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Augmentative and Alternative Communication Intervention for Persons with Chronic Severe Aphasia: Bringing Research to Practice

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Structured Abstract

Clinical Question: Should we consider a technology-based AAC intervention or a nontechnology-based AAC intervention treatment approach for a person with chronic severe Broca's aphasia and apraxia of speech?

Method: Evidence-based practice process

Study Sources: Electronic and bibliographic databases and hand searches of selected journals

Search Terms: aphasia, AAC, communication, and intervention

Primary Results:

Persons with chronic severe Broca's aphasia are able to identify and combine symbols to produce phrases and sentences using speech-generating devices.

There are no published studies that compare the relative effectiveness of technologically-based and nontechnology-based AAC interventions for persons with aphasia.

Conclusions:

In the experimental context, both types of non-AAC intervention options resulted in positive outcomes.

Variability of results within and across studies precludes us from making predictions of the magnitude of treatment effects.

Augmentative and Alternative Communication Intervention for Persons with Chronic Severe Aphasia: Bringing Research to Practice

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Scenario

Abby is a 72-year-old woman who sustained a left hemisphere stroke (anterior middle cerebral artery distribution) 3 years ago, resulting in chronic severe Broca's aphasia and apraxia of speech. Associated impairments included right hemiplegia that caused her to use a wheelchair. At the time of her stroke, Abby had recently retired from operating an office supply business. She had been widowed for 8 years and was living independently at home. Following her stroke and subsequent hospitalization, she returned home, and her youngest son and daughter-in-law moved in with her. She received speech-language treatment through a home health agency for 6 months. Treatment techniques included melodic intonation and mapping therapy (Helm-Estabrooks & Albert, 2004; Thompson, 2001). She now communicates through pointing, gestures, and head movements accompanied by speech output in the form of "yes" and "no." Most other verbalization attempts result in perseveration of approximation of her daughter's name (i.e., "Jamie Jamie Jamie") rather than the target word. She typically makes her basic wants and needs known to her daughter-in-law and son using nonverbal communication strategies, although her daughter-in-law reported that they often have to play "20 questions" before arriving at Abby's actual thought/request. Abby enjoys playing card games and has friends over approximately once every 3 months for a "game night." Abby's son would like her to be able to express her needs, wants, and thoughts more clearly/efficiently with both familiar and unfamiliar communication partners. Abby would like to fly to visit her daughter who lives out-of-state, but she has expressed concern about her lack of ability to communicate with others (e.g., flight attendants, cab drivers). To prepare Abby to communicate more effectively in her home and community settings, we asked: Should we introduce Abby to a technology-based AAC intervention approach (e.g., speech-generating device [SGD] as a part of a treatment package) or a nontechnology-based AAC intervention approach (e.g., communication book as a part of a treatment package)?

Augmentative and Alternative Communication Intervention and Aphasia

Aphasia is a language impairment resulting from damage to areas of the brain that are responsible for the formulation and comprehension of language. The most common cause of aphasia is a stroke. Persons with aphasia may demonstrate deficits in any one, multiple, or all major areas of language function—spontaneous speech, comprehension, reading, and writing. Data on the prevalence of aphasia indicate that approximately 100,000 people acquire aphasia every year in the United States (National Aphasia Association, 2011). Many persons with aphasia have little or no functional speech and rely on augmentative and alternative communication (AAC) methods to supplement or replace natural speech. AAC methods include symbols, aids, techniques, and strategies for either augmenting speech and/or providing an alternative means of communication (Lloyd, Fuller, & Arvidson, 1997). With the advent of evidence-based practice (EBP) in health care, it has become important to appraise the available evidence on the efficacy of AAC intervention in persons with aphasia. With increased accountability for healthcare costs, both private and state health insurers increasingly require data that demonstrate interventions actually work. Many consumers of AAC services want to know about the efficacy of these interventions to decide whether it's worth the cost. Are sufficient data to answer questions from direct and indirect stakeholders available? It is important to consider evidence from the available research when deciding upon an effective AAC intervention approach for an individual with chronic severe aphasia. The integration of the best

and current research evidence with clinical expertise and stakeholder perspectives is essential to bridging the gap between research and clinical practice. The purpose of this paper is to assess the efficacy of AAC intervention for persons with aphasia, using an evidence-based practice process proposed by Schlosser and Raghavendra (2003).

Using EBP to Determine the Best Intervention Approach

While working with Abby, we followed Schlosser and Raghavendra's (2003) seven-step EBP process to determine if AAC intervention would be an effective intervention approach.

Step 1: Asking a Well-Built Question

The first step in the EBP process is to formulate a well-built question that facilitates a systematic search of the available evidence to find relevant and clinically useful answers (Schlosser, Koul, & Costello, 2007). The question we formulated was: *Should we consider a technology-based AAC or a nontechnology-based AAC intervention approach for a person with chronic severe Broca's aphasia and apraxia of speech?*

Steps 2 and 3: Selecting Evidence Sources and Executing the Search Strategy

We systematically searched three electronic databases (Cumulative Index for Allied Health Literature, PubMed, Education Resources Information Center) and a bibliographic database (i.e., Academy of Neurologic Communication Disorders and Sciences) to locate studies that compared the efficacy of technology-based AAC intervention approaches to nontechnology-based AAC intervention approaches for persons with chronic severe Broca's aphasia, across experimental and non-experimental settings. The keywords used to search all three electronic databases were *aphasia, AAC, communication,* and *intervention.* We also conducted hard copy searches of selected journals, such as *Augmentative and Alternative Communication* and *Aphasiology.* Our searches revealed no published studies that compared the relative effectiveness of two or more treatment approaches in the area of aphasia and AAC. We then searched for similar or related studies published on technology-based and nontechnology-based AAC intervention approaches, using the same search strategies and keywords. We retrieved several reviews of similar or related studies: Beukelman, Fager, Ball, & Dietz, 2007; Koul & Corwin, 2003; Koul, Petroi, & Schlosser, 2010; Lasker, Garrett, & Fox, 2007; and van de Sandt-Koenderman, 2004.

Step 4: Examining the Evidence

We examined the evidence for technology-based and nontechnology-based AAC intervention approaches, appraising the methodological quality of each study according to several distinct dimensions (Schlosser & Wendt, 2006). The evaluation criteria for single-subject design studies included (a) demonstration of experimental control within a single participant and across different participants, (b) operationally defined independent and dependent variables to allow for replication, and (c) reported inter-observer agreement and treatment integrity data that were appropriate.

Evaluation criteria for group-design studies included (a) threats to internal validity were satisfactorily ruled out, (b) data were analyzed using appropriate statistical techniques and allowed an effect size to be determined, and (c) a control condition and/or a control group was included. Our findings are summarized in the following paragraphs.

Technology-Based AAC Intervention Approaches. Technology-based AAC intervention approaches include the use of dedicated SGDs and/or software programs and applications that turn computers or hand-held electronic devices into communication devices that produce digitized or synthesized speech output upon selection of messages. With the rapid proliferation of computer technology in the past decade, AAC aids such as SGDs and software programs for hand-held multipurpose electronic devices (e.g., iPod®, iPad®) have become increasingly available to persons with aphasia (Koul, 2011; Koul et al., 2010). Most dedicated SGDs, software programs, and applications (e.g., Dynavox V® & Vmax® by DynaVox Systems, SpeechPRO software by Gus Communications., SmallTalk by Lingraphica®, Vanguard Plus by PRC) are not disorder specific. These devices/software programs are designed and promoted for use by persons with speech and language impairments, irrespective of the cause of the impairment. There is, however, one commercially available SGD (Lingraphica by Lingraphica: The Aphasia Company™) that is specifically designed and promoted for use by individuals with aphasia.

Efficacy of Technology-Based AAC Intervention Approaches. Studies involving the use of technology-based AAC intervention with individuals with chronic

severe Broca's aphasia indicated that these individuals are able to access, identify, select, and combine graphic symbols to produce simple phrases and sentences (Koul, Corwin, & Hayes, 2005; Koul, Corwin, Nigam, & Oetzel, 2008; Koul & Harding, 1998; McKelvey, Dietz, Hux, Weissling, & Beukelman, 2007; Rostron, Ward, & Plant, 1996). To gain a greater insight into individual study outcomes, we used the criteria proposed by Rispoli, Machalicek, and Lang (2010). We made minor modifications to classify methodologically sound AAC intervention studies that incorporated technology as part of the treatment package into studies with positive, negative, and mixed outcomes.

Studies in which the outcomes measured showed improvement for all participants were classified as positive outcomes. Studies in which data indicated that the outcomes measured did not change as a result of AAC intervention were classified as negative outcomes. Studies in which at least half of the participants demonstrated improvement in all of the dependent measures targeted were classified as studies with mixed outcomes.

Using the Rispoli, Machalicek, and Lang criteria, we classified five single-subject design studies and two group-design studies as having positive outcomes for persons with chronic Broca's aphasia (Beck & Fritz, 1998; Koul et al., 2005; Koul et al., 2008; Koul & Harding, 1998; McKelvey et al., 2007; Nicholas, Sinotte, & Helms-Estabrooks, 2005; van de Sandt-Koenderman, Weigers, & Hardy, 2005). There were no studies that met Schlosser and Wendt's (2006) methodological appraisal criteria and were classified as having negative or mixed outcomes. Despite positive outcomes, the variability of results within and across studies and the lack of treatment generalization data indicate a critical need for additional research using well-controlled experimental designs that account for internal and external validity.

Nontechnology-Based AAC Intervention Approaches. Nontechnology-based intervention approaches do not involve the production of speech output upon selection of a message. Communication books/boards, cue cards, and memory books are examples of nontechnology approaches (Koul, 2011). Further, Garrett and Lasker (2005) and Lasker et al. (2007) proposed an intervention approach that focuses on the communication needs, cognitive-linguistic competencies, and participation levels of persons with aphasia. This approach proposes that both technology-based and nontechnology-based approaches can be used as a part of a multimodal treatment package to facilitate communication in persons with aphasia.

Although we did not conduct a traditional systematic review of studies to investigate efficacy of nontechnology-based AAC intervention approaches for persons with aphasia to answer our clinical question, our search strategies revealed a number of studies in which AAC intervention involved the use of alphabet cards, photographs, graphic symbols, written choices, gestures, drawing, writing, communication boards, or remnant books (Fox, Sohlberg, & Fried-Oken, 2001; Ho, Weiss, Garrett, & Lloyd, 2005; Lasker, Hux, Garrett, Moncrief, & Eischeid, 1997; Ward-Lonergan & Nicholas, 1995). A review of these studies indicated that people with Broca's aphasia are able to use a variety of nontechnology options with varying degrees of success. Few studies that met our evaluation criteria had positive outcomes (e.g., Garrett, Beukelman, & Low-Morrow, 1989; Ho et al., 2005). However, the preponderance of case studies in existing nontechnology-based AAC intervention literature reduces the strength of the evidence that indicates positive or mixed outcomes. Case studies by their very nature can neither rule out internal validity nor provide external validity.

Summary of the Evidence. The data on the efficacy of AAC intervention for persons with aphasia indicated that both technology-based and nontechnology-based AAC options are effective, to varying degrees, in changing the outcomes being measured in the individual studies. Despite limited controlled participant or group data, Koul et al., (2010) reported several studies that provide conclusive, preponderant, and suggestive evidence in support of the use of AAC methods with persons with aphasia.

Step 5: Applying the Evidence

Results indicated that at least in the experimental context technology-based and nontechnology-based AAC intervention options seemed to be effective. Although there are several studies that provide conclusive and preponderant evidence as to the efficacy of AAC intervention in persons with aphasia, the variability within and across studies and lack of data regarding generalization reduces the enthusiasm for that evidence. Thus, either option appeared to be a viable one. It was then time to discuss the findings with the relevant stakeholders, in this case Abby and her primary communication partners. We considered their viewpoints, preferences, concerns, and

expectations when making the decision regarding which AAC intervention to try. In this case, Abby and her adult son and daughter-in-law who live with her indicated that they were interested in trying a technology-based AAC intervention approach, in this case an SGD. Abby indicated that she wanted to be able to express her thoughts and be heard. Her daughter-in law expressed that she thought Abby's friends and family members, as well as members of the community at large, would be more receptive to spoken words than printed words or pictures.

Step 6: Evaluating the Evidence Application

Once the decision was made to try an SGD, an assessment and implementation protocol was developed that included participation of both the direct stakeholder (Abby) as well as her primary communication partners (i.e., son and daughter-in-law). A predictive assessment that involved matching the capabilities of Abby using several criterion-referenced tasks was used to select an SGD that best met her communication needs and goals (Glennen, 1997). Abby was given an opportunity to try several different SGDs from our AAC laboratory over a period of six weeks, and an SGD was selected that best fit her capabilities and was desired by her. Following this trial period, we prepared an assessment report for Medicare funding for the SGD that documented her communication impairment, sensory skills, cognitive skills, and language skills, as well as her ability to access the device using a touch screen. This report also summarized her daily communication needs and communication goals.

After Abby received her SGD, we implemented an AAC intervention program. We trained Abby on specific techniques and strategies that would enhance her ability to share information with others. With input from Abby and her family and friends, we programmed easily accessible messages in her device so that she could continue interacting with her friends and acquaintances. We also trained her primary communication partners (i.e., daughter-in-law and son) using Kagan's (1995) partner-dependent approach. This approach involves training/teaching communication partners so that they can, in turn, reveal the communicative competence of the person with aphasia. We checked the log files in her SGD to measure how frequently she used it outside the clinical context. We measured the effectiveness of her communication by administering the Communicative Effectiveness Index (CETI) scale (Lomas et al., 1989) to her son and daughter-in-law. This scale measures the effectiveness of functional communication of the persons with aphasia as reported by the caregiver.

Step 7: Disseminating the Findings

The final step in EBP involves disseminating experiences and outcomes at professional conferences and in journals so that we can all learn from the information and further our awareness of future research needed in this area. We are in the process of submitting a manuscript, based on data collected with Abby and other persons with aphasia, regarding the efficacy and social validity of AAC intervention that includes SGDs as part of the treatment package.

Conclusions

To adequately support persons with aphasia in maximizing their full inclusion, social integration, employment, and independent living, it is critical to know which interventions work and which interventions work better than others. The paucity of controlled data precluded us from being able to determine this. Future research efforts must go beyond case studies and use controlled study designs to evaluate treatment effects. This research should be conducted with greater attention to scientific methodology issues to better understand the important components of the intervention that can be generalized to a target population and reduce the gap between research and clinical practice.

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Table 1. Summary of evidence-based practice process steps

Evidence-Based Practice Process Steps*	Summary Description
Asking an answerable question	Practitioners shall formulate a question that can be answered through a systematic search of available evidence.
Selecting evidence sources	Practitioners shall select varied evidence sources, including at least several databases and hard copy searches of relevant journals.
Executing the search strategy	Practitioners shall identify keywords for searching databases that have potential to yield relevant and best evidence.
Examining the evidence	Practitioners shall identify the internal, external, and social validity of evidence.
Applying the evidence	Practitioners shall discuss the evidence with both direct and indirect stakeholders and consider their preferences and expectations before applying the evidence.
Evaluating the application of the evidence	Practitioners shall evaluate the effectiveness of the evidence-based intervention from their perspective and the stakeholders' perspective.
Disseminating the findings	Practitioners should share their EBP experiences at professional conferences and publish their results so that others can benefit from their efforts.

Note. Schlosser & Raghavendra, 2003.

Table 2. Summary of technology-based AAC intervention studies that met inclusion criteria

Authors	Number of Participants	Time Post Onset	Severity and Type of Aphasia	Dependent Variable(s)	Research Design	Results
Koul, Corwin, Nigam, & Oetzel (2008)	*n* = 3	12–106 months	3 Severe Broca's	Production of phrases and sentences of varying syntactical complexity using graphic symbols	Multiple baseline across behaviors replicated across subjects	All participants were able to combine symbols to produce two to three word sentences.
McKelvey, Dietz, Hux, Weissling, & Beukelman (2007)	*n* = 1	96 months	Broca's	Use of Visual Scene Displays during conversation interactions across 3 target behaviors	Multiple baseline across behaviors	Participant demonstrated improvement in all three behaviors
Koul, Corwin, & Hayes (2005)	*n* = 9	12–105 months	7 Severe Broca's 2 Global	Production of sentences of varying syntactical complexity using graphic symbols	Multiple baseline across behaviors replicated across subjects	Seven participants with Broca's aphasia and one with global aphasia were able to combine symbols to produce sentences of varying degrees of syntactical complexity.
Nicholas, Sinotte, & Helms-Estabrooks (2005)	*n* = 5	18–90 months	5 Severe non-fluent	Use of C-Speak Aphasia during functional communication tasks	Multiple baseline across behaviors replicated across subjects	All participants demonstrated superior performance using C-Speak across target behaviors
van de Sandt-Koenderman, Wiegers, & Hardy (2005)	*n* = 22	30 months	Aphasia type= not specified All participants exhibited limited verbal expression but relatively good comprehension	Number of sessions required to learn the use of portable electronic communication device and use of that device in functional settings	Within subject design	All participants were able to use portable device after intervention and 77% of them used the device in functional settings.
Beck & Fritz (1998)	Aphasia *n* = 10 Control *n* = 10	≥ 6 months	Anterior lesions: *n* = 5 Posterior lesions: *n* = 5	Recall of abstract vs. concrete icon messages and recall of one, two, and three icon messages using a speech generating device	Between group design	Fewer iconic codes were learned for abstract messages than for concrete messages among all participants. Participants with posterior lesions had greater difficulty learning abstract codes than participants with Broca's aphasia.
Koul & Harding (1998)	*n* = 5	8–60 months	3 Severe Aphasia 2 Global	1. Identification of single symbols and two-symbol combinations	Multiple baseline design across behaviors replicated across subjects	Participants were able to identify and combine symbols to produce short phrases with varying degrees of accuracy.