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Review

An Evidence-Based Systematic Review on Communication Treatments for Individuals With Right Hemisphere Brain Damage

Margaret Lehman Blake,[a] Tobi Frymark,[b] and Rebecca Venedictov[b]

Purpose: The purpose of this review is to evaluate and summarize the research evidence related to the treatment of individuals with right hemisphere communication disorders.
Method: A comprehensive search of the literature using key words related to right hemisphere brain damage and communication treatment was conducted in 27 databases (e.g., PubMed, CINAHL). On the basis of a set of pre-established clinical questions, inclusion/exclusion criteria, and search parameters, studies investigating sentence- or discourse-level treatments were identified and evaluated for methodological quality. Data regarding participant, intervention, and outcome variables were reported.
Results: Only 5 studies were identified, each representing a different sentence- or discourse-level treatment approach and reporting a wide range of prosodic, expressive, receptive, and pragmatic outcomes.
Conclusion: Although the state of the evidence pertaining to right hemisphere communication treatments is at a very preliminary stage, some positive findings were identified to assist speech-language pathologists who are working with individuals with right hemisphere brain damage. Clinical implications and recommendations for future research are explored.

Key Words: communication treatment, discourse, prosody, pragmatics, right hemisphere brain damage, right hemisphere communication disorder, speech-language pathology

Speech-language pathologists working in health care settings are increasingly becoming more involved in the assessment and management of cognitive-communication disorders in individuals with right hemisphere brain damage (RHBD). Often caused by cerebrovascular accidents (CVAs), traumatic brain injuries (TBIs), brain tumors, or other neurological illnesses or injuries, RHBD has been found to result in a myriad of impairments. These may include visual spatial neglect and other attention deficits as well as difficulties with memory and components of executive function such as problem solving, reasoning, organization, planning, and self-awareness (American Speech-Language-Hearing Association [ASHA], 2008; Myers, 1999; Tompkins, 1995; Tompkins, Klepousniotou, & Scott, 2013). In addition, individuals with RHBD may exhibit a wide range of communication impairments that can negatively impact functional performance in social and vocational settings (Blake, 2006; Lehman & Tompkins, 2000; Myers, 2001).

The communication deficits associated with RHBD affect the exchange of communicative intent through nonverbal and verbal means. Facial expression, body language, and *prosody* (intonation contours that are created by manipulating frequency, stress, duration, and pitch) are all nonverbal means of conveying intent. Words, sentences, and *discourse* (two or more sentences that are organized to convey information) are verbal means of conveying intent. *Pragmatics,* the functional use of language in context, often involves the combined use of verbal and nonverbal mechanisms in a communicative context. The context can include linguistic cues as well as social cues (e.g., familiarity with the communication partner, social status of speaker and partner; Blake, 2007; Ferré, Ska, Lajoie, Bleau, & Joanette, 2011; Myers, 1999; Tompkins, 1995). In the literature, conversation has been considered as part of both discourse and pragmatics.

For individuals with disorders of prosody—termed *aprosodia*—speech production may sound "flat" or monotone, and the individual may have difficulty interpreting emotion and/or intent conveyed through prosody (Baum & Dwivedi, 2003; Pell, 2006; Ross, 1981). Some research also suggests that emotional prosody may be affected more than linguistic prosody after RHBD, but this finding has not been consistently replicated (Baum & Pell, 1999; Pell, 1998; Sidtis & Van Lancker Sidtis, 2003). Prosodic comprehension and production deficits may occur either separately or concomitantly.

[a]University of Houston, Houston, TX
[b]American Speech-Language-Hearing Association, Rockville, MD
Correspondence to Tobi Frymark: tfrymark@asha.org

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Sentence- and discourse-level deficits exhibited by individuals with RHBD can affect both comprehension and production. Key features of the deficits are reduced efficiency and reduced effectiveness of communication, often due to problems conveying or comprehending intent (Joanette & Ansaldo, 1999; Myers, 2001). Comprehension deficits include misinterpretation of intended meaning. This can be related to difficulties using contextual cues and generating inferences or links between sentences to comprehend the "big picture" or gist of a story. It also can include commonly described deficits in comprehension of nonliteral language, including interpretation of metaphors, idioms, and sarcasm (Kempler, Van Lancker, Marchman, & Bates, 1999; Myers, 1999; Myers & Linebaugh, 1981; Winner & Gardner, 1977). There is growing evidence that adults with RHBD can interpret nonliteral meanings and, in fact, may generate too many possible meanings of an utterance (Blake, 2009b; Blake & Lesniewicz, 2005; Tompkins, Baumgaertner, Lehman, & Fassbinder, 2000; Tompkins, Fassbinder, Blake, Baumgaertner, & Jayaram, 2004; Tompkins, Lehman-Blake, Baumgaertner, & Fassbinder, 2001). The problem is inefficiency in selecting the meaning that is most plausible for a given context. Either deficit—not generating meanings or generating too many meanings—can lead to misinterpretations of a speaker's intent.

Discourse-level production (although typically not sentence-level production) also can be affected after RHBD (Johns, Tooley, & Traxler, 2008). Discourse is frequently described as disorganized, tangential, and overpersonalized (Blake, 2006; Chantraine, Joanette, & Ska, 1998; Glosser, 1993; Myers, 2001). Some individuals exhibit paucity of speech with very limited output, whereas others exhibit verbosity. Given the wide range of what is considered "normal" conversational patterns in the general population, it can be difficult to determine whether a person with RHBD really has discourse impairments or whether he or she was just "quirky" or a bit scattered and disorganized prior to the brain damage.

Some researchers have suggested that pragmatic deficits are the key problem associated with RHBD (Joanette & Ansaldo, 1999; Myers, 2001). These deficits can be difficult to quantify because they are broadly defined and hard to assess objectively. Definitions of pragmatics often include aspects of discourse such as organization and efficiency of language production as well as nonverbal means of communication—including prosody, facial expression, and eye contact—used in a contextually appropriate way. Pragmatic abilities are best evaluated in natural social contexts, but this makes them difficult to assess with standardized tools.

To date, it is estimated that 50%–78% of individuals with RHBD exhibit one or more communication impairments (Benton & Bryan, 1996; Blake, Duffy, Myers, & Tompkins, 2002; Côté, Payer, Giroux, & Joanette, 2007; Ferré et al., 2009). However, many of these individuals may go untreated. Blake and colleagues (2002) investigated the prevalence of cognitive and communication deficits in adults with right hemisphere stroke who were admitted to a rehabilitation hospital. Surprisingly, the authors reported that although 94% of individuals were diagnosed with a cognitive or communication deficit subsequent to RHBD, only 45% were referred for speech-language pathology (SLP) services. Further data from ASHA's National Outcomes Measurement System (NOMS) reveal that when individuals with RHBD do receive SLP services, treatment tends to focus on areas other than communication. It is interesting to note that NOMS data reveal that individuals with RHBD subsequent to stroke are most commonly treated for difficulties in swallowing (52%), memory (41%), and problem solving (40%), with disorders of expression (22%), comprehension (23%), and pragmatics (5%) being addressed far less frequently (ASHA, 2011). As noted earlier, cognitive deficits co-occur with communication deficits and are commonly known to medical professionals. This fact could partially explain the relatively large percentage of individuals with RHBD receiving treatment for cognitive versus communication deficits. The low percentages for communication treatment may be due, in part, to the complexities noted above in identifying right hemisphere communication impairments, limitations in the few available assessment tools (Blake, 2011; Tompkins et al., 2013), and lack of clarity regarding the types of speech-language pathology treatments available for these individuals. In addition, physicians who make referrals to SLP services may not be aware of the potential for cognitive-communication disorders after RHBD and of the fact that speech-language pathologists can address these deficits. Thus, referrals are not made.

The social consequences of cognitive-communication disorders after RHBD are readily apparent to speech-language pathologists who work with this population. Difficulties in interpreting others' intent, following conversations or television shows, and efficiently and effectively conveying one's own intent (be it emotional or not) can have a substantial impact on an individual's successful return to social, vocational, and recreational activities. However, little data exist regarding these consequences. The few studies in which researchers explored functional outcomes focused on the effects of neglect and anosognosia (Appelros, Nydevik, Karlsson, Thorwalls, & Seiger, 2004; Jehkonen et al., 2001; Viken, Samuelsson, Jern, Jood, & Blomstrand, 2012).

Some research evidence has begun to shed light on the treatment of aprosodia and other sentence- and discourse-level impairments following RHBD. For example, a review by Hargrove, Anderson, and Jones (2009) found initial support for the treatment of aprosodia. However, of the 14 studies included, only three (Leon et al., 2005; Rosenbek et al., 2004; Stringer, 1996) targeted individuals with right hemisphere communication disorders. Although limited by the small number of studies and small number of participants ($n = 4$), these studies provide preliminary support for the treatment of affective, expressive prosody in individuals with acquired brain injuries with reported gains in perceptual outcomes. However, in an additional exploratory study not included in the review (Russell, Laures-Gore, & Patel, 2010), researchers noted only minimal changes in acoustic performance for a single participant with RHBD subsequent to stroke.

Mixed results also were found for the treatment of discourse and pragmatics; however, even for studies with positive results, limited information regarding the intervention characteristics makes it difficult for clinicians to replicate these treatments. For example, data from NOMS reveals that individuals who receive SLP services for RHBD make measurable progress in one or more communication domains (see Figure 1; ASHA, 2011). However, the case series approach

used in NOMS does not include control groups or provide information about the treatments employed and, therefore, must be interpreted with caution. Two additional observational studies (Klonoff, Sheppard, O'Brien, Chiapello, & Hodak, 1990; Varley, 2008) suggest mixed findings for the treatment of pragmatics.While Klonoff and colleagues (1990) reported some improvements for three participants with stroke-induced RHBD; the authors noted that many aspects of pragmatics at the conversation level remained impaired, particularly self-monitoring and awareness of hyperverbality, tangentiality, eye contact, and turn-taking skills. The case study by Varley (2008) revealed similar results for a single participant with a right CVA and impaired conversational discourse.

Although observational research provides limited information regarding the specific intervention characteristics or components, it does lay preliminary groundwork in support of SLP treatment for individuals with right hemisphere communication disorders. The potential for communicative improvement coupled with a documented interest by ASHA members (i.e., a 2011 clinical topic nomination) warrants a more comprehensive and extensive review of the evidence regarding the efficacy of communication treatment in the RHBD population.

This report outlines the current state of the evidence on right hemisphere communication treatments through a systematic search of the literature. On the basis of nomination by ASHA members, and in consultation with the first author, the purpose of this review was to (a) identify and synthesize the available treatments for individuals with right hemisphere communication impairments and (b) highlight areas in need of further research.

Clinical Questions

Clinical questions were established a priori based on the following treatment and outcome considerations. First, given that right hemisphere communication deficits generally appear at the sentence or discourse level, the review questions targeted treatments provided at the sentence and discourse level. For the purposes of this review, communication treatments were further defined as any sentence- or discourse-level treatment that addressed communication deficits, including prosody, discourse, and/or pragmatics (including conversation). In addition, because communication deficits can affect comprehension and/or expression of prosody as well as discourse and pragmatics, treatments targeting receptive language, expressive language, pragmatic language, or prosodic outcomes were considered. Because RHBD typically does not affect basic language processes such as morphology, phonology, or syntax, these processes were not considered. Outcomes included, but were not limited to, production and comprehension of prosody, auditory and written comprehension, production and comprehension of inferences and figurative language, narrative discourse and formulation, topic maintenance, topic initiation, turn taking, and eye contact. On the basis of these considerations, the following clinical questions were formulated:

1. What is the effect of sentence- or discourse-level communication treatments on prosodic outcomes for individuals with right hemisphere communication deficits?
2. What is the effect of sentence- or discourse-level communication treatments on receptive language outcomes for individuals with right hemisphere communication deficits?
3. What is the effect of sentence- or discourse-level communication treatments on expressive language outcomes for individuals with right hemisphere communication deficits?
4. What is the effect of sentence- or discourse-level communication treatments on pragmatic language outcomes for individuals with right hemisphere communication deficits?

Method

Study Selection and Search Strategy

Criteria for considering studies for review are outlined in Table 1. In brief, only controlled studies (controlled trials or

FIGURE 1. Proportion of individuals making progress with diagnosis of right cerebrovascular accident (CVA) based on National Outcomes Measurement System (NOMS) data.

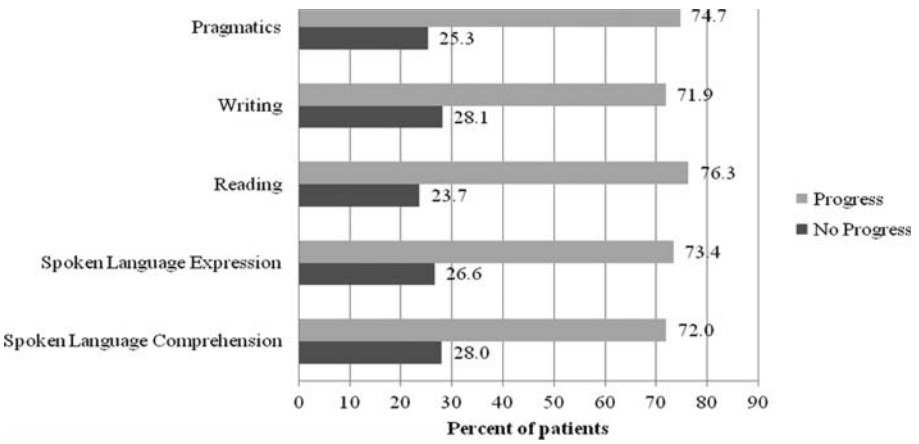


TABLE 1. Criteria for considering studies for review.

Selection criteria	Inclusion criteria	Exclusion criteria
Date of publication between 1990 and the present.	Intervention studies based on experimental or quasi-experimental design with comparison or control groups or conditions (including group and single subject designs).	Studies including animal models.
Studies published in peer-reviewed journals.	Participants ages 18 years of age or older, diagnosed with right hemisphere deficit as a result on an acquired brain injury (e.g., stroke, head injury).	Studies including individuals with neurodegenerative disorders (e.g., dementia, Parkinson's disease).
Studies published in English language only.		Studies including individuals with psychological disorders.
Studies providing original data on one or more clinical question.		Studies including individuals with mixed populations (e.g., participants with dementia and traumatic brain injury) unless data could be separated for analyses.

single-subject designs) with participants 18 years of age or older were included. Participants must have had documented right hemisphere involvement as a result of an acquired etiology (e.g., CVA, TBI). Studies including individuals with RHBD as a result of progressive neurodegenerative etiologies (e.g., dementia or Parkinson's disease) were excluded, as were studies in which right hemisphere involvement was not specified. Search methods for identification of studies are also provided in Table 1. Literature was restricted to peer-reviewed studies published in English from January 1990 to February 2012. Searching was conducted in 27 electronic databases (e.g., PubMed, CINAHL) using keyword combinations related to right hemisphere brain damage, SLP, discourse, communication, and/or treatment. The Appendix (which is available as part of the online Supplementary Materials) contains a full list of electronic databases and expanded search terms.

Data collection and analysis procedures were completed by two independent reviewers (the second author [TF] and third author [RV]). Both reviewers separately screened the titles and abstracts of all potential citations, obtaining (when necessary) the full text of studies for further scrutiny. The reviewers also performed a manual search of all article references and narrative reviews and a search of four grey literature databases (ClinicalTrials.gov, INFOMINE, Networked Digital Library of Theses and Dissertations, and World Health Organization International Clinical Trials Registry Platform). Although the reviewers excluded non-peer-reviewed literature (e.g., grey literature), a search on authors of relevant conference proceedings, presentation abstracts, or dissertations in grey literature databases was completed so that the reviewers could ensure identification of all published studies. Authors of unpublished or ongoing studies were contacted, and studies were documented for future consideration. Prior to final inclusion/exclusion, all studies were vetted by the first author (MLB), and any disagreements were documented and resolved through consensus.

Data Extraction and Coding

The same two initial reviewers (the second [TF] and third [RV] authors)—again, blind to one another's results—assessed the methodological rigor of studies based on the type of design employed. Group studies were evaluated on the following eight quality indicators (Mullen, 2007): (a) adequate description of protocol for replication; (b) adequate description of participants (groups comparable at baseline); (c) blinding of assessors; (d) adequate description of random sample; (e) reporting of treatment fidelity; (f) reporting of statistical significance (p value) or calculable from data; (g) reporting of effect size (ES) and confidence interval (CIs) or calculable from data; and (h) use of intention-to-treat analysis. Group study treatment effects were reported or calculable using Cohen's d (Cohen, 1960) and were defined as the difference between two means divided by a standard deviation for the data.

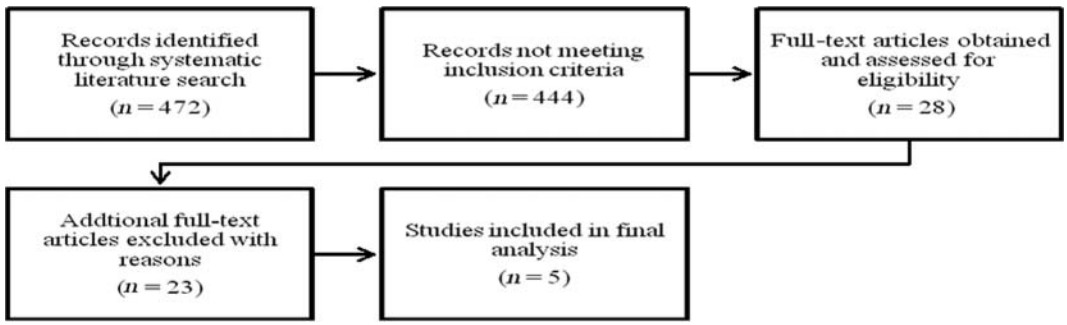
Single-participant design studies were evaluated on the following 11 quality indicators (Tate, McDonald, Perdices, Togher, & Savage, 2011): (a) reporting of adequate clinical history of subjects; (b) specification of target behaviors; (c) use of ABA or multiple-baseline design; (d) sufficient sampling conducted at baseline; (e) sufficient sampling conducted during treatment phase; (f) reporting of raw data points; (g) reporting of interrater reliability; (h) independence of assessors; (i) reporting of statistical analysis; (j) replication completed across subjects, therapists, or settings; and (k) evidence of generalization. For single-subject design studies, ES analysis involved the use of percent of nonoverlapping data (PND; Parker & Vannest, 2009) between baseline and intervention phases, as defined by the percent of intervention Phase B data above the highest baseline point in Phase A. Where necessary, authors were contacted to provide missing data or confirm overlapping data.

Results

Literature Search

Figure 2 details the flow diagram of the literature search completed between July 2011 and February 2012. Twenty-eight of 472 studies were preliminarily accepted and obtained for further scrutiny, only five of which remained in the final analysis (Cannizzaro & Coelho, 2002; Lundgren, Brownell, Cayer-Meade, Milione, & Kearns, 2011; Rosenbek et al.,

FIGURE 2. Flow chart of systematic literature search.



2006[1]; Tompkins, Blake, Wambaugh, & Meigh, 2011; Youse & Coelho, 2009).

The majority of studies (47%; 220 of 472) were eliminated primarily because they were diagnostic or descriptive in nature. Other reasons for study exclusion were (a) the study did not address a clinical question or target the right hemisphere population; (b) the study was not published in a peer-reviewed journal; (c) the study did not employ experimental or quasi-experimental methodology; or (d) the study did not provide original data.[2] Interrater reliability between the two reviewers for study inclusion was good, $\kappa = .712$.

Participant Characteristics

Table 2 summarizes the participant characteristics within the five included studies. The total number of participants across studies was small ($N = 25$), and the majority of them (72%; 18 of 25) exhibited right hemisphere communication disorders as a result of a CVA. Other etiologies included arteriovenous malformations, cerebral hemorrhage, and TBI. Age of participants ranged from 25 years to 81 years, and education ranged from 11.3 years to 13.4 years. Three participants (Tompkins et al., 2011) were enrolled in SLP treatment during the acute phase of recovery ($M = 5.2$ months; $SD = 0.8$ months); the remainder were considered chronic, with time postonset varying from 2.5 years to 16.0 years. Limited information was reported on SLP diagnoses and participant severity levels. Two studies (Cannizzaro & Coelho, 2002; Youse & Coelho, 2009) broadly characterized participants with right hemisphere deficits in "discourse production" or "conversational discourse." One study (Tompkins et al., 2011) further specified underlying discourse comprehension deficits as impairments in coarse coding or suppression. Rosenbek et al. (2006) was the only study to report severity levels along with SLP diagnosis of aprosodia. Severity levels ranged from mild to severe, and the category breakdown was as follows: *mild*, 5 studies; *moderate–severe*, 4 studies; *moderate*, 3 studies; *severe*, 2 studies. Only one study (Cannizzaro & Coelho, 2002) reported race/ethnicity. All but one study (Youse & Coelho, 2009) indicated that participants were native speakers of American English.

Interventions and Outcomes

All included studies met the broad definition of sentence- or discourse-level communication treatment and provided data on prosodic outcomes (Clinical Question 1), receptive language outcomes (Clinical Question 2), expressive language outcomes (Clinical Question 3), and pragmatic language outcomes (Clinical Question 4). Although limited information can be gleaned from the findings due to the small number of participants as well as the varied interventions and outcomes employed, the data suggest that many individuals at both the chronic and acute phases of recovery benefit from sentence- or discourse-level communication treatments. Table 3 provides a description of the treatment tasks, treatment schedule, and major findings for the five included studies.

Clinical question 1: What is the effect of sentence- or discourse-level communication treatments on prosodic outcomes for individuals with right hemisphere communication deficits? One study (Rosenbek et al., 2006) provided data to address prosody. The authors compared the effects of two mechanism-based treatments—imitative and cognitive–linguistic treatment—for 14 individuals with primarily expressive aprosodia. Treatments were based on evidence supporting both a motor-programming basis for aprosodia (imitative treatment similar to those used for motor speech disorders) and a cognitive–linguistic basis, in which there is an impairment of a "modality-specific, non-verbal affect lexicon" (Rosenbek et al., 2006, p. 380).

Both treatments used a six-step cueing hierarchy to improve ability to convey emotional tones at the sentence level (see Table 3). For the motoric-imitative treatment, the cueing hierarchy included steps such as repeating the sentence in unison in response to the clinician's production and in response to a question eliciting the target sentence. For the cognitive–linguistic treatment, cues included an emotion label (e.g., angry, happy), a description of the vocal characteristics that convey the emotion, and a picture of a face

[1]A series of articles published by Rosenbek and colleagues (see Jones, Shrivastav, Wu, Plowman-Prime, & Rosenbek, 2009; Leon et al., 2005; Rosenbek et al., 2004, 2006) provided overlapping participant data. All participant data were reported and included in the Rosenbek et al. (2006) study, along with additional data analyses reported from Jones et al. (2009).

[2]A full list of studies not meeting eligibility criteria, with reasons for exclusion, is available upon request.

TABLE 2. Participant variables.

Study	*N*	Age in yrs *M (SD)*	Education in yrs *M (SD)*	Gender	Race/ Ethnicity	H	Etiology	TPO	SLP diagnosis	Severity
Cannizzaro & Coelho (2002)	1	39.0	12.0	1M	White	R	TBI	12.0 yrs	Discourse production deficit	NR
Lundgren et al. (2011)	5	70.0 (7.3)	12.8 (1.8)	NR	NR	NR	4 CVA 1 AVM	7.6 yrs (9.8 yrs)	NR	NR
Rosenbek et al. (2006)	14	59.9 (15.6)	13.4 (1.8)	9/5[a]	NR	R	11 CVA 1 TBI 1 Hemorrhagic 1 NR	2.5 yrs (2.8 yrs)	Aprosodia	5 mild 3 moderate 4 mod–severe 2 severe
Tompkins et al. (2011)	3	67–81	11.3 (1.5)	2/1[a]	NR	R	CVA	5.2 months (0.8 months)	Coarse coding or suppression deficit	NR
Youse & Coelho (2009)	2	*P*143.0 *P*2 25.0	12.0 (NR)	2/0[a]	NR	R	TBI	*P*116.0 *P*2 7.0	Conversational discourse deficit	NR

Note. H = handedness; AVM = arteriovenous malformation; CVA = cerebrovascular accident; mod–severe = moderate to severe; NR = not reported; *P* = participant; SLP = speech-language pathology; TBI = traumatic brain injury; TPO = time postonset.

[a]Male-to-female ratio.

depicting the emotion. Cues were systematically removed as the participant successfully completed each step.

Eleven participants received 20 sessions of each treatment in random order. The remaining three participants completed only one treatment phase. Overall, the majority of the participants (86%; 12 of 14) exhibited a statistically significant response to at least one of the treatments, $d > 0.06$. Although a small effect favoring the cognitive–linguistic treatment over the imitative treatment was calculated on the basis of mean treatment gains and *SD*s provided by authors, the CIs surrounding the treatment crossed the null value, making it difficult to determine the true effect, $d = 0.24$, 95% CI [–0.55, 1.02]. Rosenbek et al. (2006) reported no significant differences based on treatment group or treatment order, with slightly larger treatment effects noted for the intervention delivered first, regardless of whether it was imitative or cognitive–linguistic. No generalization to the untreated condition was reported. The authors performed additional acoustic analyses (Jones et al., 2009) on a subset of participants ($n = 3$) to determine whether or not there were acoustic changes underlying the overall perceptual findings reported by Rosenbek and colleagues (2006). Findings were mixed with significant differences in mean fundamental frequency and fundamental frequency variability across emotions after the first treatment phase (imitative treatment; $p < .0001$), and significant differences in mean intensity and intensity variability after the second treatment phase (cognitive–linguistic treatment; $p < .001$).

Clinical question 2: What is the effect of sentence- or discourse-level communication treatments on receptive language outcomes for individuals with right hemisphere communication deficits? Two studies (Lundgren et al., 2011; Tompkins et al., 2011) provided data to address this question. Lundgren et al. (2011) used a within-subject experimental design to investigate the effects of a metaphor training program on the interpretation of metaphors in five individuals with chronic RHBD, and Tompkins and colleagues (2011) used a multiple-baseline design to examine the effects of a novel contextual constraint treatment on two aspects of discourse comprehension in three individuals with acute RHBD.

Lundgren and colleagues (2011) developed a structured intervention to facilitate the use of semantic associations to improve interpretation of metaphors. The intervention was designed to address the frequently reported difficulty with metaphor interpretation in individuals with RHBD. The authors noted that the difficulties could be due to either an underlying deficit in processing nonliteral language or a deficit in the use of contextual cues to determine intent or correct interpretation; however, the focus on semantic associations could be beneficial for either underlying deficit. The intervention is partially based on Beeman's (1998) *coarse coding hypothesis,* which proposes that the intact right hemisphere is important for activating and maintaining activation of weak or distant word and sentence meanings. Damage to the right hemisphere can thus impair the activation of these meanings, including those meanings that could be metaphoric in nature—for example, in order to interpret the metaphor "a family is a cradle," an individual must be able to combine the literal meaning of the words *family* and *cradle* with the metaphorical sense of these words (i.e., "comfort" or "secure").

The intervention consisted of a five-step training program in which participants used "bubble maps" to represent, first, word meanings and associations, and then links between words. For example, the target word *family* was written inside a bubble with five lines extending from it. The participant then generated meanings or associations of the word in bubbles attached to the lines (e.g., father, mother, home, comfort, safety). A second target word (e.g., *cradle*) was then added into a double bubble map containing both target

TABLE 3. Intervention characteristics—single-subject experimental studies.

Study	Study design	Treatment variables: Intervention	Treatment variables: Schedule	Outcome variables: Outcome measure	Outcome variables: ES	Outcome variables: *p*
Cannizzaro & Coelho (2002)	AB	*Discourse production treatment:* Story retelling and story generation training with hierarchical cues *Task:* Filmstrip or picture description	60-min session 3 times a week *Total* = 20 sessions	*Narrative performance* Initiated events—treatment Initiated events—follow up Action events—treatment Action events—follow-up Direct consequence—treatment Direct consequence—follow-up	PND 43% 0% 100% 100% 50% 0%	 NR NR NR NR NR NR
Lundgren et al. (2011)	ABA	*Metaphor training program:* Metaphor comprehension training with graphic representation and semantic association of verbal information *Task:* Word association and metaphor interpretation using "bubble map"	60-min session 2 times a week *Total* = 10 sessions	*Oral metaphor interpretation* *P*1 *P*2 *P*3 *P*4 *P*5	*d* 2.4 1.9 2.2 2.2 1.7	 .011 .002 .010 .000 .030
Rosenbek et al. (2006)	ABAC	*Imitative treatment:* Emotional prosody training with verbal prompts *Cognitive–linguistic treatment:* Emotional prosody training with verbal and visual prompts *Task:* Sentence production	60-min session 3–4 times a week *Total* = 20 sessions per treatment	*Emotional tone—% correct* Cognitive–linguistic treatment Imitative treatment Cognitive–linguistic vs. imitative	*d* –0.22 – 11.51 –0.06 – 3.68 0.24 [–0.55,1.02]	 NR NR NS
Tompkins et al. (2011)	AB	*Coarse coding treatment:* Unambiguous concept training given moderate or strong context constraints *Suppression treatment:* Ambiguous concept training given moderate or strong context constraints *Task:* Sentence comprehension	NR 10–25 probe treatment sessions	*Coarse coding treatment* *P*1 %Crit—List 1 *P*1 %Crit—List 2 *Suppression treatment* *P*2 %Crit—List 1 *P*3 %Crit—List 2	*d*-index 12.67 9.69 11.96 2.01	 NR NR NR NR
Youse & Coelho (2009)	ABA	*Interpersonal process recall:* Conversational coaching with video modeling, feedback and rehearsal *Task:* Conversational exchange with familiar and unfamiliar partner	60-min session 2–3 times a week *Total* = 6–8 weeks	Increased number of comments *P*1 Comments—familiar partner Comments—unfamiliar partner *P*2 Comments—familiar partner Comments—unfamiliar partner Decreased adequate plus comments *P*1 Adequate plus—familiar partner Adequate plus—unfamiliar partner *P*2 Adequate plus—familiar partner Adequate plus—unfamiliar partner	PND 13% 25% 0% 0% 38% 50% 17% 33%	 NR NR NR NR NR NR NR NR

Note. ES = effect size; NR = not reported; *P* = participant; PND = percent of nonoverlapping data; %Crit = percentage of correct responses that met response time criterion based on performance on a similar task by individuals who do not have brain damage.

words (e.g., *family, cradle*), and the participant was asked to identify what word associations from the first word could also be related to the second word. In the last step, participants were given a completed double bubble map and were asked to select one of three possible metaphors represented by the map.

During each treatment session, participants were also given novel metaphors to orally interpret. The authors used performance on this oral task to measure treatment-related gains. Although the task was a production task, the purpose of the treatment was to improve comprehension or interpretation of metaphors. The oral task was used instead of a multiple-choice comprehension measure because of the potential for greater sensitivity to change over time.

The participants in the Lundgren et al. (2011) study received SLP treatment two times a week for a total of 10 sessions. All five participants demonstrated significant improvement ($p < .05$) in oral metaphor interpretation (see Table 3). ESs ranged from 1.7 to 2.4 (*d* statistic); however, CIs surrounding ESs were not reported or calculable. Three of four participants maintained improvements at 3-month follow up.

Tompkins and colleagues (2011) also provided preliminary support for the benefits of communication treatment on discourse comprehension. Two specific areas of language processing were examined: (a) course semantic coding and (b) suppression. These two processes have been studied extensively by this group of researchers and have been reported to be necessary for efficient discourse comprehension often disrupted by RHBD.

Coarse semantic coding is based on Beeman's coarse coding hypothesis (Beeman, 1998), which proposes that the intact right hemisphere is important for activating and maintaining activation of weak or distant word and sentence meanings. For example, distantly related meanings of the word *apple,* such as "rotten," are not activated as efficiently in adults with RHBD as in adults without brain damage; this reduced activation is related to general discourse comprehension (Tompkins, Scharp, Meigh, & Fassbinder, 2008; Tompkins et al., 2013).

Suppression is a domain-general process that involves reducing activation of word or sentence meanings that become contextually inappropriate. For example, consider the following sentence: "He cleaned out the pen." Upon hearing this sentence, multiple meanings of the word *pen* as a writing instrument and as a farm enclosure are initially activated. Adults without brain damage quickly suppress or inhibit the contextually inappropriate meaning. Individuals with RHBD are slower to suppress that meaning, and this inefficiency is related to general discourse comprehension (Tompkins et al., 2000, 2013).

In the Tompkins et al. (2011) study, three participants with a coarse coding deficit (P1) or a suppression deficit (P2 and P3) completed a novel, implicit, contextual constraint treatment. For the probe tasks, participants heard a short declarative sentence followed by a probe word (e.g., "There was an apple—rotten."). For the coarse coding stimuli, the probe was either a distantly related word (e.g., *rotten*) or a nonword (BENPOH). The participants' task was to press a button ("yes" or "no") to indicate whether the word was real or not. For the suppression stimuli, the probe was either related to or unrelated to the sentence (e.g., "He cleaned out the pen—pencil."). The participants' task was to press a button ("yes" or "no") to indicate whether the word was related to the meaning of the sentence.

The training task introduced two levels of contextual prestimulation designed to facilitate the language processes (coarse coding and suppression). The use of contextual prestimulation in the treatment tasks was based on previous work by the research team (Blake, 2009a, 2009b; Blake & Lesniewicz, 2005; Tompkins, Lehman-Blake, Baumgaertner, & Fassbinder, 2002) showing the benefits of strong contextual bias on comprehension in this population.

In the "strongly biasing" level, two sentences (e.g., "The fruit smelled awful. It had turned very soft.") preceded the target sentence and word (e.g., "There was an apple – rotten.") In the "moderately biasing" level, only the second sentence preceded the target sentence and word. The participants' task remained the same—to respond as quickly as possible to the probe word.

The dependent variable was the percentage of responses to probe stimuli that met a predetermined response time criterion (% criterion = 1 *SD* below mean for the control group). Preliminary findings suggest that use of contextual constraint improved the underlying comprehension processes of coarse coding or suppression. ESs ranged from 2.01 to 12.67 (*d*-index; Bloom, Fischer, & Orme, 2003). Maintenance of gains was reported for the one participant (P1) for whom follow-up data were obtained. However, there was no measure of generalization to determine benefits of treatment to broader comprehension skills.

Clinical question 3: What is the effect of sentence- or discourse-level communication treatment on expressive language outcomes for individuals with right hemisphere communication deficits? One study (Cannizzaro & Coelho, 2002) provided data to address this question by examining the effects of a five-step story production training program to improve narrative discourse in one individual with RHBD. The participant had a right subdural hematoma as a consequence of TBI. Cannizzaro and Coelho (2002) based their treatment on findings that discourse deficits are commonly reported after TBI and can be related to social integration difficulties and that story grammar is one component of discourse associated with macrostructure organization (Glosser & Deser, 1992). They acknowledge that the deficits could be related to a reduction in executive control over both cognitive and linguistic organization.

Treatment included two components. The first was a five-step story retelling task in which the participant viewed a short filmstrip. The participant then retold the story and identified episodes and components of episodes in the story (e.g., initiating event, attempt, direct consequence). The second component was a four-step story generation task in which the participant was given a picture and was asked to generate a story. The story was recorded and played back to the participant, who was asked to identify missing components and to add those components using cues from the investigator.

The authors reported mixed findings (see Table 3). Although communication treatment appeared to be initially effective as demonstrated by an increased production of initiating events, actions and direct consequences during the treatment phase

(PNDs ranging from 50% to 100%), performance was not maintained at 1 and 3 months posttreatment.

Clinical question 4: What is the effect of sentence- or discourse-level communication treatment on pragmatic language outcomes for individuals with right hemisphere communication deficits? In the final study (Youse & Coelho, 2009), the authors examined the use of a social skills–based treatment to improve conversational discourse in two individuals with RHBD. Both participants had a right subdural hematoma as a consequence of TBI. The authors defined their outcomes as "conversational discourse," which could be classified as either discourse-level outcomes or pragmatic outcomes. Because the treatment program used (see next paragraph) is a social skills–based treatment, with outcomes such as initiation of conversation and adequacy of responses to a partner, it was classified for our purposes as having pragmatic language outcomes.

Youse and Coelho (2009) examined the effect of interpersonal process recall (IPR) treatment (Helffenstein & Wechsler, 1982), a social skills–based treatment using a combination of videotaped feedback, modeling, coaching, and rehearsal strategies to improve conversational discourse. The primary aim of the study was to determine whether the Attention Process Training II program (APT–II; Sohlberg, Johnson, Paule, Raskin, & Mateer, 1994) combined with IPR would facilitate improvements in attention and communication outcomes, in contrast to expectations for improvement only in communication outcomes, with the treatment of social skills in isolation.

Both IPR and APT–II were conducted according to published guidelines (Helffenstein & Wechsler, 1982; Sohlberg et al., 1994). For IPR treatment, participants were videotaped engaging in a conversation. Immediately following the interaction, the participant viewed the video and identified inappropriate or inefficient aspects of the interaction, with the help of the examiner as needed. More appropriate responses or behaviors were modeled by the examiner. The APT–II program uses auditory stimuli to enhance attentional control on a hierarchy of attentional levels (sustained, selective, alternating, and divided attention).

Although the authors reported treatment effects using an *f* statistic (Kromrey & Foster-Johnson, 1996) to compare improvements in conversational discourse after APT–II alone to improvements after APT–II combined with IPR treatment, the data that were provided enabled separate examination of IPR (social skills–based treatment) results. The effects of IPR appeared to be mixed, with minimal change in the production of essential story components during a narrative discourse task with familiar and unfamiliar conversational partners. PNDs for production of increased number of "adequate" comments (i.e., utterances that appropriately met the initiator's verbalization) and decreased number of "adequate plus" comments (i.e., utterances that provide more information than requested) ranged from 0% to 25% and from 17% to 50%, respectively (see Table 3). It is interesting to note that the authors found both APT–II and APT–II combined with IPR training (APT–II + IPR) to have positive treatment effects on conversational performance (APT–II, *f*s = 0.05–1.30; APT–II + IPR, *f*s = 0.23–0.53), but limited functional change was noted in attention from pre- to posttesting after either treatment.

Methodological Quality

Methodological quality and use of statistical analysis across studies is reported in Table 4. As can be seen, all studies were single-subject experimental design and, therefore, were evaluated using the Risk of Bias in N-of-1 Trials (RoBiN-T Scale; Tate et al., 2011) appraisal quality indicators. Most studies sufficiently described participants (four of five studies), operationally defined treatments and repeatable target behaviors (five of five studies), and provided evidence of replication of performance across participants, therapists, or settings (five of five studies) to allow for replication in a clinical setting. In addition, all studies reported statistical evaluation of the effects of treatment using visual/graphic analysis or descriptive statistics. However, studies were lacking in a number of other methodological areas, including randomization of phase sequence, blinding of assessor to

TABLE 4. Methodological quality of included studies.

Study	Cannizzaro & Coelho (2002)	Lundgren et al. (2011)	Rosenbek et al. (2006)	Tompkins et al. (2011)	Youse & Coelho (2009)
Clinical history specified	Yes	No	Yes	Yes	No
Target behavior specified	Yes	Yes	Yes	Yes	Yes
Adequate design	Yes	Yes	Yes	Yes	Yes
Randomization of phase sequence	No	No	Yes	No	No
Baseline: Sufficient sampling conducted	Yes	Yes	Yes	Yes	No
Treatment: Sufficient sampling conducted	Yes	Yes	Yes	Yes	Yes
Raw data points reported	Yes	No	Yes	Yes	Yes
Interrater reliability established	Yes	Yes	Yes	No	Yes
Assessor independence	No	Yes	Yes	No	No
Statistical analysis	Yes	Yes	Yes	Yes	Yes
Generalization: Replication completed	Yes	Yes	Yes	Yes	Yes
Generalization: Evidence of transfer effect	No	No	Yes	No	No

Note. Risk of Bias in N-of-1 Trials (Tate, McDonald, Perdices, Togher, & Savage, 2011).

treatment phase during evaluation of participants, and evidence of transfer effect of treatment.

Discussion

Systematic reviews can be a valuable resource to speech-language pathologists who want to integrate the current research evidence on a given treatment or diagnostic approach into daily clinical practice. Depending on the maturity of the research evidence, these synthesized reports can also help identify gaps in the scientific literature and lay the groundwork for further investigation. Currently, a number of reviews exist to assist speech-language pathologists working with individuals who have cognitive impairments (Bowen & Lincoln, 2007; Bowen, Lincoln, & Dewey, 2002; Cicerone et al., 2005; Lautè, Halligan, Rode, Rossetti, & Boisson, 2006). Although not specific to individuals with RHBD, these reviews summarize the research evidence for treatments of visual neglect, memory training, and other cognitive treatments for individuals with acquired brain injuries, including RHBD. An additional review by Hargrove et al. (2009) highlights the treatment of aprosodia for mixed etiologies. Up to this point, further information specific to right hemisphere communication disorders has been limited. As demonstrated by the nomination of this clinical topic by ASHA members for review, speech-language pathologists want resources that they can use to guide treatment decisions specifically for individuals with communication impairments caused by RHBD.

Since first described in the literature by Eisenson (1959, 1962), a growing body of research has emerged that documents the incidence and characteristics of individuals with right hemisphere communication disorders. However, information regarding the treatment of prosody, discourse, and pragmatics has been sparse. The current review provides a systematic analysis of the evidence targeting sentence- or discourse-level communication treatments for individuals with RHBD. A systematic search of the literature from 1990 to the present yielded only five studies that met the preestablished inclusion criteria. The heterogeneity and nature of right hemisphere communication disorders is perhaps one reason why this review found only a handful of studies, with the majority of available research focusing on the descriptive characteristics of this population. The relatively small number of researchers interested in RHBD communication deficits also contributes to the scarcity of clinical studies. Still, some positive trends were reported in experimental intervention studies. These trends, elucidated below, are especially promising because, across studies, all but three of the participants were past the acute phase of recovery, and some were many years poststroke or post-TBI.

Prosody

Current evidence for aprosodia treatments from Rosenbek's group (Jones et al., 2009; Leon et al., 2005; Rosenbek et al., 2004, 2006) is promising. The two treatments (motoric–imitative and cognitive–affective) have both been shown to be effective in creating immediate changes in prosody and maintenance of those gains. Further work by Rodriguez, Patel, Bashiti, Shrivastav, and Rosenbek (2011) is currently being done to enhance these prosodic treatments, such as adding knowledge of results feedback. In the motor planning literature, intrinsic feedback or knowledge of performance has been documented to improve performance in motoric tasks (Cirstea, Ptito, & Levin, 2006; Schmidt, 1998; Winstein, 1991) and shows promise for enhancing the positive effects of aprosodia treatments when provided in the form of visual/auditory feedback (Rodriguez et al., 2011).

Despite the promises of the treatments described above, these are only two treatments, and they were tested only on a relatively small number of participants. Other approaches to treatment for expressive aprosodia that are supported by expert opinion include contrastive stress drills and compensatory strategies (Myers, 1999; Tompkins, 1995). Contrastive stress drills, typically recommended for individuals with dysarthria and other motor speech disorders (see, e.g., Duffy, 2005), target production of word-level stress patterns or emphatic stress. These drills include tasks such as changing word meaning based on stress patterns (e.g., REbel vs. reBEL) or differentiating meaning with emphatic stress. In the latter task, a client is told that he or she will be asked a series of questions and that the answer to each question is a short declarative sentence such as "Kevin loves pizza." The clinician then asks questions (e.g., "Does David love pizza?"; "Does Kevin hate pizza?") to elicit productions in which emphatic stress moves from one word to another to create appropriate answers to the question. Compensatory strategies might involve the client stating his or her emotional state or intent prior to launching into a conversation (e.g., "I'm really angry about what happened today." or "You've gotta hear the joke I heard on the radio today."). It is obvious that these compensatory strategies will not improve the production of emotional prosody, but they can facilitate communication of emotion or intent by clueing in the listener (Myers, 1999; Tompkins, 1995). Additional research is needed to further investigate motoric–imitative and cognitive–affective treatments studied by Rosenbek and colleagues (2006) as well as to investigate other treatments noted above that have not yet been tested empirically to determine the effectiveness or efficacy of communication treatments for aprosodia associated with RHBD.

Discourse and Pragmatics

The publication of well-controlled and Phase I studies of treatments to address language-based communication disorders associated with RHBD is a small but encouraging step forward for the field. We hope that this is just the beginning. Caution is needed, considering there were few published studies, all with small numbers of participants; however, preliminary results are promising, with two studies (Lundgren et al., 2011; Tompkins et al., 2011) providing initial support for treatment to improve discourse comprehension, two studies (Cannizzaro & Coelho, 2002; Youse & Coelho, 2009) providing mixed support to improve expressive language and pragmatic outcomes, and two additional studies forthcoming (Lundgren & Brownell, 2011; Tompkins, Scharp, Meigh, Lehman Blake, & Wambaugh, 2012).

In addition to the metaphor training study included in this review, Lundgren and colleagues (personal communication,

November, 11, 2011) have developed a treatment for theory of mind (ToM) deficits in adults with RHBD (Lundgren & Brownell, 2011). This treatment is based on findings that adults with RHBD (as well as those with TBI in general) appear to have difficulties with ToM tasks such as determining what one person knows about another person's feelings, intents, or reasons for acting in a certain way (Bibby & McDonald, 2005; Griffin et al., 2006; Happé, Brownell, & Winner, 1999; Martin & McDonald, 2003). A classic task for assessing ToM is to show a client a video of a person with an item such as a ball. The person hides the ball in a certain place, such as under the couch, and then leaves the room. A second person comes in and moves the ball from under the couch to a new spot, such as under a pillow. The client is then asked, "If the first person comes back in, where will he or she look for the ball?" A client with good ToM will say "under the couch," where it was originally left. A client with poor ToM will say "under the pillow"; this client cannot dissociate what he himself knows from what the person in the story knows. Lundgren and colleagues' treatment uses cartoon drawings of a house and several characters. Characters can be placed in the same room or in different rooms, and thought bubbles can be added to show what information different characters know. Currently, several participants with right hemisphere acquired brain injuries are enrolled in the treatment, but results have yet to be published. A word of caution is necessary here. Although ToM deficits have been reported in adults with RHBD (Happé et al., 1999; see also the account of social cognition deficits by Brownell & Martino, 1998), other research studies have shown that when complexity of stimuli is controlled, ToM deficits are not replicated (Tompkins, Scharp, Fassbinder, Meigh, & Armstrong, 2008). Thus, the deficit may be a result of the complexity of ToM situations and not specific to ToM itself.

Finally, Tompkins' research group is extending their contextual constraint treatment for coarse coding and suppression deficits. Results in a manuscript submitted for publication (Tompkins, Scharp, Meigh, Lehman Blake, & Wambaugh, 2012) suggest that contextual constraint treatment for coarse coding results in generalization to narrative discourse comprehension. Although data are reported from only one additional participant, several more participants have been enrolled in the treatment program for either coarse coding or suppression deficits. Generalization of gains to broader outcomes—such as inferencing, select executive functions, and social participation—are being measured, and future publications are forthcoming. Several aspects of the contextual constraint treatment make it unique, including the implicit nature of the treatment and the extensive theoretical support for the treatment (Tompkins et al., 2011).

A key difference in the two reported comprehension treatments is the use of explicit versus implicit tasks. The majority of reported and recommended treatments for communication deficits associated with RHBD and TBI rely on metalinguistic judgments and understanding decontextualized phrases, such as matching phrases to pictures or defining idioms and metaphors. The added cognitive demands of such tasks have been shown to reduce performance in adults with RHBD (Monetta & Joanette, 2003; Tompkins, Boada, & McGarry, 1992; Tompkins et al., 2002). However, positive results have been reported for metalinguistic and metacognitive treatments for individuals with TBI (e.g., Helffenstein & Wecshler, 1982; Kennedy et al., 2002). Future studies directly comparing implicit and explicit methods are needed to determine which approach is more effective for treating cognitive and communication deficits, or which deficits are more amenable to each type of treatment.

Communication Versus Cognition

As noted in the introduction, adults with RHBD may exhibit cognitive deficits in conjunction with (or underlying) the communication deficits discussed above (e.g., Martin & McDonald, 2003; McDonald, 2000; Monetta & Joanette, 2003; Monetta, Ouellet-Plamodon, & Joanette, 2006; Tompkins et al., 2013). Much is known about attentional deficits (in particular, visuospatial neglect) and anosognosia (reduced awareness of deficits) in this population. However, very little research has been conducted on components of executive function (e.g., organization, planning, integration, and reasoning), although they logically overlap substantially with communication deficits such as disorganized discourse production, difficulties identifying and using relevant contextual cues, and ToM (e.g., Hartley, 1995).

The relationship between cognition and communication is still fuzzy. Youse and Coelho's (2009) treatment study was an initial attempt to separate the contributions of attention and pragmatics from social communication disorders; Tompkins and colleagues' (see, e.g., 2012) treatment is designed to minimize certain cognitive demands so that language deficits are not exacerbated by complex cognitive processes. It is possible that treatments that address suppression or identification and integration of contextual cues (e.g., Tompkins' contextual pre-stimulation or Lundgren's ToM treatments) are facilitating executive function processes that underlie communication, instead of language-specific, processes. However, neither group monitored executive function processes during treatment to determine if this is the case. Tompkins and colleagues' continuing work includes pre- and post-treatment administration of subtests from the Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES; MacDonald, 2005). Specific areas of the FAVRES that may be related to suppression of contextually irrelevant information—such as the Weighing Competing Options, Revising a Decision, and Identifying and Ignoring Less Relevant Information subtests—are being used to determine whether these processes may benefit from the suppression treatment.

Clinical Implications

It is obvious that speech-language pathologists cannot wait for these and other treatment studies to be completed before providing rehabilitation services to their clients with RHBD. Until evidence has been obtained, clinicians can look toward expert opinion. Recommendations from experts in the field include using theoretically based treatments and treatments designed for other neurological populations that address deficits similar to those associated with RHBD (Blake, 2007; Tompkins, 2012; Tompkins et al., 2013) as well as suggested treatments based on clinical experience (Myers, 1999).

The theoretically based treatments involve emphasis on contextual cues to (a) determine appropriate meanings of ambiguous words and sentences; (b) activate and access distant meanings or features of words that are contextually important; (c) determine meanings of nonliteral language such as idioms and metaphors; and (d) determine speakers' intents, such as interpreting sarcasm, white lies, and meanings conveyed through prosody. These suggestions are based on the extensive work by Tompkins and Blake and their colleagues regarding deficits in coarse coding and suppression and RHBD adults' ability to use strong contextual cues to determine meaning.

In terms of selecting treatments designed for other populations that may be useful for adults with right hemisphere communication disorders, Blake (2007) and Tompkins (2012) point to the literature on cognitive and pragmatic treatments for adults with traumatic brain injury (TBI; not specified as RHBD). Although there are weaknesses and gaps in the TBI treatment literature, there are recommendations for addressing cognitive and pragmatic deficits that could be extrapolated to the RHBD population. Struchen, in a 2005 review of treatment for social communication deficits, concluded that "the use of structured feedback, videotaped interactions, modeling, rehearsal, and training of self-monitoring" (p. 103) all have been supported with evidence from studies of adults with acquired TBI. Kennedy and colleagues (2002) created practice guidelines for assessment and treatment of a variety of disorders commonly associated with TBI, including memory, attention, and cognitive-communication deficits. They also developed reports on instructional techniques, group treatments, and behavioral and social treatments (Kennedy & Turkstra, 2006; Sohlberg, Elhardt, & Kennedy, 2005; Ylvisaker, Turkstra, & Coelho, 2005). Future studies of cognitive treatments with the RHBD population will help answer questions about the overlap between cognitive and communication deficits as well as about the effectiveness of treating cognitive processes to enhance communication and vice versa.

Lastly, Myers (1999) provides many suggestions for treatments that are loosely grounded in theory (based on the few theories that existed at the time) and are rooted in clinical experience. Many of the suggested activities blend cognitive and communication deficits that commonly are observed after RHBD, such as being aware of, or controlling, attentional or cognitive demands of communication tasks.

To add to our growing knowledge of evidence-based practice for RHBD, it is important for clinicians to develop their own expertise. This involves not only treating individuals with RHBD but doing so with a scientific mindset. Clinicians must examine each treatment approach and collect and review treatment outcomes (e.g., using data from NOMS and other assessment measures) to track and evaluate the effects of treatment within a controlled setting. This information can then be used to supplement or refocus their "gut feeling" about whether a treatment does or does not work.

Future Research Needs

Although the findings of this review are promising, further research is warranted. Given the limited number of participants, heterogeneity of treatments, and methodological quality of included studies, additional research should provide attention to the facets outlined in the subsections below.

Participants. Researchers need to provide a detailed description of the participant demographic profile to enable comparison across studies (e.g., race/ethnicity, SLP diagnosis and severity levels of communication and cognitive deficits, time post onset). Given that many of the included participants were at the chronic phase of recovery, further examination should explore the impact of chronicity on treatment.

Study design. Researchers need to ensure that there are randomized and well-controlled single-subject and group experimental designs.

Intervention and outcome measures. Researchers should describe, in adequate detail, the treatment protocol, schedule (e.g., length, frequency and intensity of treatment), and outcomes in order to allow for better replication. Outcomes should include measures at the communication activity/participation level as well as at the impairment level.

Conclusion

Ultimately, more well-designed studies investigating right hemisphere communication treatments are needed. It is our hope that the results of this evidence-based systematic review will encourage additional research beyond what has been mentioned above to assist speech-language pathologists with clinical decision making. Until further scientific evidence is available, speech-language pathologists should look to the current RHBD literature as well as the literature from other neurological populations and recommendations from professional organizations and experts. This information, in combination with clinical experience and patient/family preference, can assist speech-language pathologists treating individuals with right hemisphere communication disorders.

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