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A Pilot Study on the Outcomes of a Modified Intensive Comprehensive Aphasia Program

by

Thomas GM Gonzalez

A thesis submitted in partial fulfillment

of the requirements for the degree of

Master of Science in the Department of

Communication Sciences and Disorders

Idaho State University, Summer 2020

To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Thomas GM Gonzalez find it to be satisfactory and recommend its acceptance.

Victoria L. Scharp, PhD, CCC-SLP
Major Advisor

Kristofer Brock, PhD, CCC-SLP
Committee Member

Elizabeth Horn, PhD, LCPC
Graduate Faculty Representative

TABLE OF CONTENTS

List of Figures

List of Tables

A Pilot Study on the Therapeutic Outcomes of a Modified Intensive Comprehensive Aphasia Program

Thesis Abstract – Idaho State University (2020)

This pilot study investigates the language impairment, functional communication, and communication confidence outcomes of a modified intensive comprehensive aphasia program (M-ICAP). The primary purpose was to determine whether treatment gains were attained and maintained after a 30-hour M-ICAP lasting one week rather than 2-6 weeks. Quantitative data from six participants with aphasia were based on pre-, post-, and follow-up standardized scores and analyzed with multivariate and univariate testing in addition to pairwise comparisons. Correlations between participant demographics and treatment outcomes were secondary aims. Although participants did not demonstrate significant changes from pre- to post-testing with the prescribed dosage, there were increases in estimated mean differences across the communication domains. There also was maintenance at follow-up across measures, and a general trend toward significance for functional communication. Future research with larger samples and additional qualitative assessments is recommended to capture the participants' and caregivers' perspectives more fully than quantitative assessments alone.

Key Words: Aphasia, Modified Intensive Comprehensive Aphasia Program, Follow-Up Testi

A Pilot Study on the Therapeutic Outcomes of a Modified Intensive Comprehensive Aphasia Program

Aphasia Defined

Aphasia is a prevalent neurogenic language disorder. Hallowell (2017) operationally defined aphasia with the four following criteria: (1) Aphasia is acquired; (2) it is neurologically caused; (3) it adversely affects both receptive and expressive language modalities; and (4) it is not the result of a sensory, motor, psychiatric, or intellectual disorder. Specifically, the first element suggests people with aphasia (PWA) previously learned language but have experienced a partial or substantial loss of their language skills – with *loss* conveying PWA commonly have problems accessing the linguistic representations of stored ideas or concepts. The second element indicates the neurological cause of aphasia is abrupt; common etiologies include stroke, traumatic brain injury, a neoplasm, or an infection. The third element to aphasia signifies listening, reading, speaking, and writing are impaired. The fourth and final element is exclusionary to prevent overlap with other diagnoses: Aphasia is not to be confused with speech disorders, a low or reduced intelligence quotient, or psychiatric disorders (e.g., schizophrenia).

Although the current operational definition of aphasia has evolved gradually to its conceptualization, it was not until research by McNeil and Pratt (2001) that a robust definition with adequate inclusionary and exclusionary criteria was proposed to the scientific community. In previous years, it was not uncommon for dementia and Alzheimer’s disease (AD) to be accepted as alternative explanations for aphasic symptoms in patients. Aware of the unclear delineation between progressive neurogenerative disease and aphasia, McNeil and Pratt (2001) proposed the following:

> Aphasia is a multimodality physiological inefficiency with verbal symbolic manipulations (e.g., association, storage, retrieval, and rule implementation). In isolated form it is caused by focal damage to cortical and/or subcortical structures of the hemisphere(s) dominant for such symbolic manipulations. It is affected by and affects other physiological information processes to the degree that they support, interact with, or are supported by the symbolic deficits (p. 906).

Noteworthy of this definition is McNeil and Pratt’s emphasis on the inefficiency or inaccessibility of the cognitive skills necessary to create language. Furthermore, they elucidated that aphasia is a *processing* disorder of language rather than a disorder of rule governance, linguistic representation, or linguistic knowledge. Similarly, Papathanasiou and Coppens (2017) recognized the evolving definition of aphasia and the need for an operational definition to capture its complexity. Unlike the previous researchers, they emphasized that aphasia affects not only the communication and social functioning of the individuals, but also the quality of their life, their relatives’, and their caregivers’.

With this operational definition of aphasia in mind, it is easier to appreciate the multidimensionality of this chronic communication disorder. However, public awareness of aphasia continues to be lower than that of other neurological conditions with similar or lower rates of incidence and prevalence, such as cerebral palsy, multiple sclerosis, Parkinson’s disease (PD), and muscular dystrophy (Berthier, 2005; Doogan, Dignam, Copland, & Leff, 2018; Elman, Ogar, & Elman, 2000).

Literature Review

The Prevalence and Incidence of Aphasia

Prevalence refers to the number of people who live with a diagnosis within a time frame and incidence is the number of new cases identified within a time frame. In terms of prevalence, one in 250 Americans have been diagnosed with aphasia – with cases more common among older adults than younger adults (Ellis & Urban, 2016). In terms of incidence, eighty thousand new patients with aphasia are added to the total aphasia population from stroke alone every year. Additionally, age has been documented to influence the likelihood of aphasia: 43% of individuals age 85 or older are diagnosed with aphasia after their first ischemic stroke, and 28% to 35% of all individuals acquire aphasia after their first stroke (Engelter et al., 2006; Rose, Cherney, & Worrall, 2013). Lastly, there appear to be significant differences in the incidence rate of aphasia between men and women: Women are more likely to acquire aphasia after a stroke than men due to age differences at the time of stroke onset, according to a recent meta-analysis by Wallentin (2018).

Because aphasia is a chronic condition often requiring life-long support, PWA have longer hospital stays than stroke survivors without aphasia, and consequently have higher healthcare-related costs (Papathansiou & Coppens, 2017; Rose et al., 2013). In acute hospital settings, dysphagia – or swallowing disorders – commonly takes priority over aphasia due to the urgency of treating dysphagia, typically insufficient staffing ratios, and/or a lack of therapy resources or space. Foster, O'Halloran, Rose, and Worrall (2014) wrote that current service provision to PWA in the acute hospital setting from their study was incompatible with best-practice guidelines and recommendations for aphasia treatment due to the emphasis on dysphagia treatment (Rose et al., 2013). Speech-language pathologists (SLPs) from the study's interviews expressed that speech-language pathology intervention was necessary for PWA and that the current standard of care was not yet sufficient to facilitate positive change for PWA and their families in an acute hospital setting. Limited therapeutic resources towards aphasia in the acute care setting prompts a need to consider chronic treatment options for PWA. From these concerns, it is imperative that this population receive adequate services for their language deficits in addition to swallowing therapy.

The Psychological Effects of Aphasia

The high prevalence and incidence of this neurogenic language disorder necessitates an examination into the several psychological effects of aphasia. The long-term outcomes of aphasia after stroke range from depression, social isolation, and poor quality of life for PWA. (Doogan et al., 2018; Papthansiou & Coppens, 2017). Approximately 70% of PWA experience depression, which is correlated with poorer functional recovery and increased mortality (Patterson, 2002; Worrall et al., 2016). As a significant barrier to communication, aphasia impairs social participation and well-being by undermining the identity of PWA and reducing self-confidence and self-efficacy (Bakheit et al., 2007; Ross, Winslow, & Marchant, 2006). The sequalae from aphasia include a reduction in the number of opportunities for everyday activities, communication partners, and social experiences. With these adverse psychological effects on well-being, there can be higher rates of anxiety and low self-esteem.

Although PWA live with the chronic communication disorder, family members and caregivers also experience negative side-effects (Draper et al., 2007). Caregivers, for example, report significant reductions in their general health. Stroke caregiver support, including education and training programs, has been shown to alleviate stress levels, but only temporarily. In addition, there is an undeniable need to address problems related to living with a life-long communication disability. The chronic nature of aphasia impacts individuals, families, and the healthcare system and calls for exploration of service delivery models (Rose, Cherney, & Worrall, 2013). Traditional and intensive therapy are two service delivery model options that will be discussed in a subsequent section of this literature review because both have significant implications on aphasia rehabilitation.

Having analyzed the psychological effects of aphasia, Ross and colleagues (2006) indicated that PWA tend to face depression that is either secondary or tertiary to their language disorder. The primary conclusion was a need for treatment service delivery models to facilitate communication in order to counter the negative psychological effects for this population. Likewise, Shehata and colleagues (2015) found that post-stroke anxiety is even more prevalent and persistent than post-stroke depression (PSD). Additionally, Kiran and Thompson (2019) explored the psychological relationship between post-stroke aphasia (PSA) and quality of life (QoL), reporting that PSA leads to greater negative outcomes for PSD than other common diseases, including PD, Alzheimer's disease, and cancer. These negative mental states play an important role on neuroplasticity, or the ability of the brain to rewire itself, because they can reduce motivation and positive interactions between the client and clinician.

There are various frameworks through which the psychological effects of aphasia can be viewed. One is the biopsychosocial framework, which emphasizes the complex interaction of several factors that affect health and constitute disabilities (Hallowell, 2017). These factors are based on the intricate relationships among genetics, etiologies, social supports, environmental factors, and the individual's motivation to participate actively in a variety of life contexts. The World Health Organization (WHO) developed the International Classification of Functioning, Disability, and Health (ICF) as a system that considers these factors beyond the traditional medical framework. By using the WHO-ICF model as an encompassing framework, healthcare professionals understand essential patient information not only about the body structure and the associated functions affected by aphasia, but also the activities and participation adversely impacted. It is preferable that aphasia is characterized with this biopsychosocial model because only then can the full impact of aphasia on the life context and daily participation of PWA be fully understood as SLPs assess, treat, research, educate, and advocate for this population.

The Role of Neuroplasticity on Aphasia Recovery

The brain is a dynamic organ capable of functional and structural change at the cellular level following stroke (Bhatnagar, 2013; Duffy, 2013). This ability of the brain to adapt and rewire itself across the life span in response to activation and stimulation during sensory, cognitive, and motor activities is known as neuroplasticity (Patterson & Cherney, 2007). It is these functional cerebral changes that underlie long-lasting responses as a result of training for individuals with or without aphasia (Mark, Taub, & Morris, 2006). More specifically, changes to the brain occur both physiologically and microscopically throughout life, causing a structural alternation of neurons and synaptic connections in patients with and without stroke (Thompson, 2019).

It is a common misconception that the brain is incapable of neuroplasticity after injury, especially once the patient has entered adulthood. A long-standing belief held in society was that consequences of a focal brain injury were generally regarded as permanent in adults (Mark et al., 2006). By this logic, overcoming a neurogenic language disorder such as aphasia was deemed impossible, and adults with chronic aphasia were thought not to benefit from repetitive practice. However, evidence points to new synaptic pathways created in response to acquired brain injury (Kiran & Thompson, 2019; Raymer et al., 2008). Luria (1972), for example, discussed in his research on injured World War II soldiers how the brain is capable of reorganization after injury through intersystemic facilitation and reorganization, or the strategy of improving an impaired system by pairing it with an intact system. Mark and colleagues (2006), as another example, affirmed in their research that the fully developed brain is not stagnant physiologically. Rather, neuroplasticity explains brain recovery from trauma and the overall positive outcomes of aphasia therapy in general. Practice changes the performance, brain function, and the brain structure of an individual, as evidenced by the increased volume of the hippocampus (Mark et al., 2006). This concept of neural reorganization in response to intensive treatment will be explored in the subsequent sections about ICAPs and aphasia treatment (Baliki, Babbitt, & Cherney, 2018).

Ultimately, the primary purpose of rehabilitation is to promote neuroplasticity, which leads to functional gains for patients. Neuroplasticity can be analyzed with four constructs related to aphasia treatment: Timing of treatment delivery, use-it-or-lose-it principle, generalization of treatment effects, and intensity of treatment (Raymer et al., 2008). For example, timing of treatment delivery can make a significant difference in treatment outcomes. Contrary to the previous understanding, participants who received aphasia treatment three months post-stroke experienced gains equivalent to groups that received treatment during the subacute phase of aphasia recovery, or the period immediately following the stroke before the 3-month mark (Wertz et al., 1986). However, notable gains in language abilities have also been found to be attainable even many years after aphasia onset (Kendall, Oelke, Brookshire, & Nadeau., 2015). Lastly, it is well known that the adult brain can be influenced by intensity of training (Kleim and Jones, 2008).

One concern about rehabilitation based on the neuroplasticity premise is that the learned skills may not be generalizable beyond the clinical setting. Raymer and colleagues (2008), for example, found that generalization of aphasia treatment effects to untrained language targets and behaviors were mixed. One predictor supporting generalization is whether the language behavior is related to the language behavior that receives attention. A notable example from treatment in naming deficits is that a focus on specific semantic categories increased generalization to untrained items from within the same category but not to untrained items from another category (Kiran & Thompson, 2003).

Related to generalization is the importance of an enriched environment in addition to salience of experience for maximal treatment effects (Hengst, Duff, & Jones, 2019). Greater functional outcomes and positive neuroplastic changes were found to be more probable when therapy included such environments and complex rather than simple tasks (Raymer et al., 2008). Examples of enriched environments are those with a diversity of stimuli that are both interesting and functional, and complex tasks are those that challenge clients beyond repetition of targets commonly seen in block trials. These complex tasks, or skilled behaviors, resulted in greater functional gains and more positive neuroplastic changes than repetitive tasks. Lastly, training that combines specific treatment with methods for increasing attention and motivation, including meaningful training stimuli and contexts with relevant functionality, influence neural recovery and generalizability (Kiran & Thompson, 2019). Depending on the individualized needs and goals of the patient, training based on meaningful stimuli, relevant functionality, complex stimuli, and an enriched environment can be combined with high-tech augmentative and alternative communication (AAC) to evoke changes in discourse for a variety of aphasia types and severity levels, as evidenced by functional magnetic resonance imaging (Dietz et al., 2018).

In addition to timing of delivery and generalization, repetition and intensity of treatment have also been researched. Whether the intensity of service delivery is provided intensively or traditionally, repetition is viewed as essential for the maintenance of cognitive changes and functional advantages (Raymer et al., 2008). Moreover, repetition is key for long-term and consistent skills to be maintained as a therapy gain. This research on the general benefits of repetition, however, was not specific to aphasia but rather to motor learning tasks, for which the distributed practice schedule was more beneficial than the massed practice schedule. For aphasia rehabilitation, there is strong agreement that intensive training (i.e. more than 20 hours per week) resulted in significant improvements in a standardized word-retrieval measure compared to the non-intensive training (or 3 hours per week) (Hinckley & Craig, 1998; Kiran & Thompson, 2019).

Although intensive training schedules have been documented to support language rehabilitation in PWA, the maintenance of the treatment effects have had mixed results due to limited data on intensive models and a lack of follow-up studies, with some studies promoting non-intensive treatment spaced over time as more beneficial for long-term maintenance in rehabilitated language (Raymer, Kohen, & Saffell, 2006; Sage, Snell, & Lambon Ralph, 2003). However, this type of treatment may be more appropriate in general for motor skills rather than language rehabilitation. Lastly, although there are significant differences in outcomes between pre- and post-testing in intensive models, large effect sizes appear to be more common among language impairment measures than participation measures (Babbitt, Worrall, & Cherney, 2015). It should be noted that participation measures, including a discourse analysis, generally require more complex language than impairment measures because the task difficulty has shifted beyond the word-, sentence-, and paragraph-level and into more natural, spontaneous elicitations based on visual or auditory stimulus during assessment.

Current Aphasia Treatment

Aphasia therapy has been widely acknowledged in the scientific community as valuable and effective, and empirical studies have supported it for several decades (Doogan et al., 2018; Raymer et al., 2008). A seminal meta-analysis based on 21 aphasia-treatment studies, for example, revealed that recovery was more likely with aphasia treatment than without it (Robey, 1998). During the acute stage, the average effect size of the treated participants was nearly twice as great as the recovery of the control group/untreated participants. When treatment began after the acute period, there was still improvement in the performance of the participants, but to a lesser degree with an average effect size of 1.68 in comparison to the untreated individuals. Likewise, Raymer and colleagues (2008) reported qualitative research reviews and a meta-analysis that concluded language intervention rather than no treatment facilitated recovery in adults with aphasia. Rose, Cherney, and Worrall (2013) published similar findings, citing the results of meta-analyses of single-subject and controlled trial studies in addition to qualitative reviews of a single-subject design. They, too, concluded that in general, aphasia therapy is effective.

Although evidence supporting aphasia therapy has been increasing, the research question as to *when* to begin aphasia therapy for maximal treatment has not been ascertained. On one hand, Robey (1998) found in his meta-analysis on 55 quasi-experimental aphasia treatment studies that treatment during the acute period resulted in an average effect size that was greater than treatment during the post-acute period. On the other hand, it should not be understated that benefits in the post-acute period are attainable for PWA even in the chronic stages. In these later stages of aphasia, treated individuals 7 to 12 months post-onset and beyond still experienced benefits (Babbitt, Worrall, & Cherney, 2015; Berthier, 2012). Given the positive treatment outcomes across aphasia stages, two service delivery options – distributed versus intensive therapy – should be considered so that SLPs can make more appropriate and effective clinical decisions about treatment candidacy on behalf of their clients.

Service Delivery Models

Few studies have been designed that compare intensive and distributed dosages of treatment directly (Hinckley & Carr, 2005). Dignam and colleagues (2015) elucidated that treatment intensity is a crucial concern for both efficient and effective aphasia rehabilitation, given that financial and personal investment are requisites for successful treatment outcomes. Research questions, however, as to which service delivery model – distributed therapy or intensive therapy – have circulated within the literature for years (Cherney, 2012). Broadly, Cepeda and colleagues (2006) explained that distributed practice is ideal for long-term learning in participants without brain injury or stroke and is accomplished through non-intensive or distributed training. In the context of motor learning, Maas and colleagues (2008) asserted that distributed practice over a long period improves retention and immediate performance, whereas the gains of massed practice dissipate quickly after training.

In terms of aphasia rehabilitation, Bhogal, Teasell, and Speechley (2003) explored MEDLINE literature reviews for clinical trials investigating aphasia therapy after stroke between the years of 1975 and 2002. Ten clinical trials consisting of 864 survivors of stroke with aphasia were used in their study. Contrary to the previous findings on general motor learning, Bhogal and colleagues (2003) found that less intensive therapy over a longer period did not result in significant outcomes, whereas more intensive speech and language therapy delivered in a short interval of time did lead to significant outcomes, a finding consistent with the meta-analysis by Robey (1998). Specifically, these researchers concluded a significant treatment effect that compared 8.8 hours of therapy per week for 11.2 weeks to a comparison group that provided approximately 2 hours per week for a total of 22.9 weeks. Despite this finding supporting intensive therapy, this study was limited: Many of the included studies were underpowered with small sample sizes, and differences in the total number of hours for the intensive and non-intensive treatment groups were not controlled (Doogan et al., 2018).

Cherney, Patterson, Raymer, Frymark, and Schooling (2008) conducted a systematic review that summarized evidence on treatment intensity based on constraint-induced language therapy. Their study focused on measures of language impairment as well as communication activity and participation for PWA. Although they found that increased treatment intensity was correlated with large effect sizes and positive changes in language impairment outcomes for 68 individuals with acute and chronic aphasia, the authors encountered mixed results for communication activity and participation. Furthermore, they regarded their conclusions as only preliminary due to the scarcity of studies that directly addressed the treatment intensity in addition to the lack of follow-up studies on the maintenance of treatment intensity effects.

One general concern with intensive therapy, however, is the high attrition rate (Babbitt, Worrall, & Cherney, 2016; Dignam et al., 2015). For clarification, the high attrition rate suggests that more participants ended the rigorous treatment schedule than the participants who attended the distributed therapy schedule. The decrease or inconsistent attendance appears to be a problematic theme for intensive therapy in PWA likely due to the commitment required with this service delivery model. Brady and colleagues (2012), for example, reported this confounding variable with intensive therapy, concluding from their study there was not yet adequate support to argue that one speech language therapy service delivery model was definitively more beneficial than another.

While acknowledging that intensive speech-language therapy has been associated with significant improvements, Cherney (2012) noted the lack of a standard definition for treatment intensity and thus cautioned against the notion that additional therapy should always be recommended. Dosage, defined as the total amount of therapy measured in contact hours, has not been controlled in most studies comparing different levels of aphasia treatment intensity, and it is commonly confounded with intensity (Doogan et al., 2018). An underlying problem with the conventional definition of dosage is that the number of stimuli presented to research participants is unknown and varies depending on the clinician's expertise and the participants' individualized goals. Dignam and colleagues (2015), aware of the gap in the literature, controlled for dosage at the contact-hour level but encountered mixed results between intensive and distributed schedules. Specifically, they found that the distributed schedule resulted in significantly superior clinical outcomes on naming performance at post-therapy and at the 1-month follow-up, as measured for language impairment with the Boston Naming Test (BNT; Goodglass, Kaplan, Weintraub, & Segal, 2001) for assessing word-retrieval abilities. However, they also reported positive effects on their participants' communication-related QoL and functional communication with both treatment intensities. Measures from this study included the following: Communicative Effectiveness Index (CETI; Lomas et al., 1989) as a proxy-rated measure of functional communication, the Communication Confidence Rating Scale for Aphasia (CCRSA; Babbitt & Cherney, 2010), and the Assessment of Living with Aphasia (ALA-21; Kagan et al., 2010) as self-report measures of the participants' communication confidence and communication-related QoL. Ultimately, Dignam and colleagues (2015) acknowledged that no matter the intensity of treatment, the participants experienced benefits for both functional communication and QoL related to communication at post-therapy and the 1-month follow-up.

In addition, Babbitt and colleagues (2015) demonstrated in their research that the intensive service delivery model resulted in large effect sizes on language impairments and moderate effect sizes in three of their four participation measures. This recent study was based on a specific service delivery model known an Intensive Comprehensive Aphasia Program (ICAP) (Coppens & Patterson, 2017). Hula, Cherney, and Worrall (2013) observed that ICAP research has been minimal and thus should be examined more closely for a richer understanding of its effectiveness on behalf of the participants, their families, the clinicians, and third-party payers.

Intensive Comprehensive Aphasia Programs

Rose, Cherney, and Worrall (2013) in addition to Winans-Mitrik and colleagues (2014) define ICAPs as a service delivery option that optimizes rehabilitation through the following criteria: (1) ICAPs provide an intensive dosage of treatment of at least 3 hours per day over 2 or more weeks (30-hour minimum); (2) use diverse, comprehensive approaches and formats to treatment, including group and individual therapy as well as technology (e.g., computers and apps); (3) target not only the impairment but also the activity/participation levels of language and communication functioning; (4) include patient and/or family education; and (5) have a clear start and end date for the cohort of participants who begin and end the program at the same time. Based on several principles of neuroplasticity associated with rehabilitation intensity, the primary objective of an ICAP is to maximize communication potential with a focus on increasing life participation for PWA (Kleim & Jones, 2008). In terms of quantitative information, to meet the prescribed definition, ICAPs must provide a total of 30 treatment hours over 2 weeks (15 hour per week) and some ICAPs offer up to 150 hours over 4 weeks (37.5 hours per week) (Babbitt, Worrall, & Cherney, 2016).

Programs based on single treatments and programs supported by aphasia centers are not the same as ICAPs. Generally, ICAPs are provided by large urban hospitals or university clinics to PWA, and they have been steadily growing internationally (Babbitt et al., 2016; Rodriguez et al., 2013; Winans-Mitrik et al., 2014). Before 2013, the intensive model was an uncommon service delivery choice, but every year new programs are being established including those with modifications to the definition (Rose et al., 2013). Modified ICAPS, or M-ICAPs, include all features of the original ICAP, but they are altered in one central feature such as treatment intensity. For example, the difference can be that the minimum overall amount of therapy lasts 3 rather than 2 weeks. Alternatively, the difference can be that the family education may not be emphasized while individual and group therapy with technology receive the most attention.

Despite the clarity of the ICAP definition, there remains wide variability in the intensive approaches that SLPs adopt in these programs. Rose and colleagues (2013), for example, acknowledged that they were unable to obtain precise descriptions of the treatment approaches and interventions within the ICAPs in their international survey. Some SLPs may focus most of the therapy on language impairment, such as word retrieval; on communication activity, such as topic initiation and maintenance; on personal factors, such as how the client identifies him- or herself post-stroke with the aphasia; or on environmental factors, such as accessibility to sources of written information (Rose et al., 2013). Even with this variability in treatment approaches for the ICAPs, there are commonalties that have been documented in the international survey by Rose and colleagues. They are as follows: (1) Most ICAPs are provided by university programs funded through self-pay; and (2) ICAPs place focus on treatment goals and evidence-based practices, with special attention on neuroplasticity principles such as repetition and treatment intensity.

In accordance with Bhogal's findings (2002) on intensive service delivery, Babbitt and colleagues (2015) found from their ICAP that outcomes have generally been positive. Particularly, for their ICAP participants, the largest effect sizes were evident in language impairment measures, in addition to CETI, which was their participation measure that also demonstrated large effect size. Similarly, in her aphasia research on the domains of language impairment, functional communication, and communication-related quality of life, Rodriguez and colleagues (2013) found positive outcomes across the ICF domains as a result of their research-based ICAP. Additionally, in their ICAP research based on group treatment, Hoover, Caplan, Waters, and Carney (2017) reported significant changes in language impairment, functional communication, and quality of life measures for their group of twenty-seven individuals with chronic aphasia. Lastly, Babbitt and colleagues (2015) concluded from their sample of seventy-four participants that their ICAP had a significant effect not only on language impairment but also on the participation of PWA, as demonstrated by their measures from pre- to post-treatment, Large effect sizes were demonstrated on the WAB-R Aphasia Quotient (AQ), Language Quotient (LQ), and Cognitive Quotient (CQ), and a moderate effect size on the BNT. In addition, the family-reported effect size was large on the CETI and moderate for participant-reported CETI, CCRSA, and the American Speech-Language Hearing Association Quality of Communicative Life (ASHA-QCL; Paul et al., 2005).

A current challenge with ICAPs and the definition of treatment delivery models is the difficulty of making comparisons across studies (Babbitt, Worrall, & Cherney, 2016). This problem has resulted from the high degree of variation in methodologies, treatment types, outcomes, and treatment intensity leading to uncertainty as to the optimum treatment intensity (Dignam et al., 2015). Hinckley and Carr (2005) noted that although positive outcomes from intensive therapy had been reported in previous studies, the treatment was not detailed adequately, and thus replication of the research design was not feasible. Further, the intensity of treatment in the seven ICAPs investigated by Babbitt and colleagues (2016) ranged significantly, with some as few as 16 hours and others as much as 30 hours. To resolve the unequal comparisons between treatment intensities, a measure known as the Therapeutic Intensity Ratio (TIR) was developed by Babbitt and colleagues (2015). It is defined as the total number of therapy hours in a treatment program divided by the total number of possible treatment hours. Therefore, a calculation based on TIR can be applied to M-ICAPs to ensure fair comparisons of the treatment intensity between traditional ICAPS and M-ICAPS.

Treatment Candidacy

Aphasia characteristics and responsiveness to treatment vary considerably across individuals. Some individuals are more likely to respond to treatment, whereas others are not (Persad, Wozniak, & Kostopoulos, 2013). Research on treatment response has shown that the most predictive indicator of long-term recovery is initial aphasia severity, along with lesion site and size (Plowman, Hentz, & Ellis, 2012). Other predictors of long-term recovery include age, gender, level of education, and other comorbidities (Laska et al., 2001; Payabvash et al., 2010; Pedersen, Vinter & Olsen, 2004). On one hand, Babbitt, Worrall, and Cherney (2016) found that responders to intensive therapy tended to be younger and were close to a year and a half post onset. On the other hand, factors that negatively affect improvement include post stroke depression and social isolation after onset of aphasia (Berg et al., 2003; Hilari & Northcott, 2006; Vickers, 2010).

Treatment candidacy should be a consideration for all prospective clients, given the potential for high costs to provide ICAPs or traditional services, the extensive time commitment from both the individuals with aphasia and their family's participation, and the few intensive programs available. Similarly, recent research on cost-effectiveness of the traditional service delivery model has demonstrated that for every 1% increase in the outcome of interest, the cost was \$9.54 – with statistically significant improvements ending by the 17th treatment session (Ellis, Lindrooth, & Horner, 2014). The average direct cost to the participants in the study was expensive at \$412.15 (i.e., 11.6 total aphasia treatment sessions, \$35.53 per session, for significant gains).

Questions about aphasia treatment candidacy apply not only to intensive service delivery but also to traditional service delivery. For years, it was unknown who would benefit most from participation in ICAPs since recovery has proven to be a multifaceted process influenced by a variety of confounding variables (i.e. lesion size and location; aphasia type and severity) (Babbitt, Worrall, & Cherney, 2016). Whereas Lazar and Antoniello (2008) maintained the variables of age, gender, education, handedness, and initial severity do not appear to be predictors of aphasia recovery, other authors found that the lesion size and location might be influential – in addition to health status, motivation, family support systems, and personal beliefs (Plowman et al., 2012). Babbitt and colleagues (2016) found intensive therapy responders were significantly younger with a longer time post-onset (TPO) than the non-responders, whereas aphasia type, severity, naming, nonverbal cognitive measure, gender, and communication confidence were not significantly different for one of their ICAP sessions. These results were based on changes in point score on the Western Aphasia Battery-Revised (WAB-R; Kertesz, 2007), however, the average ages of the two groups (i.e. 52 and 60 years) were both relatively young for patients with stroke and aphasia. Babbitt and colleagues concluded that age was a predictor of treatment response, while acknowledging the need to consider several other variables that can influence recovery.

Similarly, Rose, Cherney, and Worrall (2013) discovered that PWA in the chronic phase can benefit from aphasia therapy. This finding suggested that those who had lived with aphasia for years stood to benefit from language therapy even after the window of recovery had seemingly passed already. Likewise, Persad and colleagues (2013) acknowledged the positive outcomes from intensive aphasia therapy but recognized the need to identify the characteristics of the ICAP participants. From their research on six ICAPs, they suggested that adults of all ages with aphasia, whether in the acute or the chronic stage, can improve in both their language skills and functional communication when provided intensive treatment. Furthermore, in contrast to Plowman and colleagues' findings on initial severity and its effect on recovery, Persad and colleagues' data indicated severity was not a predictor for improvement (2013). Moreover, using the Communication Activities of Daily Living – 2 (CADL-2; Holland, Frattali, & Fromm, 1999) as their measure, they concluded that changes in functional outcome did not appear to be correlated with TPO. This finding was consistent with that of Rose and colleagues (2013).

Given the status quo of mixed results for predictor variables and variable treatment intensities and dosages, it is imperative to continue researching this conundrum. Future studies will benefit from more clearly defined ICAPs, larger sample sizes, and more diverse demographics. Information about ICAP participants who vary in terms of aphasia severity/type, TPO, age, gender, and education can inform essential research questions about the scope of treatment candidacy. Moreover, given the scarcity of follow-up studies on ICAP participants' maintenance, additional research is needed to determine whether intensive intervention has long-lasting benefits on the language impairment, functional communication, quality of life, and communication confidence of participants.

The study will be the first on the efficacy of a clearly described M-ICAP across multiple variables. The primary ICAP modification in this study is delivering the minimum intensive dose of 30 hours of treatment over a 1-week period instead of the 2-6 weeks interval currently reported in the literature. This study will address the current gaps in the literature by including essential follow-up data and will provide initial data about whether participation in a M-ICAP as a new service delivery model is correlated with immediate and sustained benefits for PWA. The potential benefits of modified programs include reduced personal and financial costs and participant fatigue, and the abbreviated time commitment may reduce the high attrition rate associated with traditional ICAPs. The primary aim of this study is the following:

Primary Hypotheses of Study

H_0: There is no difference in language impairment, functional communication, or communication confidence following participation in a modified ICAP measured across three data points (pre-, post-, and follow-up testing).

H_1: There is a significant difference in language impairment, functional communication confidence, or communication confidence following participation in a modified ICAP measured across three data points (pre-, post-, and follow-up testing).

Methods

Experimental Development and Design

This study was a retrospective, within-subject cohort design. The Meridian Intensive Aphasia Program (MIAP) is a modified intensive comprehensive aphasia program, lasting one instead of two weeks and totaling 1080 minutes of treatment with a TIR of 75%, calculated from the total number of therapy hours divided by the total number of possible treatment hours (Babbitt et al., 2015.) Treatment was provided by graduate student clinicians under the supervision of licensed speech-language pathologists and consisted of a variety of evidence-based therapy approaches individualized to the client, individual and group therapy, and restorative and compensatory strategy training and practice. Multiple individual therapy sessions lasting 50 to 75 minutes each were provided daily after the first day; additionally, 1 to 2 group therapy sessions were included daily.

By the ICAP definition, the focus of treatment addressed all levels of the WHO-ICF, including the participants' impairment, activity limitations, and participation restrictions, as well as impairment-based and functional communication goals with compensatory strategies. Home exercise programs were created and provided to all participants in an attempt to improve carryover and generalization of skills targeted in therapy. Participants were initially assessed with an abbreviated battery of standardized tests, ranging from measures on functional communication (CADL-2), to impairment-based measures (BNT and the Comprehensive Aphasia Test; CAT; Swinburn, Porter, & Howard, 2004), and to communication confidence (CCRSA). Graduate students assessed the client on the first day and began treatment the following day.

Participants

Participants were diagnosed with aphasia via a previous speech-language pathologist and/or physician. Inclusion criteria for the proposed study included: More than 18 years of age, native English speakers, normal or corrected-to-normal vision and hearing, discharged from acute care services, a T-score above the cutoff for impairment on the CAT cognitive screening, and no outside therapy during MIAP. Exclusion criteria were as follows: Less than 18 years of age, uncorrected vision/hearing acuity, a current medical diagnosis of a neurodegenerative disease, current substance or alcohol abuse, and a T-score that fell below the cutoff for impairment on the CAT cognitive screening.

Recruitment

Participants were recruited at the Idaho State University Speech Language Clinic (ISU SLC) and area hospitals via IRB-approved flyers. Participants were assigned to one of two groups based on schedule preference (i.e., week 1 or week 2). In total, ten individuals participated in this study. Participants were paired with a graduate student from the 2019 online ISU speech-language pathology graduate student cohort. Although participants with other acquired neurogenic disorders could participate in MIAP, this study focused on participants with a diagnosis of aphasia.

Schedule and Procedures

Informed consent procedures. All participants completed the ISU Clinic Intake Protocol, which consisted of an information sheet, a consent to receive treatment, and authorization to release PHI. Furthermore, the informed consent form was approved by the ISU's Institutional Review Board and reviewed for every prospective participant. During and after the process of the informed consent review, the participants and their family member or communication support person (if applicable) were asked whether they had any concerns or questions about their involvement with MIAP. In the presence of the student clinician and the student's clinical supervisor, each participant confirmed and signed the consent form.

Risks. Fatigue was a potential risk factor for participants due to the intensive schedule of MIAP. All clinical supervisors provided at least 25% supervision and monitored for fatigue, given they were trained to recognize the signs and intervene as needed. There was also a risk of breach in confidentiality. Procedures of the ISU SLC were applied to prevent a breach of either the Video Audio Learning Tool (VALT) recordings or the physical copies of deidentified recording forms stored in a locked filing cabinet found in the research lab of the thesis advisor. Only student clinicians who had completed the Health Insurance Portability and Accountability Act and Collaborative Institutional Training Initiative trainings had access to the recordings and research lab.

Program schedule. Both weeks of MIAP included distinct sets of student-client pairs. On Monday, participants attended only half the day, including a large group orientation led by the clinical supervisors that was followed by individual assessment sessions. From Tuesday through Thursday, participants received a variety of 50- to 75-minute sessions, consisting of individual and group therapy. On Friday, there was a final set of individual and group therapy sessions in addition to post-test assessment (see Appendix A for MIAP schedule). In total, MIAP participants received approximately 30 treatment hours over the five days.

Diagnostics. The assessment sessions lasted approximately 75 minutes, consisting of screening procedures and the following assessment battery of standardized tests the BNT, CADL-2, and CCRSA, in addition to nine subtests from the Comprehensive Aphasia Test (CAT; Swinburn et al., 2004). The CAT subtests were as follows: Naming objects, naming actions, spoken words, written words, spoken sentences, written sentences, spoken paragraph comprehension, repetition of words, and repetition of complex words (see Table 1 below).

Table 1

Assessment Battery

Standardized Tests	Communication Domains
Boston Naming Test (BNT)[a]	Language Impairment
Comprehensive Aphasia Test (CAT)[b]	Language Impairment
• Naming Objects	
• Naming Actions	
• Spoken Words	
• Written Words	
• Spoken Sentences	
• Written Sentences	
• Spoken Paragraphs	
• Repetition of Words	
• Repetition of Complex Words	
Communication Activities of Daily Living (CADL-2)[c]	Functional Communication
Communication Confidence Rating Scale for Aphasia (CCRSA)[d]	Communication Confidence

[a] Boston Naming Test (BNT; Goodglass, Kaplan, Weintraub, & Segal, 2001)
[b] Comprehensive Aphasia Test (CAT; Swinburn, Porter, & Howard, 2004))
[c] (CADL-2; Holland, Frattali, & Fromm, 1999)
[d] Communication Confidence Rating Scale for Aphasia (CCRSA; Babbitt & Cherney, 2010)

The purpose of the assessments was to determine the participants' aphasia profile, including the extent of their word-finding deficits, level of communication confidence, perception of the impact aphasia has on life participation, and functional communication. The post-test and follow-up testing consisted of the same assessment battery. The post-test was administered on the last day of treatment; the follow-up testing was administered 10 to 12 weeks after the post-test.

The MIAP participants were assessed twice (pre- and post-testing) throughout the 1-week M-ICAP and once 10 to 12 weeks afterwards (follow-up testing) regarding their language impairment, functional communication, and communication confidence. The participants' language impairment was assessed with the CAT, a standardized assessment known to have good validity and reliability as a clinical and comprehensive measure for diagnosing aphasia (Howard, Swinburn, & Porter, 2010). To measure word-finding ability, the BNT was administered and has been commonly selected among researchers as a standardized assessment for tracking progress and treatment outcomes focused on language impairment (Babbitt, Worrall, & Cherney, 2015; Dignam, Rodriguez, & Copland, 2015, Hinckley & Craig, 1998; Rodriguez et al., 2013). Functional communication and communication confidence were similarly assessed but with the CADL-2 and CCRSA, respectively.

Individual treatment sessions. Lasting between 50 and 75 minutes, individual treatment sessions were based on evidence-based therapy approaches, including but not limited to Semantic Feature Analysis (SFA; Boyle & Coelho, 1995) and Verb Network Strengthening Treatment (VNeST; Edmonds, Nadeau, & Kiran, 2009). These two evidence-based therapy approaches are examples of word-finding and sentence formulation treatments, respectively; however, other techniques for such domains as syntax, reading, and partner approaches could be implemented if clinically judged to be appropriate for the participants' unique needs and goals. Although the hours of individual treatment session varied depending on the schedule, the total number by the end of the week equated to a TIR of 75% and was consistent with dosages from previous research (Babbitt et al., 2015) on ICAPs. All individual treatment sessions addressed goals based on language impairment and functional communication. Given the clients' unique clinical profile, TPO, and subtype of aphasia, various treatment techniques were incorporated by the student clinicians and guided the individualized treatment plans. Furthermore, all sessions were recorded with VALT as part of supervision and data tracking.

Group treatment sessions. The group treatment sessions served as practical opportunities for participants to implement the skills recently learned and developed from the individual sessions. Student clinicians alternated in leading either a 50- or a 75- minute group session under the guidance of a clinical supervisor to facilitate the participants' generalization of skills in a social context. Although the amount of turn-taking and topic-initiation was not controlled on an individual level, participants shared similar experiences at the group level during clinician-led sessions and lunch at the clinic site.

Social support. The purpose of MIAP was to provide intensive therapy targeting language impairment, functional communication, communication confidence, and life participation in addition to a range of social opportunities wherein PWA were supported by communication specialists and interacted with others with the same or similar diagnosis. Although there was variability in the amount of family involvement and interest depending on the participants' circumstances, the participants' friends and family members were encouraged to attend and participate in both the individual and group therapy. In addition, during some of the group therapy sessions, counseling and education about the following topics were provided to participants, family members, and friends: stroke prevention, living with aphasia, and aphasia advocacy.

Data Analysis

The dependent variables in this study were the initial change and maintenance of scores on the standardized assessments, whereas the independent variable was MIAP participation. A multivariate analysis of variance, or MANOVA, was determined to be the most appropriate as a multivariate test to conduct for statistical significance and effect size, given the multiple dependent variables, the single independent variable, and the MANOVA assumptions that could be satisfied. Mauchly's Test of Sphericity was used to analyze whether the variance within the cohort of participants was within normal limits. Univariate testing and pairwise comparisons were additional statistical tests for the exploratory nature of this pilot study, given the paucity of research on follow-up studies and M-ICAPs, no matter the MANOVA significance. Pearson product-moment correlational analysis was used as a measure for the potential significant correlations between participant demographics (months post-onset, age, education level) and language impairment, functional communication, and communication confidence. Clinical significance was based on standard error of measurement and on prior literature for each assessment (e.g., Elman et al., 1999). Effect sizes based on partial eta squared were calculated to determine the magnitude of the effects. Prior ICAP studies have documented small to large effect sizes depending on the specific measure. To compare the MIAP intensity to that of traditional ICAPs, TIR by Babbitt and colleagues (2015) was calculated by dividing the number of MIAP therapy hours (30) by the total number of possible treatment hours (40). The projected TIR for MIAP was 0.75, or 75%.

Expected Outcomes

It is expected that MIAP participants will improve on all language impairment and participation measures by the time of post-testing and follow-up testing. This expectation is supported by a retrospective, within-group ICAP study by Babbitt, Worrall, and Cherney (2015); a retrospective, within-group, ICAP research with follow-up data by Winans-Mitrik and colleagues (2014); the dosage-controlled study by Dignam and colleagues (2015); and the overall benefits of aphasia treatment as researched in the meta-analysis by Robey (1998).

Specifically, Babbitt and colleagues (2015) reported that treatment outcomes from clinical ICAPs have typically been positive, showing benefits on both language impairments and patient-reported measures (2016). Specifically, with a TIR of 75% in their retrospective ICAP study, Babbitt and colleagues reported significant changes for their 74 participants at post-testing in all impairment and participation measures, and a medium effect size on the BNT and CCRSA (2015). Likewise, Winans-Mitrik and colleagues (2014) demonstrated improvement on all impairment and participation measures for their 73 ICAP participants. Note that the data were collapsed across several ICAP cohorts in these two studies. Digman and colleagues (2015) also showed in their research based on multiple cohorts pooled for analysis that intensive schedules can result in significant improvements on language impairment, as measured by the BNT; functional communication, as measured by the CETI; communication confidence, as measured by CCRSA; and communication-related quality of life, as measured by the ALA-21 at post-testing and follow-up testing.

Other study outcomes are also possible. For example, depending on the participant's experience, his or her scores on the self-reported CCRSA may increase, decrease, or remain constant throughout the proposed study. Participants may feel more confident in their communication by the fifth day of treatment than on the first day, but there also may be a decrease in this confidence and outlook by the time of follow-up testing due to internal and external factors. An example of an internal factor is the spotlight effect, a psychological phenomenon in which individuals overestimate the degree to which their highs and lows are observed (Gilovich, Kruger, & Medvec, 2002). Participants may feel more self-conscious during MIAP and thus less confident because of the attention placed on their impairment. On the other hand, this effect may be minimized because of the MIAP group sessions, the positive social aspects, and the genuine acceptance conveyed by the supervisors and graduate student clinicians to each participant.

Lastly, it is possible that participants begin MIAP with expectations that are unrealistic. Consequently, there may be a decrease in their communication confidence and outlook on life. Some participants also may not report a change in communication confidence because their communication needs may not be adequately met during treatment and there may be a lack of follow through with the individualized home exercise programs. Similarly, scores may not change for language impairment and functional communication. This is a potential outcome to consider given that the significant findings from previous research were based on ICAPs lasting two weeks or more weeks rather than one (Babbitt et al., 2015, 2016; Persad et al., 2013; Rose et al., 2013; Winans-Mitrik et al., 2014). A reason for this outcome could be that individuals may be more likely to respond to treatment with a schedule spread over two or more weeks because of the distributed practice effect (Cepeda et al., 2006).

In terms of individual participant characteristics, it is expected that gender will not be strongly correlated with significant treatment outcomes at post-testing and follow-up. This expectation about gender is informed by previous retrospective research by Persad and colleagues (2013) which explored two ICAPs. These authors published similar findings assessing language impairment and functional communication in the context of gender and other participant-related variables. Similarly, the level of education of the participants is not expected to be strongly correlated with treatment outcomes. This expectation is supported by ICAP research by Lazar and Antoniello (2008), who found that education does not appear to be a significant predictor variable for aphasia recovery. This suggests that participants from all levels of education may benefit from ICAP participation.

Regarding the age of the participants, responders to treatment are expected to be younger than non-responders. Although this expectation is not consistent with Lazar and Antonellio (2008), it does align with the logistic regression analysis of ICAP factors researched by Babbitt, Worrall, and Cherney (2016). From their analysis on 83 first-time ICAP participants, they found that age was a predictive factor that contributed to the participants' response to treatment.

As for aphasia-related demographics, time post-onset (TPO) is expected to be strongly correlated with treatment outcomes, particularly functional communication, or the CADL-2. This expectation is consistent with research by Babbitt, Worrall, and Cherney (2015; 2016). They found in their research on 83 first-time participants that responders had a longer TPO determined by independent-samples *t* tests (2016). Maintenance of communication confidence, language impairment, and functional communication measurements are also expected in accordance with follow-up research by Winans-Mitrik and colleagues (2014).

Results

Participants

Ten individuals participated in this pilot study; however, data from four participants (P7 - P10) were incomplete and thus were excluded from a large portion of the analysis. In all, six individuals (P1 – P6; 3 males, 3 females) participated. All participants had a medical diagnosis of aphasia as part of the inclusion criteria, and their ages ranged from 33 to 78 years with a mean of 53.3 years. The post-onset ranged from 6 to 119 months with a mean of 41.7 months, and participants were mainly Caucasian. Lastly, their level of education varied between completion of high school to a bachelor's degree (see Table 2 below).

Table 2

Participant Demographics

Participant	Age	Post Onset (in months)	Education Level (in years)	Gender
P1	62	32	High school	F
P2	33	6	College degree	F
P3	78	78	High school	M
P4	44	6	High school	M
P5	39	9	High school	F
P6	64	119	Bachelor's degree	M
P7	61	28	Bachelor's degree	F
P8	67	37	High School	F
P9	79	6	High School	M
P10	58	56	High School	M

Descriptive Statistics

The average responses from the BNT, CADL-3, CCRSA, and the CAT subtests (i.e., naming objects, naming actions, spoken words, written words, spoken sentences, written sentences, spoken paragraphs, repetition of words, and repetition of complex words) were calculated from six participants with complete datasets at the three points (pre-MIAP, post-MIAP, and follow up). Standard deviations, ranges, standard error of measurement, and maximum scores of each standardized test are provided in the following tables. The descriptive statistics below are organized by language impairment, functional communication, and communication confidence, respectively.

Table 3

Descriptive Statistics Based on Language Impairment (BNT)

	N	Mean	SD	Range	SD Error	Max Score
BNT PRE-MIAP	6	8.67	3.141	3 - 12	1.282	15
BNT POST-MIAP	6	10.50	2.429	7 - 13	0.992	15
BNT FOLLOW UP	6	10.00	4.290	2 - 14	1.751	15

Table 4

Descriptive Statistics Based on Language Impairment (CAT)

	N	Mean	SD	Range	SD Error	Max Score
CAT Naming Objects PRE-MIAP	6	36.50	9.607	18 - 46	3.922	48
CAT Naming Objects POST-MIAP	6	37.50	9.160	19 - 43	3.739	48
CAT Naming Objects FOLLOW UP	6	36.00	12.681	13 - 46	5.177	48
CAT Naming Actions PRE-MIAP	6	6.17	2.483	3 - 8	1.014	10
CAT Naming Actions POST-MIAP	6	5.67	1.366	3 - 7	0.558	10
CAT Naming Actions FOLLOW UP	6	5.67	1.751	3 - 8	0.715	10
CAT Spoken Words PRE-MIAP	6	27.33	2.658	22 - 29	1.085	30
CAT Spoken Words POST-MIAP	6	27.33	3.327	21 - 30	1.358	30
CAT Spoken Words FOLLOW UP	6	27.83	3.710	21 - 30	1.515	30
CAT Written Words PRE-MIAP	6	27.83	3.430	21 - 30	1.400	30

CAT Written Words POST-MIAP	6	27.33	2.944	22 - 30	1.202	30
CAT Written Words FOLLOW UP	6	28.17	2.714	23 - 30	1.108	30
CAT Spoken Sentences PRE-MIAP	6	20.67	4.719	14 - 28	1.926	32
CAT Spoken Sentences POST-MIAP	6	24.00	4.336	17 - 30	1.770	32
CAT Spoken Sentences FOLLOW UP	6	22.17	6.706	14 - 30	2.738	32
CAT Written Sentences PRE-MIAP	6	19.33	6.022	9 - 27	2.459	32
CAT Written Sentences POST-MIAP	6	20.83	5.707	11 - 28	2.330	32
CAT Written Sentences FOLLOW UP	6	23.17	2.994	19 - 27	1.222	32
CAT Spoken Paragraph PRE-MIAP	6	3.17	0.983	2 - 4	0.401	4
CAT Spoken Paragraph POST-MIAP	6	3.33	0.816	2 - 4	0.333	4
CAT Spoken Paragraph FOLLOW UP	6	3.17	0.753	2 - 4	0.307	4
CAT Repetition of Words PRE-MIAP	6	28.67	3.011	25 - 32	1.229	32
CAT Repetition of Words POST-MIAP	6	28.17	2.041	25 -31	0.833	32
CAT Repetition of Words FOLLOW UP	6	23.67	8.571	9 - 32	3.499	32
CAT Repetition of Complex Words PRE-MIAP	6	2.83	1.169	1 - 4	0.477	6
CAT Repetition of Complex Words POST-MIAP	6	4.00	1.095	3 - 6	0.447	6
CAT Repetition of Complex Words FOLLOW UP	6	3.67	1.862	2 - 6	0.760	6

Table 5

Descriptive Statistics Based on Functional Communication (CADL-3)

	N	Mean	SD Deviation	Range	SD Error	Max Score
CADL-3 PRE-MIAP	6	87.17	7.548	74 - 95	3.081	100
CADL-3 POST-MIAP	6	90.67	7.174	77 - 97	2.929	100
CADL-3 FOLLOW UP	6	90.17	9.196	72 - 97	3.754	100

Table 6

Descriptive Statistics Based on Communication Confidence (CCRSA)

	N	Mean	SD Deviation	Range	SD Error	Max Score
CCRSA PRE-MIAP	6	62.33	17.084	33 – 80	6.975	100
CCRSA POST-MIAP	6	70.33	24.728	38 – 97	10.095	100
CCRSA FOLLOW UP	6	65.33	16.403	47 – 88	6.697	100

For a graphical representation, see Appendixes B through M (or Figures 1 through 12) for the estimated marginal means based on the standardized test scores of the six participants at pre-, post-, and follow-up testing. Estimated marginal means convey the mean response for each factor and are identical to the values from the descriptive statistics.

Correlations

Prior to analyzing the data with the one-way MANOVA, a Pearson product-moment correlational analysis was conducted between the BNT, CADL-3, CCRSA, and CAT subtests to test the assumption that moderate correlations – defined as a Pearson product-moment within the range of 0.20 through 0.60 (Meyers, Gampst, & Guarino, 2006) – existed among these variables and that the dependent variables were not too correlated with each other (e.g., $r = 0.90$). Several dependent variables were moderately correlated. For example, the BNT follow-up and the CCRSA pre-test were moderately correlated ($r = 0.228$, $p < 0.526$), showing that the MANOVA analysis was an appropriate test to perform (see Appendix N).

In terms of the participants' demographics and their performance on the standardized measures, there were several significant correlations found from this study. The first significant correlation was a moderate positive linear relationship between months post-onset and the CAT spoken paragraph score at pre-testing for all ten participants (P1-P10, Pearson coefficient = 0.665, $p = 0.036$). This relationship suggested that the greater the months post-onset, the greater the spoken paragraph score at the beginning of MIAP (see Table 7 below).

Table 7

Significant Correlations between Months Post-Onset and Spoken Paragraphs

		CAT Spoken Paragraphs
		Pre-Test
Months Post-Onset	Pearson Correlation	0.665^{*}
	Sig (2-tailed)	0.036
	N	10

The other significant correlations were based on the age of the participants and the CAT spoken word subtest with all ten participants (P1-P10) whose data were available for analysis at all three data points. First, a moderate negative linear relationship existed between age and the spoken word subtest score at pre-testing (Pearson coefficient = -0.687, p = 0.028). A strong negative linear relationship existed between age and spoken words at the time of post-testing (Pearson coefficient = -0.820, p = 0.004). Similarly, an additional strong negative linear relationship existed between age and spoken words at follow-up testing (Pearson coefficient = -0.805, p = 0.005). This inverse relationship suggests that the greater the age of the participants, the lower their score on spoken words as measured with the CAT (see Table 8 below).

Table 8

Significant Correlations between Age and CAT Spoken Words

		CAT Spoken Words		
		Pre-Test	Post-Test	Follow-up Test
Age	Pearson Correlation	-0.687^{*}	-0.820^{**}	-0.805^{**}
	Sig (2-tailed)	0.028	0.004	0.005

	N	10	10	10

Not only were significant correlations evident between age and spoken words across the three data points, but also a relationship between spoken sentences and age was found. First, a moderate negative relationship existed between age and spoken sentences at pre-testing (Pearson coefficient = -0.663, p = 0.037) for the ten participants. Second, a moderate negative relationship existed for age and spoken sentences at post-testing (Pearson coefficient = -0.685, p = 0.029). Lastly, at follow-up testing, a strong negative relationship was apparent between these two constructs (Pearson coefficient = -0.754, p = 0.031), but with a sample of eight participants (P1-P6, P9-P10). This inverse relationship suggests that the greater the age of the participants, the lower their score on CAT spoken sentences (see Table 9 below), which is consistent with the finding by Babbitt and colleagues (2016). No significant correlations were found between education level of the participants and the standardized tests (see Appendices O through R, or Tables 15 through 19) for all correlations between participant demographics and dependent variables).

Table 9

Significant Correlations between Age and CAT Spoken Sentences

		CAT Spoken Sentences		
		Pre-Test	Post-Test	Follow-up Test
Age	Pearson Correlation	-0.663^{*}	-0.685^{*}	-0.754^{*}
	Sig (2-tailed)	0.037	0.029	0.031
	N	10	10	8

Additional Analyses

Given the multiple dependent variables, the single independent variable, and the three data collection points in this research design, a one-way repeated measures multivariate analysis of variance (MANOVA) was conducted to test whether there were significant differences in the dependent variables across the three data points. First, to make accurate conclusions based on multivariate testing, the following key assumptions were considered: (1) independent random sampling, (2) a categorical independent variable, (3) a continuous or scale dependent variable, (4) absence of multicollinearity, (5) normality, and (6) homogeneity of variance. Of the six assumptions, the homogeneity of variance demonstrated a potential violation as measured by Mauchly's Test of Sphericity, as described in a subsequent paragraph, because of the large ranges in standardized scores among the participants.

As shown in Table 10 below, the results of the one-way MANOVA indicated a non-significant multivariate effect for MIAP participation, F (4, 20) = 0.595, p = 0.806; Pillai's Trace = 1.497, η_p^2 = 0.748. This result suggests there was not a statistically significant difference in the combined dependent variables across the three data points as a result of MIAP participation. However, even with the potential violation of Mauchly's Test of Sphericity, MANOVA was determined to be the most appropriate test to run given the inherent limitations of running univariate tests for the independent variable and each dependent variable. Noteworthy, nonetheless, is the large effect size; it should be observed that large effect sizes suggest the practical importance of a finding, whereas significance reveals whether a finding is due to random chance.

Table 10

Multivariate Testing

Within Subjects Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	1.497	0.595	20.000	4.000	0.806	0.748

Although multivariate testing did not reveal statistical significance, univariate tests were subsequently performed based on the exploratory nature of this research study to analyze the independent variable (i.e., MIAP participation) on each dependent variable separately (i.e., language impairment, functional communication, communication confidence). Apart from the significant finding for spoken sentences of the CAT with a medium effect size (p = 0.048, η^2 = 0.456), univariate analysis confirmed the non-significant differences of MIAP participation across each of the dependent variables (see Table 11). Nevertheless, it should be noted that two standardized measures showed a non-general trend toward significance: (1) CADL-3 (p = 0.063, η^2 = 0.424) with a medium effect size and (2) the written sentences of the CAT with a medium effect size (p = 0.061, η^2 = 0.424). These findings, however, should be interpreted with caution in this pilot study, given there were no statistically significant findings with multivariate testing.

Table 11

Univariate Tests

Source			Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	BNT	Sphericity Assumed	10.778	2	5.389	1.329	0.308	0.210
		Huynh-Feldt	10.778	1.839	5.862	1.329	0.308	0.210
		Lower-bound	10.778	1.000	10.778	1.329	0.301	0.210

CADL-3	Sphericity Assumed	43.000	2	21.500	3.686	0.063	0.424
	Huynh-Feldt	43.000	1.594	26.981	3.686	0.080	0.424
	Lower-bound	43.000	1.000	43.000	3.686	0.113	0.424
CCRSA	Sphericity Assumed	196.000	2	98.000	1.105	0.368	0.181
	Huynh-Feldt	196.000	2.000	98.000	1.105	0.368	0.181
	Lower-bound	196.000	1.000	196.000	1.105	0.341	0.181
CAT Naming Objects	Sphericity Assumed	7.000	2	3.500	0.249	0.784	0.048
	Huynh-Feldt	7.000	1.419	4.933	0.249	0.713	0.048
	Lower-bound	7.000	1.000	7.000	0.249	0.639	0.048
CAT Naming Verbs	Sphericity Assumed	1.000	2	0.500	0.306	0.743	0.058
	Huynh-Feldt	1.000	2.000	0.500	0.306	0.743	0.058
	Lower-bound	1.000	1.000	1.000	0.306	0.604	0.058
CAT Spoken Words	Sphericity Assumed	1.000	2	0.500	0.517	0.611	0.094
	Huynh-Feldt	1.000	2.000	0.500	0.517	0.611	0.094
	Lower-bound	1.000	1.000	1.000	0.517	0.504	0.094
CAT Written Words	Sphericity Assumed	2.111	2	1.056	0.664	0.536	0.117
	Huynh-Feldt	2.111	1.721	1.227	0.664	0.517	0.117
	Lower-bound	2.111	1.000	2.111	0.664	0.452	0.117
CAT Spoken Sentence	Sphericity Assumed	33.444	2	16.722	4.192	*0.048	*0.456
	Greenhouse-Geisser	33.444	1.084	30.866	4.192	0.090	0.456
	Huynh-Feldt	33.444	1.149	29.100	4.192	0.086	0.456
	Lower-bound	33.444	1.000	33.444	4.192	0.096	0.456
CAT Written Sentences	Sphericity Assumed	44.778	2	22.389	3.738	0.061	0.428
	Huynh-Feldt	44.778	1.048	42.727	3.738	0.108	0.428

	Lower-bound	44.778	1.000	44.778	3.738	0.111	0.428
CAT Spoken Paragraphs	Sphericity Assumed	0.111	2	0.056	0.122	0.886	0.024
	Huynh-Feldt	0.111	1.352	0.082	0.122	0.809	0.024
	Lower-bound	0.111	1.000	0.111	0.122	0.741	0.024
CAT Repetition of Words	Sphericity Assumed	91.000	2	45.500	1.803	0.214	0.265
	Huynh-Feldt	91.000	1.225	74.315	1.803	0.233	0.265
	Lower-bound	91.000	1.000	91.000	1.803	0.237	0.265
CAT Repetition of Complex Words	Sphericity Assumed	4.333	2	2.167	0.802	0.475	0.138
	Huynh-Feldt	4.333	2.000	2.167	0.802	0.475	0.138
	Lower-bound	4.333	1.000	4.333	0.802	0.411	0.138

Mauchly's Test of Sphericity is a critical assumption for repeated measures. If significant findings are present (i.e., $p < 0.05$), an assumption has been violated. This occurs when the variation of the differences between all combinations of the related groups are found not to be equal. As shown in Table 12 below, the assumption for sphericity has been violated for spoken sentences, $\chi^2(2) = 7.478$, $p = 0.024$; written sentences, $\chi^2(2) = 11.747$, $p = 0.003$; and the repetition of words, $\chi^2(2) = 6.036$, $p = 0.049$. Potential factors that contribute to a *p*-value less than 0.05 are the small sample size and the large range in participants' scores on these dependent variables.

Table 12

Mauchly's Test of Sphericity

Within Subjects Effect		Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	BNT	0.599	2.048	2	0.359	0.714	0.919	0.500
	CADL-3	0.476	2.965	2	0.227	0.656	0.797	0.500
	CCRSA	0.782	0.982	2	0.612	0.821	1.000	0.500

CAT Naming Objects	0.369	3.992	2	0.136	0.613	0.710	0.500
CAT Naming Verbs	0.830	0.747	2	0.688	0.854	1.000	0.500
CAT Spoken Words	0.842	0.689	2	0.709	0.863	1.000	0.500
CAT Written Words	0.544	2.435	2	0.296	0.687	0.861	0.500
CAT Spoken Sentence	0.154	7.478	2	*0.024	0.542	0.575	0.500
CAT Written Sentences	0.053	11.747	2	*0.003	0.514	0.524	0.500
CAT Spoken Paragraphs	0.321	4.542	2	0.103	0.596	0.676	0.500
CAT Repetition of Words	0.221	6.036	2	*0.049	0.562	0.612	0.500
CAT Repetition of Complex Words	0.683	1.523	2	0.467	0.760	1.000	0.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.
a. Design: Intercept
Within Subjects Design: Time
b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

For additional follow up analyses, pairwise comparisons based on the estimated marginal means of the six participants were conducted for each dependent variable with the Bonferroni adjustment for multiple comparisons. As shown in the left column of Table 13, as the same pairs of numbers are compared in given row, there are repeated numbers that differ only in positivity or negativity, upper bound or lower bound, or mean difference. Significant differences resulted for functional communication as measured by the CADL-3 between the pre- and post-test (p = 0.018), for spoken sentences on the CAT between the pre- and the post-test (p = 0.001), and the written sentences on the CAT between the pre- and the post-test (*p* = 0.021) (see Tables 13 and 14 below).

Table 13

Pairwise Comparisons for Functional Communication (CADL-3)

						95% CI	
Measure			Mean Difference (I-J)	SD Error	Sig.	Lower Bound	Upper Bound
CADL-3	Pre-Test	Post-Test	-3.500*	0.764	*0.018	-6.199	-0.801
		Follow-Up	-3.000	1.713	0.421	-9.053	3.053
	Post-Test	Pre-Test	3.500*	0.764	0.018	0.801	6.199
		Follow-Up	0.500	1.522	1.000	-4.879	5.879
	Follow-Up	Pre-Test	3.000	1.713	0.421	-3.053	9.053
		Post-Test	-0.500	1.522	1.000	-5.879	4.879

Table 14

Pairwise Comparisons for Spoken and Written Sentences (Language Impairment (CAT))

						95% CI	
Measure			Mean Difference (I-J)	SD Error	Sig.	Lower Bound	Upper Bound
CAT Spoken Sentence	Pre-Test	Post-Test	-3.333*	0.333	*0.001	-4.511	-2.155
		Follow-Up	-1.500	1.360	0.961	-6.307	3.307
	Post-Test	Pre-Test	3.333*	0.333	0.001	2.155	4.511
		Follow-Up	1.833	1.424	0.763	-3.199	6.866
	Follow-Up	Pre-Test	1.500	1.360	0.961	-3.307	6.307
		Post-Test	-1.833	1.424	0.763	-6.866	3.199
CAT Written Sentences	Pre-Test	Post-Test	-1.500*	0.342	*0.021	-2.707	-0.293
		Follow-Up	-3.833	1.833	0.272	-10.313	2.646
	Post-Test	Pre-Test	1.500*	0.342	0.021	0.293	2.707

	Follow-Up	-2.333	1.585	0.603	-7.934	3.267
Follow-Up	Pre-Test	3.833	1.833	0.272	-2.646	10.313
	Post-Test	2.333	1.585	0.603	-3.267	7.934

In addition, since there was not a significant difference between the CADL-3 post- and follow-up mean scores as well as between the CAT post- and follow-up mean scores for spoken and written sentences, this observation suggests maintenance by the time of follow-up testing. Furthermore, standard error is provided within the tables above. Lastly, although not all dependent measures showed a statistically significant improvement between pre- and post-testing, scores were maintained by follow-up testing for all dependent variables. This finding is based on the observation that the difference between the paired values for post- and follow-up testing of each dependent variable was not statistically significant (i.e., $p > 0.05$ across this pairing for all measures; see Appendix S, or Table 20, for all pairwise comparisons).

Discussion

The purpose of this retrospective, within-group study was to determine whether there were significant differences in measures of language impairment, functional communication, and communication confidence for a cohort of ten PWA for who participated in a modified intensive aphasia program. Based on a sample of six participants whose data were available at all three data collection points (pre-, post-, and follow-up), the results are contextualized for discussion across the following domains: language impairment, functional communication, and communication confidence.

Language Impairment Outcomes

Recognized as an efficient and standardized measure for verbal confrontation naming, the 15-item version of the BNT was one of two assessments that targeted the participants' language impairment. Standardized scores were provided not only from the BNT but also from several subtests of the CAT, a comprehensive and standardized aphasia assessment for language impairment but with an emphasis beyond verbal confrontation naming ability (Swinburn et al., 2004). The following subtests were administered in this pilot study: naming objects, naming actions, spoken words, written words, spoken sentences, written sentences, spoken paragraph, repetition of words, and repetition of complex words. Scores were collected at the pre-, post-, and follow-up test from all six participants.

Neither multivariate nor univariate testing performed for the BNT as the dependent variable revealed statistical significance at post- or follow-up. However, there was a non-significant trend toward improved verbal confrontational naming, or the rapid spoken labeling of nouns, between the estimated mean scores when comparing the participants' average pre-MIAP BNT scores with their post-MIAP scores, as evidenced by pairwise comparisons (from a pre-test mean of 8.67 to a post-test mean of 10.50; see Appendix S). In addition, the difference between the post- and follow-up score on the BNT was not significantly different, suggesting a maintenance of verbal confrontation naming eight to twelve weeks after MIAP participation, as demonstrated with the pairwise comparisons. BNT scores were inconsistent with the language impairment findings from Babbitt and colleagues' ICAP study (2015) who found a significant difference in BNT scores across several cohorts of ICAP participants by post-testing.

In terms of significance by post-testing, language impairment scores measured with the CAT also did not to align with previous ICAP research (Babbitt et al., 2015). The first exception to the inconsistency, however, was a significant difference between pre- and post-testing for CAT spoken sentences with a medium effect size (from a pre-MIAP mean of 20.67 to a post-MIAP mean of 24.00; see Appendix I). The second exception was the significant difference in mean scores between pre- and post-testing for CAT written sentences (from a pre-MIAP mean of 19.33 to a post-MIAP mean of 20.83; see Appendix J). These two language impairment scores, albeit broadly consistent with previous ICAP research, should be interpreted with caution because the variance within the sample size was large. Interestingly, the post- and follow-up scores for both the BNT and the CAT did not differ significantly, suggesting this communication domain was maintained 10 to 12 weeks for most participants after MIAP.

Functional Communication Outcomes

The CADL-3 is a standardized tool for measuring functional communication abilities. Some of the communication activities it assesses include, but are not limited to, reading, writing, social interaction, and nonverbal communication (Holland, Frattali, & Fromm, 1999). In the current study, there was a medium effect size for CADL-3 with a *p*-value that showed a non-general trend toward significance. Although significance was not demonstrated through multivariate and univariate testing, pairwise comparisons and estimated means revealed significant differences between pre- and post-testing for this functional communication measure (mean pre-MIAP score of 87.17 to a mean post-MIAP score of 90.67; see Appendix C). In addition, follow-up testing revealed an estimated mean that was not statistically less than the post-test score, suggesting a potential maintenance in functional communication (mean follow-up MIAP score of 90.17). Results from the CADL-3 were inconsistent with previous research by Persad and Wozniak (2013) who found significant change for approximately half of their participants on the CADL-2.

Communication Confidence Outcomes

The CCRSA is a 10-item survey designed by Babbitt and Cherney (2010) that assesses how PWA rate their confidence in a variety of communication tasks. Although there was not a significant difference in communication confidence reported by PWA in the current study, there was a general non-significant trend toward improved communication confidence from pre- to post-testing, as evidenced by the estimated means (from a mean pre-MIAP score of 62.33 to a mean post-MIAP score of 70.33; see Appendix D). In addition, despite the decline in estimated means from post-MIAP to follow-up MIAP in respect to CCRSA, the difference was not significant, suggesting communication confidence was maintained by follow-up testing (mean follow-up MIAP score of 65.33). The results from CCRSA were inconsistent with previous research on communication confidence by Babbitt and colleagues (2015) and Dignam and colleagues (2015), both of whom found significant findings on communication confidence by post-testing.

Clinical Implications

Clinical outcomes for traditional ICAPs have been positive in general, with PWA demonstrating significant improvements across multiple domains on standardized language assessments (Babbitt et al., 2016). The strength inherent to intensive therapy is built upon neuroplasticity principles (Kleim & Jones, 2008); the ICAP philosophy relies on repetition, salience, and intensity, to name a few, all of which can be adapted to the specific needs and goals of each participant and their family member(s). By contrast to ICAPs, in this pilot study on the first M-ICAP in the Northwest region, there were not significant findings across the communication domains of interest, as revealed via MANOVA testing.

With the small sample size, the results are intended to provide a preliminary understanding of whether M-ICAP is effective as measured with quantitative assessments. Clinicians and researchers may theorize that that a higher dosage in the form of additional individual or group treatment sessions, or more repetitions of treatment targets per session, could result in significant findings in the one-week of intensive aphasia treatment. However, the TIR of 75% from this pilot study matched or exceeded the TIR of previous studies (Babbitt et al., 2015; Winans-Mitrik et al., 2014; Persad & Wozniak, 2013; Hinckley & Craig, 1998). This suggests the possibility that increasing the intensity of therapy for a cohort of participants would likely not be the key factor for the standardized assessments to reveal significance in functional communication, communication confidence, and language impairment.

From this exploratory research, clinicians may offer a M-ICAP similar in design to MIAP with an eye toward maintenance of several communication domains. Standardized assessments, however, may be insufficient for fully capturing the participants' MIAP experience, especially if qualitative measures are not implemented as part of the assessment battery given the complexity of human communication (Tetnowski & Franklin, 2003). Some advantages to qualitative assessments are the following: They can help inform researchers of the participants' and families' values, quality of life, and perspectives related to communication and rehabilitation, thereby aligning more closely to their personal goals (Doekhie et al., 2018). For example, participants likely care more about their functional communication outside the clinic than about a change in a quantitative assessment score they may or may not perceive. They also may be more motivated to continue rehabilitation, even if the quantitative assessments do not reflect a significant improvement, because their MIAP experience was a positive influence on both their outlook and their social opportunities with other PWA.

Even though qualitative assessments were not a component of this research, the current findings nevertheless demonstrate preliminary evidence that a modified intensive aphasia program lasting only one week and delivering 30 treatment hours may result in maintenance across the following domains for this small sample of participants: language impairment, functional communication, and communication confidence. In relation to maintenance, a service delivery model resembling that of MIAP may be an appropriate option for prospective participants who have reduced access to care and whose primary concern is functional communication in their everyday life. In addition, the one-week duration of this type of intensive therapy may be ideal for participants and their families, depending on their schedule and availability, given the high attrition rate reported often with traditional ICAPs (Babbitt, Worrall, & Cherney, 2016).

The correlational outcomes from the current study can inform clinical practice in several ways. The first significant moderate correlation was based on months post-onset and spoken paragraphs from the CAT: The greater the months post-onset, the higher the participants' score on understanding spoken paragraphs at the time of pre-testing. At first, this finding appears to be consistent with the significant difference Babbitt and colleagues (2016) found for the variable of months post-onset when comparing treatment responders and non-responders in terms of language impairment, using the WAB-R (2016). They showed that that a longer time post-onset may be more beneficial for prospective ICAP participants. A difference between the MIAP finding and Babbitt and colleagues', however, is that the MIAP correlation was limited to this subtest of the CAT and was applicable only at pre-testing. Although the MIAP finding may have been strengthened with a larger sample size, the current finding is still informative because of the lack of significant correlations with the other CAT subtests: Months post-onset may not play a large role in determining language impairment outcomes for small samples of participants in modified intensive aphasia programs.

Second, the moderate to strong correlation between the participants' age and language impairment, specifically spoken words and spoken sentences, is informative for clinical decision making as well. Once more, consistent with Babbitt and colleagues' research on predictive factors that ICAP responders tend to be younger (2016), clinicians who provide a M-ICAP as a service delivery option may find that older participants (i.e., above the age of 60) may not perform quite as well as younger participants on standardized measures for spoken words and sentences during the program. It is strongly advised, nevertheless, to consider older participants on a case-by-case basis for their potential to improve because of the previous ICAP finding that adults of all ages with aphasia in either the acute or chronic phase of recovery can improve in language impairment and functional communication through intensive therapy (Persad et al., 2013).

Third, the lack of a strong or moderate correlation between education and the three communication domains suggests that no matter the level of education of the participants, similar outcomes are likely to be obtained. In other words, participants with less education (i.e., high school diploma or less) may improve in their functional communication to an extent that is commensurate to those of participants with more education (i.e., bachelor's degree or beyond) in a modified intensive aphasia program. This finding is consistent with previous research that education does not appear to predict recovery despite the correlations between complex language and advanced literacy associated with higher education (Lazar & Antoniello, 2008).

Limitations

The first major limitation to this pilot study is the small number of participants, which is an inherent problem in communication sciences and disorders research (Haynes and Johnson, 2009). In Winans-Mitrik and colleagues' ICAP report (2014), data were collected from 73 participants from multiple cohorts over several years; likewise, Babbitt and colleagues' ICAP data were based on 74 participants (2015). Despite the small number of participants from this study, the cohort size was comparable to that of most ICAPS. According Rose and colleagues (2013), most ICAPs operate with a group size of approximately six individuals, compelling ICAP researchers to use large aggregates of participant data collected over years rather than weeks.

A result of a small sample size is a Type II error, commonly referred to as a false negative, which reduces the overall power of a study (Haynes & Johnson, 2009). In this pilot study, it is possible that additional significant findings could have been obtained with a larger sample size. Even if a large sample size had been obtained, however, multiple aphasia subtypes and severities were pooled together, increasing the variance between the participants' scores and contributing to the heterogeneity of the sample. A clear delineation within the data by aphasia type and severity for a large sample could address the problem of large variance if the participants are compared to other participants with the same type of aphasia and severity across the communication domains at the three data points. This type of prospective study design, in turn, could reduce the possibility of a Type II error.

The second limitation is that data was not tracked between post-testing and follow-up testing. In other words, it is unknown whether participants chose to pursue other therapy during the 10- to 12-week window. In addition, depending on their goals during MIAP, participants may have received different doses and evidence-based aphasia technique(s) selected by the student clinician for treatment, and experienced various levels of motivation or fatigue. Consistent with previous ICAP research, however, tracking the number of presentations per session was not the aim of this pilot study. Rather, the focus of an ICAP or M-ICAP is to provide individualized, evidence-based treatment in accordance with the WHO-ICF, create meaningful patient-centered goals, and offer social opportunities with family education and participation (Babbitt et al., 2015).

The third limitation in this study is the variability in the number of weeks that passed before follow-up testing was conducted. The research design allowed participants to return for testing ten to twelve weeks after MIAP, thereby offering them numerous appointment options that best fit their schedule. Consequently, this inconsistency across participants' schedules may have influenced the findings.

The fourth limitation to this pilot study is the inability to identify which key component of MIAP contributed most to the improvements across the six participants. As described by Babbitt and colleagues in their ICAP research (2015), it is possible that a combination of factors, such as the intensity of MIAP, cohort collaboration, group participation, or the clinician-client bond play a role in facilitating improvements in functional communication, language impairment, and communication confidence. For example, the social aspect from group participation may have influenced a participant's motivation in rehabilitating a functional communication skill or strategy so that he or she could immediately apply the strategy in the next social opportunity with another participant. If group therapy had not been offered as a MIAP feature, the participant may have been less motivated in the individual sessions, thereby facing larger obstacles in learning and applying the targeted skill for generalization. In other words, without additional data from the participants, it is challenging to ascertain whether the motivation to apply a skill or strategy in a meaningful context or the number of repetitions within the individual therapy sessions was the main component driving any documented gains following MIAP participation. This limitation is consistent with all ICAP studies and specifically observed by Winans-Mitrik and colleagues in their ICAP research (2014).

A final limitation, though common in aphasia rehabilitation research, is the absence of a control or comparison group (Babbitt et al., 2016). This omission occurs frequently because individuals with typical neurological abilities have not been studied in intensive programs given the time commitment and expense (Winans-Mitrik et al., 2014). The lack of a control group allows only for findings that are correlational rather than causative; in other words, the strongest conclusion is that MIAP participation is correlated with a standardized functional communication measure from pre- to post-testing with evidence of maintenance. An ABA group research design could help address the problem of causation by demonstrating how the withdrawal of treatment is related to a decrease in the dependent variable(s) whereas the re-introduction of treatment is potentially related to gains; however, ABA designs can be limited in that the replication of the effect within a participant is not shown. Finally, a treatment design involving two or more cohorts could help to establish causation by demonstrating changes in the treatment group that might not yet be manifested in the delayed group.

Future Directions

To capture the full MIAP experience and to represent the participants' perspective more accurately, future research on M-ICAPs should incorporate qualitative assessments. These types of measures can provide key information about the participants' viewpoint beyond quantitative data and may translate to real-world contexts and application. It is not recommended to conclude that a lack of significant findings as measured with standardized, quantitative assessments suggests the program is not meaningful. For example, in an intensive cognitive-communication rehabilitation program for young adults with acquired brain injuries, Gilmore, Ross, and Kiran (2018) stated that caregivers anecdotally reported increased topic initiation by participants with family members and an invitation to celebrate a birthday after participation, even though these skills and experiences were not measured quantitatively. Although their data collection was more quantitative than qualitative, they recognized the importance of qualitative data in future studies. In the case of future MIAP studies, by analogy, such qualitative assessments as semi-structured interviews, patient-reported outcomes, and caregiver-reported outcomes could explore whether the perspectives of family member(s) and the participants are consistent with each other and whether both found the social communication opportunities, therapeutic alliance with the student clinicians, and overall experience to be both satisfactory and beneficial. Tetnowski and Franklin (2003), too, indicated that despite the heavy emphasis on quantitative measures over the last 40 years, supplementing assessment with qualitative methodologies is highly recommended for its comprehensive nature.

There are other qualitative assessments that can help clinician measure the outcomes of MIAP for future cohorts. Tetnowski and Franklin (2003) list principles that can strengthen assessment purposes beyond quantitative assessments alone: ethnographic observations, ethnographic interviews, and discourse analysis. The last of these measures, the discourse analysis, can be a powerful tool for determining clients' usage of language. In this type of analysis, holistic communication and higher-level linguistic functions (i.e., narratives, conversational skills, natural commenting and questioning in response to speaker) are frequently the main focus, whereas quantitative measures may be more selective in one or a couple of linguistic aspects (i.e., labeling, answering basic yes-no questions). A limitation to discourse analysis can be unreliability due to the unique abilities and needs from client to client in addition to conversation variability. However, qualitative data can be coded and analyzed for themes, linguistic functions, and sentence types through the lens of holistic communication. To improve the standard of reporting discourse analysis, Stark and colleagues (2020), for example, have addressed this potential problem by developing a working group for recommendations in the methodology, analysis, and reporting of this type of measure, including improvements in automatic transcriptions and coding of spoken discourse. Ultimately, functional communication rather than a single, specific language ability is typically the participants' goal (Perkins, Crisp, & Walshaw, 2010).

Additionally, in other future studies, the participants' perspective could be assessed in combination with the caregivers' perspective to determine whether both viewpoints align in terms of goals and generalizability of targeted skills outside the program. This omission of assessing the caregiver-specific outcomes has been recognized in previous research (Babbitt et al., 2015; Persad et al., 2013). It is a necessary step because linguistic impairments can prevent participants from expressing the original message they intend to convey and because their views may differ from those of their caregivers as to the progress achieved. Doekhie and colleagues (2018), for example, studied the different perspectives of patients, caregivers, and professionals in primary care teams through semi-structured interviews. They found that these perspectives were often misaligned and conflicted with each other. Understanding the perspectives of both the participant and the caregiver supports a patient-centered care model by helping clinicians develop more effective, personalized goals.

Although the TIR (Babbitt et al., 2015) was calculated for comparisons to intensities of traditional ICAPs, quantifiable data on the dosage delivered within each individual and group sessions would allow researchers to be more confident in their conclusions about intensive therapy as a service delivery model. Dignam and colleagues (2015) studied both intensive and distributed aphasia therapy, but the number of presentations (or exact dosage per session) for the parallel groups was not collected. It is unknown whether there were an equal number of presentations per session or across sessions between the intensive group (48 hours for 3 weeks) and the distributed group (48 hours over 8 weeks) in their research. Currently, in the aphasia literature, treatment intensity or dosage is understood to denote the total number of therapy hours within a period, not the number of presentations administered to participants (Dignam et al., 2015). Due to the unique needs of each MIAP participant, their individualized goals, and the varying skills of the student clinicians eliciting the responses, this area of future research will be challenging to implement. Furthermore, some participants may require more presentations than others, depending on their type of aphasia, the severity of their aphasia, and the restorative or compensatory evidence-based therapy strategies that are clinically judged to be most beneficial for their rehabilitation.

Another step that M-ICAP researchers can address in the future is to increase the sample size of participants by incorporating data from previous years' cohorts. This approach of including multiple cohorts was used, for example, in Babbitt and colleagues ICAP research (2015). They were able to analyze twelve cohorts with a total sample size of 74 participants for primary outcome measures. Given that data tracking from each year's cohorts has recently become an area of interest for MIAP researchers, it is likely that data on language impairment, functional communication, and communication confidence measured with the same standardized assessments can soon be tracked systematically. Thus, in future studies exploring language impairment and participation outcomes, researchers can analyze the overall quantitative outcomes on a larger scale.

Finally, with reference to increasing the sample size, a greater degree of racial and ethnic diversity should be an aim of future research to strengthen generalizability to other populations. As explained by Persad and colleagues (2013), white English-speaking males with higher levels of education tend to predominate ICAP studies, which prevents an accurate representation of the PWA population. In addition, to reduce subject self-selection, future researchers can incorporate other recruitment methods (i.e., visits to community clinics or aphasia support groups) that offer opportunities to individuals who may be less aware of the intensive aphasia programs than the participants from this current study (Haynes and Johnson, 2009). Lastly, it is also possible that current representation of PWA in intensive and traditional programs may be influenced by the high degree of family involvement, given that family member training can promote generalization (Simmons-Mackie, Kearns, & Potechin, 2005).

Conclusions

In conclusion, the outcomes of this pilot study on the first M-ICAP in the Northwestern region of the United States serve as preliminary evidence based on a small cohort of adult participants with aphasia. Primary results included: (1) Overall increases in most estimated mean differences for language impairment, functional communication, and communication confidence by post-testing but without statistical significance; (2) maintenance across the three dependent variables by follow-up testing; (3) informative data based on significant correlations between younger age and higher spoken word and sentences scores, as measured by the CAT; and (4) a clearly described M-ICAP whose schedule and procedures can be adopted and replicated in future studies. A larger sample size with increased racial diversity would strengthen generalizability of the findings, and the inclusion of qualitative measures can reveal additional benefits participants and their caregivers experience that quantitative measures cannot fully capture. Finally, the general trend toward significance for such variables as functional communication with a medium effect size in only one week of intensive treatment and maintenance across all dependent variables supports additional studies of MIAP and other M-

ICAP models. M-ICAPs have the potential to be an effective, appropriate service delivery model that requires less commitment and financial burden for clients with limited access to care compared to traditional ICAPs.

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Appendices

Appendix A

Schedule of Meridian Intensive Aphasia Program (MIAP)

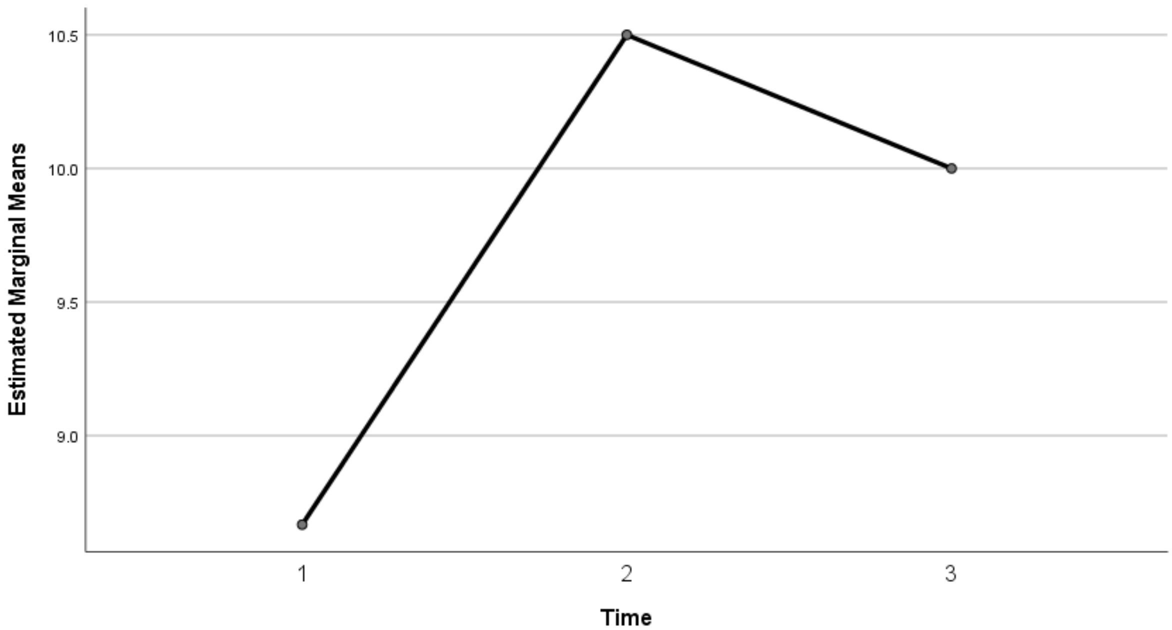
Time	Monday	Tuesday	Wednesday	Thursday	Friday
9:00		Group	Group	Group	Group
10:00		Individual	Individual	Individual	Individual
11:00		Physical Therapy*	Group	Physical Therapy	Group
12:00		Lunch	Lunch	Lunch	Lunch
1:00	Group	Individual	Individual	Individual	Home Exercise Training
2:00	Individual	Group	Group	Group	Ice Cream Social
3:00	Home	Home	Home	Home	Home

*****Physical therapy consisted of sessions led by physical therapists who completed small group sessions with the student-participant dyads targeting balance and strength exercises.

Appendix B

Figure 1

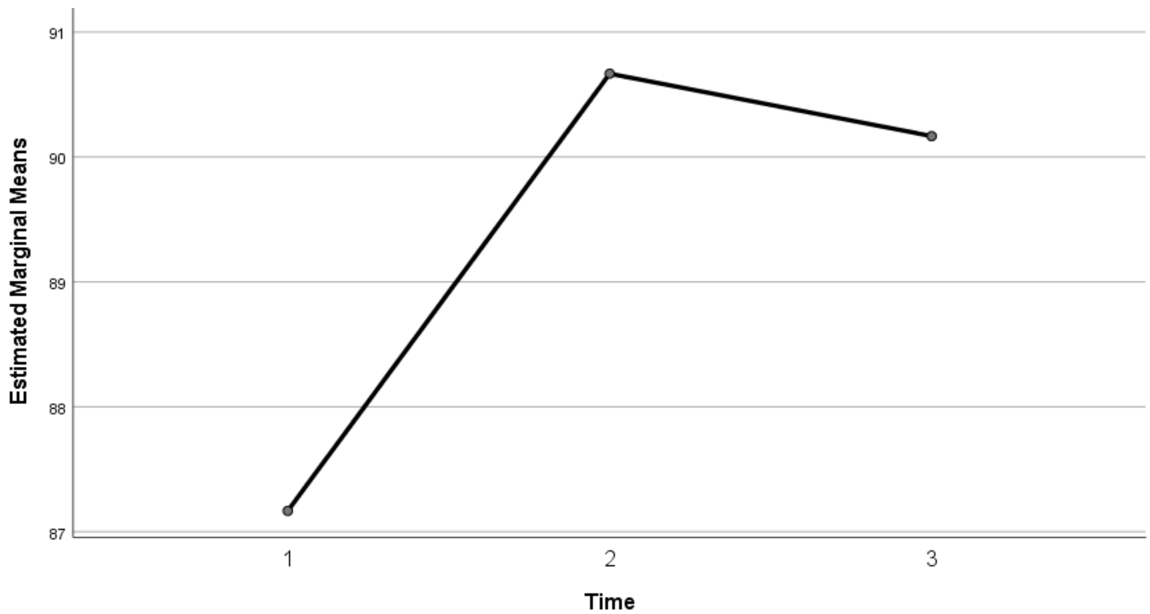
Estimated Marginal Means of BNT



Appendix C

Figure 2

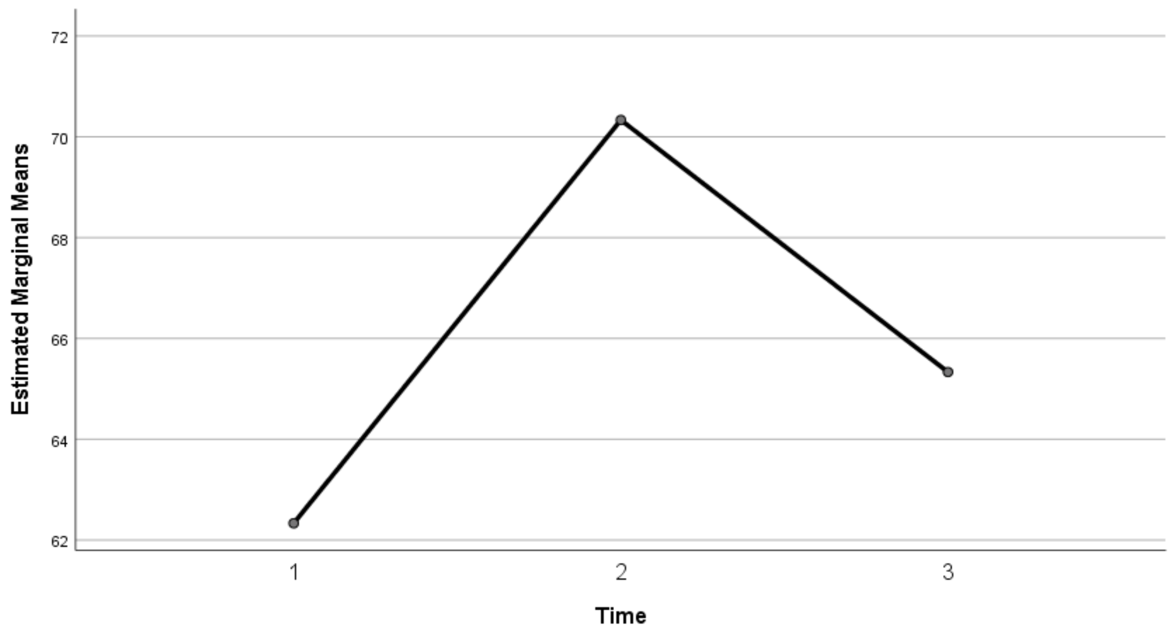
Estimated Marginal Means of CADL-3



Appendix D

Figure 3

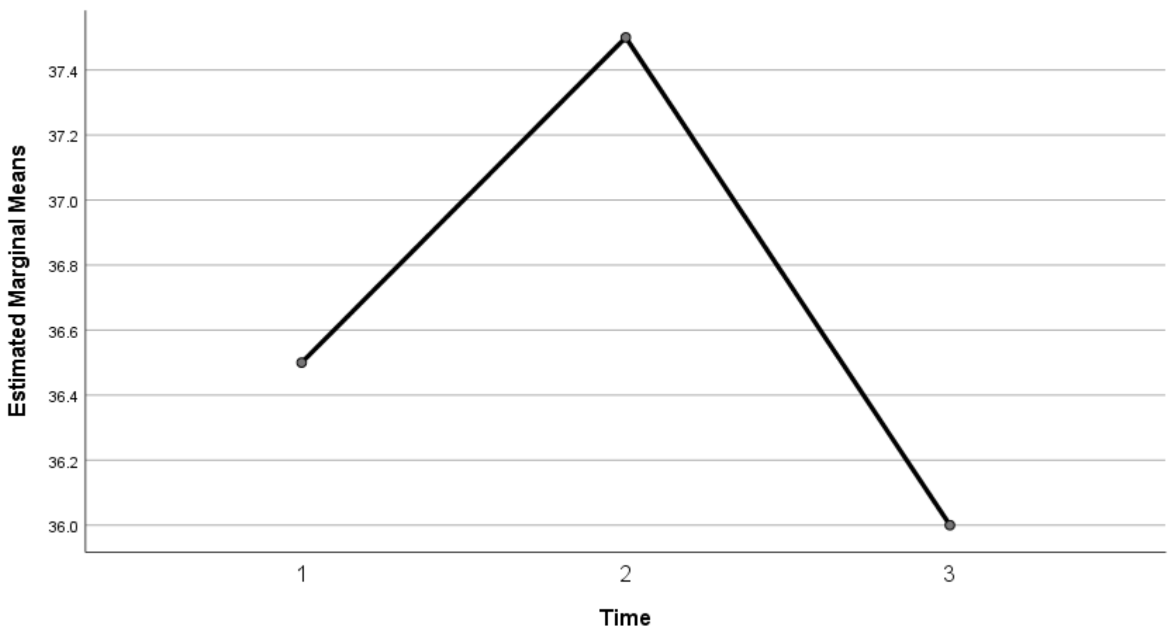
Estimated Marginal Means of CCRSA



Appendix E

Figure 4

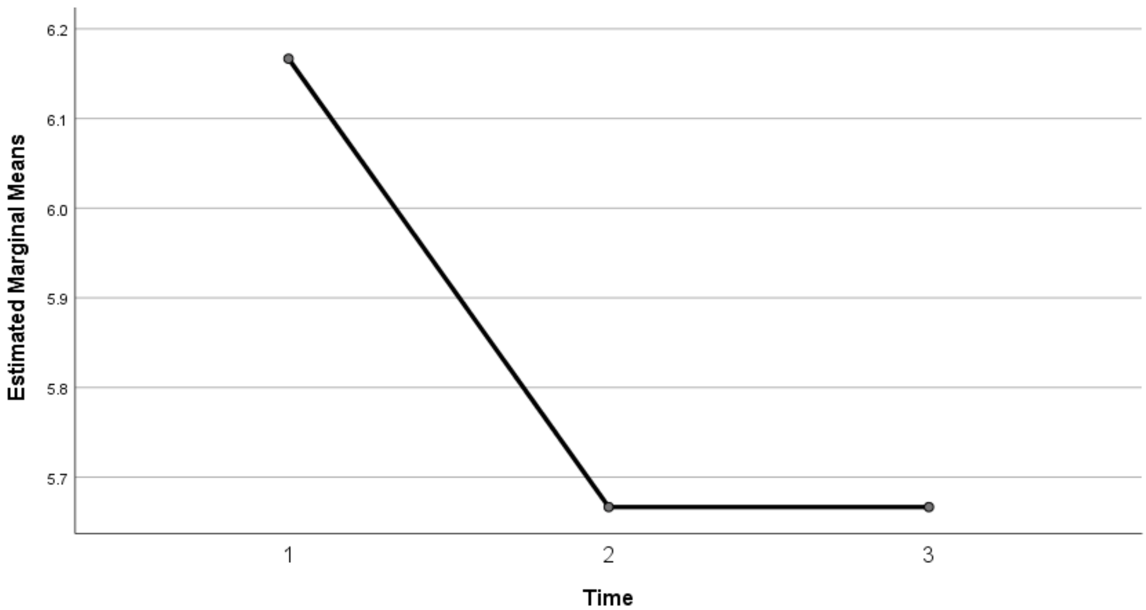
Estimated Marginal Means of CAT Naming Objects



Appendix F

Figure 5

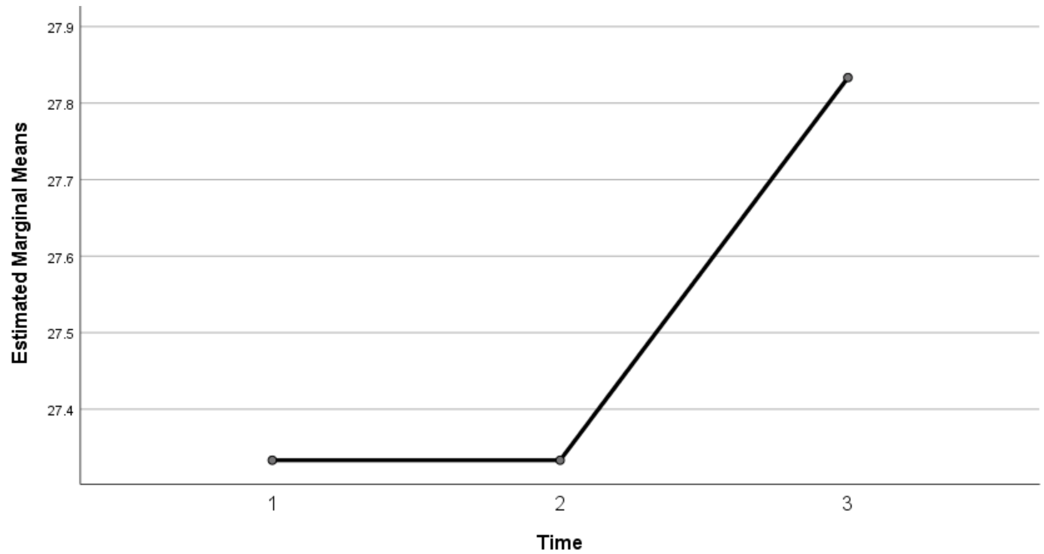
Estimated Marginal Means of CAT Naming Verbs



Appendix G

Figure 6

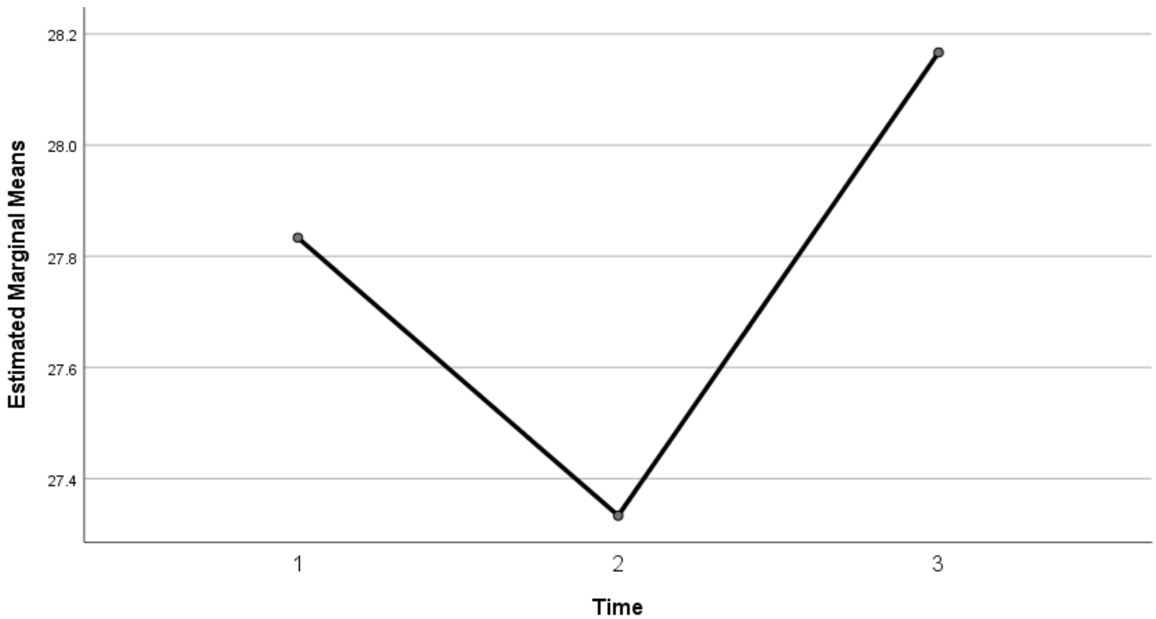
Estimated Marginal Means of CAT Spoken Words



Appendix H

Figure 7

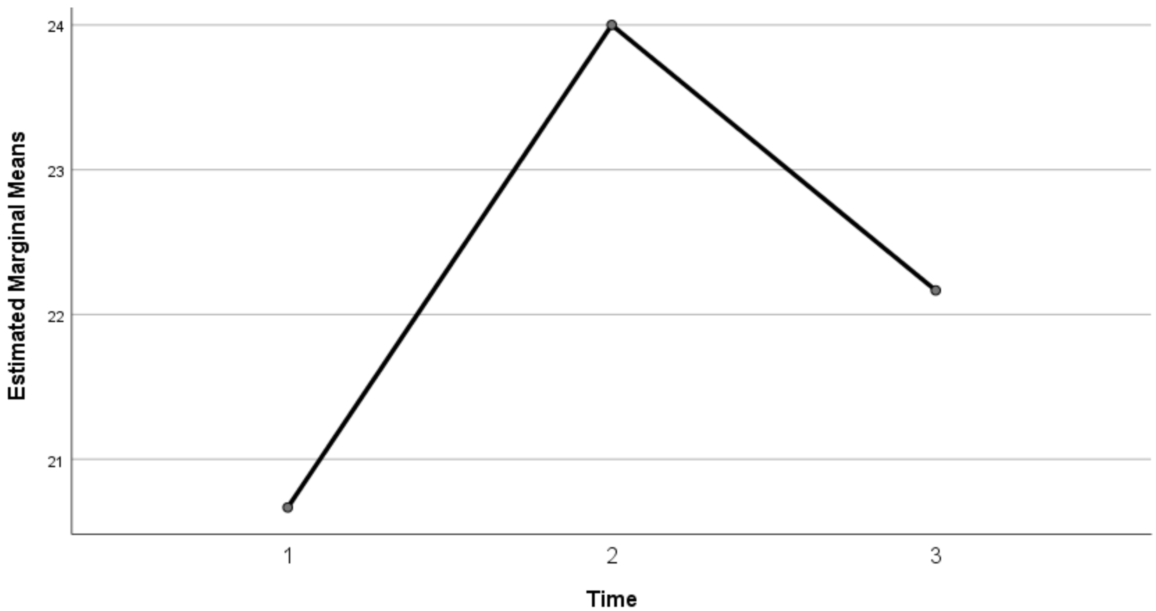
Estimated Marginal Means of Cat Written Words



Appendix I

Figure 8

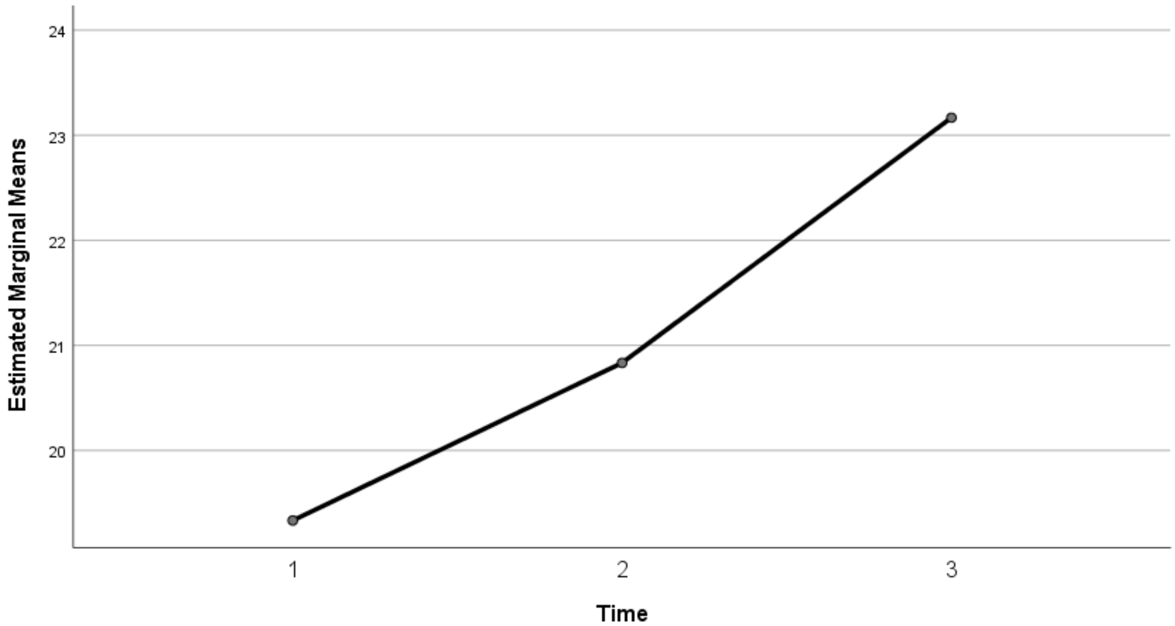
Estimated Marginal Means of CAT Spoken Sentences



Appendix J

Figure 9

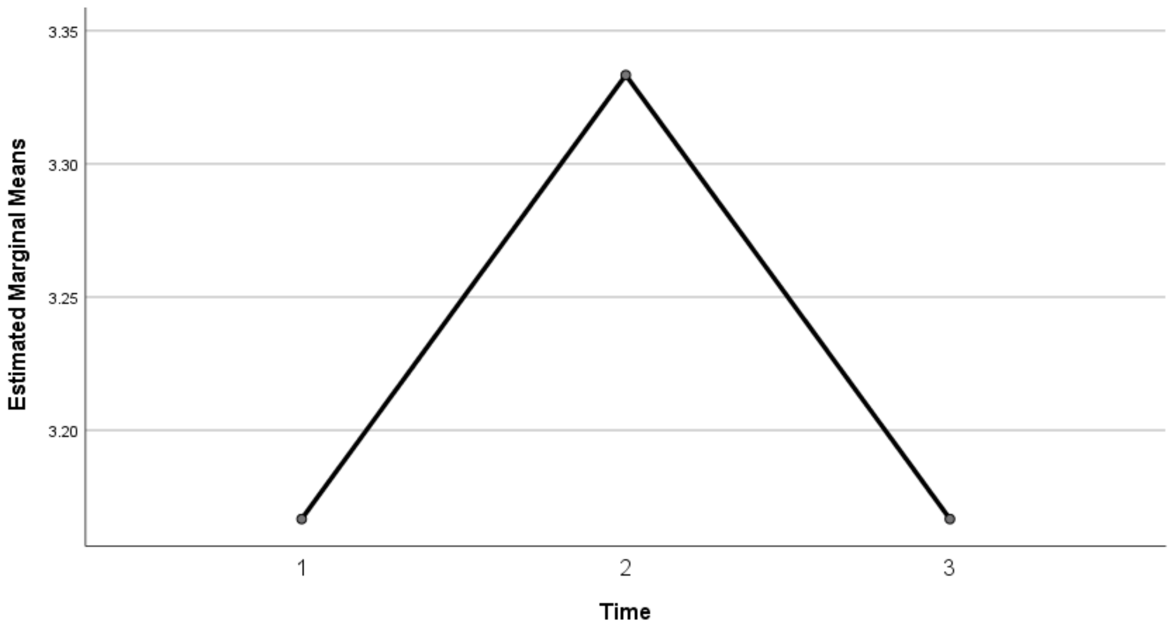
Estimated Marginal Means of CAT Written Sentences



Appendix K

Figure 10

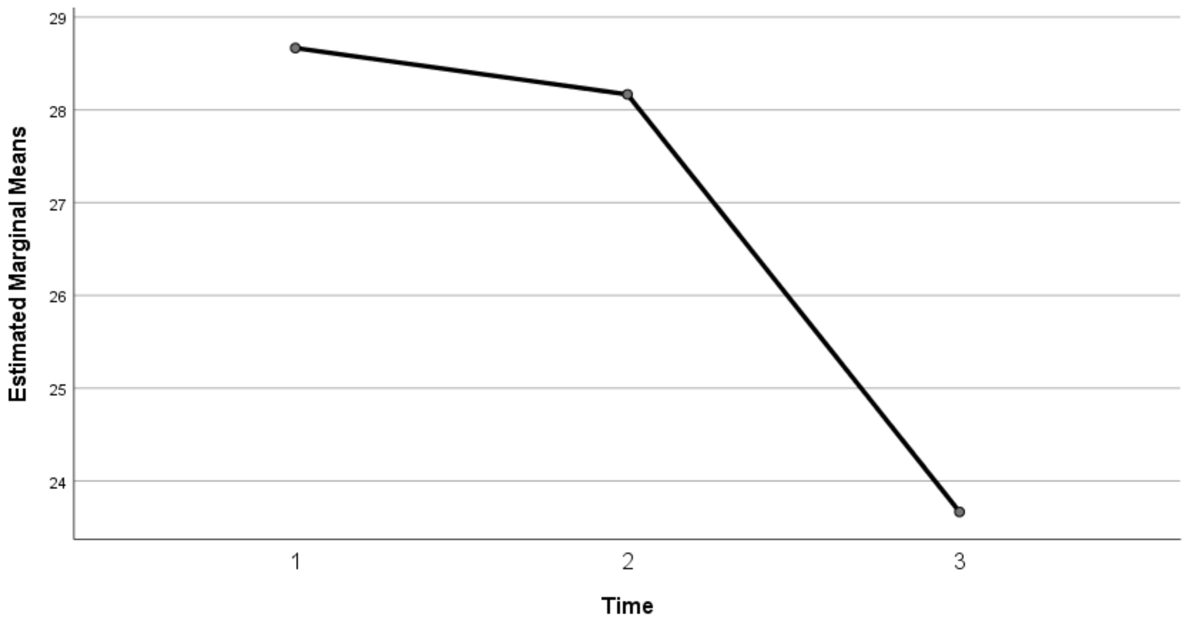
Estimated Marginal Means of CAT Spoken Paragraphs



Appendix L

Figure 11

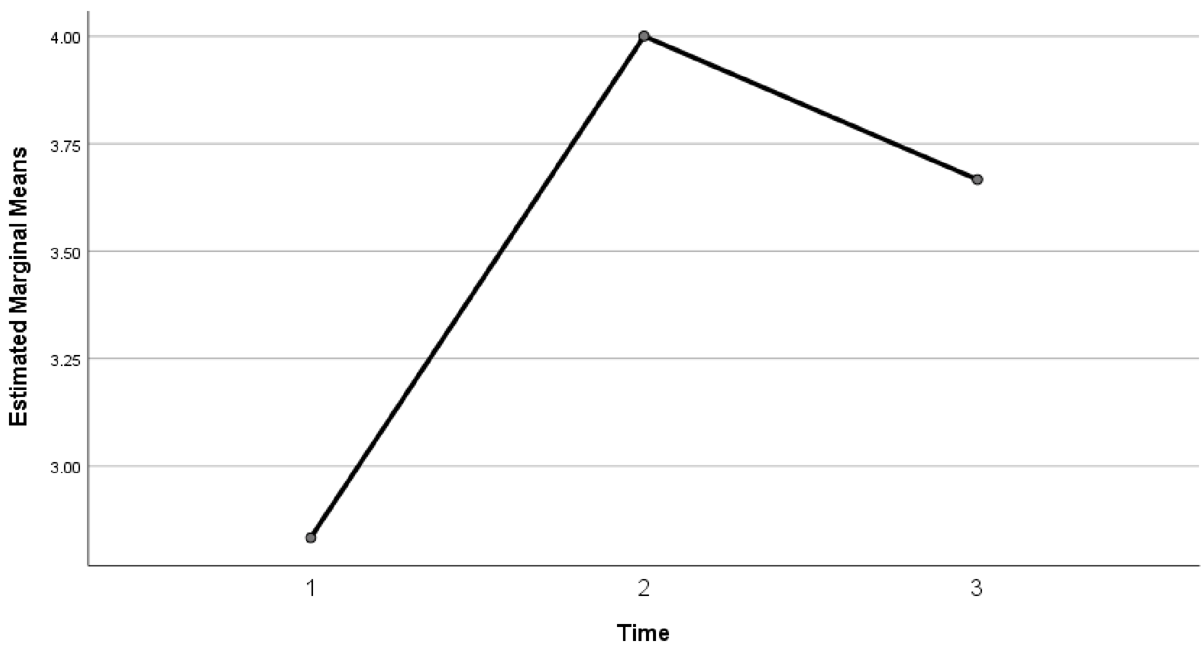
Estimated Marginal Means of CAT Repetition of Words



Appendix M

Figure 12

Estimated Marginal Means of CAT Repetition of Complex Words



Appendix N

Table 15

Correlations between Dependent Variables (BNT, CADL-3, CCRSA, and CAT)

		BNT Pre	BNT Post	BNT Fall	CADL Pre	CADL Post	CADL Fall	CCRSA Pre	CCRSA Post	CCRSA Fall	Naming Objects Pre	Naming Objects Post	Naming Objects Fall	Naming Actions Pre	Naming Actions Post	Naming Actions Fall
BNT Pre	Pearson Correlation	1	$.766^{**}$	$.737^{*}$	0.067	0.047	-0.171	-0.260	-0.164	-0.517	$.717^{*}$	$.848^{**}$	$.844^{**}$	0.516	0.308	0.301
	Sig. (2-tailed)		0.010	0.015	0.886	0.920	0.714	0.468	0.650	0.154	0.020	0.002	0.002	0.127	0.387	0.398
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
BNT Post	Pearson Correlation	$.766^{**}$	1	$.787^{**}$	0.573	0.600	0.490	0.162	0.127	-0.095	$.886^{**}$	$.917^{**}$	$.814^{**}$	0.610	$.688^{*}$	0.583
	Sig. (2-tailed)	0.010		0.007	0.178	0.154	0.265	0.655	0.727	0.807	0.001	0.000	0.004	0.061	0.028	0.077
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
BNT Fall	Pearson Correlation	$.737^{*}$	$.787^{**}$	1	-0.192	-0.252	-0.363	0.148	0.228	0.113	$.869^{**}$	$.887^{**}$	$.881^{**}$	$.721^{*}$	$.710^{*}$	$.798^{**}$
	Sig. (2-tailed)	0.015	0.007		0.680	0.585	0.424	0.684	0.526	0.772	0.001	0.001	0.001	0.019	0.021	0.006
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
CADL Pre	Pearson Correlation	0.067	0.573	-0.192	1	$.968^{**}$	$.900^{**}$	-0.078	-0.223	-0.587	0.143	0.206	-0.078	-0.242	0.306	-0.231
	Sig. (2-tailed)	0.886	0.178	0.680		0.000	0.006	0.867	0.631	0.166	0.760	0.658	0.867	0.601	0.504	0.619
	N	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
CADL Post	Pearson Correlation	0.047	0.600	-0.252	$.968^{**}$	1	$.924^{**}$	-0.225	-0.357	-0.677	0.043	0.105	-0.181	-0.289	0.164	-0.301
	Sig. (2-tailed)	0.920	0.154	0.585	0.000		0.003	0.627	0.432	0.095	0.927	0.823	0.699	0.529	0.726	0.512
	N	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
CADL Fall	Pearson Correlation	-0.171	0.490	-0.363	$.900^{**}$	$.924^{**}$	1	-0.089	-0.429	-0.617	0.045	0.031	-0.197	-0.340	0.112	-0.416

	Sig. (2-tailed)	0.714	0.265	0.424	0.006	0.003		0.850	0.337	0.140	0.923	0.948	0.672	0.456	0.811	0.354
	N	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
CCRSA Pre	Pearson Correlation	-0.260	0.162	0.148	-0.078	-0.225	-0.089	1	.906**	.908**	0.205	0.115	0.091	0.214	0.554	0.453
	Sig. (2-tailed)	0.468	0.655	0.684	0.867	0.627	0.850		0.000	0.001	0.570	0.752	0.803	0.553	0.096	0.188
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
CCRSA Post	Pearson Correlation	-0.164	0.127	0.228	-0.223	-0.357	-0.429	.906**	1	.887**	0.190	0.113	0.062	0.187	0.507	0.505
	Sig. (2-tailed)	0.650	0.727	0.526	0.631	0.432	0.337	0.000		0.001	0.599	0.756	0.864	0.605	0.135	0.136
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
CCRSA Fall	Pearson Correlation	-0.517	-0.095	0.113	-0.587	-0.677	-0.617	.908**	.887**	1	0.039	-0.183	-0.056	0.340	0.603	0.564
	Sig. (2-tailed)	0.154	0.807	0.772	0.166	0.095	0.140	0.001	0.001		0.921	0.638	0.885	0.371	0.086	0.114
	N	9	9	9	7	7	7	9	9	9	9	9	9	9	9	9
Naming Objects Pre	Pearson Correlation	.717*	.886**	.869**	0.143	0.043	0.045	0.205	0.190	0.039	1	.964**	.916**	.764*	.789**	.723*
	Sig. (2-tailed)	0.020	0.001	0.001	0.760	0.927	0.923	0.570	0.599	0.921		0.000	0.000	0.010	0.007	0.018
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Naming Objects Post	Pearson Correlation	.848**	.917**	.887**	0.206	0.105	0.031	0.115	0.113	-0.183	.964**	1	.950**	.720*	.691*	.645*
	Sig. (2-tailed)	0.002	0.000	0.001	0.658	0.823	0.948	0.752	0.756	0.638	0.000		0.000	0.019	0.027	0.044
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Naming Objects Fall	Pearson Correlation	.844**	.814**	.881**	-0.078	-0.181	-0.197	0.091	0.062	-0.056	.916**	.950**	1	.798**	.668*	0.620
	Sig. (2-tailed)	0.002	0.004	0.001	0.867	0.699	0.672	0.803	0.864	0.885	0.000	0.000		0.006	0.035	0.056
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Naming Actions Pre	Pearson Correlation	0.516	0.610	.721*	-0.242	-0.289	-0.340	0.214	0.187	0.340	.764*	.720*	.798**	1	.836**	.823**
	Sig. (2-tailed)	0.127	0.061	0.019	0.601	0.529	0.456	0.553	0.605	0.371	0.010	0.019	0.006		0.003	0.003
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
	Pearson Correlation	0.308	.688*	.710*	0.306	0.164	0.112	0.554	0.507	0.603	.789**	.691*	.668*	.836**	1	.913**

Naming Actions Post	Sig. (2-tailed)	0.387	0.028	0.021	0.504	0.726	0.811	0.096	0.135	0.086	0.007	0.027	0.035	0.003		0.000
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Naming Actions Fall	Pearson Correlation	0.301	0.583	.798**	-0.231	-0.301	-0.416	0.453	0.505	0.564	.723*	.645*	0.620	.823**	.913**	1
	Sig. (2-tailed)	0.398	0.077	0.006	0.619	0.512	0.354	0.188	0.136	0.114	0.018	0.044	0.056	0.003	0.000	
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Spoken Words Pre	Pearson Correlation	-0.098	0.503	0.244	.878**	.944**	.948**	0.545	0.419	0.528	0.405	0.274	0.177	0.450	.773**	0.592
	Sig. (2-tailed)	0.788	0.139	0.496	0.009	0.001	0.001	0.104	0.228	0.144	0.246	0.444	0.624	0.192	0.009	0.072
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Spoken Words Post	Pearson Correlation	0.157	.691*	0.205	0.748	.836*	.903**	0.284	0.125	0.075	0.488	0.411	0.244	0.193	0.499	0.247
	Sig. (2-tailed)	0.664	0.027	0.570	0.053	0.019	0.005	0.426	0.731	0.848	0.152	0.239	0.497	0.593	0.142	0.491
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Spoken Words Fall	Pearson Correlation	0.051	0.615	0.202	0.565	0.726	0.754	0.378	0.278	0.318	0.435	0.323	0.169	0.299	0.570	0.391
	Sig. (2-tailed)	0.890	0.058	0.575	0.186	0.065	0.050	0.282	0.437	0.404	0.209	0.363	0.640	0.401	0.085	0.264
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Written Words Pre	Pearson Correlation	0.134	0.460	0.263	0.653	.783*	.784*	0.494	0.389	0.444	0.188	0.200	0.204	0.050	0.331	0.166
	Sig. (2-tailed)	0.711	0.181	0.462	0.112	0.038	0.037	0.146	0.267	0.232	0.604	0.579	0.572	0.891	0.350	0.647
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Written Words Post	Pearson Correlation	-0.062	0.439	0.065	0.731	.774*	.918**	0.601	0.393	0.423	0.179	0.146	0.075	-0.026	0.360	0.101
	Sig. (2-tailed)	0.864	0.204	0.859	0.062	0.041	0.004	0.066	0.261	0.256	0.620	0.687	0.836	0.942	0.307	0.781
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Written Words Fall	Pearson Correlation	0.473	.789**	0.462	0.737	.825*	.818*	0.397	0.260	0.250	0.520	0.565	0.521	0.315	0.499	0.293
	Sig. (2-tailed)	0.167	0.007	0.179	0.059	0.022	0.025	0.256	0.468	0.517	0.123	0.089	0.122	0.375	0.142	0.412
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
	Pearson Correlation	-0.288	0.349	0.175	0.714	0.745	.798*	.649*	0.573	0.621	0.315	0.144	0.014	0.286	.701*	0.577

Spoken Sentences Pre	Sig. (2-tailed)	0.420	0.322	0.630	0.071	0.054	0.031	0.042	0.083	0.074	0.376	0.692	0.969	0.424	0.024	0.081
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Spoken Sentences Post	Pearson Correlation	0.026	0.627	0.365	.756*	.811*	.860*	0.617	0.532	0.570	0.572	0.442	0.288	0.467	.795**	.655*
	Sig. (2-tailed)	0.943	0.052	0.300	0.049	0.027	0.013	0.057	0.114	0.109	0.084	0.201	0.420	0.173	0.006	0.040
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Spoken Sentences Fall	Pearson Correlation	-0.494	0.369	0.010	0.438	0.579	0.599	0.416	0.397	0.442	0.139	-0.144	-0.350	-0.002	0.520	0.431
	Sig. (2-tailed)	0.213	0.369	0.981	0.385	0.228	0.209	0.305	0.330	0.273	0.743	0.733	0.395	0.995	0.187	0.286
	N	8	8	8	6	6	6	8	8	8	8	8	8	8	8	8
Written Sentences Pre	Pearson Correlation	0.041	0.620	0.362	.821*	.847*	.916**	0.583	0.431	0.437	0.433	0.365	0.254	0.212	.636*	0.450
	Sig. (2-tailed)	0.910	0.056	0.304	0.024	0.016	0.004	0.077	0.214	0.240	0.211	0.300	0.478	0.556	0.048	0.192
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Written Sentences Post	Pearson Correlation	-0.123	0.432	0.153	.797*	.838*	.919**	0.495	0.333	0.347	0.196	0.137	0.026	-0.055	0.407	0.216
	Sig. (2-tailed)	0.735	0.213	0.673	0.032	0.018	0.003	0.145	0.347	0.360	0.587	0.706	0.943	0.880	0.243	0.549
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Written Sentences Fall	Pearson Correlation	-0.283	0.451	0.161	0.405	0.478	0.665	.746*	0.623	.714*	0.167	0.029	0.010	0.048	0.511	0.315
	Sig. (2-tailed)	0.460	0.223	0.678	0.367	0.278	0.103	0.021	0.073	0.031	0.667	0.942	0.980	0.902	0.160	0.409
	N	9	9	9	7	7	7	9	9	9	9	9	9	9	9	9
Spoken Paragraph Pre	Pearson Correlation	-0.501	-0.267	-0.170	-0.204	-0.337	-0.362	.662*	.705*	.790*	-0.075	-0.228	-0.205	0.257	0.414	0.372
	Sig. (2-tailed)	0.140	0.455	0.639	0.661	0.459	0.426	0.037	0.023	0.011	0.837	0.526	0.570	0.473	0.234	0.289
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Spoken Paragraph Post	Pearson Correlation	-0.541	-0.124	-0.004	-0.455	-0.406	-0.359	0.529	0.601	.683*	0.024	-0.186	-0.260	0.163	0.409	0.498
	Sig. (2-tailed)	0.106	0.732	0.991	0.305	0.366	0.430	0.116	0.066	0.043	0.947	0.607	0.468	0.653	0.241	0.143
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10

Spoken Paragraph Fall	Pearson Correlation	-.685*	-0.076	0.137	-0.548	-0.505	-0.359	.694*	0.637	.824**	0.093	-0.211	-0.174	0.410	0.653	.718*
	Sig. (2-tailed)	0.042	0.847	0.725	0.203	0.247	0.430	0.038	0.065	0.006	0.812	0.587	0.655	0.273	0.057	0.029
	N	9	9	9	7	7	7	9	9	9	9	9	9	9	9	9
Rep Words Pre	Pearson Correlation	-0.093	0.209	0.278	-0.108	-0.142	-0.435	0.406	0.557	0.570	0.378	0.194	0.135	0.528	.683*	.685*
	Sig. (2-tailed)	0.799	0.562	0.436	0.817	0.761	0.330	0.245	0.095	0.109	0.282	0.591	0.710	0.117	0.030	0.029
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Rep Words Post	Pearson Correlation	-0.200	0.177	0.180	0.102	-0.023	-0.250	0.567	0.619	.697*	0.328	0.142	0.108	0.550	.731*	.663*
	Sig. (2-tailed)	0.580	0.625	0.619	0.828	0.961	0.588	0.088	0.056	0.037	0.355	0.695	0.767	0.099	0.016	0.037
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Rep Words Fall	Pearson Correlation	-0.057	0.041	0.293	-0.016	-0.060	-0.159	-0.019	0.019	0.274	0.253	0.114	0.221	0.609	0.570	0.580
	Sig. (2-tailed)	0.875	0.911	0.411	0.974	0.899	0.733	0.959	0.959	0.476	0.480	0.754	0.540	0.061	0.086	0.079
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Rep Complex Words Pre	Pearson Correlation	-0.105	0.174	0.084	0.246	0.090	0.210	0.498	0.392	0.376	0.360	0.275	0.201	0.505	0.570	0.489
	Sig. (2-tailed)	0.773	0.631	0.817	0.595	0.847	0.652	0.143	0.263	0.318	0.307	0.443	0.578	0.137	0.085	0.151
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Rep Complex Words Post	Pearson Correlation	0.071	0.452	0.378	0.234	0.225	0.095	0.403	0.487	0.378	0.559	0.436	0.250	0.493	.674*	.701*
	Sig. (2-tailed)	0.845	0.189	0.281	0.614	0.628	0.840	0.248	0.153	0.316	0.093	0.207	0.487	0.147	0.033	0.024
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10
Rep Complex Words Fall	Pearson Correlation	0.281	0.426	.661*	-0.717	-0.670	-0.631	0.162	0.190	0.357	.645*	0.530	0.579	.838**	.687*	.819**
	Sig. (2-tailed)	0.432	0.219	0.038	0.070	0.099	0.128	0.655	0.599	0.346	0.044	0.115	0.079	0.002	0.028	0.004
	N	10	10	10	7	7	7	10	10	9	10	10	10	10	10	10

		Spoken Words Pre	Spoken Words Post	Spoken Words Fall	Written Words Pre	Written Words Post	Written Words Fall	Spoken Sentences Pre	Spoken Sentences Post	Spoken Sentence Fall
BNT Pre	Pearson Correlation	-0.098	0.157	0.051	0.134	-0.062	0.473	-0.288	0.026	-0.494
	Sig. (2-tailed)	0.788	0.664	0.890	0.711	0.864	0.167	0.420	0.943	0.213
	N	10	10	10	10	10	10	10	10	8
BNT Post	Pearson Correlation	0.503	.691*	0.615	0.460	0.439	.789**	0.349	0.627	0.369
	Sig. (2-tailed)	0.139	0.027	0.058	0.181	0.204	0.007	0.322	0.052	0.369
	N	10	10	10	10	10	10	10	10	8
BNT Fall	Pearson Correlation	0.244	0.205	0.202	0.263	0.065	0.462	0.175	0.365	0.010
	Sig. (2-tailed)	0.496	0.570	0.575	0.462	0.859	0.179	0.630	0.300	0.981
	N	10	10	10	10	10	10	10	10	8
CADL Pre	Pearson Correlation	.878**	0.748	0.565	0.653	0.731	0.737	0.714	.756*	0.438
	Sig. (2-tailed)	0.009	0.053	0.186	0.112	0.062	0.059	0.071	0.049	0.385
	N	7	7	7	7	7	7	7	7	6
CADL Post	Pearson Correlation	.944**	.836*	0.726	.783*	.774*	.825*	0.745	.811*	0.579
	Sig. (2-tailed)	0.001	0.019	0.065	0.038	0.041	0.022	0.054	0.027	0.228
	N	7	7	7	7	7	7	7	7	6
CADL Fall	Pearson Correlation	.948**	.903**	0.754	.784*	.918**	.818*	.798*	.860*	0.599
	Sig. (2-tailed)	0.001	0.005	0.050	0.037	0.004	0.025	0.031	0.013	0.209
	N	7	7	7	7	7	7	7	7	6
CCRSA Pre	Pearson Correlation	0.545	0.284	0.378	0.494	0.601	0.397	.649*	0.617	0.416
	Sig. (2-tailed)	0.104	0.426	0.282	0.146	0.066	0.256	0.042	0.057	0.305

	N	10	10	10	10	10	10	10	10	8
CCRSA Post	Pearson Correlation	0.419	0.125	0.278	0.389	0.393	0.260	0.573	0.532	0.397
	Sig. (2-tailed)	0.228	0.731	0.437	0.267	0.261	0.468	0.083	0.114	0.330
	N	10	10	10	10	10	10	10	10	8
CCRSA Fall	Pearson Correlation	0.528	0.075	0.318	0.444	0.423	0.250	0.621	0.570	0.442
	Sig. (2-tailed)	0.144	0.848	0.404	0.232	0.256	0.517	0.074	0.109	0.273
	N	9	9	9	9	9	9	9	9	8
Naming Objects Pre	Pearson Correlation	0.405	0.488	0.435	0.188	0.179	0.520	0.315	0.572	0.139
	Sig. (2-tailed)	0.246	0.152	0.209	0.604	0.620	0.123	0.376	0.084	0.743
	N	10	10	10	10	10	10	10	10	8
Naming Objects Post	Pearson Correlation	0.274	0.411	0.323	0.200	0.146	0.565	0.144	0.442	-0.144
	Sig. (2-tailed)	0.444	0.239	0.363	0.579	0.687	0.089	0.692	0.201	0.733
	N	10	10	10	10	10	10	10	10	8
Naming Objects Fall	Pearson Correlation	0.177	0.244	0.169	0.204	0.075	0.521	0.014	0.288	-0.350
	Sig. (2-tailed)	0.624	0.497	0.640	0.572	0.836	0.122	0.969	0.420	0.395
	N	10	10	10	10	10	10	10	10	8
Naming Actions Pre	Pearson Correlation	0.450	0.193	0.299	0.050	-0.026	0.315	0.286	0.467	-0.002
	Sig. (2-tailed)	0.192	0.593	0.401	0.891	0.942	0.375	0.424	0.173	0.995
	N	10	10	10	10	10	10	10	10	8
Naming Actions Post	Pearson Correlation	.773**	0.499	0.570	0.331	0.360	0.499	.701*	.795**	0.520
	Sig. (2-tailed)	0.009	0.142	0.085	0.350	0.307	0.142	0.024	0.006	0.187
	N	10	10	10	10	10	10	10	10	8
Naming Actions Fall	Pearson Correlation	0.592	0.247	0.391	0.166	0.101	0.293	0.577	.655*	0.431
	Sig. (2-tailed)	0.072	0.491	0.264	0.647	0.781	0.412	0.081	0.040	0.286

	N	10	10	10	10	10	10	10	10	8
Spoken Words Pre	Pearson Correlation	1	.787**	.868**	0.506	.673*	0.559	.941**	.923**	.875**
	Sig. (2-tailed)		0.007	0.001	0.135	0.033	0.093	0.000	0.000	0.004
	N	10	10	10	10	10	10	10	10	8
Spoken Words Post	Pearson Correlation	.787**	1	.933**	0.549	.764*	.728*	.708*	.823**	.770*
	Sig. (2-tailed)	0.007		0.000	0.100	0.010	0.017	0.022	0.003	0.025
	N	10	10	10	10	10	10	10	10	8
Spoken Words Fall	Pearson Correlation	.868**	.933**	1	0.518	.695*	.651*	.817**	.907**	.926**
	Sig. (2-tailed)	0.001	0.000		0.125	0.026	0.041	0.004	0.000	0.001
	N	10	10	10	10	10	10	10	10	8
Written Words Pre	Pearson Correlation	0.506	0.549	0.518	1	.892**	.874**	0.433	0.429	0.433
	Sig. (2-tailed)	0.135	0.100	0.125		0.001	0.001	0.212	0.216	0.284
	N	10	10	10	10	10	10	10	10	8
Written Words Post	Pearson Correlation	.673*	.764*	.695*	.892**	1	.836**	0.626	0.626	0.584
	Sig. (2-tailed)	0.033	0.010	0.026	0.001		0.003	0.053	0.053	0.128
	N	10	10	10	10	10	10	10	10	8
Written Words Fall	Pearson Correlation	0.559	.728*	.651*	.874**	.836**	1	0.398	0.569	0.371
	Sig. (2-tailed)	0.093	0.017	0.041	0.001	0.003		0.254	0.086	0.366
	N	10	10	10	10	10	10	10	10	8
Spoken Sentences Pre	Pearson Correlation	.941**	.708*	.817**	0.433	0.626	0.398	1	.922**	.936**
	Sig. (2-tailed)	0.000	0.022	0.004	0.212	0.053	0.254		0.000	0.001
	N	10	10	10	10	10	10	10	10	8
Spoken Sentences Post	Pearson Correlation	.923**	.823**	.907**	0.429	0.626	0.569	.922**	1	.943**
	Sig. (2-tailed)	0.000	0.003	0.000	0.216	0.053	0.086	0.000		0.000

	N	10	10	10	10	10	10	10	10	8
Spoken Sentences Fall	Pearson Correlation	.875**	.770*	.926**	0.433	0.584	0.371	.936**	.943**	1
	Sig. (2-tailed)	0.004	0.025	0.001	0.284	0.128	0.366	0.001	0.000	
	N	8	8	8	8	8	8	8	8	8
Written Sentences Pre	Pearson Correlation	.838**	.827**	.786**	.806**	.900**	.801**	.806**	.808**	.780*
	Sig. (2-tailed)	0.002	0.003	0.007	0.005	0.000	0.005	0.005	0.005	0.022
	N	10	10	10	10	10	10	10	10	8
Written Sentences Post	Pearson Correlation	.733*	.768**	.694*	.822**	.922**	.720*	.729*	.656*	.743*
	Sig. (2-tailed)	0.016	0.009	0.026	0.003	0.000	0.019	0.017	0.039	0.035
	N	10	10	10	10	10	10	10	10	8
Written Sentences Fall	Pearson Correlation	.697*	0.617	.678*	.905**	.904**	.808**	.708*	.708*	0.664
	Sig. (2-tailed)	0.037	0.077	0.045	0.001	0.001	0.008	0.033	0.033	0.073
	N	9	9	9	9	9	9	9	9	8
Spoken Paragraph Pre	Pearson Correlation	0.434	-0.051	0.171	-0.082	0.043	-0.206	0.544	0.405	0.332
	Sig. (2-tailed)	0.211	0.888	0.636	0.822	0.905	0.569	0.104	0.245	0.421
	N	10	10	10	10	10	10	10	10	8
Spoken Paragraph Post	Pearson Correlation	0.541	0.178	0.442	-0.022	0.096	-0.174	.741*	0.592	.734*
	Sig. (2-tailed)	0.107	0.622	0.201	0.953	0.791	0.631	0.014	0.071	0.038
	N	10	10	10	10	10	10	10	10	8
Spoken Paragraph Fall	Pearson Correlation	0.663	0.195	0.480	0.206	0.275	0.040	.771*	.725*	0.697
	Sig. (2-tailed)	0.052	0.615	0.190	0.595	0.474	0.919	0.015	0.027	0.055
	N	9	9	9	9	9	9	9	9	8
Rep Words Pre	Pearson Correlation	.638*	0.284	0.514	-0.033	0.025	-0.011	.710*	.673*	0.619
	Sig. (2-tailed)	0.047	0.427	0.129	0.928	0.944	0.975	0.021	0.033	0.102

	N	10	10	10	10	10	10	10	10	8
Rep Words Post	Pearson Correlation	.738*	0.333	0.553	0.055	0.172	0.070	.781**	.733*	0.607
	Sig. (2-tailed)	0.015	0.347	0.098	0.880	0.635	0.848	0.008	0.016	0.110
	N	10	10	10	10	10	10	10	10	8
Rep Words Fall	Pearson Correlation	0.439	-0.016	0.113	-0.136	-0.200	-0.171	0.374	0.241	0.239
	Sig. (2-tailed)	0.205	0.964	0.755	0.708	0.580	0.637	0.286	0.503	0.568
	N	10	10	10	10	10	10	10	10	8
Rep Complex Words Pre	Pearson Correlation	0.450	0.209	0.283	-0.301	-0.005	-0.058	0.458	0.557	0.137
	Sig. (2-tailed)	0.192	0.562	0.428	0.398	0.990	0.873	0.183	0.095	0.746
	N	10	10	10	10	10	10	10	10	8
Rep Complex Words Post	Pearson Correlation	0.606	0.462	0.610	-0.124	0.065	0.093	.685*	.797**	0.683
	Sig. (2-tailed)	0.063	0.179	0.061	0.732	0.858	0.799	0.029	0.006	0.062
	N	10	10	10	10	10	10	10	10	8
Rep Complex Words Fall	Pearson Correlation	0.361	0.116	0.317	-0.087	-0.168	0.078	0.334	0.456	0.245
	Sig. (2-tailed)	0.305	0.749	0.372	0.810	0.642	0.831	0.345	0.185	0.559
	N	10	10	10	10	10	10	10	10	8

Appendix O

Table 16

Correlations between Participant Demographics (Age, Education, Months Post-Onset) and Dependent Variables (BNT, CADL-3, CCRSA)

		BNT Pre	BNT Follow Up	BNT Follow Up	CADL Pre	CADL Post	CADL Follow Up	CCRSA Pre	CCRSA Post	CCRSA Follow Up
Months Post Onset	Pearson Correlation	-0.544	-0.502	-0.462	-0.507	-0.495	-0.417	0.452	0.446	0.537
	Sig. (2-tailed)	0.104	0.139	0.179	0.246	0.259	0.352	0.189	0.196	0.136
	N	10	10	10	7	7	7	10	10	9
Age	Pearson Correlation	-0.077	-0.516	-0.237	-0.498	-0.594	-0.630	0.018	0.072	0.048
	Sig. (2-tailed)	0.832	0.127	0.509	0.256	0.160	0.129	0.961	0.843	0.903
	N	10	10	10	7	7	7	10	10	9
Education	Pearson Correlation	-0.325	0.154	-0.072	0.019	0.073	0.411	0.463	0.085	0.338
	Sig. (2-tailed)	0.360	0.671	0.843	0.968	0.876	0.360	0.178	0.816	0.373
	N	10	10	10	7	7	7	10	10	9

Appendix P

Table 17

Correlations between Participant Demographics (Age, Education, Months Post-Onset) and Dependent Variables (CAT), Part 1

		Naming Objects Pre	Naming Objects Post	Naming Objects Follow Up	Naming Actions Pre	Naming Actions Post	Naming Actions Follow Up	Spoken Words Pre	Spoken Words Post	Spoken Words Follow Up
Months Post Onset	Pearson Correlation	-0.414	-0.465	-0.434	-0.071	-0.136	-0.060	-0.053	-0.309	-0.072
	Sig. (2-tailed)	0.234	0.175	0.210	0.845	0.708	0.870	0.884	0.385	0.842
	N	10	10	10	10	10	10	10	10	10
Age	Pearson Correlation	-0.469	-0.311	-0.181	-0.224	-0.456	-0.304	-.687*	-.820**	-.805**
	Sig. (2-tailed)	0.172	0.382	0.616	0.533	0.185	0.394	0.028*	0.004*	0.005*
	N	10	10	10	10	10	10	10	10	10
Education	Pearson Correlation	0.112	0.020	0.030	0.160	0.284	0.143	0.499	0.485	0.489
	Sig. (2-tailed)	0.759	0.957	0.934	0.659	0.427	0.693	0.142	0.155	0.151
	N	10	10	10	10	10	10	10	10	10

Appendix Q

Table 18

Correlations between Participant Demographics (Age, Education, Months Post-Onset) and Dependent Variables (CAT), Part 2

		Written Words Pre	Written Words Post	Written Words Follow Up	Spoken Sentences Pre	Spoken Sentences Post	Spoken Sentences Follow Up	Written Sentences Pre	Written Sentences Post	Written Sentences Fall
Months Post Onset	Pearson Correlation	-0.239	-0.128	-0.335	0.069	0.027	0.026	-0.296	-0.321	0.020
	Sig. (2-tailed)	0.506	0.725	0.344	0.849	0.940	0.950	0.406	0.366	0.960
	N	10	10	10	10	10	8	10	10	9
Age	Pearson Correlation	-0.253	-0.406	-0.365	-.663*	-.685*	-.754*	-0.606	-0.559	-0.340
	Sig. (2-tailed)	0.480	0.245	0.300	0.037*	0.029*	0.031*	0.063	0.093	0.371
	N	10	10	10	10	10	8	10	10	9
Education	Pearson Correlation	0.338	0.570	0.373	0.469	0.489	0.404	0.510	0.485	0.485
	Sig. (2-tailed)	0.339	0.086	0.288	0.171	0.151	0.321	0.132	0.155	0.186
	N	10	10	10	10	10	8	10	10	9

Appendix R

Table 19

Correlations between Participant Demographics (Age, Education, Months Post-Onset) and Dependent Variables (CAT), Part 3

		Spoken Paragraph Pre	Spoken Paragraph Post	Spoken Paragraph Follow Up	Repetition Words Pre	Repetition Words Post	Repetition Words Follow Up	Repetition Complex Words Pre	Repetition Complex Words Post	Repetition Complex Words Follow Up
Months Post Onset	Pearson Correlation	.665*	0.482	0.472	0.215	0.333	-0.169	0.449	0.196	0.075
	Sig. (2-tailed)	0.036*	0.159	0.200	0.551	0.347	0.641	0.193	0.588	0.837
	N	10	10	9	10	10	10	10	10	10
Age	Pearson Correlation	0.041	-0.356	-0.231	-0.486	-0.422	-0.354	-0.074	-0.492	-0.326
	Sig. (2-tailed)	0.911	0.312	0.549	0.154	0.224	0.315	0.839	0.149	0.357
	N	10	10	9	10	10	10	10	10	10
Education	Pearson Correlation	0.112	0.250	0.512	-0.041	0.159	-0.054	0.353	0.130	0.218
	Sig. (2-tailed)	0.757	0.486	0.159	0.911	0.660	0.882	0.317	0.720	0.545
	N	10	10	9	10	10	10	10	10	10

Appendix S

Table 20

Pairwise Comparisons

Measure			Mean Difference (I-J)	SD Error	Sig.[b]	95% CI Lower Bound	95% CI Upper Bound
BNT	Pre-Test	Post-Test	-1.833	0.872	0.269	-4.917	1.250
		Follow-Up	-1.333	1.054	0.785	-5.059	2.392
	Post-Test	Pre-Test	1.833	0.872	0.269	-1.250	4.917
		Follow-Up	0.500	1.478	1.000	-4.722	5.722
	Follow-Up	Pre-Test	1.333	1.054	0.785	-2.392	5.059
		Post-Test	-0.500	1.478	1.000	-5.722	4.722
CADL-3	Pre-Test	Post-Test	-3.500*	0.764	0.018*	-6.199	-0.801
		Follow-Up	-3.000	1.713	0.421	-9.053	3.053
	Post-Test	Pre-Test	3.500*	0.764	0.018	0.801	6.199
		Follow-Up	0.500	1.522	1.000	-4.879	5.879
	Follow-Up	Pre-Test	3.000	1.713	0.421	-3.053	9.053
		Post-Test	-0.500	1.522	1.000	-5.879	4.879
CCRSA	Pre-Test	Post-Test	-8.000	5.544	0.626	-27.592	11.592
		Follow-Up	-3.000	4.131	1.000	-17.600	11.600
	Post-Test	Pre-Test	8.000	5.544	0.626	-11.592	27.592
		Follow-Up	5.000	6.393	1.000	-17.593	27.593
	Follow-Up	Pre-Test	3.000	4.131	1.000	-11.600	17.600
		Post-Test	-5.000	6.393	1.000	-27.593	17.593
CAT Naming Objects	Pre-Test	Post-Test	-1.000	1.000	1.000	-4.534	2.534
		Follow-Up	0.500	2.643	1.000	-8.839	9.839
	Post-Test	Pre-Test	1.000	1.000	1.000	-2.534	4.534
		Follow-Up	1.500	2.460	1.000	-7.193	10.193
	Follow-Up	Pre-Test	-0.500	2.643	1.000	-9.839	8.839
		Post-Test	-1.500	2.460	1.000	-10.193	7.193
CAT Naming Verbs	Pre-Test	Post-Test	0.500	0.764	1.000	-2.199	3.199
		Follow-Up	0.500	0.847	1.000	-2.492	3.492
	Post-Test	Pre-Test	-0.500	0.764	1.000	-3.199	2.199
		Follow-Up	0.000	0.577	1.000	-2.040	2.040
	Follow-Up	Pre-Test	-0.500	0.847	1.000	-3.492	2.492
		Post-Test	0.000	0.577	1.000	-2.040	2.040
CAT Spoken Words	Pre-Test	Post-Test	0.000	0.516	1.000	-1.825	1.825
		Follow-Up	-0.500	0.671	1.000	-2.871	1.871
	Post-Test	Pre-Test	0.000	0.516	1.000	-1.825	1.825
		Follow-Up	-0.500	0.500	1.000	-2.267	1.267
	Follow-Up	Pre-Test	0.500	0.671	1.000	-1.871	2.871
		Post-Test	0.500	0.500	1.000	-1.267	2.267

CAT Written Words	Pre-Test	Post-Test	0.500	0.806	1.000	-2.349	3.349
		Follow-Up	-0.333	0.422	1.000	-1.823	1.157
	Post-Test	Pre-Test	-0.500	0.806	1.000	-3.349	2.349
		Follow-Up	-0.833	0.872	1.000	-3.917	2.250
	Follow-Up	Pre-Test	0.333	0.422	1.000	-1.157	1.823
		Post-Test	0.833	0.872	1.000	-2.250	3.917
CAT Spoken Sentence	Pre-Test	Post-Test	-3.333*	0.333	0.001*	-4.511	-2.155
		Follow-Up	-1.500	1.360	0.961	-6.307	3.307
	Post-Test	Pre-Test	3.333*	0.333	0.001	2.155	4.511
		Follow-Up	1.833	1.424	0.763	-3.199	6.866
	Follow-Up	Pre-Test	1.500	1.360	0.961	-3.307	6.307
		Post-Test	-1.833	1.424	0.763	-6.866	3.199
CAT Written Sentences	Pre-Test	Post-Test	-1.500*	0.342	0.021*	-2.707	-0.293
		Follow-Up	-3.833	1.833	0.272	-10.313	2.646
	Post-Test	Pre-Test	1.500*	0.342	0.021	0.293	2.707
		Follow-Up	-2.333	1.585	0.603	-7.934	3.267
	Follow-Up	Pre-Test	3.833	1.833	0.272	-2.646	10.313
		Post-Test	2.333	1.585	0.603	-3.267	7.934
CAT Spoken Paragraphs	Pre-Test	Post-Test	-0.167	0.477	1.000	-1.853	1.520
		Follow-Up	0.000	0.447	1.000	-1.581	1.581
	Post-Test	Pre-Test	0.167	0.477	1.000	-1.520	1.853
		Follow-Up	0.167	0.167	1.000	-0.422	0.756
	Follow-Up	Pre-Test	0.000	0.447	1.000	-1.581	1.581
		Post-Test	-0.167	0.167	1.000	-0.756	0.422
CAT Repetition of Words	Pre-Test	Post-Test	0.500	1.057	1.000	-3.235	4.235
		Follow-Up	5.000	3.296	0.569	-6.650	16.650
	Post-Test	Pre-Test	-0.500	1.057	1.000	-4.235	3.235
		Follow-Up	4.500	3.640	0.814	-8.364	17.364
	Follow-Up	Pre-Test	-5.000	3.296	0.569	-16.650	6.650
		Post-Test	-4.500	3.640	0.814	-17.364	8.364
CAT Repetition of Complex Words	Pre-Test	Post-Test	-1.167	0.654	0.404	-3.478	1.145
		Follow-Up	-0.833	1.138	1.000	-4.854	3.188
	Post-Test	Pre-Test	1.167	0.654	0.404	-1.145	3.478
		Follow-Up	0.333	0.989	1.000	-3.161	3.828
	Follow-Up	Pre-Test	0.833	1.138	1.000	-3.188	4.854
		Post-Test	-0.333	0.989	1.000	-3.828	3.161

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.