Perspectives on Treatment for Communication Deficits Associated With Right Hemisphere Brain Damage

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Purpose: To describe the current treatment research for communication (prosodic, discourse, and pragmatic) deficits associated with right hemisphere brain damage and to provide suggestions for treatment selection given the paucity of evidence specifically for this population.
Method: The discussion covers (a) clinical decision processes and evidence-based practice; (b) a review of right hemisphere communication deficits and existing treatment studies; (c) accounts of right hemisphere function, right hemisphere deficits, and theoretically motivated treatments; and (d) a guide for exploring and selecting treatments based on deficits rather than etiology.
Conclusions: Controlled treatment studies for communication deficits specifically for adults with right hemisphere brain damage are limited to aprosodia. For other communication deficits, clinicians may select treatments based on current theories of right hemisphere function and right hemisphere deficits, and/or treatments developed for other etiologies for which deficits are similar to those associated with right hemisphere damage.

Key Words: evidence-based practice, neurogenic speech and language, cognitive-communication disorders, stroke

The field of speech-language pathology has come a long way in understanding communication deficits associated with right hemisphere brain damage (RHD) since they were first described in the 1960s and 1970s. Despite an increasing body of information about the deficits, knowledge about how to treat them is lacking. There has been a plethora of research on neglect and treatments for visual neglect, and those treatments have been reviewed extensively elsewhere (Cappa et al., 2003, 2005; Cicerone et al., 2000, 2005; Gouvier, Webster, & Warner, 1986; Halper & Cherney, 1998; Manly, 2002; Tompkins, Lehman, Wyatt & Schulz, 1998). Treatments for aspects of *communication* that often are affected by RHD, including prosody, discourse, and pragmatics, are sparse.

This review explores areas of communication commonly affected by RHD and the few published studies of treatments for those communication deficits. Suggestions are provided to guide design and selection of appropriate treatments in the absence of evidence. The ensuing discussion is divided into four sections:

1. Clinical decision processes and evidence-based practice
2. A brief review of communication deficits commonly associated with RHD and the existing treatment studies
3. Accounts of right hemisphere function, right hemisphere deficits, and theoretically motivated treatments for RHD
4. A guide for exploring and selecting treatments based on deficits rather than etiology in the absence of treatment research specifically for RHD

Clinical Decision Processes and Evidence-Based Practice for RHD

Evidence-based practice depends on three components: clinical expertise, client values, and the best current evidence (see Irwin, 2006, for a review of evidence-based practice related to neurogenic communication disorders). Therapy suggestions for RHD based on clinical expertise can be found in books, chapters, and articles (Halper, Cherney, & Burns, 1996; Myers, 1999a, 1999b; Tompkins, 1995), and can be developed over time through clinical experience. Development of clinical expertise with this population can be a slow process, however, as individuals with RHD often make up only a small portion of a speech-language pathologist's caseload. One study (Blake, Duffy, Myers, &

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Tompkins, 2002) reported that while 94% of patients with RHD admitted to a rehabilitation unit were diagnosed with at least one cognitive or communication deficit, only 45% of them were referred for speech-language evaluation or treatment. In another recent study, seven speech-language pathologists working in acute care and/or rehabilitation settings estimated that they evaluated or treated, on average, four individuals with RHD per month (range = 2–8; Blake, 2006). If these small RHD caseloads are representative of other speech-language pathologists in similar settings, it may take a long time for a clinician to see enough patients with RHD to develop clinical expertise in dealing with that population.

The second component of evidence-based practice is client values. The inclusion of client values in the content and structure of treatment is important to facilitate client interest and participation in therapy. This may be particularly important for individuals with RHD who are not aware of, or who deny, that they have deficits that require rehabilitation (see Cherney, 2006, for a discussion of ethical decision making involving clients with anosognosia). Goals of therapy also must be selected on a client-by-client basis, particularly when treatment is designed to improve functional communication in various contexts (e.g., Murray & Clark, 2006).

The third component of evidence-based practice is the use of the current best evidence. For RHD, treatment studies for remediation of neglect and aprosodia, which often result from RHD, are available. On the other hand, there is very little evidence available regarding treatments for RHD deficits in discourse and pragmatics. In the absence of evidence specific to treatment of a population, two options will be discussed: designing treatments based on theories of the underlying deficit, and cautiously exploring the use of treatments based on deficits rather than etiology.

Communication Deficits and Existing Treatment Studies

Prosody

Aprosodia is the inability (or reduced ability) to produce or comprehend affective aspects of language, including prosodic contours (Ross, 1981). Many studies have implicated the right hemisphere in the production and comprehension of prosody, specifically emotional prosody (e.g., Baum & Dwivedi, 2003; Pell, 2006; Ross, 1981; Walker, Daigle, & Buzzard, 2002). Recently, a few studies of treatment for production of emotional prosody have been published (Leon et al., 2005; Rosenbek et al., 2004; Stringer, 1996). Only 6 individuals were included in these three studies combined, but it is a starting point for treatment selection and more research.

Stringer (1996) conducted a single-subject study that involved both pitch biofeedback (to target increased variation in pitch) and "expression modeling." The pitch biofeedback took place within 15-min sessions three times per week. The second component, expression modeling, included imitation of vocal prosody and instruction regarding facial expressions that enhanced expression of emotion. The modeling was done within the broader context of outpatient rehabilitation (speech, occupational, and physical therapy). After 2 months of treatment, the patient demonstrated improvement in both imitation and elicited productions of pitch contours and emotional prosody. The gains were maintained at a 2-month follow-up session. The activities used in therapy (particularly for the expression modeling) were not well described, and thus would be difficult to replicate.

Rosenbek and colleagues (2004; Leon et al., 2005) have conducted Phase I studies that evaluate two treatments for aprosodia: a motoric-imitative treatment and a cognitive-linguistic treatment. The motoric-imitative treatment was based on the hypothesis that aprosodia is caused by a motor programming impairment. In this treatment, clients practiced producing emotionally laden sentences (e.g., "I received a huge pay raise" [happy]; "Get out of my house" [angry]) with the proper emotional prosody. Productions of appropriate prosody were elicited using a six-step hierarchy that involved gradually reducing the support from the clinician. The hierarchy began with a production in unison and ended with the client producing a target sentence with the intended prosody while imagining speaking to a family member.

The cognitive-linguistic treatment was based on the hypothesis that aprosodia is caused by a reduction in access to emotional words and prosody (Leon et al., 2005; Rosenbek et al., 2004). This treatment focused on learning the characteristics of prosody used to express specific emotions. Another six-step hierarchy was used, beginning with descriptions of the vocal characteristics used to express specific emotions. Throughout the hierarchy, the client matched the descriptors to an emotional label and to facial representations of the emotion, followed by producing emotionally laden sentences (similar to those above) using the appropriate vocal characteristics.

Individuals in the treatment research participated in approximately 20 therapy sessions, each 1 hr long, over the course of 1 month. As there was no convincing evidence (or theoretical support) that aprosodia was due to a motoric versus a cognitive deficit, participants received both motoric and cognitive therapies. The results indicated that all 5 participants improved their use of emotional prosody after both the motoric-imitative and cognitive-linguistic treatments. Gains generalized to untreated sentences with target emotions but not to untreated emotions (Leon et al., 2005; Rosenbek et al., 2004).

Pragmatics and Discourse

Pragmatic deficits have been suggested by some to be central to the communication disorders associated with RHD (Joanette & Ansaldo, 1999; Myers, 2001; Sabbagh, 1999). For the current purposes, pragmatics and discourse are discussed together, because they are often difficult to clearly separate. There are some features that seem to fit better in one category than the other; for example, eye contact and turn taking generally are considered to be pragmatic skills, while the ability to generate inferences typically is considered a part of discourse. In contrast, many of the characteristics of expressive communication, such as topic

maintenance and appropriate topic and word choice, can be considered part of either discourse or pragmatics. Both pragmatics and discourse are associated with appropriate use of context—either to comprehend or express ideas efficiently and effectively or to interact appropriately in social situations.

Adults with RHD often have difficulties with discourse comprehension that include problems understanding discourse that contains abstract, nonliteral, or ambiguous information, or when multiple interpretations are present (Benowitz, Moya, & Levine, 1990; Brownell, Potter, Bihrle, & Gardner, 1986; Kempler, Van Lancker, Marchman, & Bates, 1999; Lehman & Tompkins, 2000; Myers & Brookshire, 1996; Myers & Linebaugh, 1981; Wapner, Hamby, & Gardner, 1981). Deviant characteristics of discourse produced by adults with RHD include the presence of egocentric or overpersonalized responses, irrelevant comments and digressions from the topic, a focus on tangential or irrelevant details, disorganized thoughts, and responses that seem impulsive and not well thought out (Chantraine, Joanette, & Ska, 1998; Glosser, 1993; Myers, 2001). These individuals tend to do better with discourse themes that are supported by well-known scripts or schemas, such as going to a restaurant or a grocery store. In communicative interactions, inappropriate use of eye contact and turn taking as well as problems initiating conversation also have been reported (Myers, 1999a; Tompkins, 1995).

Only one treatment study has addressed discourse and pragmatic deficits specifically in adults with RHD (Klonoff, Sheperd, O'Brien, Chiapello, & Hodak, 1990). Klonoff and colleagues described 3 individuals with RHD enrolled in an intensive day program for adults with brain injury. The psychoeducationally based program was designed to enhance individuals' independence and facilitate return to work, and included both individual and group sessions. Treatment addressed cognitive, speech-language, physical, and emotional issues. Group sessions also targeted pragmatics, education, and psychosocial issues. The participants with RHD evidenced cognitive-communication deficits, including difficulties with abstract thinking, inferential reasoning, verbal learning, cognitive flexibility, visuospatial problem solving, awareness of deficits, and pragmatics (generally defined in terms of eye contact, topic maintenance, and initiation of conversation). Changes in pragmatic abilities were discussed anecdotally but not formally measured.

The program consisted of approximately 5 hr of therapy, 5 days per week. The participants were enrolled in the program for anywhere from 3 to 15 months. Criteria for discharge were not provided. The authors reported that all 3 participants demonstrated improvements in some areas, but all continued to exhibit difficulties with self-monitoring, even after role-playing activities and reviews of behaviors. Although all returned to work, the work settings were substantially different from premorbid situations (Klonoff et al., 1990).

This study provides only minimal evidence for the effectiveness of treatment of pragmatic deficits after RHD. The treatment was not adequately described, thus preventing clinicians from replicating the program with their clients. The absence of specific pre- and posttreatment data limits the conclusions that can be drawn.

Theoretically Motivated Treatments

In the absence of evidence for treatments designed for communication deficits associated with RHD, treatments may be derived from hypotheses or theories of right hemisphere processes. The reader is referred to Halper et al. (1996), Myers (1999a, 1999b), and Tompkins (1995) for some theoretically based treatment suggestions.

There are several current accounts of the intact right hemisphere's role in language. Unfortunately these either have not been directly tested with adults with RHD or are not specific enough to explain the variety of deficits associated with RHD. There also are several proposed accounts of the deficits associated with RHD. One of these has been empirically tested, while the others await careful experimental investigation.

Accounts of Normal Right Hemisphere Function

Evidence from recent imaging and visual field studies is consistent with claims that the intact right hemisphere plays a role in extralinguistic processes, including discourse comprehension (Ferstl, Rinck, & von Cramon, 2005; Mason & Just, 2004; Virtue, Haberman, Clancy, Parrish, & Jung-Beeman, 2006), generating and comprehending nonliteral language (Marshal, Faust, & Hendler, 2005; Van Lancker Sidtis, 2006), understanding jokes (Bartolo, Benuzzi, Nocetti, Baraldi, & Nichelli, 2006; Coulson & Wu, 2005), and integrating information across sentences (Long & Baynes, 2002; Long, Baynes, & Prat, 2005). It is not yet clear how the right and left hemispheres work together to complete such language processing, or how lesions to the right hemisphere might specifically disrupt the processing. While several studies have examined the role of the right hemisphere in various aspects of language processing, the coarse coding framework (Beeman, 1993, 1998; Beeman, Bowden, & Gernsbacher, 2000; Jung-Beeman, 2005) and the propositional/discourse representation model (Long & Baynes, 2002; Long et al., 2005) provide explanations for broader right hemisphere contributions to language.

In his coarse coding framework, Beeman (1993, 1998; Beeman et al., 2000; Jung-Beeman, 2005) proposed that the intact left and right hemispheres play complementary roles in language processing. In this account, both hemispheres participate in semantic activation, integration, and selection (Jung-Beeman, 2005). However, the quality of processing differs. The left hemisphere is important for "fine coding" words and sentence structure and the selection of meaning. The right hemisphere codes language more "coarsely," which results in overlapping activation for distantly related words and concepts. The right hemisphere also maintains activation of the distantly related concepts until they can be selected (as appropriate) by the left hemisphere. Beeman has provided the majority support for this hypothesis from studies of adults without brain damage, including visual field and imaging studies (see Jung-Beeman, 2005, for a review). An independent study has recently tested the coarse

coding hypothesis with adults with RHD. Tompkins and colleagues (Tompkins, Scharp, Meigh, & Fassbinder, in press) reported that their RHD group demonstrated word-level difficulties with activation and maintenance of distantly related meanings.

A second account of right hemisphere function described how the intact right and left hemispheres process meaning within and across sentences (Long & Baynes, 2002; Long et al., 2005). Results from two studies suggest that the left hemisphere is dominant for constructing a propositional representation that is based on individual words and the grammatical structure of a sentence. In contrast, the discourse representation, which reflects the main idea or concepts of a passage, requires integration of information across sentence boundaries as well as integration of world knowledge and inferences with information from the text. This discourse representation purportedly is accessible to both the right and left hemispheres. This hypothesis has not directly been tested on adults with RHD. However, the authors speculate that RHD could interrupt the ability to construct or access a discourse representation, which would explain many of the discourse comprehension deficits associated with RHD, such as difficulties integrating information for generating some types of inferences (Myers & Brookshire, 1996; Rehak, Kaplan, Weylman, Kelly, & Brownell, 1992), revising interpretations (Brownell et al., 1986; Tompkins, Bloise, Timko, & Baumgaertner, 1994), or selecting the most plausible meaning of a passage (Tompkins, Baumgaertner, Lehman, & Fassbinder, 2000; Tompkins, Fassbinder, Blake, Baumgaertner, & Jayaram, 2004; Tompkins, Lehman-Blake, Baumgaertner, & Fassbinder, 2001).

One problem with accounts of normal right hemisphere functioning is that predictions about performance after RHD either implicitly or explicitly suggest that the right hemisphere is essentially incapacitated, thus resulting in global deficits in extralinguistic processing. For example, Beeman (1993) predicted that RHD would abolish right hemisphere coarse coding processing, resulting in an inability to generate inferences. Supporting data were provided in one study. However, multiple other studies have demonstrated that adults with RHD can generate some types of inferences (Blake & Lesniewicz, 2005; Brownell et al., 1986; Lehman-Blake & Tompkins, 2001; Rehak et al., 1992; Tompkins et al., 2000, 2001, 2004; see Lehman & Tompkins, 2000, for a review of potential factors influencing inferencing processes). The coarse coding framework also purports that damage to the right hemisphere is expected to result in specific difficulties with predictive inferences (Beeman, 1998). However, generation of predictive inferences (even multiple possible inferences) has been reported in two studies (Blake & Lesniewicz, 2005; Lehman-Blake & Tompkins, 2001).

Another problem for the coarse coding framework is that instead of causing difficulty in activating distantly related meanings, evidence from adults with RHD suggests that these individuals generate multiple possible inferences, and the problem is in efficiently suppressing or inhibiting inferences that are not appropriate (Tompkins et al., 2000, 2001, 2004; Tompkins, Lehman-Blake, Baumgaertner, & Fassbinder, 2002; see discussion of the suppression deficit hypothesis below). Indeed, Tompkins and colleagues (2004) suggested that the presence of multiple potential inferences in Beeman's (1993) original stimuli created a processing conflict that could explain the absence of evidence of inferencing that he reported. Instead of *not* generating inferences, the participants may have generated two different inferences, and the inability to quickly select the most probable interpretation led to the poor performance on the task.

In the propositional/discourse representation model (Long & Baynes, 2002; Long et al., 2005), both the right and left hemispheres appear to have access to the discourse model, which could explain why adults with RHD are able to use some contextual cues or appropriately integrate some information but not others. Despite the apparent consistencies between accounts of normal right hemisphere function and deficits associated with RHD, none of the proposals has been examined critically enough to be able to predict what specific processes might be affected and to what degree, and/or to link predicted performance to size or site of lesion.

Treatment based on accounts of normal right hemisphere functioning must be used with caution, given the gaps between knowing what an intact hemisphere does and the specific deficits caused by a lesion to a localized area of that hemisphere, which could interrupt a portion of a large network and/or intrahemispheric processes. Treatments proposed to date include working on extralinguistic processes, such as generating inferences or identifying appropriate meanings based on contextual cues or world knowledge (Myers, 1999a, 1999b). An important component of treatment for discourse representations would be to examine the context for cues that lead to an appropriate interpretation. Examples of tasks and stimuli consistent with the predictions of these accounts are provided in the Appendix.

Accounts of Deficits Resulting From RHD

There are several accounts that explain deficits exhibited by adults with RHD. These include the suppression deficit hypothesis, the social inference theory, and the frontal lobe/executive function account. A fourth model, the cognitive resources model, implicates a general demand for cognitive resources as a component of RHD deficits. Each will be discussed in turn.

Tompkins and colleagues (2000, 2001, 2002, 2004) have proposed that one potential deficit underlying communication disorders associated with RHD is an *inefficiency* (not *inability*) in suppressing or inhibiting unwanted or irrelevant interpretations. This hypothesis was derived from reports of deficits associated with RHD and has been tested with this population. When confronted with an ambiguous sentence (e.g., "She picked up the spade" – card/shovel; "Carl explored the layout of the house" – buyer/burglar), adults with and without RHD generated both possible interpretations. When context was then provided that disambiguated the stimulus (e.g., "She dug a shallow hole for her daffodil bulbs"; "He was planning to break in that

night"), adults with RHD were slower than those without brain damage to reject the contextually inappropriate meaning. Suppression function was related to discourse comprehension for adults with RHD. The authors do not claim that the suppression function is housed solely within the right hemisphere, but rather that damage to processing networks in the right hemisphere can result in suppression deficits. Due to the complex nature of the language stimuli, individuals with left hemisphere lesions have not been included in the studies.

It is not clear how best to remediate an inefficient suppression process that results in slow but eventually accurate integration of contextual information. One option is to focus on conscious awareness and use of contextual cues that can provide disambiguation (Tompkins & Baumgaertner, 1998). Treatments developed from this framework are similar to those supported by the propositional/discourse representation model (see Appendix for examples). They include having the client select the *most appropriate* interpretation out of several plausible ones. Treatment stimuli can include nonliteral language (e.g., idioms, metaphors), ambiguous words or sentences, and/or humor (e.g., puns, comic strips). Social situations or short vignettes in which a speaker's comments can be interpreted in more than one way (e.g., sarcasm, white lies) also can be used. The role of relevant contextual cues in disambiguating meaning or selecting one interpretation over another is a key factor. The clinician and client can discuss why one meaning is preferred over another, and identify the relevant contextual cues that support the conclusions.

Social Inferences and Theory of Mind

Social inferences are those that are required to understand others' behaviors, beliefs, and intentions. Theory of mind, the ability to understand that another person's knowledge or beliefs may differ from one's own, is closely related to social inferences (Martin & McDonald, 2003). Theory of mind is most commonly discussed in relation to children with autism spectrum disorders but has recently been explored as a potential explanation for pragmatic deficits after RHD (Griffin et al., 2006; Happé, Brownell, & Winner, 1999). Results suggest that adults with RHD have difficulty with tasks requiring comprehension of causal inferences that rely on understanding a character's motives or beliefs (e.g., telling a white lie to be polite; Happé et al., 1999). However, Tompkins, Scharp, Fassbinder, and Meigh (in press) recently examined the validity of the theory of mind deficit in adults with RHD in a meticulously controlled study. Their results indicated that previous results (Happé et al., 1999) supporting theory of mind deficits after RHD could be explained simply by the complexity of the stimuli. Martin and McDonald (2003), in their review of potential explanations for pragmatic deficits, also suggested that the complex nature of social inferences (e.g., multiple cues from various modalities and direct conflicts in literal vs. intended meanings, such as in lies and sarcasm) could result in deficits, so the problem may not be specific to social inferencing but rather a result of problems with complex inferencing and integration processes.

Treatment of social inferences must be considered carefully, given the weaknesses in the theories. If a client's deficits are noted most often in social situations, clinicians may consider treatment focusing on social inferences. Vignettes can be constructed in which a speaker's remark can be interpreted in different ways depending on what the speaker believes about what the listener knows. Examples are provided in the Appendix. As with the other treatments described, the focus should be on determining what information in the context can help guide the correct interpretation. This type of treatment essentially would target complex integration and inferencing processes, but the stimuli would be tailored toward social situations. In this way, the specific areas in which the deficit appeared (social situations) could be addressed, while working on a (presumably) broader underlying deficit (complex inferencing).

Frontal Lobe/Executive Function Model

Martin and McDonald (2003) describe a frontal lobe/executive function account of pragmatic deficits. This explanation originally was derived from the literature on traumatic brain injury, and it suggests that pragmatic deficits resulting from traumatic brain injury could be a result of damage to the frontal lobes or to executive function networks with extensive connections to the frontal lobes. Martin and McDonald provide justification for applying the frontal lobe account to adults with RHD. First, many of the participants in RHD research have strokes affecting the middle cerebral artery, which supplies much of the frontal, parietal, and temporal lobes (both cortical and subcortical regions). Thus, one might assume that executive function networks frequently would be affected. Second, pragmatic and discourse deficits resulting from RHD often mirror executive function deficits. Impulsivity, disorganization, poor planning, and poor judgment associated with executive function deficits are reflected in tangential, disorganized discourse, including responses that are not well thought out and may not be appropriate for a given situation (Tompkins, 1995).

It can be difficult to clearly distinguish between frontal lobe and right hemisphere functions, given the preponderance of participants with right frontal lobe damage in the RHD literature and the frequency of bilateral frontal lobe lesions in adults with traumatic brain injury and executive function deficits (Martin & McDonald, 2003). To help differentiate right hemisphere from frontal lobe processes, McDonald (2000a) examined whether pragmatic abilities in adults with RHD were more closely related to executive function or visuoperceptual ability, the latter of which is typically considered to be a right hemisphere process. The results indicated that pragmatics and visuoperceptual deficits were significantly related, while pragmatic abilities were not meaningfully related to executive function. The researchers concluded that the executive function/frontal lobe account may not be the best explanation for communication deficits associated with RHD. Further research is needed to determine the potential link between executive function and communication in adults with RHD.

Given the questions surrounding the executive function account, treatment should proceed with caution. However, if

a clinician has noticed similar deficits in both executive function and communication, treatment could be designed to treat both. Traditional executive function tasks could be selected, with an explicit link between general processes and communication (see below for discussion of selecting treatments not originally designed for adults with RHD). For example, organization and planning could be addressed both in a cognitive task, such as preparing a menu or preparing a meal, and then in a speech-writing task. The similarities between organizing a meal and organizing one's thoughts could be discussed.

Cognitive Resources Hypothesis

The suggestion that amount of cognitive effort affects performance after brain damage has been around since the beginning of research on language and the brain (see review in Monetta & Joanette, 2003). Monetta and Joanette reviewed data from dual-task, divided visual-field studies and studies designed to elicit "disordered" performance from adults without brain damage by increasing the level of difficulty of a task or a response (Monetta, Ouellet-Plamodon, & Joanette, 2006). They asserted that communication processes frequently reported to be affected after RHD, including interpreting metaphors, discourse-level language, and pragmatics, lie on the complex end of the continuum of language abilities and that the contribution of cognitive resources cannot be ignored as a component of the communication deficits associated with RHD. They indicated that this hypothesis is not designed to replace any other accounts, but rather should be considered along with hypotheses for specific abilities (Monetta & Joanette, 2003).

The cognitive resource hypothesis does not directly guide treatment selection but rather suggests that complexity of tasks and stimuli should be carefully considered. Speech-language pathologists are well-versed in techniques to vary difficulty, including manipulations such as number of cues or distractors, length of stimuli, and amount of time allowed for a response. In discourse tasks, the distance between important cues and the point at which they must be integrated can be varied. For social inferences, the number of characters in a setting could be manipulated, as well as how familiar the situation is to a given client.

Treatment Selection Based on Deficits, not Etiology

Given the paucity of evidence specifically for individuals with RHD and weaknesses in current RHD theories (e.g., contradictory predictions and/or absence of evidence from the RHD population), another option is to select treatments that address specific deficits, rather than treatments designed for the population or etiology. Treatments for communication deficits may be selected based on the similarity between the deficits described in a treatment study and the deficits exhibited by an individual client, regardless of the etiology of the deficits. The following discussion focuses on traumatic brain injury and RHD, given the similarities between deficits associated with traumatic brain injury and those that are noted or implied in the RHD literature. The cross-population comparisons refer to cognitive (Prigatano, 1996; Tompkins, 1995), attentional (Halper et al., 1996; Myers, 1999a, Tompkins, 1995), and discourse/pragmatic (McDonald, 1999, 2000a, 2000b; Martin & McDonald, 2003; Tompkins, 1995) deficits. An important caveat is that despite the cross-population comparisons that frequent the literature, only one study directly compared these two populations using the same measures (Prigatano, 1996; see below for further discussion of this study).

In considering treatments designed for deficits associated with etiologies other than RHD, it is critical that they be closely examined to determine whether they are sound, theoretically motivated, and have adequate evidence of effectiveness. Only then should clinicians explore whether a treatment might be suitable for a deficit exhibited by a specific client with RHD. There are several studies of treatments for discourse and pragmatic deficits associated with traumatic brain injury (see Struchen, 2005, and Cannizzaro, Coelho, & Youse, 2002, for reviews). At least a few of these provide good evidence (Class I or II) for efficacy. Careful examination of the studies, their theoretical basis, and relevance to specific deficits exhibited by specific individuals with RHD should be conducted before selecting any treatment.

A series of questions designed to aid treatment selection (quoted from Cicerone, 2005, p. 57; modified from Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000) may serve as a guide for determining whether treatments originally created for a different population may be appropriate for a client with RHD. These same questions also may assist in selecting an appropriate treatment designed for adults with RHD (e.g., determining whether the motoric-imitative aprosodia treatment would be appropriate for a specific client with RHD).

1. Is the patient sufficiently similar, in most important ways, to the patients described in the clinical trial or practice guideline?

Clinicians should identify the most important factors in comparing their clients with those described in treatment studies. The client's age, time postonset, etiology or location of lesion, and course (e.g., deteriorating vs. improving condition) are just a few characteristics that can be considered. Although traumatic brain injury and RHD typically are characterized as having a sudden onset and recovering course, the average age of a typical client and the etiology, extent, and type of neurological damage obviously are different in these two populations.

The etiological dissimilarities may be less important if a functional approach to treatment is chosen. For example, Murray and Clark (2006) presented treatments for neurogenic communication disorders targeted toward deficits and not etiologies "because all neurogenic language disorders are associated with both linguistic and cognitive symptoms" (p. xii). Their model of language and cognitive processing emphasizes the interconnectedness of component neural processes. Using this approach, the important aspects of a particular client are related to deficits and not to etiologies. Indeed, in some treatment studies (particularly for attention and other cognitive deficits), participants are selected on the basis of deficits rather than etiologies, resulting in mixed

groups of individuals with unilateral/focal lesions (due to stroke or tumor) along with participants with diffuse, traumatic brain injury (e.g., Diamond et al., 2003; Ownsworth, McFarland, & Young, 2000; Sohlberg & Mateer, 1987; Strache, 1987; von Cramon, Matthes von Cramon, & Mai, 1991).

In 2003, the Ad Hoc Joint Committee on Interprofessional Relationships of the American Speech-Language-Hearing Association and Division 40 (Clinical Neuropsychology) of the American Psychological Association published a technical report on cognitive-communication rehabilitation (Ylvisaker, Hanks, & Johnson-Green, 2003). In the report, they suggested that "in some cases, *nominally* different clinical populations are *functionally* equivalent" (p. 14). The example given was young adults with traumatic brain injury who exhibit attentional and behavioral problems that are similar to those in individuals with attention-deficit/hyperactivity disorders. The functional diagnoses for both groups are associated with executive function deficits and frontal lobe dysfunction. The committee concluded that evidence from one population can be cautiously applied to a second population if the *functional* diagnoses are the same. Similarly, aphasia or aphasic deficits can be caused by traumatic brain injury that affects primarily the left perisylvian area. In this instance, aphasia treatments may be employed (e.g., Ylvisaker, Szekeres, & Feeney, 2001).

Either implicitly or explicitly, the application of treatments based on deficits or functional diagnoses has been used to justify the use of some treatments from the traumatic brain injury literature with adults with RHD. Examples can be found in publications by several leading experts in RHD, including Halper and colleagues (1996), Myers (1999a), and Tompkins (1995). Additionally, Ponsford (2004) and Turner and Levine (2004) provided in-depth comparisons of the neurophysiological consequences of vascular and traumatic brain injuries, and then proposed using the same treatments regardless of etiology.

2. Is the nature of the cognitive [communication] impairment similar to the impairment targeted by the clinical trial or practice guideline?

Neurologically, similar deficits may be a result of damage to the same regions (e.g., the frontal lobes), albeit from different etiologies (Turner & Levine, 2004). Alternatively, Howieson, Loring, and Hannay (2004) suggested that similar behavioral effects can result from lesions to different regions of a neural network, because "brain regions are not isolated. They work together as fully interconnected, distributed neural networks" (p. 287).

Functional equivalency (i.e., similar functional or behavioral consequences regardless of etiology of brain damage) is implied by those who propose using treatments designed for traumatic brain injury with adults with RHD (e.g., Myers, 1999a; Ponsford, 2004; Tompkins, 1995). The same assumption is made in treatment studies (mentioned above) that include both individuals with focal and diffuse lesions without creating groups based on etiologies. Another example is the Ross Information Processing Assessment (Ross-Swain, 1996), which was normed on individuals with traumatic brain injury and RHD combined as a single group. The manual explicitly states that the inclusion criteria were "diffuse or disseminated bilateral brain lesions … or … unilateral right hemisphere lesions" (p. 39). This practice again suggests that, for the purposes of this assessment, the deficits were more important than the etiology.

As mentioned above, only one study has directly compared cognitive-communication deficits caused by RHD and traumatic brain injury using the same measures. Prigatano (1996) examined awareness of deficits in adults with moderate-severe traumatic brain injury and RHD.[1] All participants completed a competency rating scale, and the self-ratings were compared with ratings obtained from relatives or significant others. Ratings also were compared with performance on a neuropsychological measure. The authors concluded that participants with traumatic brain injury were more likely than adults with RHD to overestimate their abilities on social/emotional items (as compared with ratings from relatives). In this study, ratings from the group with traumatic brain injury were meaningfully related to scores on the neuropsychological measure, while ratings from the RHD group were not related to the test scores. Interpretation of results was complicated by the questionable validity of ratings from relatives (which correlated with neuropsychological test results only for the group with traumatic brain injury) and results from previous studies indicating that ratings from adults with traumatic brain injury typically do not correlate with neuropsychological test scores.

McDonald (1999, 2000a, 2000b; Martin & McDonald, 2003) has published several reviews of pragmatic disorders following brain injury that include descriptions of pragmatic deficits based on the separate RHD and traumatic brain injury literatures. Notably absent were direct comparisons of the two groups on the same tasks. One conclusion drawn from the cross-study comparisons was that while adults with either RHD or traumatic brain injury had problems interpreting nonliteral language (e.g., sarcasm), only difficulties in participants with RHD were linked to individuals' abilities to interpret emotional cues (McDonald, 2000b).

The few studies available suggest that while deficits in pragmatics and awareness caused by traumatic brain injury and RHD may appear similar on the surface, they are not necessarily equivalent. Future studies are needed to specifically and directly compare deficits caused by diffuse traumatic brain injury and focal RHD, and to determine to what extent the behavioral consequences of different types of etiologies can validly be equated.

3. Are there coexisting cognitive [communication] impairments that are likely to influence the effectiveness of the intervention?

Participants included in treatment studies typically are "ideal" in that they exhibit a specific problem without any co-occurring deficits (Montgomery & Turkstra, 2003). While such selection criteria may be necessary to answer a particular research question, they cause problems in generalizing results to typical clients who rarely have one isolated deficit. Clinicians must compare their individual

[1]Severity was not a selection criterion for adults with RHD. Traumatic brain injury and RHD groups did not differ on overall scores on the neuropsychological measure.

clients with those described in the research study and determine whether co-occurring deficits may prevent their clients from fully participating or benefiting from a given treatment. This is true for selecting any treatment, regardless of whether it was originally designed for the population to which a specific client belongs.

One deficit commonly associated with RHD that should be carefully considered is anosognosia, or denial of illness. This deficit has been reported to occur in approximately 38% of individuals with RHD admitted to a rehabilitation unit (Blake et al., 2002). Individuals who are not aware of their deficits or have poor insight into potential consequences of their deficits are not as likely to actively participate in therapy and often have poorer outcomes (Hartman-Maeir, Soroker, Oman, & Katz, 2003; Jehkonen et al., 2001; Noe, Ferri, Caballero, Villodre, Sanchez, & Chirivella, 2005). Cherney (2006) describes a framework for clinical decision making for clients with anosognosia that involves consideration of medical factors, client preferences, issues of quality of life, and other external/contextual factors.

4. What are the expected benefits and potential costs of applying the intervention?

Given the gaps in our knowledge regarding theoretical and neurophysiological bases for treatment of cognitive-communication deficits, benefits and costs are difficult to measure. All of the components of evidence-based practice—clinical experience (e.g., past success or failure with particular treatments for particular deficits), the client's values, and the existing theoretical basis or efficacy data—must be integrated to generate an educated guess as to the potential costs and benefits of a treatment.

5. Is the treatment feasible to apply the intervention in this clinical setting?

Factors that should be considered include the time in treatment (both per session and number of sessions), in- versus outpatient treatment settings, and equipment needed (e.g., computers, software). If group treatment is considered, the availability of an appropriate number and type of group members must be evaluated.

Feasibility, as with all of the other criteria, should be evaluated in the selection of any therapy, including those originally developed for the population of interest. For example, the one existing study of pragmatic treatment for adults with RHD involved an intensive, multidisciplinary day program. This type of treatment may not be possible to implement in many rehabilitation settings.

6. Is the intervention consistent with the patient's own preferences, values, and expectations?

This question ties back to one component of evidence-based practice, the client's values. Cherney (2006) also discusses this in relation to anosognosia, and determining whether to recommend treatment when the client resists treatment due to reduced awareness of deficits.

Conclusions and Future Directions

There is a striking need for treatment research for communication disorders associated with RHD. This article provides one perspective on approaching treatment in the absence of evidence. Currently there is no one accepted theory of RHD communication deficits. Accounts of intact right hemisphere function need to be examined in relation to damage to the system, and further research is needed to test the veracity of current accounts of right hemisphere deficits. The treatments suggested herein are only provisional, until evidence is obtained to sufficiently support the underlying theories, or until the treatments themselves are carefully evaluated to establish efficacy and effectiveness. Additionally, there is a need to evaluate deficit-based treatments specifically with adults with RHD to examine whether they may be appropriate. It would be prudent to directly compare cognitive and communication deficits caused by different etiologies to verify the anecdotal reports of similarities, and to further explore the effects of diffuse versus focal damage to neural networks subserving cognitive and communication functions.

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Appendix

Treatment Suggestions

The treatment suggestions provided here are based on theories of right hemisphere processing and accounts of communication deficits caused by right hemisphere brain damage. Currently no empirical evidence exists to support or refute the efficacy or effectiveness of these treatments.

Treatment suggestions based on accounts of the intact right hemisphere's processing capabilities

Generating inferences or themes

(a) Present pictures (e.g., Norman Rockwell paintings) and ask the client to describe what is happening (see also Myers, 1999a, 1999b).
Guided description:
* Ask how different characters in the picture are related to one another.
* Ask how other visual cues (e.g., a person's clothing, facial expression, signs in the background) might add to the meaning of the picture.
* Provide several titles and ask client to select the most appropriate. Discuss why one is more appropriate than the others.
* Ask the client to generate a title for a picture.
* Increase complexity by selecting pictures that are more visually or inferentially complex; select pictures that require integration of features from the picture more than interpretation via world knowledge.

(b) Provide homographs (e.g., ball, spring, bank) and ask client to generate two or more meanings.

Using context to constrain meaning

(a) Put ambiguous words into context and then discuss which meaning is more appropriate.
Example: ball
Cinderella went to the ball.
The ball of string rolled down the stairs.
I had a ball at the ball.
Example: spring
The spring in my mattress broke.
I love to see the first robin of spring.

(b) Provide context through word pairs: one ambiguous and one related to a meaning of the ambiguous word.
* Discuss which meaning is appropriate for different word pairs.
Examples: BANK – MONEY versus BANK – RIVER
WARM – KIND versus WARM – COLD
HOT – SPICY versus HOT – COLD versus HOT – HANDSOME

(c) Provide contexts that do not disambiguate meaning. Discuss potential meanings.
Examples: Huck Finn went fishing in the spring.
In the spring there are many tadpoles.
* Add sentences that provide disambiguating cues. Identify the cues and discuss why the alternative meaning is no longer appropriate.
Examples: Huck Finn went fishing in the spring.
It was his favorite time of year. OR
There were more fish there than in the lake.
* Ask client to generate a sentence that would disambiguate the initial sentence. Discuss what cues in the sentence provide the necessary context.

Treatment suggestions based on suppression deficit hypothesis

(a) Any of the treatments described above that address the use of context and contextual cues could be used.

(b) Provide contexts in which an initial interpretation has to be reanalyzed in light of additional information (jokes and headlines are a good source of materials).
Example: When she turned 65, my grandmother started walking 5 miles a day. Now she's 92, and we have no idea where she is.
* Discuss the initial interpretation of the first sentence and the altered interpretation suggested by the second sentence.

(c) Provide jokes or puns; discuss the different interpretations and why they can be humorous.
Example: Due to budgetary concerns, the cemetery must now run on a skeleton crew.

Treatment suggestions based on social inferences theory

(a) Provide scenarios that describe a relationship between people. Ask questions about the intent of a character's response (vignette taken from Brownell et al., 1991).
Example: Hal and Mark are amateur golfers. Hal hated Mark because he often would cheat. One day, Mark played poorly. At the end of the game, Hal said: "You sure are a good golfer."
Guided discussion:
* What did Hal mean? (Was he being complimentary? sarcastic?)
* How did you figure it out? (What clues led you to this conclusion?)
* Discuss which clues are important (e.g., Hal hated Mark), which are not (e.g., they are both amateur golfers).
* If Hal and Mark were friends, would that change how you would interpret Hal's remark?
* If Mark played well that day, would that change how you would interpret Hal's remark?