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Pilot Study of Crowdsourcing Evidence-Based Practice Research for Adults with Aphasia

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Pilot Study of Crowdsourcing Evidence-Based Practice Research for Adults with Aphasia

by

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Thesis

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Dedication

To my wife, Maggie.

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Abstract

Pilot Study of Crowdsourcing Evidence-Based Practice Research for Adults with Aphasia

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The purpose of this study is to explore crowdsourcing as a research paradigm for creating evidence-based practice research in the field of speech pathology. Using an Internet survey, respondents provided de-identified information about one patient with aphasia they had treated in the previous year. The respondents were then asked to rate the success of treatment. Analysis and grading of the responses was performed to identify which responses were usable for the purpose of planning a treatment for a patient with similar demographics and diagnostic make-up. Results showed that crowdsourcing is a viable research method; however, further refinements to the collection and analysis are required before it can be an effectively used.

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BACKGROUND

Understanding EBP

Clinical decision-making in medical settings has been greatly impacted by the evidence-based practice (EBP) medical model for evaluating and treating individuals (Justice, 2008; Dodd, 2007; Zipoli, 2005; Togher, 2011; Ratner, 2006). The field of speech-language pathology is no exception (Johnson, 2006; Justice, 2008; Zipoli, 2005; Togher, 2011; Ratner, 2006). Researchers and practitioners have defined broadly EBP as the "conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996, pg. 71). In this definition, EBP is described as a *process* where the clinician systematically gathers and synthesizes pertinent information from three sources: (1) Empirically validated scientific evidence from research studies, (2) prior clinician knowledge and experience, and (3) client preferences (Dodd, 2007; Justice, 2008). These sources are used to decide the best course of treatment for an individual patient (Justice, 2008; Dodd, 2007; Togher, 2011). EBP is a departure from previous medical models where the clinician would use personal experience as the primary factor in picking a course of treatment for a client. The clinical experience medical model, although still widely practiced in some form across the world, is highly susceptible to subjective judgments that may compromise patient care (Dodd, 2007). Research literature has shown many examples of widely practiced treatments that have little basis in the research literature, such as Non-Speech Oral Motor Exercises (Lof, 2008). Continued use of treatments without empirical backing wastes resources and misrepresents the field of speech-language pathology. The profession-wide intent to use EBP is a clear departure from using only subjective opinions about treatment efficacy. SLPs have agreed that moving toward judicious use of objective empirical research is a way to improve patient care.

Evidence-based practice is new to the field of speech-language pathology. EBP requires further understanding to become *the* primary medical model for the field of speech-language pathology (Justice, 2008). Consider, for example, the various ways in which the concept of empirical evidence in medical research can be deconstructed: What is empirical evidence as it applies to treatment research? How many studies (and of what quality) are needed to affirm that a particular treatment is validated by empirical evidence? How do clinicians resolve “mixed” or inconclusive results? How do clinicians determine that the clinical populations in the study are relevant to the individual client undergoing treatment (Justice, 2008; Enderby, 2004)? These questions must be systematically answered in order for EBP to be considered the gold standard of medical models. Without a better understanding of how to answer these questions, issues will arise in the EBP process that will undercut the benefits of the process. Consider one of these questions.

What is “empirical evidence” and how do we weigh one piece of evidence against another piece of evidence (Justice, 2008; Johnson, 2006)? In order to codify the use of empirical studies and answer the question, The American Speech, Language, and Hearing Association (ASHA) have created rating scales that rate evidence on an axis between the strongest and the weakest based on the methodology and execution of the study (ASHA 2004). The strongest evidence comes from well-executed and well-designed meta-analysis of more than one randomized control trial, whereas the weakest evidence comes from expert opinions from practitioners in the field (Johnson, 2006).

Figure 1. The Evidence-Based Practice Pyramid.

This type of scale allows a consumer of research to determine the strength of evidence as a basis for treatment. The scale and those like it structure how clinicians interpret evidence so that they are best able to understand and categorize information from multiple sources. The researchers at http://www.speechbite.com from Sydney, Australia have created a method for analyzing research evidence. They have created a database that rates the research on a given diagnostic or treatment category by the strength of supportive evidence. Efforts like this are creating a new way of cataloguing and understanding the evidence of diagnostic and treatment categories. There are limits to these scales, however.

The number of studies rated with the highest credibility is few, with some diagnostic categories completely excluded, which undermines the purpose of the scales (Reilly et al., 2004; Dodd, 2007; Johnson, 2006). Furthermore these rating scales do not address some important topics with regard to practical use in client treatment. First, the scales do not address how to compare evidence for and against a specific treatment with similar credibility ratings. This leaves consumers of the evidence unable to determine the research community's consensus. Second, the scales do not shed light on whether study participants are comparable to specific clients that will be receiving the treatment based on these studies (Enderby, 2004; Montgomery &Turkstra, 2003; Vallino-Napoli, 2004). This is called the problem of generalization and is part of the reason that single-subject design has received new attention (Byiers et. al., 2012). Finally, the scales do not provide guidelines for SLPs to understand and determine substantial effect sizes and confidence intervals in a specific clinical situation (Johnson, 2006). These issues create problems for the implementation of EBP and the scales that help to understand the research that is supposed to substantiate EBP. The need for EBP however, is greater than ever, when we consider the benefit it offers to clinicians and clients.

Need for EBP

Regardless of the issues involved in understanding and implementing EBP, there is a high demand for its use. Consider that using EBP gives clients the best possible services informed by the highest quality evidence (Johnson, 2006; ASHA, 2004; Justice & Fey, 2004). Researchers also have noted that using EBP in clinical decision-making will create more accountability in the practice of speech-language pathology (Justice & Fey, 2004) and credibility to individual clinicians (Dollaghan, 2004).

The need for EBP extends to the interaction between those receiving care (e.g. parents, clients, patients) and clinicians. Given the wide range of treatments for various disorders, to become informed consumers, clients must understand treatment costs, time requirements, and the empirical research evidence in favor and against certain treatments (Weiss, Fiske, Ferraioli, 2008). This requires clinicians who understand and are able to communicate in parent-friendly language the facts from relevant studies. Auert and colleagues (2012) found that most parents of children with autism think that it is the SLP's job to supply "parents with information, including relevant research literature, and involving them in the research process." Involvement by parents will allow them to gain a greater sense of control over their child's therapeutic progress and provide them with the information and background needed to continue the process at home. Further, the parents in the Auert study indicated that among the most important features of the intervention process is that the clinician is using the most current relevant research and treatments.

EBP use is founded on ethical principles as well. Chabon, Morris, and Lemoncello (2011) reasoned that the use of EBP should be guided by the ethical principles of beneficence, non-maleficence, justice, and autonomy. They point to several American Speech and Hearing Association Ethical Principles that taken together provide a framework with which to understand the ethical requirement that SLPs use EBP. In order for SLPs to fulfill their ethical obligations, they are required to not only seek out the most relevant knowledge, but they are to do so over a period of their lifetime. In conjunction with communicating the information to patients, and using the treatments only when there is a reasonable expectation of benefit means that EBP use is a requirement for ethical practice.

Lastly, although there is little research on the subject, but much firsthand experience, the use of EBP can help with insurance payouts. Insurance companies require documentation that the treatment chosen for each client is effective. Unfortunately, insurance companies will deny payouts and limit treatment time without evidence showing treatment efficacy and the need for longer treatment periods. These demands leave viable treatments unfunded because of a lack evidence to support them.

Weaknesses of EBP

The disparity between theoretical EBP and actual EBP could not be greater. According to a national survey conducted by Hoffman and colleagues (2013) of 2,763 SLPs in 28 states, 91% had no scheduled time to support EBP activities and the majority of SLPs researched a mere 0 to 2 EBP questions per year. This result points to a larger trend in the research literature: *almost no one uses EBP* (Hoffman, Ireland, Hall-Mills, and Flynn 2013; Frymark, 2009; Zipoli, 2005). Far from being a method that brings greater accountability into the practice of Speech-language pathology, it is a process that is not used. Although there have been attempts to create more opportunities for clinicians to engage in the EBP process (Frymark, 2009), the recent findings of Hoffman et al. (2013) indicate that they have not been successful.

The lack of use is not due to clinician attitudes, however. A majority of clinicians find that EBP is necessary, useful to practice, and improves the quality of patient care (Togher, 2011; Zipoli, 2005). The most common impediment to EBP as indicated by multiple surveys, however, is time (Hoffman, Ireland, Hall-Mills, and Flynn 2013; Frymark 2009; Zipoli 2005). Limited time is the most crucial weakness of EBP and raises several questions. Are the demands on SLPs in clinical practice too great to allow for EBP? Is there a lack of connection between the research literature and the consumers of the research literature? Is the way the literature is presented an impediment to EBP?

Regardless of time constraints, there are other causes for concern. Even though the literature on various diagnostic categories is growing, there are categories where there is no usable data concerning the best treatment approach (Reilly, Douglas, & Oates, 2004; Dodd 2007). There also is concern about achieving EBP based on the highest credibility ratings such as randomly controlled trials (RCTs). RCTs may not be possible in the case of rare disorders with small and dispersed clinical populations (Enderby, 2004; Montgomery & Turkstra, 2003; Vallino-Napoli, 2004). This is further exacerbated when co-morbid diagnosis, multilingualism, and the other factors that are idiosyncratic to specific cases are considered.

Although randomized control-trials may be the gold standard for documenting evidence of treatment efficacy, there are some clear shortcomings of large-scale RCT evaluations when used for individualized clinical decisions (Chabon et al., 2011). The application of group average scores in RCTs ignores the important variable of individual difference or individualized response to intervention (Enderby, 2004; Chabon, Morris, and Lemoncello, 2011). The absence of data about population characteristics and social constructs such as race, ethnicity, and disability category restricts the useful application of research findings. Evidence is limited to individuals who share characteristics with those who participated in a study, yet research within diverse backgrounds is scarce (Chabon, Morris, and Lemoncello, 2011). Individual-case studies then gain credence due to their extensive understanding of each case. The method proposed in this paper will allow consumers of research to keep individual information, while gaining the ability to average over large populations as in RCTs.

Other factors that contribute to the lack of EBP use include: Clinicians feeling that they are not capable of using EBP even when they have been trained in EBP methodologies (Spek, 2013); the EBP research process is inaccessible to clinicians both as consumers and creators of the research; students of the EBP process are instructed in EBP procedures in an academic setting, but not in a clinical setting; clinicians perceiving that they might learn more from their peers; and finally, the possibility of publication bias towards positive outcomes might skew clinicians perceptions of the research literature (Togher, 2011). Issues with EBP will remain without a systematic undertaking to reorganize and rethink how to it is used. Crowdsourcing provides a possible solution.

Crowdsourcing

Crowdsourcing is defined as outsourcing some job to a distributed group of people, typically by dividing the job into microtasks (Chi 2012). It has been for writing an online encyclopedia (Wikipedia), providing a labor market for digital tasks (Amazon Mechanical Turk), creating an entertainment and information video archive online (Youtube) and more. In the case of Wikipedia, hundreds of thousands of contributors have created and currently maintain millions of online pages, each one dedicated to a single topic. This allows millions of users to access information on any given topic, and all of the information is vetted through a system of checks and balances. Although

Wikipedia has millions of pages, the company has only 35 paid employees. The rest are volunteers committed to the dispersion of knowledge. The leverage that crowdsourcing allows in the Wikipedia case is an example of its possible power. Through only a few key paid positions, Wikipedia is able to amass a group of workers that each contribute on a small scale to the overall project.

Crowdsourcing has used for decades, but the process did not become mainstream until widespread access to the Internet was available. Once the Internet was accessible to the wider populations, the power of crowdsourcing could be tapped. So powerful are the prospects of crowdsourcing, that some have even called it part of a network that allows “distributed innovation” to take place (Bogers, 2012). Distributed innovation is the process where gains in technology and knowledge are not confined to one entity or firm. Consider the history of the “Linux” operating system, one of the most stable and advanced operating system available. Linux shows us a history of distributed innovation through crowdsourcing; many people coming together to create a product that exceeds the abilities of any one organization.

Crowdsourcing is found scientific and medical research as well (Armstrong, 2012; Cook, 2011; Behrand, 2011; Ekins, 2011). Dermatology, psychology, pharmacology are some of the fields that have published research based on the methodology of crowdsourcing. Armstrong et al. (2012), in a study that investigated crowdsourcing as a means for judging acne treatments, points out that crowdsourcing will provide an important and valuable platform for collecting high-volume patient data in real world settings. The study contrasts this with medical or academic settings where the highly structured environments allow for more variable control, but far fewer research participants. Crowdsourcing medical research is new, but the possibilities are promising. Further, with the publishing of literature on optimizing crowdsourcing on the rise (Chi 2012), the ability to utilize crowdsourcing for research purposes will increase.

While crowdsourcing is used in increasing numbers of medical fields every year, there has not been study that investigates crowdsourcing in the field of speech-language pathology. Crowdsourcing is a research methodology that might hold great promise for research in the field speech-language pathology, especially considering the above discussion about EBP research. Crowdsourcing provides the technology that will allow not only academic researchers, but also practicing clinicians the opportunity to provide information about the effects of treatments. Crowdsourcing will provide a data set for clinical decisions that is larger than that available from traditional research methods. The present study will investigate crowdsourcing in speech-language pathology.

The Study

The purpose of this pilot study is to explore the use of crowdsourcing as a methodology for research and improving the use EBP in the field of speech-language pathology.

Aim 1: To understand if SLPs to will respond to a survey requesting anonymous de-identified information about a patient they have treated. This will involve examining the rate at which clinicians respond to requests for information and the demographics of the people who respond.

Aim 2: To evaluate whether the anonymous de-identified information about a specific client can serve as research for a clinician involved in the EBP process. This will evaluate the survey responses for quality and quantity of information provided.

METHODS

Participants

Speech-language pathologists who work with patients with aphasia were contacted anonymously via email with invitations to respond to a survey affiliated with the Communication Sciences and Disorders Department at The University of Texas at Austin. The email list was collected from an online ASHA database of clinicians in addition to websites of SLPs that indicated they worked with aphasic patients. A total of 300 invitations were disseminated in October of 2013 through Google Forms. Google Forms is a web-based survey system that allows researchers to develop a survey and email it to all potential respondents. Google Forms then records the responses for the researchers to access. Reflecting on the project's primary focus to determine the viability of evidence-based practice (EBP) in the field of speech-language pathology via the use of crowdsourcing, the online setting was both necessary and intended. Using Dillman's (2006) approach to Internet survey strategies, multiple contacts were initiated to remind potential respondents about the survey over a one-month period.

At the beginning of the survey there was a paragraph that briefly explained the purpose of the study, made a statement of informed consent, and noted that responses would be confidential. Maintaining anonymity for the reported aphasia patient was emphasized in the instructions. The survey questions were selected to collect a significant amount of demographic information about the respondent. Demographic information was collected to understand the types of persons that responded to the survey. The questions about the patient were selected to solicit a complete picture of the patient and the treatment the patient received, without revealing identifying information. The author of this paper developed an initial survey over the course of several weeks. Three professors in the Communication Sciences and Disorders at the University of Texas reviewed and provided commentary in a focus-group setting. The survey also was provided to several graduate students at the University of Texas for a focus-group review. During this process the survey was revised several times to take into account the input from focus group participants. The focus group participants were aware of the purpose of the study.

Speech-language pathologists responded to the survey from any location and at any time during the data collection period. Participants were not required to respond during their hours of employment. Received responses were stored with no identifying information online in a secure drive. The investigator then analyzed the profiles and evaluated for identifying information.

At the end of the data collection period a total of 18 SLPs responded to the survey. From a group of 18 survey respondents, 13 met the necessary criteria for having worked with aphasia patients in the past year. The SLP survey respondents ranged from 23-62 years of age and included 11 females and 2 males, with no exclusions. Each participant was asked to describe one clinical case they had in the past year that was most representative of the patients seen regularly. The age of the reported aphasic patients ranged from 30-73. There were no preset exclusions on the basis of gender or age. Reporting was voluntary and responded to survey prompts such as cause of aphasia, means of diagnosis, type of diagnosis, severity, other co-morbid diagnoses, bilingual capabilities, session frequency and length, intervention methods, intervention description, method for determination of effectiveness, and treatment effect on patient's life. The survey is included as Appendix A.

Data and Analysis

A total of 33 questions were included in the survey; 11 demographic questions about the responder, and 22 clinical case questions, about the patient the responder treated. Questions about a patient were limited to ones that. The demographic questions included information about sex, age, degrees earned, years employed as SLP, certification status, primary setting, years in setting, number of patients with aphasia in past year, number of patients with aphasia in past 5 years, and percentage of patients seen with aphasia in past year. The clinical case questions included information about patient's age, time of treatment start after onset, aphasia cause, how diagnosis was determined, diagnosis, severity, co-morbid diagnosis, bilingual abilities, length of treatment, dosage of treatment, details of treatment, group settings, how treatment efficacy was determined, and treatment efficacy.

Treatment efficacy was determined by 4 separate questions on a 7-point Likert Scale from 1- Unsuccessful to 7- Extremely Successful. Those questions were: Effect of treatment on quality of life, effect of treatment on communication abilities, effective of treatment on life skills, and effect of treatment on integration into family or community. The combination of these scores was used to create a Success Quotient (SQ) to compare the success of a given treatment from one patient to another.

After responses were logged and the response period closed, a group of three students in graduate school for speech-language pathology at the University of Texas at Austin who have had instruction in EBP methods rated the usability of the clinical cases provided for EBP purposes. Each was given a 4-question survey and asked to rate each clinical case response for the ability to convey clinically relevant information that could be used in a hypothetical EBP process for a patient with similar demographics. Two of the questions were on a 5-point Likert scale. Question (1) determined if the information in the clinical case could be used to improve the treatment plan for a similar client, and (2) determined if the clinical case provided enough relevant clinical information. The other two questions were open ended and allowed the rater to explain the reasoning behind the choices made on the Likert questions. Averaging the rater's scores for each clinical case created a Usability Index (UI). Viable profiles were qualified with a mean UI score above the neutral mark (≥ 3).

RESULTS

Respondent Demographics

The response rate to the survey was 6%, with 18 of 300 respondent speech language pathologists submitting completed surveys. The number of usable responses was 66%, 13 of 18. This makes for a total usable response rate of 4.3%, or 13 out of 300. Demographic data for the respondents, including the number of patients with aphasia treated in the past year, is shown in Table 1. The mean age of the respondents was 35.6 years with a standard deviation of 12.69 years and a range from 23 to 62. Most of the respondents were female (84.6%, *n* = 11), two were male (15.4%).

Table 1: Respondent Demographics

Degree		Setting		Years as SLP		# Patients with Aphasia*	
Bachelors	30.9%	Private Clinic	69%	0-10	61%	0-5	54%
Masters	61.5%	School	15%	11-20	23%	6-10	30%
PhD	7.6%	Hospital	7.6%	21-30	7.7%	11-20	8%
		University	7.6%	31+	7.7%	20+	8%

* Seen in the last year

Patient Demographics and Treatment Data

The mean age of the patients at onset of treatment reported by the responders was 59.7 years; the standard deviation was 14.2, with a range of 29 to 75. Average length of time between onset of aphasia and treatment was 69 weeks; standard deviation was 119.7 weeks, with a range of 1 week to 364 weeks. When asked which diagnostic test was used to establish diagnosis and severity, respondents reported that the Western Aphasia Battery was used for 2 patients, the Boston Diagnostic Aphasia Examination was used for 4 patients, and the Boston Naming Test was used for 1 patient. There was no diagnostic test used for 4 patients, and 2 patients had informal testing. The cause of the patients' aphasia as reported by the respondents is located in Figure 2. The diagnosis of the aphasia type is in Figure 3. The severity of the aphasia is reported in Figure 4.

Figure 2: Cause of aphasia in patients as reported by respondents.

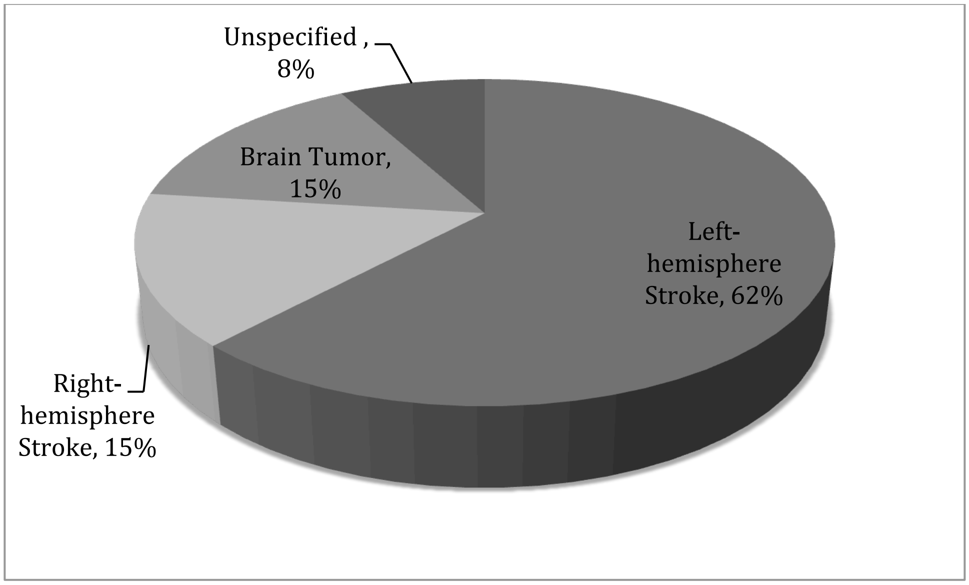


Figure 3: Type of aphasia in patients as reported by respondents.

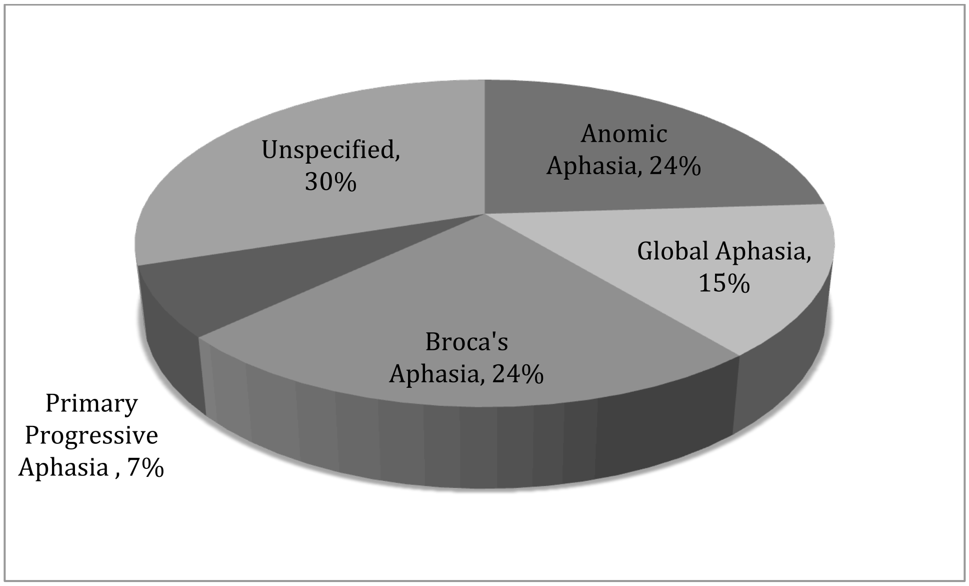
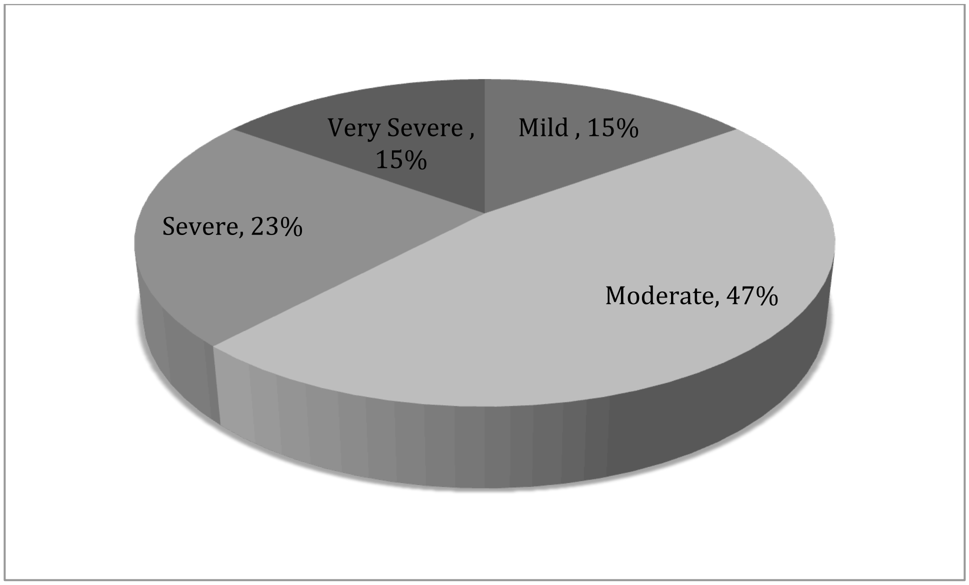


Figure 4: Severity of aphasia in patients as reported by respondents.



Respondents indicated that their patients had the following co-morbid diagnosis: 1 case of high frequency hearing loss, 3 cases of hemiparesis, 1 case of mild dysphagia; 1 case of apraxia, 2 cases of diabetes, 1 case of high blood pressure, 1 previous stroke, 1 case of alcoholism, and 1 with previous falls. Two patients were Spanish bilingual.

The mean length of intervention was 14.9 weeks with a standard deviation of 13.5 weeks and a range of 4 to 52 weeks. Two patients had 3 sessions a week, 5 patients had 2 sessions a week, 5 had 1 session a week, and 1 had 10 sessions a week. The length of each treatment session was reported to be an average of 1.3 hours with a standard deviation of .84 hours and a range from 30 minutes to 3 hours. The types of treatments used and the percentage they were used during the intervention period for all respondents are included in Table 2 and the specific treatments used during the intervention period and the percentage they were used are included in Table 3.

Table 2: Treatment types used during therapy period for all respondents.

Treatment Types	**% Use**
Language Therapy	100%
Computer-based Intervention	38%
Speech/Articulation/Phonation	30%
Assistive Devices	7%
Counseling	38%
Family Counseling	15%
Group Therapy	7%
Pictures	7%
Swallowing/Feeding Therapy	7%

Table 3: Specific treatments used during therapy period for all respondents.

Specific Treatments Used	% Use
Semantic Feature Analysis Therapy (SFAT)	46%
Prompting Aphasics Communication Effectiveness (PACE)	23%
Language Treatment	7%
Life Skills Training	7%
Constraint Induced Language Therapy (CILT)	7%
Script Training	23%
Augmentative and Alternative Communication (AAC)	23%
Response Elaboration Training (RET)	7%
Melodic Intonation Therapy (MIT)	23%
PROMPT	7%
Gesture Facilitation of Naming (GFN)	15%
Supported Communication Intervention (SCI)	15%
Diet Modification	7%

When asked how respondents determined treatment effectiveness during and at the termination of treatment, 10 respondents indicated informal assessment (77%); 3 administered the same test as the one used to determine diagnosis and severity (23%); 3 relied on professional opinion (23%); 1 used an alternate test (7%); 1 did not determine treatment effectiveness (7%). Figures 5 through 8 show how the treatment affected Quality of Life, Communication Abilities, Life Skills, and Societal Integration respectively, according to the professional opinion of the respondent.

Figure 5: Respondents professional opinion of the effect of treatment on Quality of Life based on a 7-point Likert scale. No respondents stated that the treatment was "Extremely Successful" or "Not Successful."

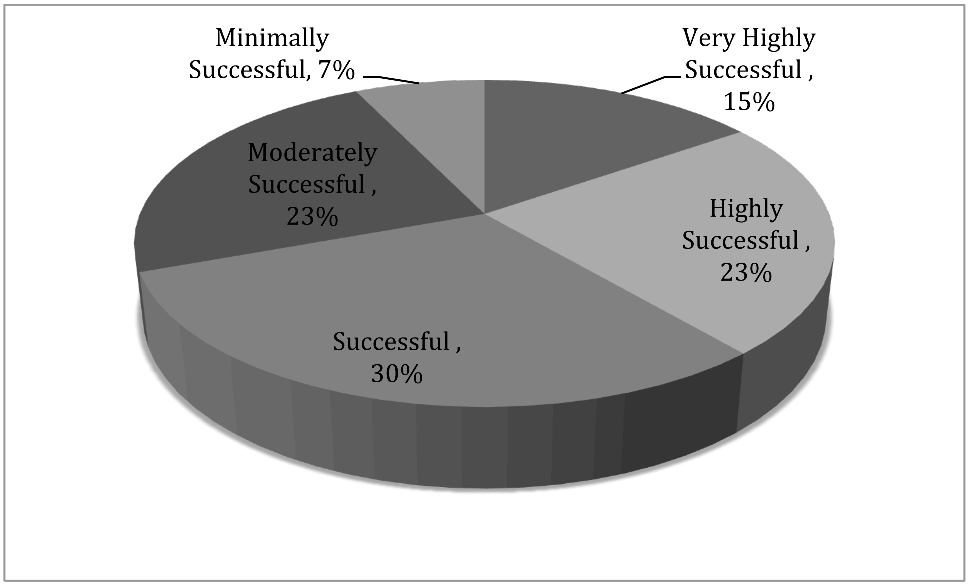


Figure 6: Respondents professional opinion of the effect of treatment on Communication Ability based on a 7-point Likert scale. No respondents stated that the treatment was "Extremely Successful" or "Not Successful."

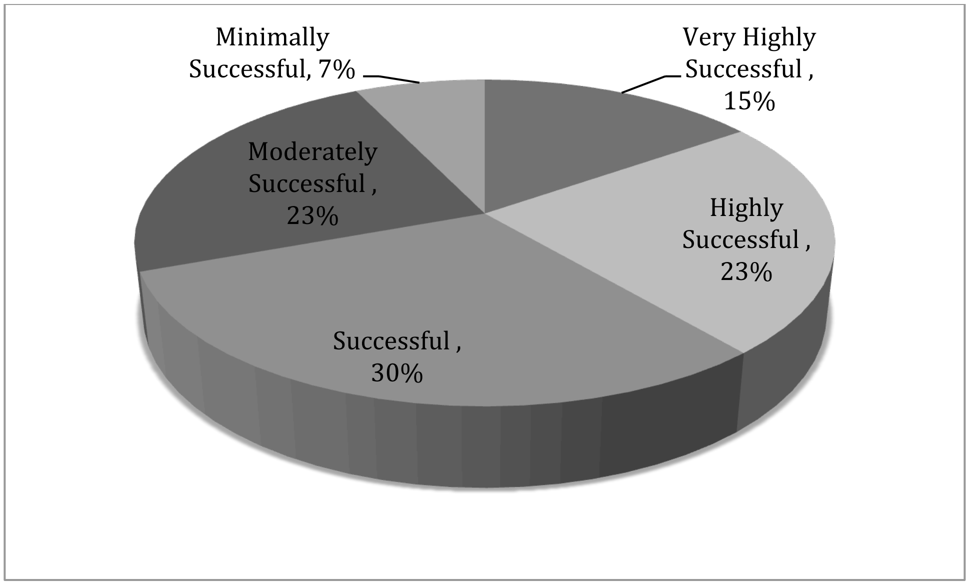


Figure 7: Respondents professional opinion of the effect of treatment on Life Skills based on a 7-point Likert scale. No respondents stated that the treatment was "Extremely Successful," "Minimally Successful," or "Not Successful."

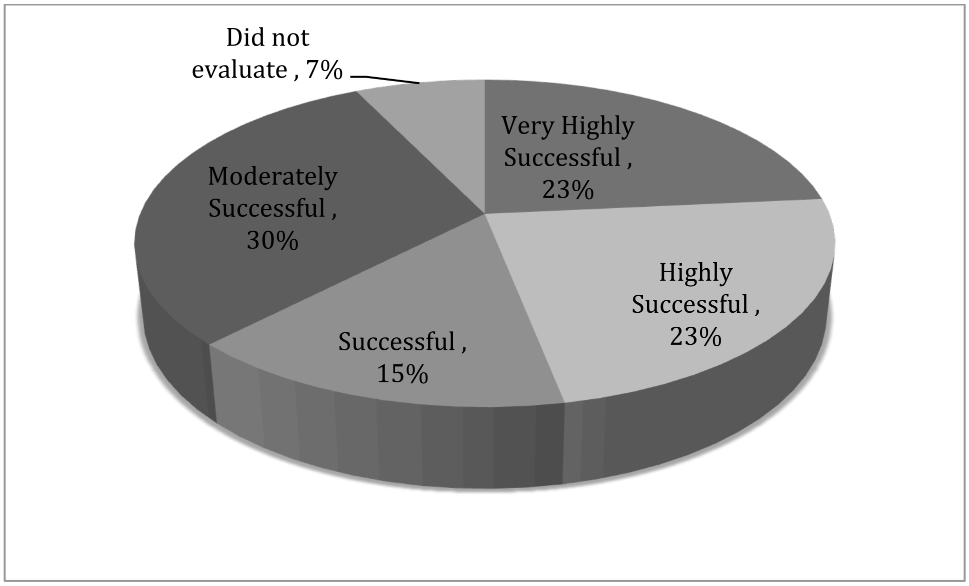
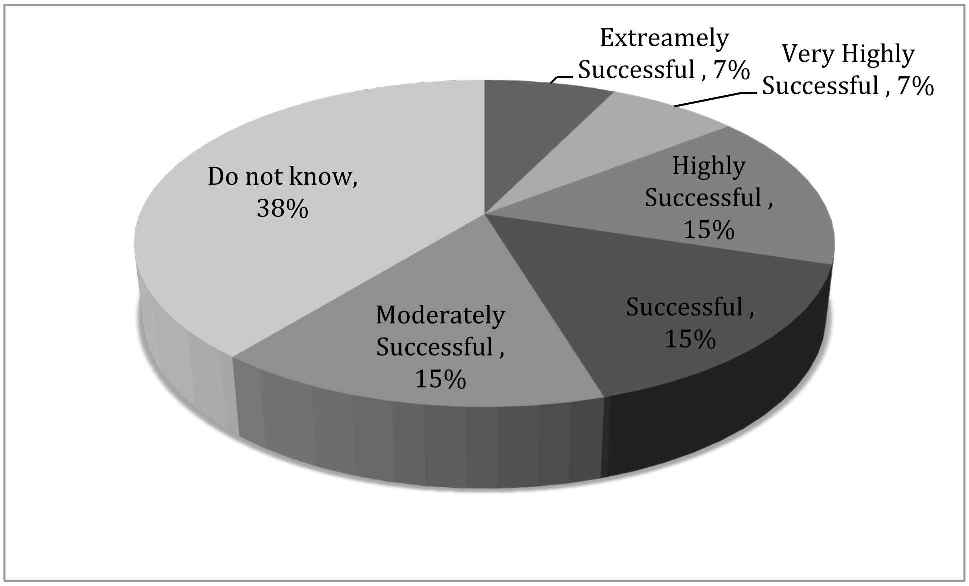


Figure 8: Respondents professional opinion of the effect of treatment on Societal and Family Integration based on a 7-point Likert scale. No respondents stated that the treatment was "Minimally Successful," or "Not Successful."



A Success Quotient was calculated by adding the Likert score numerical values for the previous questions about Quality of Life, Communication Abilities, Life Skills, and Integration for each of the patients. On a Likert-scale score of 1 to 7 (7 being highest possible success) the mean score was 4.23 with a standard deviation of 1.11, and a range of 2.33 to 6. Usability Scores that were obtained from graduate student scorers were on a Likert score from 1 to 5 (5 being the best possible, 3 being neutral). The mean score was 3.17 with a standard deviation of .81 and a range of 2 to 4.33.

Preliminary Analysis of Data Sets

While we don't have the sample size to run group statistics, here are the possible types of information that can be obtained in the future. In all of the following figures, a Pearson Correlation was attempted, but because of the extremely small sample size, all results were found to be insignificant. In future iterations of this research with a larger sample size, these types of information can be invaluable.

Figure 9: Success Quotient vs. Number of aphasia patients seen in the last year. Using a Pearson Correlation, r = 0.1803, one-tailed p = 0.277, and two-tailed p = 0.555. The figure shows a weak positive correlation, with a larger sample size, a more conclusive result is possible.

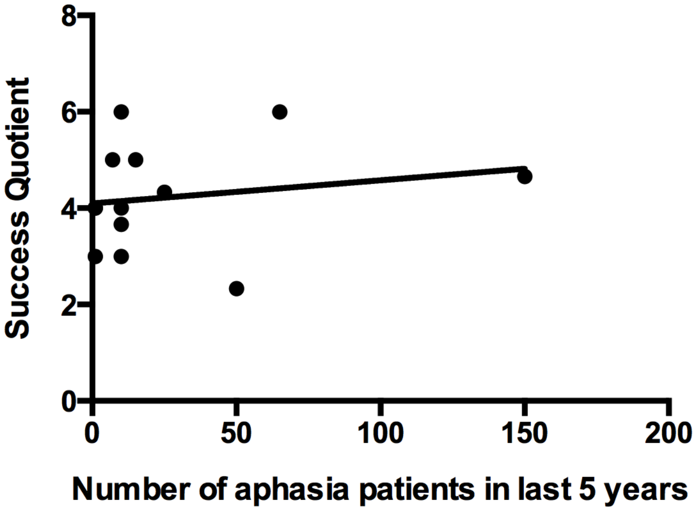


Figure 10: Usability Score vs. Number of patients seen in the last 5 years. Using a Pearson Correlation, r = 0.6213, one-tailed p = 0.011, and two-tailed p = 0.0234. The figure shows a moderate positive correlation, with a larger sample size, a more conclusive result is possible.

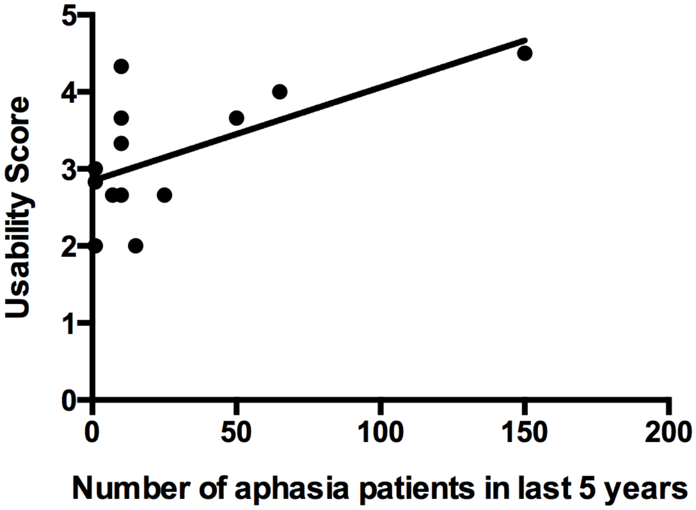


Figure 11: Usability Score vs. Number of years in the profession. Using a Pearson Correlation, r = 0.4716, one-tailed p = 0.0518, and two-tailed p = 0.1037. The figure shows a weak positive correlation, with a larger sample size, a more conclusive result is possible.

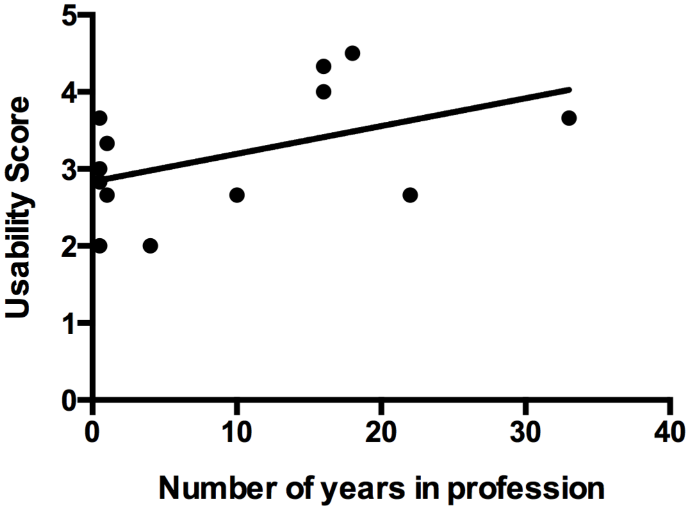


Figure 12: Success Quotient vs. Cause of aphasia. Error bars indicate one standard deviation.

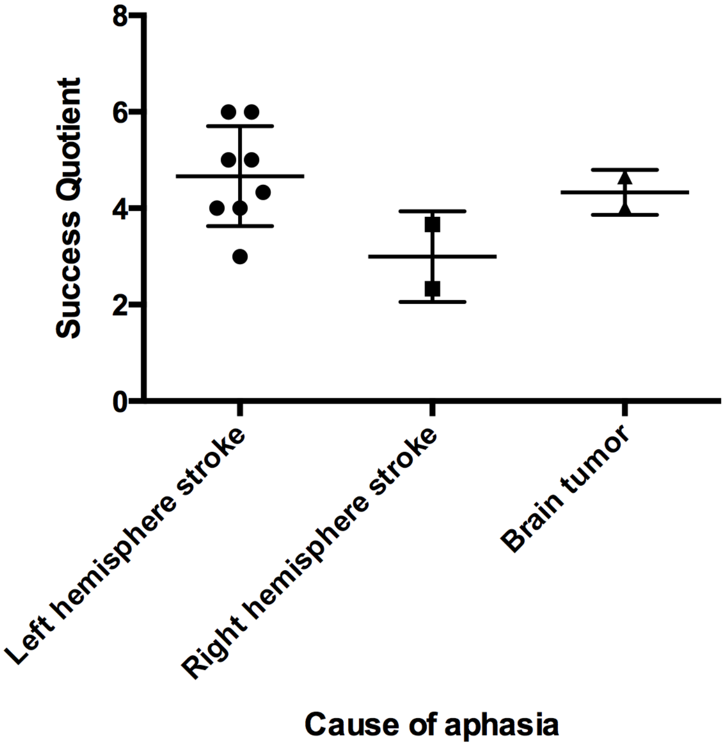


Figure 13: Success Quotient vs. Type of Aphasia. Error bars indicate one standard deviation.

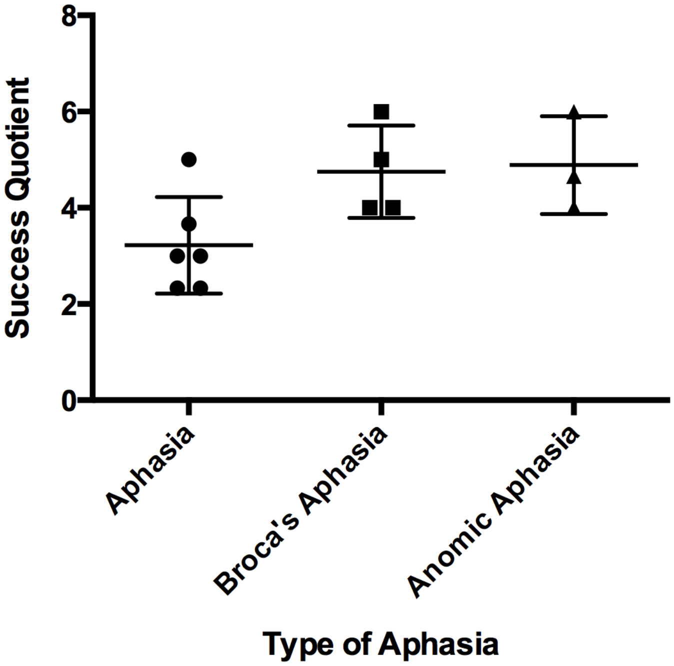


Figure 14: Usability Score vs. Degree Type. Error bars indicate one standard deviation.

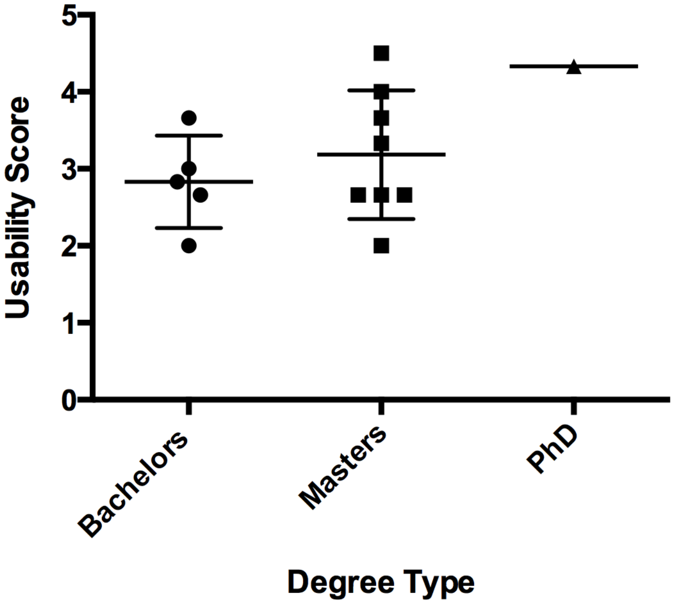


Figure 15: Success Quotient vs. Length of Intervention. Using a Pearson Correlation, r = -0.3255, one-tailed p = 0.1509, and two-tailed p = 0.3018. The figure shows a weak negative correlation, with a larger sample size, a more conclusive result is possible.

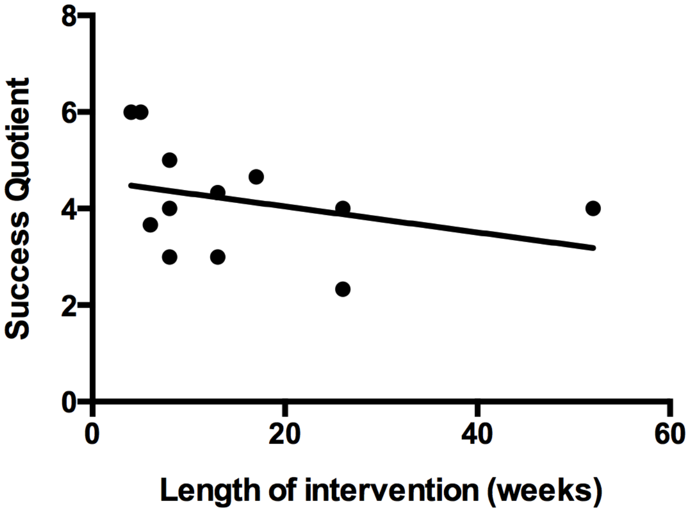


Figure 16: Success Quotient vs. Time after onset of aphasia (weeks). Using a Pearson Correlation, r = -0.1464, one-tailed p = 0.3249, and two-tailed p = 0.6498. The figure shows a weak negative correlation, with a larger sample size, a more conclusive result is possible.

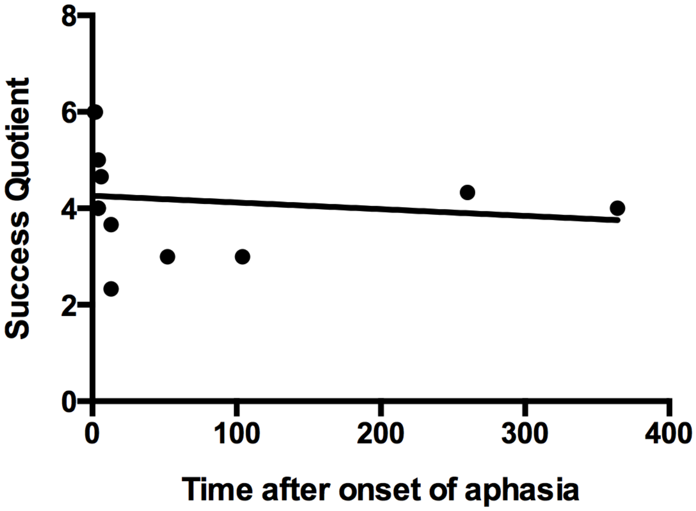


Figure 17: Usability Score vs. Clinical Setting. Error bars indicate one standard deviation.

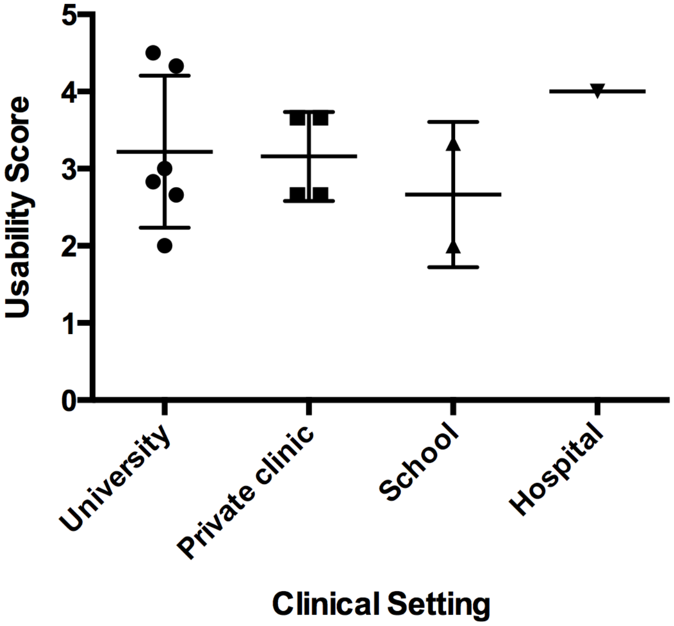


Figure 18: Success Quotient vs. Severity of Aphasia. Using a Pearson Correlation, r = -0.3229, one-tailed p = 0.1529, and two-tailed p = 0.3059. The figure shows a weak negative correlation, with a larger sample size, a more conclusive result is possible.

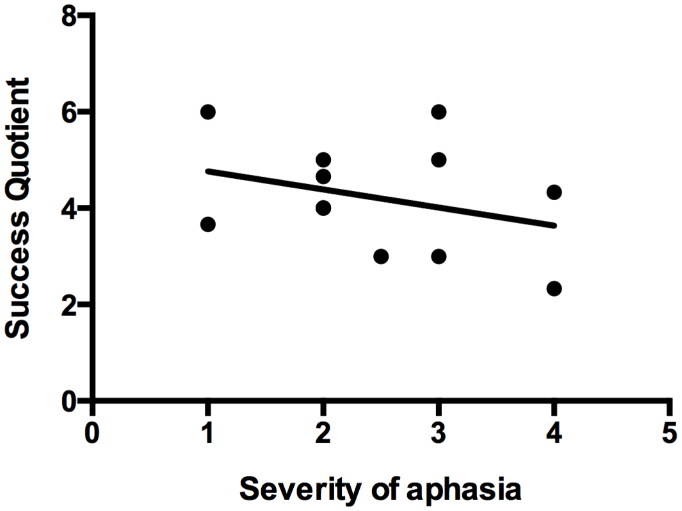
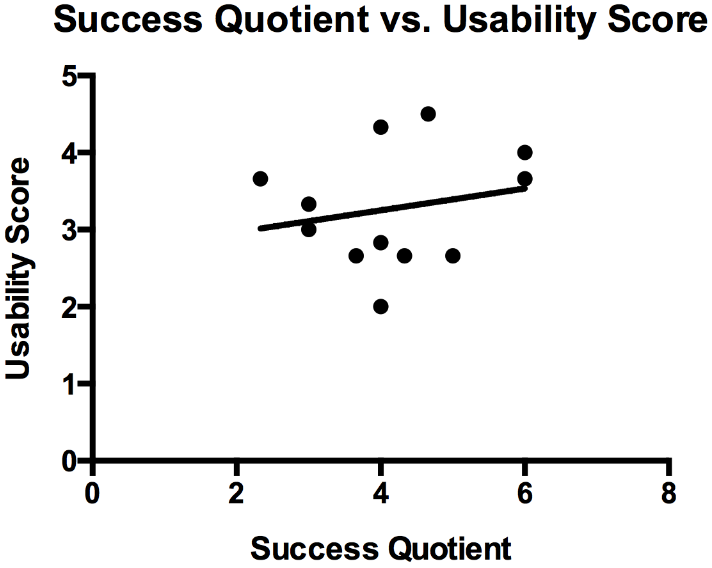


Figure 19: Success Quotient vs. Usability Score. Using a Pearson Correlation, r = 0.209, one-tailed p = 0.2572, and two-tailed p = 0.5144. The figure shows a weak positive correlation, with a larger sample size, a more conclusive result is possible.



Individual Cases

Each individual patient case is included in Appendix A. Here we will review two cases: one with the highest usability score and one with the lowest usability score.

Patient 4's profile received a usability score of 2, which is the lowest score of all the case studies. Sixty-three year-old who presented with left-hemisphere stroke received 3 hours of therapy a week 3 times a week for an unspecified period of time. Therapy methods include speech therapy, language therapy, computer based intervention, and semantic feature analysis. There was no diagnostic test used to establish diagnosis or severity, and professional opinion was the primary method for judging treatment effectiveness. The treatment was judged to be highly successful for life skills, communication abilities, and quality of life. The respondent described the semantic feature analysis protocol in two sentences and nothing else about the treatment. The usability graders when asked about what was useful about this profile indicated that the description of the treatment was helpful. The graders when asked about what additional information is needed to increase usability indicated that more diagnostic pretesting and post-testing, and more information about other treatment aspects were needed.

Patient 9's profile received a usability score of 4.5, which is the highest score of all the case studies. Seventy-two year-old who presented with anomic aphasia due to brain tumor received a 45-minute session twice a week for a 4-month period. Diagnosis and severity was determined by Boston Diagnostic Aphasia Examination and the Boston Naming Test. Diagnosis was moderate anomic aphasia with comorbidity of mild dysphagia. Therapy methods included language therapy, semantic feature analysis, and circumlocution induced naming. The respondent gave the following description of the treatment:

> "Presented picture cards for confrontational naming. When anomia occurred, circumlocution induced naming technique was employed. Initially, SFA was used to teach patient to use circumlocution in a structured way. Later in therapy,

> patient was taught to use this as a self cuing strategy which was usually successful in accessing the name of pictures.”

The patient was administered the same test used to determine diagnosis and severity during pretesting to determine treatment outcomes. The respondent indicated that the treatments effect on quality of life was successful and the intervention effect on communicative abilities and life skills was highly successful. Other contributing factors included the patient was highly motivated and completed homework assignments between therapy session. The usability graders when asked about what was useful about this profile indicated that the description of the diagnostic and intervention execution were very useful. The graders did not specify any additional information that would be helpful.

In general the respondents that used pre and post testing to determine diagnosis and treatment effectiveness, described in detail the treatment being used, and indicated other factors that were instrumental to the treatment had higher usability scores. In general, the respondents that did not determine treatment effectiveness with post testing, did not describe the treatment they used, and left out other factors had lower usability scores.

DISCUSSION

The aims of this study were to (1) understand if speech-language pathologists would respond to a survey requesting anonymous de-identified information about a patient they treated and to (2) evaluate whether the anonymous de-identified information can serve as research for a clinician involved in the EBP process. Both of these aims were met, along with the accumulation of data that can be used for other research purposes. However, due to the fact that this is a pilot study, and therefore did not have the appropriate resources to carry out a full study of the subject, the results should be seen as guiding further research, than being the final word on the subject. The response rates for this study were low compared to the range of rates found in most Internet survey research (Dillman, 2009). This does not necessarily undermine the practicality of crowdsourcing as a research design, however. When we consider the type and detail of information being requested, a response rate of 6% might be considered good. In this study we were requesting information that some participants might have thought constituted a breach of patient privacy. We took every precaution to make anonymous both the respondent and the patient whose specific case was being detailed. As well we described the precautions to the respondents as created through the University of Texas IRB system. In spite of the precautions there is a barrier to providing this information because of possible perceived violations of privacy. With this in mind, it is fair to consider any respondent detailing their de-identified patient's information as a success for this type of research method, although this claim requires further investigation.

The usability scores of the patient profiles were useful in clinical decision making according to the graders. Seven of the responses were scored as better than neutral in terms of usability and 6 scored as less than neutral. Table 4 describes the methods to improve crowdsourcing for evidence-based practice research.

Table 4. Ways to improve crowdsourcing for evidence-based practice research.

Ways to Improve	**Description**
More Treatment Options	While we attempted to give as many options for respondents to select from types of treatments that were used in therapy, there could be some that were not included due to oversight. Respondents would therefore not have an opportunity to register that that particular treatment was used. More treatment options, and the ability for respondents to create other treatment options that can be used again by future respondents would be a positive step.
Better treatment descriptions	The quality of the descriptions of treatment can also be improved. While it is assumed that many respondents will be familiar with the various treatments and knew the technical name for them, this might not always be the case. Better descriptions and easier access to the description (by say a hover-over pop up) would make it more likely that respondents would understand which treatment they performed on their patient.
Better Treatment Quantification	Allowing users to describe what percentage a given therapy was used during the course of treatment will give more accurate overall quantification of the treatment.
Better interface	While this survey used Google Forms to request information, more aesthetically appealing web portals with specific cues for details might increase the quality and quantity of the information being collected.
Rating system	A rating system that allows other users to grade specific profiles and give feedback on what information is missing would allow respondents to hear directly from the consumers of their information what can be done to improve the offering. There is also the ability to have groups of graders that have volunteered to review all profiles from a specific diagnostic category (like Wikipedia, where a few users monitor a single page to ensure the most accurate information is present).
Collaborative	An option for reviewers to contact the clinician who wrote the profile to request changes and improvements in a collaborative fashion would allow for the same "peer-review" process to take place, but in a crowdsourced fashion.

Reviewing the preliminary analysis of data sets, we see a few interesting trends that provide insights and confirm presuppositions. Again, although the results were on the whole insignificant according to a pearson correlation analysis, there are some indications that relationships exist between the variables. We will review a few here. Success quotient vs. number of patients with aphasia in the past year shows a positive correlation. The positive correlation is expected considering that the more patients a clinician has, the more "practice" he or she gets, and therefore the better the outcomes. The strongest correlation was found in usability score vs. number of patients with aphasia seen in the last 5 year. Here we see a moderate positive correlation. A possible explanation is that clinicians who have more experience with aphasia are more aware of the treatments and academic literature on the treatments. They therefore would be able to describe the treatment they gave, leading to a better usability score. A similar result could explain the positive correlation between usability score and number of years in the profession and usability score and degree type (the PhD respondent had the second highest usability score). We see better success quotients for patients with left-hemisphere stroke than those with either right-hemisphere stroke and brain tumor. We also see better success quotients for those with anomic aphasia as compared to aphasia. This intuitively makes since, considering that on the whole, anomic aphasia is considered less severe than a diagnosis of aphasia. Some interesting negative correlations occurred between the success quotient and the length of intervention as well as treatment start time after onset of aphasia and success quotient. The longer the duration between onset of aphasia and treatment start, the decline in patient success. And the longer the treatment intervention, the less likely the clinician will judge the treatment to be a success. Finally, there is a negative correlation between severity of aphasia, and the treatment success. This result also conforms to what is generally understood to be the case in the academic literature.

Crowdsourcing as conceived in this study creates research data for a meta-analysis of single subject case studies. Single subject case studies have a rich history in communication sciences and disorders, as well as being a strong alternative to randomized control trials (Byiers 2012). Adjusting single subject research design to fit with the crowdsourcing paradigm is difficult, however. There are several key factors that are needed to make this plausible. One, there must be a uniformity of data collection on the researchers side. There are several ways to make this possible, a few of which were tried for this study. The use of drop down menus and select response questions were used to keep uniformity of response. Specifying which diagnostic pre-testing and post-testing exams should be given, as well as a place for indicating how close to the prescribed administration procedures the exams were given would also create more standardization. This would allow consumers of the information to have specific numerical scores to decide if the treatment documented was actually effective, instead of using subjective opinion like this study does.

This can only go so far because of the second factor, uniformity of data collection on the clinician side. Here it becomes much more difficult. As the results indicated there were a wide variety of diagnostic tests, methods, and procedures to understanding the pre-treatment and post-treatment conditions of the patients. Scores were difficult to compare in order to evaluate treatment with such a small sample size. To account for this, we solicited expert opinion from the respondents about how successful they believed their treatment was. Although this provided some insight, there are many questions that such an approach raises. For instance, what gives us any indication that clinicians are capable of providing accurate estimates of their patients' progress? Further, there is reason to believe that selection bias might confound what patient profiles the respondents want to share with us.

Questions of validity and reliability are not a death knell for crowdsourcing, however. The key benefit of crowdsourcing is that it has the capability of producing a large sample size. The large sample size has the ability to offset data reliability and validity concerns (Bates, 2013). Even with the possibility of respondents reporting highly biased or even false data, as long as the majority of respondents' information is fairly unbiased and true, the overall outcomes should be unbiased and true. There is also ways in which other respondents can grade the level of quality of a given response. For example, on the Amazon website, an online market place, users are able to review products, other users are then able to rate how "helpful" the review is, giving other users a chance to determine whether or not a given review adds to the accumulated feedback about that given product.

Likewise in a crowdsourcing system where respondents have the ability to judge others responses, the system will have a built in mechanism for weighting certain responses. When someone provides a clinical profile that seems false or not well constructed, other users can downgrade that profile, giving it less weight in the overall results. This also has the added benefit of removing possible pseudo-scientific results, a problem in the speech pathology community (Lof, 2011).

Motivating crowdsourcing participation is a sector of research literature that is growing. Crowdsourcing, which is primarily done through online avenues, is unique in the research design because it is not based on a handful of researchers, but on an entire community. This community not only has to have access to the gatekeepers to share the information, but also has to have a motivation to share the information. Although the first motivator that inevitably comes up is money, the prospect of monetarily rewarding hundreds of thousands of participants seems unattainable. As well, money might not even be the best motivator.

Some research has suggested that participation in online communities and the intrinsic reward of learning new ideas are better motivators for participating in crowdsourcing than monetary rewards (Antikainen, 2010). The website Patients Like Me, for example, benefited immensely from having a way of connecting users with similar diagnosis and encouraging them to connect and share data that could be usable for other users (Riedl, 2013). This crowdsourcing model offered nothing but the opportunity to learn from and teach others who are in similar circumstances in terms of medical diagnosis.

Others researchers have suggested that because knowledge is a public good, the motivation to participate in crowdsourcing projects stems from a moral obligation people feel to help in ways that will lead to the overall public good (McLure, 2000; Bryant et al., 2005; Lakhani and Wolf, 2005; Zeityln, 2003). Others have indicated that reputation and enhancement of professional status could be motivators (Bagozzi and Dholakia, 2002; Hargadon and Bechky, 2006; Lakhani and Wolf, 2005). And although monetary compensation is always a possibility, idea competitions that reward top users with either money or community notoriety is more effective than paying everyone equally (Schweitzer, 2012; Antikainen, 2010). Any attempt to create a crowdsourced research design for speech-language pathology would need to include any or all of these motivators to provide the best possible results.

The most concerning aspect of a crowdsourcing model of medical research, however, and one that might be blamed for the lower than normal response to this study's survey is security of patient data. Any attempt to share patient information over the Internet is met by a flurry of state and federal laws regulating how that information is shared, stored, and used. When the patient's data is de-identified these regulations are relaxed, however, there is always the possibility that identifying information could accidently or purposefully be included in anything uploaded on the Internet. The surest way to guard against that is to ensure that clinicians who upload that information are fully aware of their responsibilities as an SLP to not disclose any information about their patient that can be traced back to them or their patient. If this fails, having a way for other users to report when a specific clinical case profile has identifying information and removing it instantly from the semi-public domain. A hardwired system could have a scanning feature that inspects for proper names, locative names, and other identifying language and flags it for inspection. Although this system of checks would be cumbersome to any attempt at crowdsourcing, an unwavering diligence to patient privacy is of the utmost importance to maintain the moral and ethical standards to conduct such research.

How to use the research findings gathered through crowdsourcing is an issue that remains ripe for exploration. Consider two ways in which the information can be analyze and made into actionable research findings. The first method is to aggregate the information and make global statements about results. For example, take the conclusion "Semantic Features Analysis Therapy when used in therapy sessions of at least 1 hour, 3 times a week has the highest overall positive effect among treatment types for patients age 50-59 presenting with anomic aphasia caused by left hemisphere stroke." Statements like these could be made for all of the various findings about the trends found in the data allowing users to get actionable information to use in evidence-based practice. This method would have the benefit of being accessible to all clinicians easily, because of the very specific description of the results. The downside to this way is that it does not allow users of the data to interact with it. This brings us to a second way that the data can be analyzed and used. Whereas in the first case the data was aggregated, in the second, users are able to search for patient profiles based on patient type. For example, a user could search based on a new client she has received, inputting specific information about age, diagnosis, severity, type of deficits, and more. The user would then be given results of previously provided patient profiles based on the best matches with the new client. That way the user could find an individual case study that provides them the closest match to their new client.

Ideally, any system in place would allow both the first type and the second type of information to be accessible. As well, users would be able to interact with the data, including a rating system that allows other users to determine the quality of the individual cases, allowing those cases to get higher weighting in a search system.

FUTURE WORK

This pilot study was limited in scope for the purpose of exploring the variables that went into the process of using crowdsourcing as a research methodology for evidence-based practice. The next phase of this exploration should consist of creating a larger database of possible respondents, then recruiting them through a marketing campaign that can effectively describe what the project is and how it can benefit them and their profession. A drawback of the limited resources and time of this study is that we were only able to send an email with a small paragraph describing what the project was attempting to provide. Future iterations of this research could create an email that has a link to a website that has full explanations and possibly even video demonstrations to create maximal understanding for the possible respondent.

Aphasia was used in this study because of the stability and widespread use of diagnostic tests for aphasia. Future work on this research should include other diagnostic categories in the scope of practice for speech language pathology. Some of these diagnostic categories will be easier to construct data gathering forms than others, due to the nature of certain diagnostic categories. For instance, fluency has many different diagnostic tests and no clear understanding of the causes of stuttering. This would make pre- and post-testing more difficult to undertake, and therefore undermine the ability of crowdsourcing to have robust results.

Finally, the construction of a website that is based on the crowdsourcing of evidence-based practice for speech language pathology is an advisable next step for this type of research. This website will allow users to form a community where they can continuously build a database of case profiles for all users to learn from and build on. This site would create the community motivation discussed earlier and is best exemplified by the website Wikipedia. This website could link to academic articles about the therapy being described in a specific case profile. Videos of therapy techniques should also be part of the website. Videos created by the members of the online community to demonstrate how treatment techniques are executed will allow maximal sharing of information and knowledge. Though the online portal crowdsourcing has the ability to create a dynamic, interactive community that can further evidence-based practice research.

CONCLUSIONS

The previous study sought to determine if crowdsourcing is an appropriate and effective research model in speech-language pathology. We sent out invitations to respond to a 33-question response form survey that asked for demographic information about the respondent and de-identified clinical information about one client that the respondent treated in the past year who had aphasia. Even though there was a smaller response rate than most surveys, the fact that respondents were providing de-identified patient information with only a one-paragraph explanation of the purposes of the study indicates that people are willing to participate. Graduate students trained in the use of evidence-based practice analyzed the results in order to determine how useful the responses were for planning a treatment intervention for a similar patient. The graders found that the respondents provided usable information on the whole. These results show that although there is promise in crowdsourcing as a research model, there is much that will need to go into each attempt at its use. Many factors were discussed, including using various methods in the crowdsourcing literature to increase participation, creating better pre and post testing requirements for participation, and how to develop this research methodology in the future.

APPENDICES

APPENDIX A: THE SURVEY

The University of Texas at Austin Department of Communication Sciences and Disorders Research Request: Clinical Experience Survey

Demographics

What is your sex?

What is your age?

What degrees have you earned in Speech Language Pathology?

Check all that apply.

B.A/B.S.
M.A./M.S.
PhD
AuD
Other:

How many years have you been employed as a speech-language pathologist?

Are you a certified speech-language pathologist?

Mark only one oval.

Yes
No
Other:

What best describes the primary setting you are currently employed in as a speech-language pathologist?
Choose all that apply
Check all that apply.

- School
- Private Clinic
- Hospital
- Rehabilitation Clinic
- Skilled Nursing Facility
- Long-Term Care Facility
- University Setting
- Other:

How many years have you been in this setting?

How many patients with aphasia have you seen in the past year?

How many patients with aphasia have you seen in the past 5 years?

What percentage of your patients that you've seen in the past year had aphasia?

What percentage of your patients that you've seen in the past 5 years had aphasia?

Clinical Case

Please think of ONE PATIENT you've treated for aphasia in the past year that has already been discharged from your care. Please do not include any identifying information about this patient.

What was the patient's age at initiation of treatment?

How long after onset of aphasia did you first start treating this patient?

What caused the patient's aphasia?

Check all that apply.

Left hemisphere stroke
Right hemisphere stroke
Left hemisphere hemorrhage
Right hemisphere hemorrhage
Brainstem Stroke
Traumatic Brain Injury
Brain Tumor
Unknown
Other:

Which diagnostic test did you use to establish diagnosis and severity?

Choose all that apply

Check all that apply.

Western Aphasia Battery (WAB)
Boston Diagnostic Aphasia Examination (BDAE)
Boston Naming Test (BNT)
Minnesota Test for Differential Diagnosis (MTDDA)
Porch Index of Communicative Ability (PICA)
None

What was the diagnosis?

Choose all that apply

Check all that apply.

Aphasia
Broca's Aphasia
Weirnicke's Aphasia
Anomic Aphasia
Global Aphasia
Fluent Aphasia
Non-Fluent Aphasia
Primary Progressive Aphasia
Other:

What was the severity?

Choose all that apply

Check all that apply.

- Mild
- Moderate
- Severe
- Very Severe
- Other:

What other co-morbid diagnosis or other relevant factors were present?

Example: hemiparesis, dysphagia, tremor, illiterate pre-stroke, previous stroke, etc...

Was the patient bilingual? If yes, what languages? Which languages did you treat them in?

For example, "The patient was bilingual in English and Spanish, and I treated the patient in Spanish."

How long was the intervention period?

(example: 5 weeks, 10 weeks, 3 months)

How many sessions per week?

How long was each session?

(example: 30 minutes, 1 hour)

Which one or more of the following was part of the intervention process?

Choose all that apply

Check all that apply.

- Speech / Articulation / Phonological Therapy
- Language Therapy
- Swallowing / Feeding Therapy
- Computer Based Intervention
- Assistive Devices
- Counseling
- Family Counseling
- Other:

Which one or more of the following best exemplifies the intervention used for the patient?

Choose all that apply

Check all that apply.

- Constraint Induced Language Therapy (CILT)
- Melodic Intonation Therapy (MIT)
- Semantic Feature Analysis Therapy (SFAT)
- Gesture Facilitation of Naming (GFN)
- Augmentative and Alternative Communication (AAC)
- Visual Action Therapy (VAT)
- Prompting Aphasics' Communication Effectiveness (PACE)
- Supported Communication Intervention (SCI)
- Response Elaboration Training (RET)
- PROMPT
- Script Training
- Other:

Please describe how you executed the intervention with this patient.

Include enough to allow someone to recreate the treatment with another patient with aphasia.

What percentage of the treatment was in a group setting?

How did you determine treatment effectiveness during and at the termination of treatment?

Check all that apply.

- Informal Evaluation
- Administering same test used to determine diagnosis and severity
- Administering Alternate Test
- Professional Opinion
- Did Not Determine
- Other:

What was the effect of this intervention on QUALITY OF LIFE for this patient?
Based on your professional opinion or on administration of test (either completed by you, the patient's family or the patient)
Check all that apply.

7 - Extremely Successful
6 - Very Highly Successful
5 - Highly Successful
4 - Successful
3 - Moderately Successful
2 - Minimally Successful
1 - Unsuccessful
Other:

What was the effect of the intervention on the COMMUNICATIVE ABILITIES of this patient?
Based on your professional opinion or on administration of test
Check all that apply.

7 - Extremely Successful
6 - Very Highly Successful
5 - Highly Successful
4 - Successful
3 - Moderately Successful
2 - Minimally Successful
1 - Unsuccessful
Other:

What was the effect of the intervention on LIFE SKILLS with this patient?
Based on your professional opinion or on administration of test
Check all that apply.

7 - Extremely Successful
6 - Very Highly Successful
5 - Highly Successful
4 - Successful
3 - Moderately Successful
2 - Minimally Successful
1 - Unsuccessful
Other:

Currently, how integrated is the patient in his or her family and/or society?
If you do not know, please select, "I don't know."
Check all that apply.

- 7 - Extremely Integrated
- 6 - Very Highly Integrated
- 5 - Highly Integrated
- 4 - Integrated
- 3 - Moderately Integrated
- 2 - Minimally Integrated
- 1 - Not Integrated
- I don't know
- Other:

Please describe any other factors that contributed to the treatment efficacy, patient recovery, or anything you deem relevant.

What, in your opinion, was the most important aspect of treatment leading to the success or failure of the treatment?

APPENDIX B: THE RESPONSES

Patient 1:

Patient age at treatment start:	29
How long after Aphasia onset did you first treat patient:	7 months
Patient's Aphasia cause:	Left Hemisphere Stroke
Diagnostic test used to establish diagnosis and severity:	Multilevel Assessment/Questionnaire
Diagnosis:	Broca's Aphasia
Severity:	Moderate
Other co-morbid diagnosis/ relevant factors:	Diabetes
Patient bilingual/treatment language:	Spanish/English home languages. Treated patient in English (patient's dominant language)
Length of intervention:	1 year
Number of sessions per week:	1
Session length:	1-2 hours
Intervention method(s) employed:	Language Therapy, Counseling
Intervention technique(s):	Gesture Facilitation of Naming (GFN), Supported Communication Intervention (SCI)
Description of intervention execution:	
Percentage of treatment in group setting:	0
Determinant for treatment effectiveness:	Informal Evaluation, Administering same test used to determine diagnosis and severity , Sentence Production Program for Aphasia 2nd edition
Effect of intervention on patient's quality of life:	Successful
Effect of intervention on patient's communicative abilities:	Successful
Effect of intervention on patient's life skills:	Successful
Current level of patient integration with his/her family and/or society:	Moderately Integrated
Other contributing factors to treatment efficacy/patient recovery:	Treatment settings include home and community outings.
Most important aspect leading to treatment success or failure:	Patient's and caregiver motivation and decrease pressure/environmental stress

Patient 2:

Patient age at treatment start:	69
How long after Aphasia onset did you first treat patient:	2 weeks
Patient's Aphasia cause:	Left hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	Western Aphasia Battery (WAB), Boston Naming Test (BNT)
Diagnosis:	Anomic Aphasia
Severity:	Mild
Other co-morbid diagnosis/ relevant factors	High-frequency hearing loss
Patient bilingual/treatment language:	No
Length of intervention:	5 weeks
Number of sessions per week:	3
Session length:	3 hours
Intervention method(s) employed:	Language therapy, computer based intervention
Intervention technique(s):	Language Treatment
Description of intervention execution:	Picture Naming using Therapy app on the iPad Auditory Comprehension tasks- 4-5 sentence paragraph with 4 comprehension questions. Reading Comprehension- read short stories of increasing length and complexity and answered questionsSpelling- single words of increasing length and complexity Writing- created short paragraphs with a prompt.
Percentage of treatment in group setting:	
Determinant for treatment effectiveness:	Did not determine
Effect of intervention on patient's quality of life:	Very highly successful
Effect of intervention on patient's communicative abilities:	Very highly successful
Effect of intervention on patient's life skills:	Very highly successful
Current level of patient integration with his/her family and/or society:	Extremely integrated
Other contributing factors to treatment efficacy/patient recovery:	High patient motivation and positive attitude, family support, received TPA drug which dramatically increased his rate of progress
Most important aspect leading to treatment success or failure:	

Patient 3:

Patient age at treatment start:	60
How long after Aphasia onset did you first treat patient:	4 weeks
Patient's Aphasia cause:	Brain Tumor
Diagnostic test used to establish diagnosis and severity:	
Diagnosis:	Anomic Aphasia
Severity:	Moderate
Other co-morbid diagnosis/ relevant factors	
Patient bilingual/treatment language:	No
Length of intervention:	8 weeks
Number of sessions per week:	2
Session length:	1 hour
Intervention method(s) employed:	Language therapy
Intervention technique(s):	Semantic Feature Analysis Therapy (SFAT), Prompting Aphasics' Communication Effectiveness (PACE)
Description of intervention execution:	Patient started with confrontation naming. Proceeded to semantic feature analysis and describing a picture to his sister. Also looking and analyzing poems.
Percentage of treatment in group setting:	
Determinant for treatment effectiveness:	Informal evaluation
Effect of intervention on patient's quality of life:	Successful
Effect of intervention on patient's communicative abilities:	Highly successful
Effect of intervention on patient's life skills:	Moderately successful
Current level of patient integration with his/her family and/or society:	Did not know
Other contributing factors to treatment efficacy/patient recovery:	High motivation, family support
Most important aspect leading to treatment success or failure:	

Patient 4:

Patient age at treatment start:	63
How long after Aphasia onset did you first treat patient:	Did not know
Patient's Aphasia cause:	Left hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	None
Diagnosis:	Aphasia, Broca's Aphasia, Anomic Aphasia
Severity:	Moderate
Other co-morbid diagnosis/ relevant factors	None
Patient bilingual/ treatment language:	
Length of intervention:	Did not know
Number of sessions per week:	3
Session length:	3 hours
Intervention method(s) employed:	Speech/articulation/phonological therapy, language therapy, computer based intervention
Intervention technique(s):	Semantic Feature Analysis Therapy (SFAT)
Description of intervention execution:	Provided 6 categories (group, use, function, place, similar items, characteristics) for the patient and asked him to name all the characteristics of the object in the picture card.
Percentage of treatment in group setting:	
Determinant for treatment effectiveness:	Informal evaluation, administering same test used to determine diagnosis and severity, professional opinion
Effect of intervention on patient's quality of life:	Highly successful
Effect of intervention on patient's communicative abilities:	Highly successful
Effect of intervention on patient's life skills:	Highly successful
Current level of patient integration with his/her family and/or society:	Did not know
Other contributing factors to treatment efficacy/patient recovery:	
Most important aspect leading to treatment success or failure:	

Patient 5:

Patient age at treatment start:	58
How long after Aphasia onset did you first treat patient:	1 year
Patient's Aphasia cause:	Left hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	Diagnosed by other
Diagnosis:	Aphasia
Severity:	Moderate, Severe
Other co-morbid diagnosis/ relevant factors	Hemiparesis
Patient bilingual/treatment language:	No/English
Length of intervention:	2 months
Number of sessions per week:	1
Session length:	30 minutes
Intervention method(s) employed:	Language therapy, computer based intervention, assistive devices, counseling
Intervention technique(s):	Semantic Feature Analysis Therapy (SFAT), various life skills training tasks
Description of intervention execution:	I came into treatment after the patient had already been seen by other clinicians. My treatment was based on what my supervisor advised, and I didn't agree with some of the things we were working on. I had a co-clinician as well. We had him practice writing his name and address, practiced reading numbers aloud, had him do functional math and reading tasks (like telling time, reading a recipe because he liked to bake, and counting money). There were executed with worksheets from workbook and clinician-made worksheets. He was also seen by other clinicians.
Percentage of treatment in group setting:	
Determinant for treatment effectiveness:	Informal evaluation
Effect of intervention on patient's quality of life:	Moderately successful
Effect of intervention on patient's communicative abilities:	Moderately successful
Effect of intervention on patient's life skills:	Moderately successful
Current level of patient integration with his/her family and/or society:	Did not know
Other contributing factors to treatment	Patient was highly motivated and received

efficacy/patient recovery:	a total of four hours of therapy each week
Most important aspect leading to treatment success or failure:	

Patient 6:

Patient age at treatment start:	70
How long after Aphasia onset did you first treat patient:	1 month
Patient’s Aphasia cause:	Left hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	Boston Diagnostic Aphasia Examination (BDAE)
Diagnosis:	Global Aphasia
Severity:	Severe
Other co-morbid diagnosis/ relevant factors	
Patient bilingual/ treatment language:	
Length of intervention:	2 months
Number of sessions per week:	2
Session length:	1 hour
Intervention method(s) employed:	Language therapy, computer based intervention, counseling
Intervention technique(s):	Constrained Induced Language Therapy (CILT), Semantic Feature Analysis Therapy (SFAT), Script Training
Description of intervention execution:	
Percentage of treatment in group setting:	
Determinant for treatment effectiveness:	Administering alternate test
Effect of intervention on patient’s quality of life:	Highly successful
Effect of intervention on patient’s communicative abilities:	Successful
Effect of intervention on patient’s life skills:	Very highly successful
Current level of patient integration with his/her family and/or society:	Very highly integrated
Other contributing factors to treatment efficacy/patient recovery:	
Most important aspect leading to treatment success or failure:	

Patient 7:

Patient age at treatment start:	62
How long after Aphasia onset did you first treat patient:	2 years
Patient's Aphasia cause:	Unknown
Diagnostic test used to establish diagnosis and severity:	None
Diagnosis:	Primary Progressive Aphasia
Severity:	Severe
Other co-morbid diagnosis/ relevant factors	None
Patient bilingual/ treatment language:	No
Length of intervention:	3 months
Number of sessions per week:	1
Session length:	90 minutes
Intervention method(s) employed:	Language therapy
Intervention technique(s):	Augmentative and Alternative Communication (AAC), Response Elaborative Training (RET)
Description of intervention execution:	Patient was shown a picture and asked to describe what was happening. Patient typically answered in single words. Clinician prompted patient to elaborate by pointing to other parts of the picture and/or asking, "What else do you see?" Clinician expanded patient's response by combining/adding ideas and encouraged patient to repeat whole phrase. Clinician also encouraged client to write her responses as an alternative method of communication. Patient's written responses were typically phrases or short sentences.
Percentage of treatment in group setting:	
Determinant for treatment effectiveness:	Informal evaluation
Effect of intervention on patient's quality of life:	Moderately successful
Effect of intervention on patient's communicative abilities:	Moderately successful
Effect of intervention on patient's life skills:	Moderately successful
Current level of patient integration with his/her family and/or society:	Did not know
Other contributing factors to treatment efficacy/patient recovery:	Patient was more comfortable repeating phrases with the clinician. Patient enjoyed

	looking at pictures of photographs from magazine like National Geographic although she started out by describing simple pictures from the Language Activity Resource Kit (LARK).
Most important aspect leading to treatment success or failure:	

Patient 8:

Patient age at treatment start:	75
How long after Aphasia onset did you first treat patient:	3 months
Patient's Aphasia cause:	Right hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	Boston Naming Test (BNT)
Diagnosis:	Aphasia
Severity:	Mild
Other co-morbid diagnosis/ relevant factors	None
Patient bilingual/ treatment language:	No
Length of intervention:	1.5 months
Number of sessions per week:	2
Session length:	60 minutes
Intervention method(s) employed:	Language therapy, swallowing/feeding therapy
Intervention technique(s):	Diet modification
Description of intervention execution:	Diet modification to honey thickened liquids, instruction and repeat demonstration of compensatory strategies for safe swallow. Word-recall exercises.
Percentage of treatment in group setting:	0
Determinant for treatment effectiveness:	Informal evaluation
Effect of intervention on patient's quality of life:	Moderately successful
Effect of intervention on patient's communicative abilities:	Successful
Effect of intervention on patient's life skills:	Successful
Current level of patient integration with his/her family and/or society:	Integrated
Other contributing factors to treatment efficacy/patient recovery:	Patient depressed and withdrawing for socialization
Most important aspect leading to treatment success or failure:	Patient willingness to modify diet and preform exercises

Patient 9:

Patient age at treatment start:	72
How long after Aphasia onset did you first treat patient:	6 weeks
Patient's Aphasia cause:	Brain tumor
Diagnostic test used to establish diagnosis and severity:	Boston Diagnostic Aphasia Examination (BDAE), Boston Naming Test (BNT)
Diagnosis:	Anomic Aphasia
Severity:	Moderate
Other co-morbid diagnosis/ relevant factors	Mild dysphagia
Patient bilingual/ treatment language:	No
Length of intervention:	4 months
Number of sessions per week:	2
Session length:	45 minutes
Intervention method(s) employed:	Language therapy
Intervention technique(s):	Semantic Feature Analysis Therapy (SFAT), Circumlocution induced naming
Description of intervention execution:	Presented picture cards for confrontational naming. When anomia occurred, circumlocution induced naming technique was employed. Initially, SFA was used to teach patient to use circumlocution in a structured way. Later in therapy, patient was taught to use this as a self cuing strategy which was usually successful in accessing the name of pictures.
Percentage of treatment in group setting:	None
Determinant for treatment effectiveness:	Administering same test used to determine diagnosis and severity
Effect of intervention on patient's quality of life:	Successful
Effect of intervention on patient's communicative abilities:	Highly successful
Effect of intervention on patient's life skills:	Highly successful
Current level of patient integration with his/her family and/or society:	Integrated
Other contributing factors to treatment efficacy/patient recovery:	Patient highly motivated and completed home work assignments between therapy sessions
Most important aspect leading to treatment success or failure:	Patient ability to recognize that circumlocutionary speech was a successful self cueing strategy

Patient 10:

Patient age at treatment start:	45
How long after Aphasia onset did you first treat patient:	5 years
Patient's Aphasia cause:	Left hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	None
Diagnosis:	Aphasia, Non-Fluent Aphasia
Severity:	Very Severe
Other co-morbid diagnosis/ relevant factors	Hemiparesis, Apraxia
Patient bilingual/ treatment language:	No
Length of intervention:	3 months
Number of sessions per week:	2
Session length:	45 minutes
Intervention method(s) employed:	Language therapy, computer cased intervention, counseling
Intervention technique(s):	Semantic Feature Analysis Therapy (SFAT), Augmentative and Alternative Communication (AAC), Script Training
Description of intervention execution:	The patient was very successful using semantic features. AAC- iPad apps.
Percentage of treatment in group setting:	0
Determinant for treatment effectiveness:	Informal evaluation, professional opinion
Effect of intervention on patient's quality of life:	Successful
Effect of intervention on patient's communicative abilities:	Successful
Effect of intervention on patient's life skills:	Highly successful
Current level of patient integration with his/her family and/or society:	Highly integrated
Other contributing factors to treatment efficacy/patient recovery:	
Most important aspect leading to treatment success or failure:	Counseling

Patient 11:

Patient age at treatment start:	62
How long after Aphasia onset did you first treat patient:	1 month
Patient's Aphasia cause:	Left hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	Boston Diagnostic Aphasia Examination (BDAE)
Diagnosis:	Broca's Aphasia, Apraxia
Severity:	Moderate
Other co-morbid diagnosis/ relevant factors	
Patient bilingual/ treatment language:	
Length of intervention:	6 months
Number of sessions per week:	1
Session length:	90 minutes
Intervention method(s) employed:	Speech/articulation/phonological therapy, language therapy, family counseling, group
Intervention technique(s):	Melodic Intonation Therapy (MIT), PROMPT, Script Training, Verb/Noun descriptive techniques
Description of intervention execution:	Initiated scripted language for settings consistent to client (determined by client and family interview). Used PROMPT to facilitate motor/cognitive mapping to improve concomitant apraxia issues. MIT facilitated increased use of non-concrete words (decreased shot-gun style speech) and to help normalize prosody.
Percentage of treatment in group setting:	
Determinant for treatment effectiveness:	Informal evaluation, administering alternate test, questionnaires and evaluation in non-clinic setting
Effect of intervention on patient's quality of life:	Highly successful
Effect of intervention on patient's communicative abilities:	Moderately successful
Effect of intervention on patient's life skills:	Not evaluated
Current level of patient integration with his/her family and/or society:	Did not know
Other contributing factors to treatment efficacy/patient recovery:	Healthy marriage and pre-morbid attitude toward life in general (relatively happy)
Most important aspect leading to treatment success or failure:	Getting the spouse involved in therapy sessions, so that she could implement

therapy goals at home 24/7 (client and spouse actively participated in developing and reworking goals and objectives)

Patient 12:

Patient age at treatment start:	38
How long after Aphasia onset did you first treat patient:	3 months
Patient's Aphasia cause:	Right hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	Boston Diagnostic Aphasia Examination (BDAE), Boston Naming Test (BNT)
Diagnosis:	Global Aphasia, Non-Fluent Aphasia
Severity:	Very severe
Other co-morbid diagnosis/ relevant factors	Previous stroke, hemiparesis, diabetes, high blood pressure, noncompliance with medication
Patient bilingual/ treatment language:	Yes/ English
Length of intervention:	6 months
Number of sessions per week:	1
Session length:	1 hour
Intervention method(s) employed:	Speech/articulation/phonological therapy, language therapy, pictures, reading, writing
Intervention technique(s):	Melodic Intonation Therapy (MIT), Gesture Facilitation of Naming (GFN), Augmentative and Alternative Communication (AAC), Prompting Aphasics' Communication Effectiveness (PACE)
Description of intervention execution:	To begin the session, we would "warm up" by reading and singing the Melodic Intonation Phrases in the notebook. Then identification of functional items, with pictures and words was attempted as well as saying the words and/or phrases which matched the pictures. Then this patient was presented with phonologically similar words so that the focus was on how to make different sounds and word shells correctly in imitation and then in response to written stimuli and/or pictures. Writing was also encouraged to facilitate communication about everyday events and reading in unison was attempted to encourage fluent speech production
Percentage of treatment in group setting:	None
Determinant for treatment effectiveness:	Informal evaluation, professional opinion

Effect of intervention on patient’s quality of life:	Minimally successful
Effect of intervention on patient’s communicative abilities:	Minimally successful
Effect of intervention on patient’s life skills:	Moderately successful
Current level of patient integration with his/her family and/or society:	Moderately integrated
Other contributing factors to treatment efficacy/patient recovery:	This patient did not complete the home assignments. This patient had difficulty coming to therapy and feeling well enough to focus on communication.
Most important aspect leading to treatment success or failure:	Often when a breakthrough was made, this patient would stop coming for a week or two due to illness, transportation problems, depression, etc. Carry-over was difficult.

Patient 13:

Patient age at treatment start:	73
How long after Aphasia onset did you first treat patient:	10 days
Patient's Aphasia cause:	Left hemisphere stroke
Diagnostic test used to establish diagnosis and severity:	Informal testing since resolving so quickly
Diagnosis:	Broca's Aphasia
Severity:	Severe
Other co-morbid diagnosis/ relevant factors	Alcoholic, previous falls
Patient bilingual/ treatment language:	No
Length of intervention:	4 weeks
Number of sessions per week:	10-12
Session length:	30 minutes
Intervention method(s) employed:	Speech/articulation/phonological therapy, language therapy, counseling, family counseling
Intervention technique(s):	Melodic Intonation Therapy (MIT), Prompting Aphasics' Communication Effectiveness (PACE), Supported Communication Intervention (SCI)
Description of intervention execution:	Utilized co-treatments with music therapy for MIT. Initially started with familiar song and music and then transitioned to functional phrases. Utilized picture cards and magazines to promote communication through naming and description. Utilized environmental stimuli and her family for supported conversations to improve comprehension and expression. Mild comprehension deficits treated this way so that she had visual support to improve her understanding.
Percentage of treatment in group setting:	0
Determinant for treatment effectiveness:	Informal evaluation
Effect of intervention on patient's quality of life:	Very highly successful
Effect of intervention on patient's communicative abilities:	Very highly successful
Effect of intervention on patient's life skills:	Very highly successful
Current level of patient integration with his/her family and/or society:	Highly integrated

Other contributing factors to treatment efficacy/patient recovery:	During the course of hospitalization scans of her brain revealed that internal swelling was resolving quickly and this likely played a significant role in her speech/language recovery
Most important aspect leading to treatment success or failure:	Family involvement in the treatment plan that helps determine the patient’s interests and the family’s ability to carryover techniques taught by the SLP

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