

Albert Einstein Healthcare Network

Annual Progress Report: 2009 Formula Grant

Reporting Period

January 1, 2010 – June 30 2010

Formula Grant Overview

The Albert Einstein Healthcare Network received \$119,376 in formula funds for the grant award period January 1, 2010 through December 31, 2011. Accomplishments for the reporting period are described below.

Research Project 1: Project Title and Purpose

A Feasibility Study of Fruit and Vegetable Consumption in Low Income Communities - The purpose of this project is to collect preliminary data from supermarket shoppers in a low income community about their purchasing of fruits and vegetables and to assess the feasibility of our methods. The results will provide us with preliminary data that will be used in designing a larger intervention study on the use of incentives to promote healthier eating, particularly in low income populations.

Anticipated Duration of Project

1/1/2010 - 12/31/2011

Project Overview

The broad research objective is to identify effective methods and approaches to improve healthier eating, particularly for low income populations. The specific research aims are: 1) To collect pilot data on purchase and consumption of fruits and vegetables in a low-income community and assess the feasibility of our research methods; 2) To describe healthy foods purchasing patterns, examining which individual and household characteristics are independent predictors of greater purchases of fruits and vegetables; and 3) To assess whether incentives in the form of discount coupons for fruits and vegetables can be studied as a potential intervention to encourage family members to buy more healthy foods.

The project will help us to determine the feasibility of using electronic supermarket data to obtain information about grocery purchasing behaviors. This is a 12 month trial examining food purchases in a cohort of adult shoppers who have at least one child living in the home. We will enroll 15-25 individuals who conduct the majority of their grocery shopping at the Fresh Grocer and examine their food purchase patterns over three time periods. We will also examine the use and impact of an incentive in the form of discount coupons for fruit and vegetable purchases. We

will analyze self-report data as well as purchase data obtained from the Point of Sale system maintained by the Fresh Grocer, which records all purchases made with frequent shopper cards.

Principal Investigator

Etienne Juarez Phipps, PhD
Director, Einstein Center for Urban Health Policy and Research
Albert Einstein Healthcare Network
5501 Old York Rd.
Philadelphia, PA 19141

Other Participating Researchers

Shana Stites, MA, Erin Kulick, MPH, Leonard E. Braitman, PhD - employed by Albert Einstein Healthcare Network

Expected Research Outcomes and Benefits

Identifying effective strategies for improving healthier eating for low income populations is both a clinical challenge and a public health priority. Approximately, only 38% of Americans consume the recommended servings of vegetables and only 23% consume the suggested amount of fruit. In low income households, close to 20% of households do not purchase fruits and vegetables at all. The consumption of fruits and vegetables is strongly associated with the prevention and management of chronic diseases such as diabetes, cardiovascular disease, and obesity. Low-income populations are disproportionately affected by these health conditions.

The overall objective of this project is to build the foundation for a more formally organized randomized controlled trial to determine the effectiveness of incentives to improve healthy eating, targeting increased consumption of fruits and vegetables, particularly for low income populations.

Summary of Research Completed

We organized the study team and have had several organizational meetings to finalize procedures for recruitment, how coupons will be operationalized for the study, and procedures for receiving shopping data from the supermarket. We have completed test runs of the data from aggregate shoppers to examine data quality and set up formulas to enable categorization and subsequent analysis. We worked with the supermarket to design and print the coupons and have purchased the study coupons from them.

We finalized materials and obtained IRB approval for advertisements and the coupons themselves. We finalized the patient packets which include the completed study materials and coupons and have sent the material out to the first cohort of enrolled participants.

We began recruitment at the supermarket in May. After verifying eligibility, we have consented and enrolled 25 participants. We are cleaning and entering data from the first retrospective

period of one month prior to consent. We are continuing to enroll participants at this time.

Research Project 2: Project Title and Purpose

The Role of Left Inferior Frontal Cortex in Sequencing and Language - The project purpose is to explore an important component of language - the sequencing of words in a sentence - that is commonly impaired in non-fluent aphasia. Non-fluent aphasia is a stroke-related disability that features poor grammatical structure, effortful speech and impaired comprehension under some conditions. It is a complex syndrome that may consist of dissociable components. Understanding the cognitive and neuroanatomical bases of these components is critical for the accurate categorization of aphasic impairments and their subsequent treatment. A preliminary study suggested a key role for the left inferior frontal cortex (LIFC) of the brain in sequencing. This project aims to reproduce those results, clarify the relationship between the sequencing of words and sentence production, and test whether the sequencing deficit is specific to language.

Anticipated Duration of Project

1/1/2010 – 12/31/2011

Project Overview

Objective #1: To clarify the role of left inferior frontal cortex (LIFC) in sequencing for language.

Objective #2: To clarify the relationship between such sequencing impairments and deficits in other linguistic and non-linguistic functions.

Specific aim #1: To determine whether damage to a specific sub-region of LIFC (posterior portion, Brodmann area 44/6/9) is predictive of impairment in flexibly sequencing words. We will compare patients with damage to this region of LIFC with patients who have damage to other areas of the brain. This will provide more accurate information about the anatomical basis of such impairments.

Specific aim #2: To correlate impairment in sequencing words with difficulty in producing complete, grammatical sentences during other tasks. We will compare patients' performance in multiword naming with their performance in describing events and scenes and telling stories. This will clarify current theories of the relationship between different components involved in sentence production.

Specific aim #3: To correlate impairment in sequencing words with impairment in sequencing non-linguistic items such as tones and visual stimuli. This will allow us to determine the extent to which patients' impairments are language-specific.

Principal Investigator

Myrna F. Schwartz, PhD
Associate Director
Albert Einstein Healthcare Network
Moss Rehabilitation Research Institute
1200 West Tabor Rd

MossRehab, 4th Fl. Sley
Philadelphia, PA 19141

Other Participating Researchers

Malathi Thothathiri, PhD - employed by Albert Einstein Healthcare Network/ Moss Rehabilitation Research Institute

Expected Research Outcomes and Benefits

Persons with mild or moderate non-fluent aphasia are able to function independently in many everyday situations, but they either avoid interactions that require prolonged or subtle communication or are dependent on others to “translate” for them in such situations. This can have a negative impact on psychosocial wellbeing and quality of life. This project seeks to understand whether an impairment in flexibly sequencing words lies at the core of patients’ grammatical difficulties. Previous research and a preliminary study conducted prior to this project have validated the tasks that we will use. The preliminary study implicated a specific area of the brain within the left inferior frontal cortex. If successful, this project will a) allow us to predict specific impairments in patients from their anatomical profiles; b) use the tasks developed herein to diagnose more accurately the cognitive deficits of patients; and c) determine whether the sequencing difficulties are circumscribed to language and if so, possibly harness patients’ preserved abilities in sequencing other kinds of stimuli (e.g., pictures) to design therapy.

Summary of Research Completed

Specific aim #1: To determine whether damage to a specific sub-region of LIFC (posterior portion, Brodmann area 44/6/9) is predictive of impairment in flexibly sequencing words.

Thus far, we have tested 7 patients with damage to different areas of the brain. Three of these patients have damage to the posterior portion of LIFC, one has damage to *another* part of LIFC and three have no damage in frontal cortex at all and only damage in posterior brain regions. All completed the multiword priming task, where they produced two nouns in a “X and Y” phrase. We manipulated whether a repeated noun appeared in a consistent or inconsistent position compared to previous prime trials. We measured patients’ impairment in flexibly sequencing words by computing the increase in reaction time for inconsistent compared to consistent trials as a percent of patients’ baseline latencies. A higher percent increase indicates greater difficulty in flexible sequencing. Table 1 shows the scores for the 7 patients. Consistent with our predictions, patients with damage to the posterior portion of LIFC (patients 1, 2 and to a smaller extent 3) showed the most difficulty in this task.

We are currently collecting data from matched healthy controls. We have data from two such subjects (#1: -0.29% increase, #2: 1.54% increase). Testing with five others is currently in progress. Once we have a sample of 8 subjects, we will compute statistics to determine which of the patients differ significantly from the controls. Qualitatively, patients #1 and #2 above (Table

1) quite obviously show an exacerbated difficulty in switching the positions of words in an utterance compared to other patients and healthy controls.

Specific aim #2: To correlate impairment in sequencing words with difficulty in producing complete, grammatical sentences during other tasks.

We tested the same 7 patients as above in a variety of other language production tasks.

The verbal fluency task is a measure of executive function, which is thought to be supported by LIFC. The task does not involve sequencing however. Participants are asked to produce names from superordinate and subordinate categories. A smaller difference between the average number of responses in superordinate compared to subordinate categories is taken to reflect impaired executive function. Going in, we hypothesized that an ability to flexibly sequence multiple words (a form of executive function) may dissociate from other kinds of executive function. Table 2 shows the scores for the 7 patients. Patients who experienced difficulty sequencing multiple words also scored low on this task (patients 1, 2, and 3). However, other patients, with no damage to LIFC also had scores in the same range (notably patients 5 and 7). Prior studies suggest that healthy controls have scores around 7. We are currently collecting and analyzing verbal fluency data from 8 healthy controls. The mean and standard deviation of their scores will allow us to examine which of the patients deviate significantly from normative performance.

The scene description task measures participants' ability to produce frequent (actives) and infrequent (passives) sentence structures. We considered the possibility that any sequencing difficulties in patients might come to the fore particularly during the production of infrequent sentence structures. Disfluencies during the production of passives vs. actives are shown in Table 2. While LIFC patients seemed to be more disfluent on average (patients 1, 3, 4), they were not particularly so on passive structures. Nor did this difficulty correlate with *posterior* LIFC damage. Patient 2, who has posterior LIFC damage, showed little disfluency even on passive structures. On the other hand, patient 4, who has damage to other parts of LIFC produced the most disfluent passives. Thus, this pattern of results suggests a dissociation between patients' ability to flexibly sequence words and their ability to produce infrequent sentence structures (at least within the context of a constrained experimental task).

We are still coding and analyzing data from two other language production tasks (data collection is complete). Moving picture description tests the sequencing of nouns in the context of a full sentence. Story telling is a naturalistic measure of expressive language. We anticipate that coding for all 7 patients will be complete by September 2010.

We are also collecting data from healthy controls on the verbal fluency, scene description and moving picture tasks (story telling has already been normed with other controls). Data from seven controls is currently being collected or coded. As with specific aim #1, once we have complete data from 8 subjects, we will compute statistics comparing patients and healthy controls.

Specific aim #3: To correlate impairment in sequencing words with impairment in sequencing non-linguistic items such as tones and visual stimuli.

We have finished testing the 7 patients on three sequencing tasks (Match, Delete and Reverse) using three different kinds of stimuli (syllables, tones and abstract pictures). Patients (and healthy controls) varied widely in their musical experience and their ability to manipulate musical tones, with some participants failing even in a simple match task comparing two sequences of tones. Therefore, we will drop this stimulus type in future testing.

We were particularly interested in patients' ability to do the Reverse task. In prior literature, it has been proposed that this task taps into the ability to *manipulate sequences* by reordering the items (in this case, putting them in reverse). However, our testing revealed that some participants quickly picked up on other strategies. In order to judge whether two 3-item sequences were the reverse of one another, they simply attempted to note whether the middle item was the same in both sequences or whether the first item in the first sequence appeared at the end in the second sequence.

The variable use of explicit strategies is non-optimal from the point of view of our measuring a presumably implicit sequencing ability. We are currently investigating other sequencing tasks that are not as amenable to explicit strategizing. Nevertheless, our current data are informative in one respect. All patients showed numerically greater accuracy on the reverse task with visual compared to verbal stimuli (Table 3). Four out of seven patients performed above chance on the visual reverse task. Zero out of seven patients did the same on the syllable version. Thus, all of the aphasic patients tested showed a selective impairment in manipulating sets of syllables. This failure could result from impaired verbal working memory, encoding of temporal order for verbal stimuli or the manipulation of verbal sequences. Only the last process is relevant for our current purposes. We hope to tease apart these possibilities by using a new sequence manipulation task that has minimal working memory requirements and is less amenable to task strategies.

Table 1. Multiword priming scores

Patient #	Description of brain lesion	% increase in reaction time (inconsistent minus consistent)
1	Extensive damage to posterior LIFC	27.93
2	Extensive damage to posterior LIFC	42.95
3	Some damage to posterior LIFC	12.08
4	Damage to LIFC, but not posterior parts	8.45
5	No damage in LIFC. Posterior brain regions only.	5.84
6	No damage in LIFC. Posterior brain regions only.	0.84
7	No damage in LIFC. Posterior brain regions only.	N/A*

* Reaction time data from patient 7 were not usable due to too many naming errors.

Table 2. Verbal fluency and Scene description scores

Patient #	Description of brain lesion	Verbal fluency: super- minus subordinate	Scene description: passive vs. active
1	Extensive damage to posterior LIFC	2	2.7 vs. 3.2
2	Extensive damage to posterior LIFC	2.86	0.5 vs. 0.92
3	Some damage to posterior LIFC	2.71	2.25 vs. 2.0
4	Damage to LIFC, but not posterior parts	3.86	2.75 vs. 0.4
5	No damage in LIFC. Posterior brain regions only.	1.71	1.5 vs. 0.14
6	No damage in LIFC. Posterior brain regions only.	5.71	0.0 vs. 0.18
7	No damage in LIFC. Posterior brain regions only.	3.43	0.5 vs. 0.17

Table 3. Sequence manipulation scores

Patient #	Description of brain lesion	Syllable Reverse % correct	Visual Reverse % correct
1	Extensive damage to posterior LIFC	52.5	70*
2	Extensive damage to posterior LIFC	50	57.5
3	Some damage to posterior LIFC	65	67.5*
4	Damage to LIFC, but not posterior parts	42.5	70*
5	No damage in LIFC. Posterior brain regions only.	52.5	62.5
6	No damage in LIFC. Posterior brain regions only.	52.5	72.5*
7	No damage in LIFC. Posterior brain regions only.	55	62.5

* indicates above chance performance

Research Project 3: Project Title and Purpose

Longitudinal Multi-modal Neuroimaging of Natural Recovery after Traumatic Brain Injury: A Pilot Study - This project will provide pilot data for a large-scale future study whose aims include 1) determining the pattern of longitudinal changes in structural and functional neuroimaging indices associated with traumatic brain injury (TBI) and their relationship with behavioral improvements and 2) developing a “recovery potential” index, based on the difference between structural and functional imaging measures obtained at different points of post-injury, and collect data on its relationship with behavioral recovery. This project will

demonstrate our capability to collect and analyze longitudinal multi-modal neuroimaging data and to estimate the appropriate sample size for the larger study to be proposed for NIH funding.

Anticipated Duration of Project

1/1/2010 - 12/31/2011

Project Overview

The specific aims of this project are 1) to demonstrate, under our recruitment and neuroimaging infrastructure, the feasibility of longitudinal, multi-modal neuroimaging data collection to study neural recovery after TBI, 2) to develop and validate the “recovery potential index” that is based on the difference between structural and functional imaging measures obtained at different points of post-injury, and 3) to estimate, for each neuroimaging modality, the sample size necessary to demonstrate longitudinal changes between 3 and 6 months.

To achieve these goals, we will test 4-9 survivors of TBI on four neuroimaging measures twice, at 3 and 6 months from the date of injury. To measure longitudinal improvements in behavior, a global behavioral outcome measure and a neuropsychological test battery consisting of six executive function tests will be administered at each time point. Recovery potential index will be calculated from the difference between the masks covering significant areas of hypoperfusion at 3 months and the masks covering significant atrophy at 6 months for each individual. Then, the variability of the index across subjects will be assessed. Regarding sample size calculation, using obtained estimates of the magnitude of longitudinal changes (i.e., difference between 3 and 6 months) and their variances, we will calculate necessary sample sizes for each imaging indices with a type I error level 0.05 and a power of 0.8.

Principal Investigator

Junghoon Kim, PhD
Institute Scientist
Moss Rehabilitation Research Institute
60 E. Township Line Rd.
Elkins Park, PA 19027

Other Participating Researchers

Brian Avants, PhD - employed by University of Pennsylvania
John Whyte, MD, PhD, Tessa Hart, PhD - employed by Moss Rehabilitation Research Institute

Expected Research Outcomes and Benefits

The “recovery potential” index to be developed and validated in this project has a potential to be used as a biomarker to predict future recovery from traumatic brain injury. This index may ultimately contribute to the development of efficient intervention by helping to reveal the neural mechanism of recovery and to predict its individual differences.

Summary of Research Completed

Review by the Peer Review Committee of MossRehab: The Peer Review Committee of MossRehab approved the current project in October, 2009. The Committee's comments were fully answered. No significant changes were made to the original proposal.

Approval by the IRB of Albert Einstein Healthcare Network: The Institutional Review Board (IRB) of AEHN approved the study in December, 2009 and confirmed that the project qualifies for an exempt status because it requires less than 10 subjects.

Modification of the protocol and consent form: The Center for Advanced Magnetic Resonance Imaging and Spectroscopy (CAMRIS) of the University of Pennsylvania (Penn), where the imaging will occur, requested that the protocol should include a mandatory pregnancy urine test prior to MRI. The modified protocol and consent form was approved by the AEHN IRB in June, 2010.