, 1.5 hr/wk sessions to discuss various topics related to effective communication. Patients were assessed at baseline, post-treatment, and at 3 and 6 mo.</p>	<ol style="list-style-type: none"> Social communication skills, as assessed by SCSQ-A, GAS and SWLS, improved significantly pre- to post-assessment (p<0.05). For those in the TBI+ group (those with a substance disorder, a psychiatric disorder, or other neurological complications) significant improvement was noted on their SCSQ-A, GAS, SWLS scores (p<0.01, p<0.000 and p=0.01 respectively). The improvement on the PPIC was not significant (p=0.40).

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
	Outcome Measure: Profile of Pragmatic Impairment in Communication (PPIC), Social Communication Skills Questionnaire-Adapted (SCSQ-A), Goal Attainment Scale (GAS), Satisfaction with Life Scale (SWLS).	3. There were no significant differences comparing the groups (TBI only to TBI+) at baseline, post-intervention or 6 mo post-intervention for the PPIC, person ratings on SCSQ-A, GAS and SWLS.

Discussion

An RCT by Westerhof-Evers et al. (2017) compared the use of a Social cognition and Emotion regulation treatment (T-ScEmo) to a treatment for general cognitive gains (control group), to evaluate how participants performed on emotion perception, social understanding, and social behavior. The T-ScEmo group had statistically significant improvements on emotion perception (facial affect recognition), theory of mind, proxy-rated empathic behavior, societal participation, and treatment goal attainment, when compared with the Cogniplus group (Westerhof-Evers et al., 2017). Participants in the T-ScEmo group also reported higher quality of life and their life partners rated relationship quality to be higher than those in the Cogniplus group.

In an RCT conducted by Dahlberg et al. (2007) it was found that subjects in the experimental group, when exposed to twelve, 1.5 hour communication sessions, significantly improved their scores on the general participation in conversation subscale on the Profile of Functional Impairment in Communication and the Social Communication Skills questionnaire-adapted (Dahlberg et al., 2007). These improvements were also noted at 6 and 9 month follow up periods. Therefore, this treatment model shows promise for improving social communication skills in an ABI population.

Finch et al., (2017) conducted pre-post study in adults with brain injury aimed at improving and maintaining social communication skills, in particular, the study authors focused on improved perceived communication skills, and achievement of goals. The results from this study indicated that goal-driven interventions may help individuals with TBI achieve social communication goals.

The Braden et al. (2010) study examined the efficacy of the Group Interactive Structured Treatment (GIST) for social competence in a cohort study examining 30 individuals greater than one year post ABI. The 13 week training covered the following topics: skills of the great communicator, self-assessment and goal setting, starting conversations, keeping conversations going and using feedback, assertiveness in solving problems, practice in the community, social confidence through positive self-talk, social boundaries, videotaping, video review, conflict resolution, closure and celebration (Braden et al., 2010). Overall, data gathered from several subjective social communication tools supported the hypothesis that social communication skills and social competence can be improved several years post injury. Further, the program seemed to be effective for individuals with TBI who also have comorbidities.

Although interventions addressing social skills have been studied in detail in other populations, including mental health; in individuals with ABI, there is limited evidenced-based research addressing this area.

Conclusions

There is level 1b evidence that pragmatic interventions including role-playing, improve a variety of social communication skills in individuals with an ABI, as well as self-concept and self-confidence in social communications.

There is level 4 evidence suggesting that a goal-driven, metacognitive approach to intervention may be beneficial in assisting individuals with TBI to achieve social communication goals.

There is level 2 evidence that conversation group therapy has a beneficial effect on pragmatic and quality of life concerns in individuals with an ABI.

Training in social skills, social communication or pragmatics is effective in improving communication following brain injury.

Goal-driven interventions may be effective in improving social communication skills and goals following TBI.

Conversation group therapy appears to have a beneficial effect on pragmatic and quality of life concerns following brain injury.

7.2.3 Training Communication Partners

The success of communication interventions often relies on the understanding, compliance and competence of communication partners. Training of communication partners has become a central component of communication interventions with many populations. This development is consistent with the World Health Organization (2001) emphasis on *context* (environmental and attitudinal) as a determinant in health and disability outcomes. Training of communication partners has been shown to have a positive effect on communication effectiveness and reacquisition of communication skills in children with language disorders and developmental disabilities (Girolametto et al., 1994), adults with aphasia (Kagan et al., 2001), adults with dementia (Ripich et al., 1999), and adults with ABI (Togher et al., 2004).

It is not surprising that following an ABI, individuals may have difficulty engaging in meaningful conversation with others. Training communication partners is particularly helpful in successfully facilitating communication with those with moderate to severe ABI. The strategies that are most useful in ensuring success of treatment include speaking in short, simple sentences, making and maintaining eye contact, and asking the patient to repeat the messages being conveyed (Behn et al., 2013). Also, asking patients to clarify they understand the information and repeating the information when necessary, while allowing adequate time to receive an answer. Presenting the information in written form can also elicit a positive outcome from patients (Behn et al., 2013). Eliminating environmental distractions will be a tremendous aid to allow proper focus and attention for optimal results. Communication partners should present choices to patients and clarify the intent of the message being delivered. Using a variety of modes of communication (such as nonverbal) can also be a useful strategy (Behn et al., 2012, Togher et al., 2004, Togher et al., 2016, Sim et al., 2013, Togher et al. 2013).

Table 7.3 Training Communication Partners

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
<p>Behn et al. (2012) Australia RCT PEDro=6 N=15</p>	<p>Population: Caregivers=10, TBI=5. <i>TBI</i>: Mean Age=29.2 yr; Gender: Male=3, Female=2; Mean Time Post Injury=6.8 yr. Treatment: Caregivers were randomly assigned to a program on how to facilitate better conversations with individuals who had a TBI. The treatment group (n=5) participated in a range of collaboration and elaboration conversational strategies (17 hr across 8 wk). Collaborative strategies were designed to encourage those with a TBI to participate more actively in conversations. The control group (n=5) was not trained. Outcome Measure: Adapted Measure of Support in conversation (MSC), Adapted Measure of Participation in Conversation, La Trobe Communication Questionnaire, Modified Burden Scale.</p>	<ol style="list-style-type: none"> 1. The trained group improved significantly on the MSC-acknowledging competence ($p<0.001$) and MSC-revealing competence ($p=0.002$). 2. Study results found paid caregivers were able to benefit from training; all participants were able to improve their communication skills with those who had sustained a TBI. 3. Trained caregivers also found they experienced greater levels of burden and described negative aspects of caring more often than those who were not in the paid group.
<p>Togher et al. (2004) Australia RCT Crossover PEDro=5 N=40</p>	<p>Population: Police Officers=20, TBI=20. <i>TBI</i>: Gender: Male=20, Female=0; Mean Age=36.75 yr; Mean Time Post Injury=8.8 yr. Treatment: Patients were randomly assigned to interact with trained (treatment; n=10) or untrained (control; n=10) male police officers. Trained officers were provided with a 6 wk program targeting communication strategies using videos, theory, and transcripts Outcome Measure: Analyzed transcripts, Communication effectiveness.</p>	<ol style="list-style-type: none"> 1. Partner training resulted in more efficient and focused interactions, and fewer episodes of unrelated utterances by the people with ABI. 2. Trained communication partners were able to use strategies such as providing appropriate feedback and support during service encounter interactions, which enabled people with ABI to respond in an appropriate manner.
<p>Togher et al. (2016) Australia PCT N_{Initial}=44, N_{Final}=38</p>	<p>Population: TBI; Gender: Male=26, Female=18. <i>Control</i> (n=15): Mean Age=38.1 yr; Mean Time Post Injury=9.7 yr. <i>JOINT</i> (n=14): Mean Age=30.3 yr; Mean Time Post Injury=8yr; <i>TBI SOLO</i> (n=15): Mean Age=39.7 yr; Mean Time Post Injury=8.1 yr; Treatment: Participants were allocated to one of three groups: 1) control group, no training; 2) the JOINT group, attended all sessions together with their communication partner; or 3) the TBI SOLO group, attended sessions without their communication partner. The training was 2.5 hr/wk of group sessions and 1 hr/wk of individual sessions for 10 wk. Outcomes were assessed before and after treatment, and at 6 mo follow-up.</p>	<ol style="list-style-type: none"> 1. Post treatment, communication partners in JOINT reported greater overall improvements compared to TBI SOLO ($p=0.05$) and control ($p<0.001$). 2. Post treatment, individuals with TBI and their partners reported more positive change on LCQ in JOINT ($p<0.001$ for both) and TBI SOLO ($p=.01$; $p=0.004$) compared to controls, with only a significant difference on LCQ significant others reports between JOINT and TBI SOLO conditions ($p=0.002$). 3. At follow-up, individuals with TBI reported increase in positive change in communication skills in JOINT ($p=0.01$) and TBI SOLO ($p=0.03$) compared to controls, with no significant difference between JOINT and TBI SOLO.

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
	Outcome Measure: La Trobe Communication Questionnaire (LCQ) - Self Report and Significant Other Report.	4. At follow-up, more change was reported in communication partners in JOINT than TBI SOLO ($p=0.01$) and controls ($p<0.001$).
<p>Sim et al. (2013) Australia PCT $N_{Initial}=29, N_{Final}=27$</p>	<p>Population: TBI; Gender: Male=24, Female=5. <i>JOINT Group (n=14)</i>: Mean Age=30.29 yr; Mean Time Post Injury=8.04 yr <i>Control Group (n=15)</i>: Mean Age=38.07 yr; Mean Time Post Injury=9.71 yr. Intervention: Participants and their everyday communication partners (ECPs) were allocated into either the JOINT training that received social communication training or a waitlist control group. The training was 2.5 hr/wk of group sessions and 1 hr/wk of individual sessions for 10 wk Outcome Measure: Exchange Structure Analysis (ESA), Productivity analysis, Information giving moves (K1), Information requesting or receiving moves (K2), Dynamic Moves (DM), Per Minute Speaking Time (PMST).</p>	<ol style="list-style-type: none"> 1. Those ECPs in the JOINT group, compared to controls, changed their use of questions more often ($p=0.04$) and their DM (information tracking/negotiation; $p=0.07$). 2. Participates with TBI in the JOINT group made greater improvements in PMST than controls ($p=0.03$). 3. No significant between group changes were identified for ECPS in K1 and K2. 4. No significant between group differences were determined for those with TBI in DM, K1, or K2.
<p>Togher et al. (2013) Australia PCT $N_I=44, N_F=38$</p>	<p>Population: TBI; Gender: Male=38, Female=6. <i>Control (n=15)</i>: Mean Age=38.1 yr; Mean Time Post Injury=9.7 yr. <i>JOINT (n=14)</i>: Mean Age=30.3 yr; Mean Time Post Injury=8 yr. <i>TBI SOLO (n=15)</i>: Mean Age=39.7 yr; Mean Time Post Injury=8.1 yr. Intervention: Participants were allocated to one of three groups: 1) control group, no training; 2) the JOINT group, attended all sessions together with their communication partner; or 3) the TBI SOLO group, attended sessions without their communication partner. The training was 2.5 hr/wk of group sessions and 1 hr/wk of individual sessions for 10 wk. Training included role-play, listening to audio-recordings, practice interactions, and conversation strategies. Outcomes were assessed before and after treatment, and at 6 mo follow-up. Outcome Measure: Adapted Measure of Participation in Conversation (MPC), Adapted Measure of Support in Conversation (MSC).</p>	<ol style="list-style-type: none"> 1. On the MPC, the JOINT group had greater improvements than the control group for both casual conversations (CC) and purposeful conversations (PC) on the Interaction scale (CC: $p=0.01$, PC: $p=0.03$) and on the Transaction scale (CC: $p=0.003$, PC: $p=0.008$). 2. The JOINT group made greater gains compared to the TBI SOLO group for Transaction scores in both conditions (CC: $p=0.02$, PC: $p=0.01$), and the Interaction scale for PC ($p=0.03$). 3. There were no significant differences between the TBI SOLO group and the control group on the MPC. 4. There were no significant between group differences on the MSC. 5. At 6mo follow-up, there were no significant changes on outcome measures.

PEDro=Physiotherapy Evidence Database rating scale score (Moseley et al., 2002).

Discussion

In a RCT conducted by Togher et al. (2004), the benefits of training individuals regarding how to effectively communicate with individuals post ABI was evident. Police officers were trained to respond to individuals with ABI, while the remaining officers who volunteered did not participate in the training. Overall, it was noted that trained officers significantly reduced the number of inquiries required to gain

the necessary information from their callers, as well as spent less time establishing the nature of the service request and more time answering the questions being presented.

Behn et al. (2012) found that training allowed for caregivers to interact more easily with the individual with a TBI and encouraged a two-way dialogue. The training in this study was a number of didactic and performance-based approaches such as modeling, role-playing, feedback and rehearsal. As well, the strategies used were both elaborative and collaborative.

When looking at training communication partners, the most efficacious way to improve interactions is to have both the individual with an ABI and their communication partner participate in training together. Two studies by Togher et al. (2013; 2016) found that those who completed social communication training together, made significantly greater gains in participation and overall communication compared to individuals with TBI who attended alone or those who received no training. In a similar study, providing training to communication partners allowed for their communication styles to be modified, which in turn allowed for the individual with TBI to improve their communication (Sim et al., 2013). This study highlighted the benefits of monitoring the two-way interaction using discourse analysis to ensure that information is given, received, and negotiated in an effective and appropriate way (Sim et al., 2013).

Conclusions

There is level 2 evidence to support the effectiveness of interventions that focus on training the communication partners of individuals with severe TBI.

There is level 2 evidence that providing training to both the communication partner and the individual with a TBI together is more effective than only training the individual with TBI alone or no training at all.

Providing communication training to individuals who interact with people with TBI is effective and encourages two-way dialogue.

Providing training to the communication partner and the individual with TBI together is more effective than training the individual with TBI alone.

7.3 Non-Verbal Communication

After an ABI, issues may present in either verbal or nonverbal communication skills; Difficulties with conversation may include topic introduction, topic maintenance, topic choice, turn taking and perspective taking (College of Audiologists and Speech Language Pathologists of Ontario, 2002)

Pragmatics describes “a person’s ability to perceive, interpret and respond to the contextual and situational demands of conversation” (Wiseman-Hakes et al., 1998). In other words, pragmatics refers to the interaction between language behavior and the context in which language occurs (Strauss HM & RS, 1994). Studies have shown that the conversations of individuals with ABI, compared to individuals without injury, have been rated as significantly less interesting, less appropriate, less rewarding, more effortful, and more reliant on conversation partners to maintain the flow of the conversation (Bond &

Godfrey, 1997; Coelho et al., 1996). Since it is through conversation that we form and maintain relationships, impaired communication can have a significant negative impact on social competence, vocational competence and academic competence. Social communication deficits in ABI can result in social isolation, frustration, and a sense of helplessness (Kilov et al., 2009; Sarno et al., 1986).

Goals of treatment regarding non-verbal communication post ABI include initiating conversation with others, learning to understand the emotion presented in verbal language, the ability to respond appropriately, and to maintain conversation. In order to achieve these goals, the necessary strategies to be employed consist of environmental and behavioural modification, counselling and support, pragmatic skills training, and targeted speech and language therapy. Patients will require positive reinforcement of the appropriate responses, as well as auditory/visual feedback by others.

7.3.1 Emotional Intelligence

Table 7.4 Effectiveness of Pragmatic and Emotional Intelligence Interventions

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
<p>Westerhof-Evers et al. (2017) Netherlands RCT PEDro=7 N_{Initial}=61, N_{Final}=56</p>	<p>Population: TBI; Mean Age=43.2 yr; Gender: Male=83, Female=17; Severity: Moderate to severe.</p> <p>Treatment: Participants were randomly assigned to receive Treatment for Impairments in Social Cognition and Emotion Regulation (T-ScEmo, n=30) protocol or Cogniplus (n=29) training. The TScEmo protocol is aimed at enhancing emotion perception, perspective taking, theory of mind, goal-directed social behaviour through 20 individual treatment sessions offered 1-2x/wk by neuropsychologists. Cogniplus is an individually administered computerized attention training aimed at improving general cognition. Outcomes were assessed baseline (T0), post-intervention (T1), and 3-5 mo follow-up (T2).</p> <p>Outcome Measure: The Awareness of Social Inferences Test (TASIT-short), Sixty faces test (FEEST), Cartoon test, Faux Pas test (FP), Wechsler Adult Intelligence Scale (WAIS-III digit span), Trail Making Test (TMT A and B/A), Test of Everyday Attention Lottery (TEA lottery), Dysexecutive Questionnaire-Social scales (DEX-Soc-self, DEX-Soc-proxy), Brock's Adaptive Functioning Questionnaire-Social monitoring scale (BAFQ-SM-self, BAFQ-SM-proxy), BAFQ empathy scale (BAFQ-Emp-self, BAFQ-Emp-proxy), Role Resumption List (RRL), Quality of Life after Brain Injury (QOLIBRI satisfaction, QOLIBRI burden), Treatment Goal Attainment (TGA), Relationship Quality Scale (RQS-self, RQS-life partner).</p>	<ol style="list-style-type: none"> 4. For the primary outcome of TASIT-short, there was no significant improvements over time in either group and no significant differences between groups. 5. Significant Time x Group interactions from T0 to T1 were observed for FEEST (p=0.01), CT (p=0.02), RRL (p<0.01), and TGA (p<0.01). No significant interactions from T0 to T1 were observed for FP, DEX-Soc-self, DEX-Soc-proxy, BAFQ-SM-self, BAFQ-SM-proxy, BAFQ-Emp-self, BAFQ-Emp-proxy, QOLIBRI satisfaction, QOLIBRI burden, RQS-self, RQS-life partner, WAIS-III digit span, TMT A, TMT B/A, or TEA lottery. 6. Significant Time x Group interactions from T0 to T2 were observed for FEEST (p<0.01), CT (p=0.02), BAFQ-Emp-proxy (p=0.02), RRL (p<0.01), QOLIBRI burden (p=0.04), RQS-life partner (p=0.02), and TGA (p<0.01). No significant interactions from T0 to T2 were observed for FP, DEX-Soc-self, DEX-Soc-proxy, BAFQ-SM-self, BAFQ-SM-proxy, BAFQ-Emp-self, QOLIBRI satisfaction, RQS-self, WAIS-III digit span, TMT A, TMT B/A, or TEA lottery.

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
<p>Neumann et al. (2015) USA RCT PEDro=9 N_{Initial}=71, N_{Final}=60</p>	<p>Population: TBI; <i>Faces</i> (n=24): Mean Age=41 yr; Gender: Male=23, Female=1; Mean Time Post Injury=10.5yr; Mean GCS=6.9; <i>Stories</i> (n=23): Mean Age=41.5 yr; Gender: Male=18, Female=5; Mean Time Post Injury=10.9 yr; Mean GCS=4.4; <i>Control</i> (n=24): Mean Age=39.5 yr; Gender: Male=16, Female=8; Mean Time Post Injury=9.8yr; Mean GCS=5.3. Treatment: Participants randomly assigned to one of three interventions for 1 hr sessions 3 days/wk for 3 wk. Faces intervention taught individuals to recognize emotions in facial expressions, whereas stories intervention taught individuals to recognize emotion within stories. Control group underwent cognitive training. Participants assessed at pre-treatment and post-treatment within 4 days, at 3 mo and 6 mo. Outcome Measure: Diagnostic Assessment of Nonverbal Accuracy 2-Adult Faces (DANVA 2-AF), Emotional Inference From Stories Test (EIST), Interpersonal Reactivity Index (IRI), Neuropsychiatric Inventory (NPI) Irritability and Aggression domain.</p>	<ol style="list-style-type: none"> 1. According to DANVA 2-AF, participants trained in the faces intervention had a significant improvement across all follow-up time points compared to controls (p=0.031). 2. No significant improvement for the stories intervention on DANVA 2-AF compared to controls (p=0.239). 3. No significant improvement on EIST for the stories intervention (p=0.167) and faces (p=0.349) compared to controls. 4. Across all post-treatments assessments, there was a main effect of time as performance decreased for the stories intervention on EIST compared to controls (p=0.001). 5. NPI irritability and aggression and IRI empathy were not significant for faces or story interventions compared to controls.
<p>McDonald et al. (2013) Australia RCT PEDro=6 N=20</p>	<p>Population: Severe TBI=16, CVA=3, Other=1; Mean Age=45.62 yr; Gender: Male=15, Female=5; Mean Time Post Injury=9.41 yr. Treatment: Patients were assigned to either a treatment group (n=10) or a control group (n=10). Patients receiving treatment attended 2hr/wk treatment sessions for 3 wk. Sessions consisted of a therapist and two participants. The program was tailored to focus on prosodic cues that may be seen in expressions of emotions. Outcome Measure: Awareness of Social Interference Test Form B-Part 1 (audio presentation), Prosodic Emotion Labelling Task, Communication Questionnaires.</p>	<ol style="list-style-type: none"> 1. No significant treatment effects were found for the TASIT B, while accuracy on the prosody task (p=0.074) and rating of intensity of emotions (p=0.076) approached significance. 2. The treatment group showed a significant change on the self-report communication questionnaire (p=0.013).
<p>Radice-Neumann et al. (2009) USA RCT PEDro=5 N_{Initial}=21, N_{Final}=19</p>	<p>Population: TBI=19, ABI=2; Mean Age=43 yr; Gender: Male=12, Female=8; Mean Time Post Injury=12 yr; Mean GCS=4.08. Treatment: Patients were randomly assigned to receive either the facial affect recognition (FAR; n=10) training or the stories of emotional inference training (SEI; n=9). In the FAR training, individuals practiced identifying and discriminating emotions from facial expressions and focused on processing their internal emotions. SEI involved reading stories and answering questions. Sessions were 1:1 for 1 hr, 3 x/wk for 2-3 wk.</p>	<ol style="list-style-type: none"> 1. The FAR group improved on the DANVA2-AF over time (p<0.001), with changes being seen from pre-post (p<0.001) but not post to follow-up (p=0.244). 2. The SEI group also improved on the DANVA2-AF (p=0.006). The change occurred between the two pre-tests (p=0.004). 3. No significant changes were found for either group on the DANVA2-AP or the ability to infer emotions on video. 4. Both groups improved on their ability to infer emotions from contextual situations (LEAS; both p=0.019).

Author/ Year/ Country/ Study Design/ N	Methods	Outcomes
	<p>Outcome Measure: Levels of Emotional Awareness Scale (LEAS), Diagnostic Assessment of Nonverbal Affect – adult faces/adult paralinguistic (DANVA2-AF and DANVA2-AP), Brock Adaptive Functioning Questionnaire (BAFQ).</p>	<p>5. On the BAFQ, caregivers, indicated those in the FAR group showed improvement in the behaviour of patients (p=0.042); out of 4 emotional behaviours, only aggression changed significantly (p=0.047); SEI did not improve in perceived behaviour.</p>
<p>Gabbatore et al. (2015) Italy Pre-Post N_{Initial}=20, N_{Final}=15</p>	<p>Population: TBI; Mean Age=36.7 yr; Gender: Male=10, Female=5; Mean Time Post Injury=76.13 mo; Mean GSC=4.5. Treatment: Participants received a control procedure with non-communication activities for 3 mo. This was followed by a 3 mo cognitive pragmatic training program (2 sessions/wk) consisting of 5-patient groups focussed on improving pragmatic abilities, self awareness, and executive function. Outcome Measure: Assessment Battery for Communication (ABaCo-comprehension, production, linguistic, extralinguistic, paralinguistic, and context), Attentive Matrices, Trail Making test, Verbal Span, Spatial Span, Immediate and Deferred Recall test, Tower of London test, Wisconsin Card Sorting test (WCST), Coloured Progressive Matrices Raven, Aachener Aphasia test-denomination scale (AAT), Sally and Ann Task, Strange Stories Task.</p>	<ol style="list-style-type: none"> 1. No significant improvements in ABaCo (production and comprehension) were observed during the nonspecific control period. 2. Participants showed significant improvements from pre-training to post-training for ABaCo comprehension (p<0.001), production (p<0.001), linguistic (p=0.005), extralinguistic (p=0.008), paralinguistic (p=0.02), and context (p=0.01). 3. At 3 mo follow-up post-treatment, AbaCo scores did not show significant differences from post-treatment. 4. From pre-training to post-training, no significant differences were observed for Verbal Span, Spatial Span, Attentive Matrices test, Trial Making test, Tower of London test, Raven’s Colored Progressive Matrices, AAT, Sally and Ann task, or the Strange Stories task. Improvements were observed for the Immediate and Deferred Recall task (p=0.01) and Wisconsin Card Sorting test (p=0.003).

PEdro = Physiotherapy Evidence Database rating scale score (Moseley et al., 2002).

Discussion

Westerhof-Evers et al. (2017) conducted an RCT that is outlined in Table 7.2 describing social communication training. Not only did this study evaluate social understanding and social behaviour, it also examined emotional regulation and perception. On the emotional intelligence components of the study, the experimental group improved significantly on the facial affect recognition (Westerhof-Evers et al. 2017). Participants in the experimental group also reported higher quality of life and their life partners rated relationship quality to be higher than those in the control group (Westerhof-Evers et al. 2017).

A short treatment aimed at improving the ability to recognize emotional prosody was overall found to be ineffective (McDonald et al., 2013). Activities consisted of mostly games designed to focus on prosodic cues but found no change related to communication competence. Significance was approached for the treatment group in terms of improvements in the accuracy on the prosody task and ratings of intensity of emotions. However, participants in the treatment group self-reported that their ability to comprehend daily conversations had improved (McDonald et al., 2013).

Radice-Neumann et al. (2009) and Neumann et al. (2015) demonstrated that training focused on emotional processing can be effective when introduced to a group of individuals who had sustained an ABI. They assert that individuals with ABI can re-learn affective recognition skills. Two interventions to

enhance emotion processing were utilized in both studies. The first intervention (Facial Affect Recognition), focused on attention to important visual information and attention to the participant's own emotional experience. The second intervention (Stories of Emotional Inference) taught patients to read emotions from contextual cues presented in stories and then relate these stories to personal events. Participants who received Facial Affect Recognition training had more positive outcomes. Participants were better at reading faces (emotions) and were more descriptive in relating how they or others would feel in a similar situation. Decreased level of aggression was an additional finding. The Stories of Emotional Inference group produced fewer improvements; however, they were able to make more emotional inferences about how they would feel in a given context. They did not make improvements in their ability to infer how others would feel in a given situation. The authors hypothesized that this might be related to self-centeredness, a trait often attributed to individuals post ABI (Radice-Neumann et al., 2009). However, Neumann et al. (2015) notes that the ability to identify one's own emotions is an important precursor to recognizing the emotions of others and therefore, should not be dismissed prematurely.

Gabbatore et al., (2015) evaluated a cognitive pragmatic rehabilitation program aimed at improving communicative-pragmatic abilities, in particular self-awareness and executive functioning. Study authors aimed at improving comprehension and production of a communication act. No improvements in comprehension were found from baseline to pre-training ($p=0.41$), however, significant improvements were demonstrated at post-training and follow-up (Gabbatore et al., 2015).

Conclusions

There is level 1b evidence that facial affect recognition training is beneficial at improving the emotional perception of individuals with ABI.

There is level 1b evidence that short intervention designed to improve the ability to recognize emotional prosody was minimally effective in individuals with ABI.

There is level 4 evidence that a Cognitive Pragmatic Treatment (CPT) program is effective in improving communicative-pragmatic abilities in individuals with ABI.

Facial affect recognition training improves emotional perception post ABI.

Short intervention designed to improve emotional prosody is not effective post ABI.

Cognitive Pragmatic Treatment (CPT) program is effective at improving comprehension and production of a communication act.

7.4 Alternative Communication Strategies

Following severe ABI, patients present with significant communication challenges that interfere with daily communication needs. Whereas those who sustain a mild or moderate ABI may be more readily

able to communicate using natural speech with minor difficulties, those with severe ABI may not be able to meet communication needs through speech alone and may benefit from an augmentative or alternative communication (AAC) strategy (M. S. Bourgeois et al., 2001; Burke et al., 2004; de Joode et al., 2012; Fager et al., 2006; Johannsen-Horbach et al., 1985). Many individuals eventually recover their speech abilities post ABI, but there are still many who remain unable to speak for extended periods of time (Fager et al., 2006). For this specific group, assessments and AAC interventions may be a continual process, ensuring that the individual's level of function is matched appropriately with new systems as needed (Fager et al., 2006).

In the AAC domain, there are divisions of complexity that include simple, low-tech options (e.g. alphabet boards, picture-based communication boards, memory books, conversation books, day planners) and high tech options that include Voice Output Communication Aids (i.e., Dynavox, McCaw, Message Mate, Big Mack, Voice Pal and Boardmaker) (Fager et al., 2006). Notably, both low-tech and high-tech solutions to communication difficulties may have access that is either direct (i.e. touching/ pointing) or indirect (i.e. switch access or partner-assisted scanning).

Clinicians working in the area of AAC or Assistive/Enabling Technology are well acquainted with the recent explosion of technology options available. Presently, clinicians and patients have access to an extensive set of devices and peripherals including but not limited to iPad, Android, and Windows based tablets as well as a wide variety of associated applications and software (e.g. Proloquo2go, Talking Tiles). Changes in cost, improved ease of access/availability in mainstream retail, and rapid changes in the technology itself and associated applications have resulted in AAC clinical practice that is both invigorating and exhausting. Given that we are in the midst of an unprecedented technology growth, the research in this area is lagging and limited.

In this particular area, difficulties sustained post ABI include verbal expression and severe dysarthria, with the primary goal of treatment being to allow individuals with severe ABI to efficiently access and communicate effectively via AAC. Particular treatment strategies for ACC may be to complete an initial assessment of the individuals needs from access and communication perspectives. From there, clinicians are able to determine the best device and method of access for individuals on a one-to-one basis (taking into account age and gender). And finally, to allow time for training and teaching of both patient and communication partners (i.e. facilitator).

While there is a great deal of discussion around the importance of AAC, there is limited literature supporting the effectiveness of the strategies currently available for ABI populations. Further research is required in order to understand how these communication approaches or alternatives work to benefit individuals with an ABI and their care giving team.

7.8.1.1 Organizational Word Retrieval Strategies:

Burke et al. (2004) studied the use of three organizational word retrieval strategies for adults with ABI who use AAC. These organizational strategies included semantic topic, geographic place, and first letter of alphabet. While the subjects retrieved words more accurately when using the alphabet organization strategy, they expressed the preference for use of the semantic topic strategy. Clinicians may consider providing these three strategies for clients using AAC, and assisting with identification of the most beneficial and preferred strategy for the individual client.

7.8.1.2 Non-Electronic Communication Board:

Assistive devices for AAC range in their properties and capabilities. Non-electronic communication boards, along with electronic counterparts, can aid individuals post ABI with messages and symbols depicted on the display. However, the number of messages they can display are limited, and they do not have the capacity for speech output (Iacono et al., 2011). This option would be ideal for people with complex communication needs, as they are easy to access, less expensive, and generally more easy to use by patients, caregivers and clinicians.

7.8.1.3 Eye-Gaze Communication Board:

Assistive technologies aim to improve outcomes in individuals with physical and cognitive impairments. Gaze-based communication boards use computers controlled by the individual's eyes. This device replaces keyboard and mouse with eye gaze for those who have physical impairments that prevents the use of upper limb motor function (Borgestig et al., 2016). By using their eyes, individuals can control the computer and gain access to communication and activities, including playing games, music, and perform a range of activities that they would not otherwise be physically able to do (Borgestig et al., 2016). The limitation of this technology is that is not as cost effective as other AAC devices, and novice users may experience fatigue quickly, as there is a substantial learning curve with the type of specific eye movements needed to operate the communication board (it does not mimic natural/intuitive eye movements required for daily activities) (Borgestig et al., 2016).

7.8.1.4 Bliss Symbols:

Bliss symbols or boards have been available and utilized for several years. The use of these symbols has been found to be very effective with those who have been diagnosed with aphasia or Broca's aphasia (Rajaram et al., 2012). However, there is little in the literature specific pertaining to individuals with an ABI.

7.8.1.5 Pictograms:

Pictograms allow individuals to express their thoughts, emotions, wants and needs with pictures, as there is not a verbal explanation of all words. Pictogram-based ACC has been used for >30 years and has been shown to help learn new linguistic skills (Pahisa-Solé & Herrera-Joancomartí, 2017).

7.8.1.6 Picture/Symbol Based Boards:

Despite the surge in technology, picture and symbol based boards remain in high use today (e.g. pictograms, Boardmaker). These symbols or pictures may represent a concept, object, activity, place or event. Symbols, pictures, and boards in general may be used with minimal training and software may be individualized (Bhatnagar SC & F, 1999). The selection of symbols should be appropriate to the individual's communicative needs. Picture/symbol software is also available for computers, iPads, and iPhones.

Figure 1: Picture/Symbols



7.8.1.7 Alphabet Boards:

Individuals with dysarthria or who are non-verbal may benefit from an alphabet board. These boards are helpful for spelling single word or short phrase messages. Board sizes may vary depending on the person's abilities, necessity, or access (Bhatnagar SC & F, 1999). A lexical communication board is another type of AAC that uses common words such as nouns, pronouns, verbs and adjectives to improve sentence formation in patients, however this is not supported by academic sources and therefore requires further research.

7.8.1.8 Memory Aids:

The use of memory aids as an AAC tool has been studied extensively in patients with dementia and Alzheimer's, however their use in individuals with an ABI are not well documented. There are a number of different aids that can be used to compensate for memory loss, and decline of cognitive and linguistic skills. Memory books are amongst the most popular and capitalize on procedural memory skills (page turning and reading aloud), they also promote transfer of information and increase social closeness (M. Bourgeois et al., 2001). Memory aids help compensate for memory loss by helping to access stored information and memories, therefore they can be an extremely effective tool that are easily accessible and straightforward to use from a patient's perspective (M. Bourgeois et al., 2001)

7.8.1.9 Synthetic Voice:

Synthetic voice, or synthesized speech uses computer-generated text-to-speech synthesis to extract speech and sound components from words and then combine them to form a natural sounding voice (JL Flaubert, 2017) This differs from digitized speech, which uses human voices stored as segments of sounds waves. Synthesized speech is ideal because it allows greater message flexibility and accuracy of what the individual is trying to convey (JL Flaubert, 2017).

7.8.1.10 Sign Language:

All the above AAC treatments are considered to be "aided" forms of communication, meaning they require external support by way of auxiliary materials (communication board, printed words, etc.) (Sigafoos & Drasgow, 2001). In contrast, natural gestures and sign language are forms of "unaided" AAC (Sigafoos & Drasgow, 2001) American Sign Language is the most commonly used, however there are other systems including Pidgin Signed English (PSE), and Signed Exact English (SEE). The advantages of sign language as an AAC are that it is portable (it does not require materials or devices), and it can be

easier to teach than speech; communication partners, and clinicians can help individuals with hand formations (Sigafoos & Drasgow, 2001). There is no literature to support use of sign language in brain injured populations specifically, therefore more research in this field is required to make conclusions about its efficacy as a potential therapy.

Augmentative and alternative communication interventions designed to assist with organization, access, and efficiency of communication may be beneficial for individuals with severe ABI.

7.5 Conclusion

Cognitive-Communication post-ABI represents a unique area of rehabilitation. Cognitive communication deficits are primarily treated by SLPs, and can include both verbal and non-verbal communication, such as emotional intelligence. For other cognitive deficits related to attention, memory, and executive functioning please see Module 6.

7.6 Summary

There is level 1b evidence that yes/no training and an enriched environment does not significantly improve communication responses in individuals with an ABI.

There is level 4 evidence that retrieval practice is more effective for memory recall in individuals with an ABI than massed restudy (i.e., cramming) and spaced restudy (i.e., distributed learning).

There is level 4 evidence that targeted therapy towards figurative language improves communication in chronic TBI individuals.

There is level 4 evidence that text-to-speech technology improves reading rates post ABI.

There is level 2 evidence suggesting memory group interventions can improve everyday memory functioning post ABI.

There is level 1b evidence that pragmatic interventions including role-playing, improve a variety of social communication skills in individuals with an ABI, as well as self-concept and self-confidence in social communications.

There is level 4 evidence suggesting that a goal-driven, metacognitive approach to intervention may be beneficial in assisting individuals with TBI to achieve social communication goals.

There is level 2 evidence that conversation group therapy has a beneficial effect on pragmatic and quality of life concerns in individuals with an ABI.

There is level 2 evidence to support the effectiveness of interventions that focus on training the communication partners of individuals with severe TBI.

There is level 2 evidence that providing training to both the communication partner and the individual with a TBI together is more effective than only training the individual with TBI alone or no training at all.

There is level 1b evidence that facial affect recognition training is beneficial at improving the emotional perception of individuals with ABI.

There is level 1b evidence that short intervention designed to improve the ability to recognize emotional prosody was minimally effective in individuals with ABI.

There is level 4 evidence that a Cognitive Pragmatic Treatment (CPT) program is effective in improving communicative-pragmatic abilities in individuals with ABI.

7.7 References

References

- American Speech-Language-Hearing Association. (1987). *The role of speech-language pathologists in the habilitation and rehabilitation of cognitively impaired individuals: a report of the Subcommittee on Language and Cognition* (0001-2475 (Print) 0001-2475). Retrieved from
- Aronow, H. U. (1987). Rehabilitation effectiveness with severe brain injury: Translating research into policy. *Journal of Head Trauma Rehabilitation*, 2(3), 24-36.
- Barreca, S., Velikonja, D., Brown, L., Williams, L., Davis, L., & Sigouin, C. S. (2003). Evaluation of the effectiveness of two clinical training procedures to elicit yes/no responses from patients with a severe acquired brain injury: a randomized single-subject design. *Brain Inj*, 17(12), 1065-1075.
- Behn, N., Togher, L., Power, E., & Heard, R. (2012). Evaluating communication training for paid carers of people with traumatic brain injury. *Brain Inj*, 26(13-14), 1702-1715.
- Bhatnagar SC, & F, S. (1999). Communicating with nonverbal patients in India: Inexpensive augmentative communication devices. Retrieved from <http://www.dinf.ne.jp/doc/english/asia/resource/apdrj/z13jo0400/z13jo0405.html>
- Bloom, L., & Lahey, M. (1978). *Language development and language disorders*. New York: Wiley.
- Bond, F., & Godfrey, H. P. (1997). Conversation with traumatically brain-injured individuals: a controlled study of behavioural changes and their impact. *Brain Inj*, 11(5), 319-329.
- Borgestig, M., Sandqvist, J., Parsons, R., Falkmer, T., & Hemmingsson, H. (2016). Eye gaze performance for children with severe physical impairments using gaze-based assistive technology: a longitudinal study. *Assistive technology*, 28(2), 93.
- Bourgeois, M., Dijkstra, K., Burgio, L., & Allen-Burge, R. (2001). Memory aids as an augmentative and alternative communication strategy for nursing home residents with dementia. *Augmentative and Alternative Communication*, 17(3), 196-210.
- Bourgeois, M. S., Dijkstra, K., Burgio, L., & Allen-Burge, R. (2001). Memory aids as an augmentative and alternative communication strategy for nursing home residents with dementia. *AAC: Augmentative and Alternative Communication*, 17(3), 196-210.
- Braden, C., Hawley, L., Newman, J., Morey, C., Gerber, D., & Harrison-Felix, C. (2010). Social communication skills group treatment: a feasibility study for persons with traumatic brain injury and comorbid conditions. *Brain Inj*, 24(11), 1298-1310.
- Brownell, H., Lundgren, K., Cayer-Meade, C., Milione, J., Katz, D. I., & Kearns, K. (2013). Treatment of metaphor interpretation deficits subsequent to traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 28(6), 446-452.
- Burke, R., Beukelman, D. R., & Hux, K. (2004). Accuracy, efficiency and preferences of survivors of traumatic brain injury when using three organization strategies to retrieve words. *Brain Inj*, 18(5), 497-507.
- Coelho, C. A., DeRuyter, F., & Stein, M. (1996). Treatment efficacy: cognitive-communicative disorders resulting from traumatic brain injury in adults. *J Speech Hear Res*, 39(5), S5-17.

- College of Audiologists and Speech Language Pathologists of Ontario. (2002). Preferred practice guideline for cognitive-communication disorders. Retrieved from http://www.caslpo.com/Portals/0/ppg/ppg_ccd.pdf
- Dahlberg, C. A., Cusick, C. P., Hawley, L. A., Newman, J. K., Morey, C. E., Harrison-Felix, C. L., & Whiteneck, G. G. (2007). Treatment Efficacy of Social Communication Skills Training After Traumatic Brain Injury: A Randomized Treatment and Deferred Treatment Controlled Trial. *Arch Phys Med Rehabil*, 88(12), 1561-1573.
- de Joode, E., Proot, I., Slegers, K., van Heugten, C., Verhey, F., & van Boxtel, M. (2012). The use of standard calendar software by individuals with acquired brain injury and cognitive complaints: a mixed methods study. *Disability and Rehabilitation: Assistive Technology*, 7(5), 389-398.
- DePompei, R., & Williams, J. (1994). Working with families after TBI: A family-centered approach. *Topics in Language Disorders*, 15(1), 68-81.
- Duffy, J. (2005). Defining, understanding and categorizing motor speech disorder. *Motor speech disorders - substrates differential diagnosis, and management*. (2nd ed., pp. 3-16). St. Louis, MO: Elseiver Mosby.
- Fager, S., Hux, K., Beukelman, D. R., & Karantounis, R. (2006). Augmentative and alternative communication use and acceptance by adults with traumatic brain injury. *Augment Altern Commun*, 22(1), 37-47.
- Finch, E., Cornwell, P., Copley, A., Doig, E., & Fleming, J. (2017). Remediation of social communication impairments following traumatic brain injury using metacognitive strategy intervention: a pilot study. *Brain Inj*, 31(13-14), 1830-1839.
- Gabbatore, I., Sacco, K., Angeleri, R., Zettin, M., Bara, B. G., & Bosco, F. M. (2015). Cognitive Pragmatic Treatment: A rehabilitative program for traumatic brain injury individuals. *The Journal of Head Trauma Rehabilitation*, 30(5), E14-E28.
- Girolametto, L., Verbey, M., & Tannock, R. (1994). Improving Joint Engagement in Parent-Child Interaction An Intervention Study. *Journal of Early Intervention*, 18(2), 155-167.
- Halpern, H., Darley, F. L., & Brown, J. R. (1973). Differential language and neurologic characteristics in cerebral involvement. *Journal of Speech and Hearing Disorders*, 38(2), 162-173.
- Harvey, J., Hux, K., Scott, N., & Snell, J. (2013). Text-to-speech technology effects on reading rate and comprehension by adults with traumatic brain injury. *Brain Inj*, 27(12), 1388-1394.
- Iacono, T., Lyon, K., & West, D. (2011). Non-electronic communication aids for people with complex communication needs. *International Journal of Speech-Language Pathology*, 13(5), 399-410.
- JL Flaubert, C. S., AM Jette. (2017). *The Promise of Assistive Technology to Enhance Activity and Work Participation.*: National Academies of Sciences.
- Johannsen-Horbach, H., Cegla, B., Mager, U., Schempp, B., & Wallesch, C. W. (1985). Treatment of chronic global aphasia with a nonverbal communication system. *Brain and Language*, 24(1), 74-82.
- Jorgensen, M., & Togher, L. (2009). Narrative after traumatic brain injury: A comparison of monologic and jointly-produced discourse. *Brain Injury*, 23(9), 727-740.
- Kagan, A., Black, S. E., Duchan, J. F., Simmons-Mackie, N., & Square, P. (2001). Training Volunteers as Conversation Partners Using "Supported Conversation for Adults with

- Aphasia" (SCA): A Controlled Trial. *Journal of Speech, Language, and Hearing Research*, 44(3), 624-638.
- Kennedy, M., & Deruyter, F. (1991). Cognitive and language bases for communication disorders. *Communication disorders following traumatic brain injury: Management of cognitive, language, and motor impairments*, 123-190.
- Kennedy, M., & Turkstra, L. (2006). Group intervention studies in the cognitive rehabilitation of individuals with traumatic brain injury: Challenges faced by researchers. *Neuropsychology Review*, 16(4), 151-159.
- Kennedy, M. R. T., Coelho, C., Turkstra, L., Ylvisaker, M., Moore Sohlberg, M., Yorkston, K., Chiou, H. H., & Kan, P. F. (2008). Intervention for executive functions after traumatic brain injury: A systematic review, meta-analysis and clinical recommendations. *Neuropsychological Rehabilitation*, 18(3), 257-299.
- Kilov, A. M., Togher, L., & Grant, S. (2009). Problem solving with friends: Discourse participation and performance of individuals with and without traumatic brain injury. *Aphasiology*, 23(5), 584-605.
- Lennox, D. B., & Brune, P. (1993). Incidental teaching for training communication in individuals with traumatic brain injury. *Brain Injury*, 7(5), 449-454.
- MacDonald, S., & Wiseman-Hakes, C. (2010). Knowledge translation in ABI rehabilitation: A model for consolidating and applying the evidence for cognitive-communication interventions. *Brain Injury*, 24(3), 486-508.
- Mackay, L. E., Bernstein, B. A., Chapman, P. E., Morgan, A. S., & Milazzo, L. S. (1992). Early intervention in severe head injury: Long-term benefits of a formalized program. *Arch Phys Med Rehabil*, 73(7), 635-641.
- McDonald, S., Togher, L., Tate, R., Randall, R., English, T., & Gowland, A. (2013). A randomised controlled trial evaluating a brief intervention for deficits in recognising emotional prosody following severe ABI. *Neuropsychological Rehabilitation*, 23(2), 267-286.
- Moseley, A. M., Herbert, R. D., Sherrington, C., & Maher, C. G. (2002). Evidence for physiotherapy practice: A survey of the Physiotherapy Evidence Database (PEDro). *Australian Journal of Physiotherapy*, 48(1), 43-49.
- Neumann, D., Babbage, D. R., Zupan, B., & Willer, B. (2015). A randomized controlled trial of emotion recognition training after traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 30(3), E12-E23.
- O'Neil-Pirozzi, T. M., Strangman, G. E., Goldstein, R., Katz, D. I., Savage, C. R., Kelkar, K., Supelana, C., Burke, D., Rauch, S. L., & Glenn, M. B. (2010). A controlled treatment study of internal memory strategies (I-MEMS) following traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 25(1), 43-51.
- Pahisa-Solé, J., & Herrera-Joancomartí, J. (2017). Testing an AAC system that transforms pictograms into natural language with persons with cerebral palsy. *Assistive technology : the official journal of RESNA*, 1-9.
- Perdices, M., Schultz, R., Tate, R., McDonald, S., Togher, L., Savage, S., Winders, K., & Smith, K. (2006). The Evidence Base of Neuropsychological Rehabilitation in Acquired Brain Impairment (ABI): How Good is the Research? *Brain Impairment*, 7(02), 119-132.

- Radice-Neumann, D., Zupan, B., Tomita, M., & Willer, B. (2009). Training emotional processing in persons with brain injury. *Journal of Head Trauma Rehabilitation*, 24(5), 313-323.
- Rajaram, P., Alant, E., & Dada, S. (2012). Application of the self-generation effect to the learning of blissymbols by persons presenting with a severe aphasia. *AAC: Augmentative and Alternative Communication*, 28(2), 64-73.
- Ripich, D. N., Zioli, E., Fritsch, T., & Durand, E. J. (1999). Training Alzheimer's disease caregivers for successful communication. *Clinical Gerontologist*, 21(1), 37-56.
- Sarno, M. T., Buonaguro, A., & Levita, E. (1986). Characteristics of verbal impairment in closed head injured patients. *Arch Phys Med Rehabil*, 67(6), 400-405.
- Sigafoos, J., & Drasgow, E. (2001). Conditional Use of Aided and Unaided AAC: A Review and Clinical Case Demonstration. *Focus on Autism and Other Developmental Disabilities*, 16(3), 152-161.
- Sim, P., Power, E., & Togher, L. (2013). Describing conversations between individuals with traumatic brain injury (TBI) and communication partners following communication partner training: Using exchange structure analysis. *Brain Inj*, 27(6), 717-742.
- Story, T. B. (1991). Cognitive rehabilitation services in home and community settings. In J. S. K. P. H. Wehman (Ed.), *Cognitive rehabilitation for persons with traumatic brain injury: A functional approach* (pp. 251-267). Baltimore, MD, England: Paul H. Brookes Publishing.
- Strauss HM, & RS, P. (1994). Pragmatics and treatment. . In Chapey R (Ed.), *Language Intervention Strategies in Adult Aphasia*. (pp. 246-268). Baltimore: Williams & Wilkins.
- Struchen, M. (2005). Social communication interventions. In High W, Sander A, & H. K. (Eds.), *Rehabilitation for traumatic brain injury* (pp. 88-117). New York, NY: Oxford University Press.
- Sumowski, J. F., Coyne, J., Cohen, A., & Deluca, J. (2014). Retrieval practice improves memory in survivors of severe traumatic brain injury. *Arch Phys Med Rehabil*, 95(2), 397-400.
- Togher, L., McDonald, S., Code, C., & Grant, S. (2004). Training communication partners of people with traumatic brain injury: A randomised controlled trial. *Aphasiology*, 18(4), 313-335.
- Togher, L., McDonald, S., Tate, R., Power, E., & Rietdijk, R. (2013). Training communication partners of people with severe traumatic brain injury improves everyday conversations: a multicenter single blind clinical trial. *J Rehabil Med*, 45(7), 637-645.
- Togher, L., McDonald, S., Tate, R., Rietdijk, R., & Power, E. (2016). The effectiveness of social communication partner training for adults with severe chronic TBI and their families using a measure of perceived communication ability. *NeuroRehabilitation*, 38(3), 243-255.
- Turkstra, L. S. (1998). The effect of stimulus presentation rate on syntax test performance in brain-injured adolescents. *Aphasiology*, 12(6), 421-433.
- Westerhof-Evers, H. J., Visser-Keizer, A. C., Fasotti, L., Schonherr, M. C., Vink, M., van der Naalt, J., & Spikman, J. M. (2017). Effectiveness of a Treatment for Impairments in Social Cognition and Emotion Regulation (T-ScEmo) After Traumatic Brain Injury: A Randomized Controlled Trial. *J Head Trauma Rehabil*, 32(5), 296-307.

- Wielandt, S. M., Sage, K., Heijenbrok-Kal, M. H., & Van De Sandt-Koenderman, M. W. M. E. (2016). Candidacy for conversation partner training in aphasia: findings from a Dutch implementation study. *Aphasiology*, *30*(6), 699-718.
- Wiseman-Hakes, C., MacDonald, S., & Keightley, M. (2010). Perspectives on evidence based practice in ABI rehabilitation. "relevant Research": Who decides? *NeuroRehabilitation*, *26*(4), 355-368.
- Wiseman-Hakes, C., Stewart, M. L., Wasserman, R., & Schuller, R. (1998). Peer group training of pragmatic skills in adolescents with acquired brain injury. *J Head Trauma Rehabil*, *13*(6), 23-36.
- World Health Organization. (2001). International Classification of Functioning, Disability and Health.
- Ylvisaker M, & SF, S. (1994). Communication Disorders Associated with Closed Head Injury. In C. R. (Ed.), *Language Intervention Strategies in Adult Aphasia*. (book) (pp. 546-568). Baltimore: MD: Williams & Wilkins.
- Ylvisaker, M. S., & Urbanczyk, B. (1990). The efficacy of speech-language pathology intervention: Traumatic brain injury. *Semin Speech Lang*, *11*(4), 215-226.