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Who Benefits From an Intensive Comprehensive Aphasia Program?

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Purpose: This article summarizes current outcomes from intensive comprehensive aphasia programs (ICAPs) and examines data from one ICAP to identify those who respond and do not respond to treatment. **Methods:** Participants were divided into 2 groups, responders and nonresponders, based on ±5-point change score on the Western Aphasia Battery–Revised Aphasia Quotient. Independent-samples t tests and χ^2 tests were performed to identify differences between groups on demographic (age and gender) and aphasia-related factors (months postonset, type of aphasia, aphasia severity, naming, nonverbal cognition measure, and self-rating of communication confidence). Logistic regression determined if factors contributed to a treatment response. **Results:** There were significant differences between the groups on age and months postonset. Gender, type of aphasia, naming, nonverbal cognitive measure, and communication confidence were not significantly different. Logistic regression indicated that age was the only predictive factor contributing to treatment response. **Conclusions:** This study only identified age as a predictor of responders. Future research may need to examine a broader scope of variables that can impact recovery in aphasia. **Key words:** *aphasia*, *intensive*, *prognosis*, *treatment*

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IN RECENT YEARS, intensive comprehensive aphasia programs (ICAPs) have been increasing in number, with a growing literature examining their outcomes (Babbitt, Worrall, & Cherney, 2015; Code, Torney, Gildea-Howardine, & Willmes, 2010; Dignam, Copland, et al., 2015; Hinckley & Craig, 1998; Persad, Wozniak, & Kostopoulos, 2013; Rodriguez et al., 2013; Rose, Cherney, & Worrall, 2013; Winans-Mitrik et al., 2014). To be considered an intensive program, an ICAP must provide therapy ranging from a total of 30 hr over 2 weeks (15 hr per week) up to 150 hr over 4 weeks (37.5 hr per week) for a cohort of participants who start and end the program at the same time (Rose et al., 2013). To be considered comprehensive, an ICAP must target impairment and activity/participation language skills, provide family education, and use a variety of service delivery approaches (e.g., individual-, group-, and technology-based). Intensive comprehensive aphasia programs

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provide greater overall intensity and number of hours of therapy than treatment typically provided in outpatient settings. Outcomes from clinical ICAPs reported in the studies cited earlier have been generally positive, with many participants showing significant improvements across multiple-language domains on standardized assessments including patient-reported measures; yet, there are also participants who do not make changes (Code et al., 2010; Persad et al., 2013; Rodriguez et al., 2013; Winans-Mitrik et al., 2014).

People with aphasia, family members, clinicians, supporting organizations, and insurance companies invest time and considerable resources into ICAPs. However, research has not yet been conducted that is able to predict who will benefit most from participation in an ICAP. Recovery during rehabilitation is a complex process and many factors contribute. Previous research attempting to predict recovery from aphasia has highlighted the heterogeneity of factors that lead to improvements (Cherney & Robey, 2008). These factors can be divided into neurological characteristics, which include size and location of lesion, and type and severity of the aphasia (Watila & Balarabe, 2015). Basso (1992) describes other demographic characteristics as anagraphic (an inventory or record). These include age, gender, and handedness. In looking at which characteristics impact recovery, some have reported that aphasia severity, lesion size, and location are important (Plowman, Hentz, & Ellis, 2012). Others have reported that age, education, and type of stroke and aphasia predict recovery (El Hachioui et al., 2013). Still others have reported that age, gender, handedness, education, and variability in initial severity do not seem to be important factors that predict recovery (Lazar & Antoniello, 2008). These authors also reported that that lesion size and location might be predictors. In addition, some potential factors, such as premorbid neurological and health status (i.e., learning disabilities, high blood pressure, diabetes, and depression), may confound recovery, but they are not typically measured or reported. Such factors may impact deficits and recovery in ways that are not yet known (El Hachioui et al., 2014; Goldstein, Levey, & Steenland, 2013; Watila & Balarabe, 2015). Furthermore, personal characteristics and environments, such as motivation, personal beliefs, and family support systems, may impact recovery (Cruice, Worrall, & Hickson, 2011; Cruice, Worrall, Hickson, & Murison, 2003; Votruba, Rapport, Whitman, Johnson, & Langenecker, 2013). A final challenge in interpreting prognostic studies is that there is sparse information regarding the type and amount of speech–language treatment participants received during long-term recovery.

It may be possible to identify factors that contribute to prognosis by looking at one type of service delivery model. Table 1 summarizes the results of seven articles that report outcomes of ICAPs. Even looking at this one service delivery model, there is considerable variation across the studies in terms of methodology, type of treatment, intensity of treatment, and outcome measures. This makes comparisons across studies difficult. Nevertheless, the outcomes show that participants in ICAPs do make progress, progress is not uniform across participants, and not every participant makes progress in every area measured. This suggests that further research may yet be able to identify patterns of prognostic factors.

In terms of the types of therapy provided in the programs, four reported on clinical treatment programs whereas three were research studies. All but one reported using evidence-based treatments; another program did not describe the therapy beyond mentioning it was individualized (Code et al., 2010; Hinckley & Craig, 1998). All reported a social or group component. Four of the studies mentioned a family component, with family either participating in therapy or receiving education.

Another difference among prior studies was the intensity of treatment provided. There is a range of what is called intensive, as the ICAPs in these seven studies reported delivering between 16 and 30 hr of therapy per week. One approach to describing intensity

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Table 1. Research to date on clinical and research intensive comprehensive aphasia programs

Authors	Date	Title	Type of Program/ Research Design	*n*	Intensity	Components of Therapy	Outcome Measures	Significant Outcomes	Nonsignificant Outcomes
Clinical Intensive Comprehensive Aphasia Programs									
Babbitt, Worrall, & Cherney	2015	Structure, processes, and retrospective outcomes from an intensive comprehensive aphasia program	Clinical Single-group Retrospective analysis Pre/post	74	6 hr/day 5 days/week 4 weeks 120 hr total TIR = 75%	Evidence-based Individualized Group Computer Family education	Impairment: WAB AQ, LQ, CQ, BNT Participation: CCRSA ASHA-QCL CETI (participant and family member)	Impairment: Significant change in all measures Large effect size = AQ, LQ, CQ Medium effect size = BNT Participation: Significant change in all measures Medium effect size = QCL, CCRSA, CETI (participant) Large effect size = CETI (family member)	Impairment: ANOVA showed no significant differences in LQ change scores on months postonset, severity of aphasia, type of aphasia
Winans-Mitrik et al.	2014	Description of an intensive residential aphasia treatment program: Rationale, clinical processes, and outcomes	Clinical Single-group Retrospective analysis Baseline/pre/post	73	5 hr/day 5 days/week 4 weeks 100 hr total TIR = 62.5%	Evidence-based Individualized Group	Impairment: CAT Discourse: Story retell Procedure Participation: ACOM (participant and family member)	Significant group change from baseline to pretreatment on all measures Greater magnitude of change and rate of change on all measures from pre- to posttreatment as compared with baseline to pretreatment	

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Table 1. Research to date on clinical and research intensive comprehensive aphasia programs (*Continued*)

Authors	Date	Title	Type of Program/ Research Design	*n*	Intensity	Components of Therapy	Outcome Measures	Significant Outcomes	Nonsignificant Outcomes
Persad & Wozniak	2013 Study 1	Retrospective analysis of outcomes from two intensive comprehensive aphasia programs	Clinical Single-group Retrospective analysis Pre/post	54	4.5 hr/day 5 days/week 6 weeks 138 hr total TIR = 57.5%	Research-based Individualized Social and recreational activities Caregiver participation	Analysis of Responders (≥5 pt. change on WAB-R AQ) compared with nonresponders (<5 pt. change on WAB-R AQ)	Significant difference = Responders have more severe initial AQ Significant correlation = Lower initial AQ score correlates with greater AQ change score	ANOVA showed no significant differences of responder vs. nonresponder in AQ change scores for: age, months postonset, and gender No correlations for age, months postonset and AQ change scores
Persad & Wozniak	2013 Study 1	Retrospective analysis of outcomes from two intensive comprehensive aphasia programs	Clinical Single-group Retrospective analysis Pre/post	70	5 hr/day 5 days/week 4.5 weeks 112.5 hr total TIR = 62.5%	Evidence-based Individualized Computer Social/ community/ leisure activity	Impairment: WAB-R AQ Participation: CETI CADL-2	Impairment: Significant change for one third of participants on WAB-R AQ Participation: Significant change for approximately one-half of participants on CETI and CADL-2 Significant correlation between Initial AQ score and CADL change score Factors: Significant correlation for age and time postonset (older and longer time postonset may have less than AQ change scores) Significant correlation for age and gender (male participants younger than female)	No correlation for AQ change scores, CADL and CETI

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Table 1. Research to date on clinical and research intensive comprehensive aphasia programs (*Continued*)

Authors	Date	Title	Type of Program/ Research Design	*n*	Intensity	Components of Therapy	Outcome Measures	Significant Outcomes	Nonsignificant Outcomes
Hinckley & Craig	1998 Study 1	Influence of rate of treatment on the naming abilities of adults with aphasia	Clinical Single group Retrospective analysis Pre/post/ follow-up ABA: 6 weeks—Intensive 6–8 weeks—No treatment 6 weeks—Intensive	15	4.5 hr/day 5 days/week 6 weeks 135 hr total TIR = 56% vs. No therapy	Individualized treatment Small group Computers	Impairment: BNT Discourse: Cookie Theft Picture content units	Significant change during first Intensive on BNT and Discourse content units Significant change during second Intensive on BNT and Discourse content units	No significant change during no-treatment phase
Hinckley & Craig	1998 Study 2	Influence of rate of treatment on the naming abilities of adults with aphasia	Clinical Single group Retrospective analysis Pre/post/ follow-up ABA: 6 weeks—Intensive 6 weeks—<3 hr/week SLT 6 weeks—Intensive	15	4.5 hr/day 5 days/week 6 weeks 135 hr total TIR = 56% vs. <3 hr/week 6 weeks <18 hr total TIR ≤7.5%	Individualized treatment Small group Computers	Impairment: BNT Discourse: Cookie Theft Picture content units	Significant change during first Intensive on BNT and Discourse content units Significant change during second Intensive on BNT and Discourse content units	No significant change during non-Intensive treatment phase

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Table 1. Research to date on clinical and research intensive comprehensive aphasia programs (*Continued*)

Authors	Date	Title	Type of Program/ Research Design	*n*	Intensity	Components of Therapy	Outcome Measures	Significant Outcomes	Nonsignificant Outcomes
Hinckley & Craig	1998 Study 3	Influence of rate of treatment on the naming abilities of adults with aphasia	Clinical Single group Retrospective analysis Pre/post/ follow-up ABA: 6 weeks—Intensive 6 weeks—3–5 hr/week SLT 6 weeks—Intensive	15	4.5 hr/day 5 days/week 6 weeks 135 hr total TIR = 56% vs. 3–5 (avg. 4) hr/week 6 weeks 18–30 hr total TIR = 7.5%–12.5%	Individualized treatment Small group Computers	Impairment: BNT Discourse: Cookie Theft Picture content units	Significant change during first Intensive on BNT Significant change during second Intensive on BNT and Discourse content units	No significant change during first Intensive on Discourse content units No significant change during non-Intensive treatment phase
Research Intensive Comprehensive Aphasia Programs									
Dignam, Rodriguez, & Copland	2015	Evidence for intensive aphasia therapy	Research Phase II nonrandomized Parallel group Pre/post/ follow-up	LIFT: 16 D-LIFT: 16	LIFT: 3–4 hr/day 16 hr/week 3 weeks 48 hr total TIR = 40% vs. Distributed LIFT: 1–2 hr/day 3–4 days/week 6 hr/week 8 weeks 48 hr total TIR = 15%	Naming treatment Computers Group education	Impairment: BNT Participation: CETI (family) CCRSA ALA	Impairment: Significant changes in LIFT and D-LIFT at posttreatment and follow-up D-LIFT showed significantly greater changes than LIFT at both posttreatment and follow-up Participation: CETI and CCRSA were significantly higher for both groups posttherapy ALA was significantly higher for both groups posttreatment and follow-up	Participation: No significant differences between LIFT and D-LIFT on CETI, CCRSA, and ALA at posttreatment and follow-up

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Table 1. Research to date on clinical and research intensive comprehensive aphasia programs (*Continued*)

Authors	Date	Title	Type of Program/ Research Design	*n*	Intensity	Components of Therapy	Outcome Measures	Significant Outcomes	Nonsignificant Outcomes
Rodriguez et al.	2013	Aphasia LIFT: Exploratory investigation of an intensive comprehensive aphasia program	Research Pre/post/ follow-up	LIFT1: 4 LIFT2: 7	LIFT1: 4 hr/day 5 days/week 2 weeks 40 hr total TIR = 50% LIFT2: 5 hr/day 5 days/week 4 weeks 100 hr total TIR = 62.5%	Goal setting Family education Individual therapy Evidence-based treatments Group Challenge task Computer (LIFT2)	Impairment: CAT—Naming subtest BNT Discourse: Procedural and narrative production-content information units Participation: CETI (family) ASHA-QCL ALA	Impairment: Significant but small change on BNT Participation: Significant change on CETI posttreatment and further increases at follow-up Significant change on ALA posttherapy	Impairment: No significant change: CAT Naming subtest No Significant change: Discourse Participation: QCL approached significance on follow-up
Code, Torney, Gildea-Howardine, & Willmes	2010	Outcome of a 1-month treatment intensive for chronic aphasia: Variable individual responses	Research Small group Single subject 3 Baselines/post/ follow-up	7	1 month—daily treatment (no other description, based on Mackenzie, 1991)	Individualized (no description) Group (no description, except AOS group) Counseling offered to participant Family counseling and education	Impairment: EAAT Participation: CETI	Impairment: Significant change pre- to posttreatment and posttreatment to follow-up Participation: Significant changes on CETI for three participants and maintained at follow-up	Participation: No significant change on CETI for three participants (no scores for one participant)

Note. ACOM = Aphasia Communication Outcome Measure; ALA = Assessment for Living with Aphasia; ANOVA = analysis of variance; AOS = apraxia of speech; ASHA-QCL = American Speech-Language-Hearing Association Quality of Communicative Life; BNT = Boston Naming Test; CADL-2 = Communication Activities of Daily Living–Second Edition; CAT = Comprehensive Aphasia Test; CCRSA = Communication Confidence Rating Scale for Aphasia; CETI = Communicative Effectiveness Index; D-LIFT = Distributed–Language Impairment and Functioning Treatment; EAAT = English version–Aachen Aphasia Test; LIFT = Language Impairment and Functioning Treatment; SLT = speech–language therapy; TIR = Therapeutic Intensity Ratio; WAB-R AQ, LQ, CQ = Western Aphasia Battery-Revised Aphasia Quotient, Language Quotient, Cognitive Quotient.

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is to report not only the number of hours of therapy provided but also include a measure of how intensively the therapy was provided. Using the Therapeutic Intensity Ratio (TIR) described by Babbitt et al. (2015), the "intensiveness" of the treatments can be compared. The TIR is based on the definition of cumulative intervention intensity (Warren, Fey, & Yoder, 2007). To summarize briefly, the concept of cumulative intervention intensity is expressed as the following formula: the number of properly administered teaching episodes in a session (dose) × the number of times a dose is provided per day per week (dose frequency) × the total time period over weeks or months (intervention duration). The "intensiveness" of a treatment is a percentage ratio of how many hours of therapy are delivered per week divided by the total potential hours of therapy that could be delivered, using a 40-hr workweek as a maximum number of hours. On the basis of the reported number of hours of therapy per week, the TIR for these studies ranged from 40% to 75%. In contrast, the TIR for distributed treatment in the studies that compared intensive with distributed treatments ranged from 7.5% to 15% TIR (Dignam, Copland, et al., 2015; Hinckley & Craig, 1998).

It is not yet clear what the optimum treatment intensity should be (Dignam, Copland, et al., 2015). Reporting on the "intensiveness" of a treatment program will allow for better interpretation of outcomes across studies; however, more detailed information about the actual treatment dose and active ingredient are important components needs to be described (Cherney, 2012). As Baker (2012) noted, there is a lack of consensus regarding the definition of intensive treatment. It may be possible to define and distinguish between minimal, moderate, and maximum intensity treatment protocols if research studies provide more specific information about dose, dosage, duration, and intensiveness.

A variety of outcome measures were used across studies. The clinical programs reported using the Western Aphasia Battery–Revised (WAB-R; Kertesz, 2007), the Boston Naming Test (BNT; Goodglass, Kaplan, Weintraub, & Segal, 2001), the Comprehensive Aphasia Test (CAT; Swinburn, Porter, & Howard, 2004), and discourse measures as impairment-based measures. Research ICAPs used the CAT, the BNT, the Aachen Aphasia Test (AAT; Huber, Poeck, & Willmes, 1983), and discourse measures. For participation measures, the clinical programs used the Communication Activities of Daily Living–Second Edition (Holland, Frattali, & Fromm, 1999), the Communication Confidence Rating Scale for Aphasia (CCRSA; Babbitt, Heinemann, Semik, & Cherney, 2011), the American Speech-Language-Hearing Association Quality of Communicative Life (ASHA-QCL; Paul et al., 2005), the Communicative Effectiveness Index (CETI) for caregivers and persons with aphasia (Lomas et al., 1989), and the Aphasia Communication Outcome Measure for caregivers and persons with aphasia (Hula et al., 2015). The research ICAPs used the CCRSA, the ASHA-QCL, the CETI for caregivers, and the Assessment for Living with Aphasia (Kagan et al., 2010). The variety of measures administered highlights the lack of consensus regarding which assessments should be included to measure impairment and participation.

All seven studies reported positive and significant changes or correlations of specific factors from pre- to posttreatment on most of the selected outcome measures. Several studies noted no correlations or relationships between any of the factors they examined. Table 1 summarizes significant and nonsignificant changes reported by each study. It is difficult to find common patterns with these results because of the small number of studies, differences between research and clinical programs, differences in the number of participants, and the variety of outcome measures. However, it is important for future research and implementation of clinical programs to understand the similarities and differences in outcomes across the programs.

Babbitt et al. (2015) reported significant differences on all impairment and participation measures from pre- to posttreatment.

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Effect sizes were large for the WAB-R Aphasia Quotient (AQ), Language Quotient (LQ), and Cognitive Quotient (CQ) and moderate for the BNT. Family-reported effect size was large on the CETI and moderate for participant-reported CETI, ASHA-QCL, and CCRSA. Winans-Mitrik et al. (2014) described improvements from baseline to the start of the program, perhaps because participants received ongoing treatment during that interim. Nevertheless, the authors found that during the intensive program, the magnitude of change from pre- to posttreatment was significantly greater than during the baseline phase. Rodriguez et al. (2013) noted that there were significant differences on the BNT and participation measures, with two participation measures also showing significant differences at follow-up. Dignam, Copland, et al. (2015) compared an intensive treatment with a distributed treatment and found that both groups improved significantly from pre- to posttreatment on the BNT, with the distributed group demonstrating significantly greater improvement at posttreatment and follow-up. The participation measures showed significant differences at posttreatment and follow-up for both groups, but there were no significant differences between the groups at either time point. Hinckley and Craig (1998) also compared intensive treatment versus little or no treatment and reported significant change from pre- to posttreatment for the intensive treatment and no change during the nonintensive and no-treatment phases. Although the studies reported mostly positive changes, who makes a good candidate for an intensive program and which factors may contribute to responsiveness to treatment are still unknown.

Only one study has explored what characteristics may contribute to improvements. Persad et al. (2013) examined two different programs. In one ICAP, there was no significant difference between responders (81%) and nonresponders (19%) in terms of age, time postonset, and gender. There was a significant difference in initial severity on the WAB-R AQ between the groups. The responders were initially more severe on the WAB-R AQ. Conversely, three participants in the nonresponder group were mild and either close to or at ceiling on their WAB-R AQ scores and therefore did not show significant changes. In the other ICAP, approximately half of the participants demonstrated significant improvements in participation measures and approximately two thirds in impairment measures. Only three participants (4%) did not show gains on any measure. There was no difference between the groups related to age, gender, time postonset, and initial WAB-R AQ. They did find a relationship with WAB-R AQ change scores that suggested older participants attended later postonset and men sought treatment at a younger age than women did. These results indicate that there are possible factors contributing to who responds to treatment following participation in an ICAP.

Building on the findings of Persad et al. (2013), our aim was to explore further participant factors that are associated with benefit from an ICAP. The clinical program in this research aligns with the characteristics of ICAPs by providing evidence-based treatment that includes individualized goals, group treatments with a social focus, and family participation and education (Babbitt et al., 2015). We have previously reported on retrospective outcomes from 74 participants in this clinical ICAP showing significant gains from pre- to posttreatment on all impairment and participation measures (Babbitt et al., 2015). This is a secondary analysis of the data set, with an additional nine first-time participants ($N = 83$) from a consecutive cohort. The current analysis examined the question whether there were any independent variables that contributed to a response to treatment (dependent variable) following participation in an ICAP.

METHODS

Participants

Data from 83 first-time participants in this ICAP were included in the data analysis. The

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month-long clinical ICAP was offered twice a year from 2008 to 2014 for a total of 12 programs. Pre- and postevaluations took place on the first day of the program and during the last week of the program. Institutional review boards of Northwestern University and the University of Queensland approved the retrospective analysis of the clinical data.

The average age of the participants was 54.6 years ($SD = 16.1$, range = 18–86 years). Fifty-eight participants were male and 25 were female. Three participants were African American or Asian and 80 were Caucasian. Seventy-eight participants were right-handed. Reported education level showed that 78 had at least some college, up to an advanced degree, and 5 had 9th- to 11th-grade or high school diploma. The average pretreatment WAB-R AQ score was 49.2 ($SD = 22.4$, range = 7–91.4), and average time postonset was 15.1 months ($SD = 14.1$, range = 3–87 months). Most participants ($n = 78$) had a left-hemisphere stroke, and 57 had a diagnosis of nonfluent aphasia. Fifty participants had a diagnosis of motor speech impairment including apraxia of speech ($n = 46$), dysarthria ($n = 3$), or both ($n = 1$). See Table 2 for a summary of demographic and stroke characteristics.

Assessments and treatment

Participants in this ICAP were evaluated with impairment-based and self-reported participation outcome measures. Impairment measures included the WAB-R, including AQ, LQ, and CQ, and the BNT. Patient-reported outcome measures (PROMs) included the ASHA-QCL, the CCRSA, and the CETI (completed by both the participant and a family member). This ICAP provided treatment for 6 hr a day, 5 days a week for 4 weeks, for a total of 120 hr (75% TIR) to cohorts of 10 participants at a time. Detailed description of the assessments, treatment, and program structure was provided by Babbitt et al. (2015).

Data analysis

The 83 first-time participants were divided into two groups: responders and nonresponders. Responders were defined as participants who achieved 5 points or greater improvement on the WAB-R AQ from pre- to posttreatment. Nonresponders were those who did not achieve a 5-point change. A 5-point change has been used as a benchmark for a clinically significant change in previous studies (Katz & Wertz, 1997; Persad et al., 2013); hence, this criterion was selected as an indicator of benefit from this program. Independent-samples t tests and χ^2 analyses were performed to determine if there were significant differences between the two groups. Logistical regression was then used to identify the factors that may contribute to a treatment response to the ICAP. The independent variables included age, months postonset, type of aphasia, aphasia severity, naming, nonverbal cognition measure, and self-rating of communication confidence. Factors such as lesion location and size were not included because the clinical program did not require neurological reports from participants.

RESULTS

Of the 83 first-time participants, there were 57 responders (69%) compared with 26 nonresponders (31%). Independent-samples t tests showed that responders were significantly younger with longer time postonset than the nonresponders, $t\ (81) = 2.0$, $p = .02$, and $t\ (81) = -1.8$, $p = .04$. Gender and type of aphasia were not significantly different between the groups. There were no significant differences at the outset between responders and nonresponders on the severity of aphasia measured by the WAB-R AQ score, the BNT, the Raven's Progressive Matrices (nonverbal cognition), or communicative confidence (CCRSA). As expected, the independent-samples t test demonstrated that the two groups were significantly different on the mean change scores of the WAB-R AQ, $t\ (81) = 9.0$, $p < .001$. See Tables 3 and 4 for results of independent-samples t tests and χ^2 analyses.

The logistic regression analysis included factors of age, months postonset, type of

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Table 2. Demographics and stroke characteristics of 83 first-time participants

	n	*M*	*SD*	Range
Demographics				
Age (years)		54.6	16.1	18–86
Gender				
Male	58			
Female	25			
Race/ethnicity				
African American	2			
Asian	1			
Caucasian (Hispanic = 3)	80			
Handedness				
Right	78			
Left	5			
Education				
College/advanced degree	78			
High school education	5			
Stroke characteristics				
WAB-R AQ score		49.2	22.4	7.2–91.4
Months postonset		15.1	14.1	3–87
Etiology				
LH stroke	75			
RH stroke	1			
TBI	3			
Tumor	2			
Inf. disease	2			
Aphasia type				
Nonfluent	57			
Fluent	26			
Motor speech diagnosis				
Apraxia of speech	46			
Dysarthria	3			
Both	1			

Note. WAB-R AQ = Western Aphasia Battery–Revised Aphasia Quotient; Inf. disease = infectious disease; LH = left hemisphere; RH = right hemisphere; TBI = traumatic brain injury.

aphasia, initial severity of aphasia, and change scores on the BNT, Raven's Progressive Matrices, and the CCRSA to identify whether any factor was associated significantly with response to treatment (i.e., WAB-R AQ change score). The model was not statistically significant, $\chi^2(7) = 11.13$, $p = .113$, and only age was a significant factor ($p = .027$). See Table 5 for regression results of factors that contribute to the response to treatment.

Further examination of the 26 nonresponders (<5-point change on the WAB-R AQ) indicated that there were only nine participants (11% of the total number of participants) who did not change on any of the language and patient- and family-reported outcome measures. The mean age of these nine participants (53.8 years, $SD = 16.1$, range = 23–75 years) was similar to the mean age of the total ($N = 83$) participants (54.6 years, $SD = 16.1$, range = 18–86 years). One nonresponder of these nine had an initial WAB-R AQ score of 91.4, thus approaching ceiling and the cutoff score of 93.8 for the presence of aphasia; after the ICAP, a change score of 4 points was recorded. Three others in this

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Table 3. Comparison of responders' and nonresponders' demographic characteristics

Demographics (Total $N = 83$)		Responders			Nonresponders			Statistics	
		n	*M*	*SD*	*n*	*M*	*SD*	*t* Test/χ^2	*p*
Age (years)		57	52.2	16.5	26	59.8	14.1	$t(81) = 2.0$	<.02*
Months postonset		57	16.9	16.3	26	11.0	5.7	$t(81) = -1.8$	<.04*
Gender	M	38			20			$\chi^2 = 0.89$	<.35
	F	19			6				
Aphasia type	NF	41			16			$\chi^2 = 0.90$	<.34
	F	16			10				

Note. F = female; FL = fluent; M = male; NF = nonfluent.
*Significant difference.

group of nine were in the severe range (0–30 on the initial WAB-R AQ), whereas four were in the mild range (61–90). Only one participant was in the moderate range of severity (31–60). Three participants demonstrated decreased self-ratings on the CETI after participation in the ICAP. This may reflect either a better understanding of the impact of their deficits at the end of the program or they had not fully understood the questions at the beginning of the program and rated themselves too high initially. The family members of these nine participants also rated minimal changes on the CETI of less than 12 points, which Lomas et al. (1989) noted as indicative of change.

DISCUSSION

The primary aim of the article was to examine whether demographic and aphasia-related characteristics contributed to response to

Table 4. Comparison of responders and nonresponders on initial impairment and participation measures

Impairment Measures	Total *N*[a]	Responders ($n = 57$)			Nonresponders ($n = 26$)			Statistics, *t* Test	*p*
		n	*M*	*SD*	*n*	*M*	*SD*		
WAB-R AQ difference score	83	57	10.1	4.5	26	1.3	3.0	$t(81) = 9.0$	<.001*
WAB-R AQ/100	83	57	47.17	18.9	26	53.61	28.5	$t(81) = 1.2$	<.11
BNT/60	78	54	14.7	18.2	24	19.3	20.8	$t(76) = 0.97$	<.17
Raven's Progressive Matrices/37	60	43	30.4	4.7	17	27.0	6.5	$t(58) = -0.08$	<.5
CCRSA/40	77	54	30.2	4.7	23	28.5	5.3	$t(81) = 1.0$	<.16

Note. BNT = Boston Naming Test; CCRSA = Communication Confidence Rating Scale for Aphasia; WAB-R AQ = Western Aphasia Battery–Revised Aphasia Quotient.
[a]The number of participants who completed the measure. Reasons for not completing the measure include fatigue, frustration with task, severity of aphasia, or participant refusal.
*Significant difference.

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Table 5. Logistic regression results of factors that contribute to response to treatment

AQ_Bin	Coeff.	*SE*	*z*	$p > \lvert z \rvert$	[95% CI]
AgeEval1	−.0547804	0.0247635	−2.21	.027	[−0.1033159, −0.0062448]
MPOEval1	.0646623	0.045863	1.41	.159	[−0.0252276, 0.1545521]
TypeAph	.724964	0.9213061	0.79	.431	[−1.080763, 2.530691]
AQ1_100	−.0367806	0.0321172	−1.15	.252	[−0.0997291, 0.0261679]
BNT1_60	.0453133	0.0332797	1.36	.173	[−0.0199137, 0.1105402]
Rav1_37	−.0637839	0.0788451	−0.81	.419	[−0.2183174, 0.0907496]
CCRSA1_40	−.0243009	0.0576266	−0.42	.673	[−0.137247, 0.0886453]
_cons	6.003454	3.664301	1.64	.101	[−1.178443, 13.18535]

Note. AgeEval1 = age at first evaluation; AQ_Bin = binary assignment to the responder and nonresponder groups; AQ1_100 = Aphasia Quotient score at first evaluation; BNT1_60 = Boston Naming Test score at first evaluation; CCRSA1_40 = Communication Confidence Rating Scale for Aphasia at first evaluation; MPOEval1 = months postonset at first evaluation; Rav1_37 = Raven's Progressive Matrices score at first evaluation; TypeAph = type of aphasia.

treatment following participation in one particular ICAP. Results from the logistic regression showed that a model of factors could not be created on the basis of the variables that were included. Responders tended to be younger, and this was significant based on *t* tests between the groups (a mean of 52 years compared with 60 years of age). We also found that the number of months postonset after participation in an ICAP was significantly different between the groups on an independent-samples *t* test. The nonresponders averaged slightly less than a year postonset, and the responders were close to a year and a half postonset. Therefore, responders tended to be younger and started the program at a slightly later time postonset. Although time postonset did not seem to be a factor that predicts response to treatment, a longer time postonset may be more conducive for participants to complete an intensive therapy program.

A systematic review of intensive treatment reported that there were challenges in providing high-intensity versus low-intensity treatment, including resource limitations, refusal of treatment, and severity of impairment (Bakheit et al., 2007; Brady, Kelly, Godwin, & Enderby, 2012; Smith et al., 1981). Several studies included acute or subacute participants. Researchers did not fully describe reasons why participants dropped out or treatment was not delivered as intended but mentioned not tolerating therapy, health issues, or distance. Timing of intensive treatment may need to be taken into account when exploring reasons for dropping out of an intensity study early poststroke (Bakheit et al., 2007). Close to half of first-time participants (43%) were between 1 and 5 years postonset (n = 36) when they started the ICAP, indicating that persons with aphasia may be better able to tolerate an intensive therapy schedule and choose to take part in intensive therapy at a longer time postonset.

Another issue is that the results of this study may not be generalizable to many persons with aphasia because those who take part in ICAPs have sought out treatment and are willing to travel and invest a significant amount of time to participate (Ellis, Dismuke, & Edwards, 2010). Overall, these results are positive, as approximately 70% of participants can expect to show response to treatment on the WAB-R AQ results. This is comparable with previous research on ICAPs in that the majority of participants see improvements in at least one area measured (Code et al., 2010; Persad et al., 2013; Rodriguez et al., 2013; Winans-Mitrik et al., 2014). Our examination of the nine participants (11%) who did not make gains on any impairment and participation measures did not reveal any apparent pattern with regard to aphasia severity. Eight

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participants were rated at both ends of the severity spectrum, and only one participant fell in the moderate range. The contrast in the diagnoses and severity levels of the nonresponders may indicate different reasons for nonresponsiveness to treatment. Apraxia of speech impacted the participants with lower WAB-R AQ scores, whereas the participants with WAB-R AQ scores in the mild range had diagnoses of fluent aphasia. A larger sample size may improve our ability to identify patterns or factors that are associated with limited or no progress; it is hard to make conclusions from nine participants.

One aspect of the study that needs closer attention is whether the decision to use a single-impairment measure to differentiate responders and nonresponders was adequate to detect change. In addition, the selection of the cutoff score, a ±5-point change score on the WAB-R AQ, although based on prior research (Katz & Wertz, 1997; Persad et al., 2013), may not have been the best criterion to use. A large percentage (65%) of nonresponders and family members rated themselves or the participant positively on participation measures after the program, even though impairment measures did not change. Given that ICAPs are comprehensive by definition, using one impairment measure provides a very narrow picture of response to treatment. The finding that participants and family members reported positive changes on participation measures could represent a placebo effect, or it might be an indicator that other changes occurred that were not detected by the single measure. A broader definition of what constitutes a responder may identify those persons whose changes are not captured by impairment measures while still controlling for the placebo effects.

The International Classification of Functioning, Disability and Health (ICF) recommends evaluating impairment and activity/participation to provide a more complete picture of a person's abilities (World Health Organization [WHO], 2001). Worrall et al. (2011) found in qualitative interviews that persons with aphasia identified goals that aligned with the ICF in terms of activity/participation. A large literature exists on PROMs for stroke and aphasia that can be utilized for self-ratings of skills and ability (Babbitt et al., 2011; Doyle et al., 2004; Hula et al., 2015; Kagan et al., 2010; Lomas et al., 1989; Paul et al., 2005). A responder could be defined as a participant who demonstrates significant change across two measures each, representing both impairment and activity/participation measures.

An alternative to researchers and clinicians determining a priori what outcome measures are important could be to ask participants what outcome measures are important to them and individually determine responders as those who made improvements in the areas they identified as important. With changes in reimbursement for health care moving toward a value-driven concept versus reimbursing for time and care, patient-reported outcomes and priorities become an important piece of that concept (Rundell et al., 2015). As participants with different types and severity of aphasia seek treatment, it is important to identify personalized goals. Another patient-centered approach to identifying who responds to treatment would be to complete goal-setting activities with the participants and ask participants to rate themselves in terms of making progress (Gustafsson, Fleming, Cornwell, Worrall, & Brauer, 2014; McClain, 2005). Ideally, researchers and clinicians should implement a broader lens when examining who responds to treatment. All of these approaches to measuring improvement may need to be incorporated.

In this study, we were unable to determine a model of factors that explain differences in response to treatment. Furthermore, previous research has reported inconclusive results regarding which factors predict recovery. Therefore, it is important to consider whether other factors not previously studied may impact prognosis and recovery. These range from micro-level gene expression factors to macro-level demographic and personal characteristic factors (e.g., overall health status, exercise habits, and premorbid psychological state). Other macro-level

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factors that may affect responsiveness to treatment positively are stronger social networks, supportive families, or access to community resources. Research should be designed to identify whether such factors, alone or in combination, may be different in persons who respond to treatment.

In terms of micro-level changes that occur, research is beginning to explore how brain-derived neurotrophic factor (BDNF) has been found to be an important neurotrophin for neuron survival, genesis, repair, and recovery (Rostami et al., 2011). Polymorphism of the ApoE ε4 gene may contribute to variability in recovery after stroke (Cramer & Procaccio, 2012; Pearson-Fuhrhop, Kleim, & Cramer, 2009). Other research indicates that there may be an interaction of the micro- and macro-levels. For example, researchers found that mice isolated immediately following stroke produced less BDNF and showed more histological damage and depressive-like behavior than mice that interacted with other mice (O'Keefe et al., 2014). This suggests that isolation following aphasia may lead to depression, which could affect BDNF at the micro-level, thereby affecting response to treatment at the macro-level. Much more research is needed to examine the role of gene expression as a result of neuronal injury and how premorbid alterations in gene expression might impact response to treatment.

Limitations

The major limitation to this study is that the data are derived from a clinical program and there was no comparison with control subjects typical of a research study. The participants were a self-selected sample and the treating clinicians administered the pre- and posttreatment evaluations, thereby potentially introducing assessor biases. Nevertheless, these pilot data provide preliminary evidence supporting participation in ICAPs as most participants made gains.

Clinical implications

It appears that, so far, there are few variables that can predict which participants respond to treatment. This supports the idea that the individualized, intensive, and comprehensive treatment benefits different types of aphasia and a wide range of severity levels. Because more ICAPs are being established each year, it is important to evaluate their outcomes as participants and families continue to seek out intensive treatment.

Another finding was that the percentage of persons who did not make gains in any area that we measured was approximately 11%; therefore, most persons with aphasia do respond to treatment after taking part in an ICAP. This study was unable to identify which factors contribute to improvements using only one impairment-based measure. The broad scope of ICAP treatment extends beyond impairment-based protocols to include WHO-ICF principles of activity/participation. Researchers may need to create a different definition and model for responder versus nonresponder to treatment.

CONCLUSION

Findings from this research study were unable to identify a model of factors that contribute to response to treatment for those participants who were considered responders. The groups were not significantly different in terms of gender, type of aphasia, naming, nonverbal cognition, or confidence. Only one factor was identified—age, which implies that being younger contributes to response to treatment. Age was significantly different between the responder and nonresponder groups, who had mean ages of 52.2 and 59.8 years, respectively. However, age did not appear to be a defining factor, as the responder group included participants from 18 to 86 years of age and the nonresponder group included participants from 23 to 85 years of age. There also was a significant difference in months postonset, approximately 6 months, between responders and nonresponders; however, this did not emerge as a factor in the logistic regression model.

Future research should examine other factors that contribute to treatment response. In

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addition, persons with different severity and types of aphasia may identify different outcome goals. As a result, different outcome measures may be appropriate for different subpopulations. A person with more severe aphasia at a later point in the recovery process may identify activity/participation goals, whereas someone with less severe aphasia who is earlier in the recovery process may have specific impairment goals, or vice versa. It also may be essential both for participants to rate the importance of impairment and participation skills and for researchers to identify responders versus nonresponders on the basis of achievement of individually identified outcomes.

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