New Jersey Commission on Brain Injury Research
Final Narrative Report

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Kessler Foundation

Examining Apathy, Depression, and Executive Functions in Individuals with TBI

Grant Number:
No. 10-3218-BIR-E-0

Grant Period:
From 06/01/10 to 05/31/14

Final Report Submitted on 7/30/14

1. Original aims of the project.

The present proposal has the following specific aims:

Aim 1. Explore the relationship among apathy, depression, and executive abilities on cognitive functions in persons with TBI. Specifically, we will examine cognitive performance using traditional neuropsychological measures to assess the impact of apathy on cognitive functions, in particular, increased executive dysfunction.

Aim 2. Evaluate the cerebral substrate for apathy in individuals with TBI. Apathy has been reported clinically in the literature in persons with TBI, however, there is little understanding of the cerebral underpinnings of apathy in such individuals. To meet this void in the research, we will elucidate patterns of cerebral activation of apathy in persons with MS.

Aim 3. Explore the relationship between apathy and executive functioning using functional neuroimaging. We will examine role of apathy on the patterns and levels of cerebral activation on fMRI tasks of executive function.

2. Project successes.

All data has been collected, scored and entered into the database. The fMRI data are preprocessed and checked for significant movement in the scanner that could impact the quality of the data. We are now in the process of analyzing our data and determining directions for future grant submissions. We are also in the process of manuscript preparation. We will also submit our findings to national conferences for presentation once finalized.

3. Project challenges.

As in many research organizations there can be turnover of Research Assistants during a grant cycle. During this grant period, one Research Assistant on the current project left the organization to attend graduate school a new Research Assistant was hired and trained.

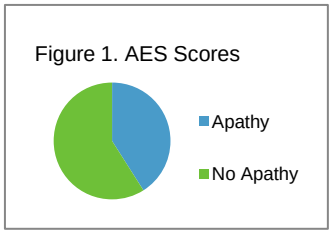
4. Implications for future research and/or clinical treatment

TBI carries with it clusters of psychiatric, behavioral, and cognitive symptoms, all of which significantly impact a person's everyday life, including vocational performance. However, few studies to date have examined the interaction between symptoms in these various areas and most researchers and clinicians examine such symptoms in isolation. A clear understanding of the interaction and influence of these symptoms on one another will enable us to focus treatment efforts that will maximize improvement across domains, thus maximizing the improvement in daily functioning and overall quality of life. Our final data analysis are expected to provide this direction to clnicians and researchers.

5. Plans to continue the research, including applications submitted to other sources for ongoing support. Explain how you have leveraged NJCBIR funding to obtain additional federal or other support for brain injury research and list the appropriate funding organizations.

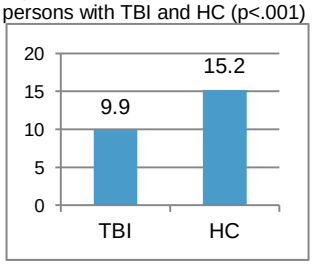
Results of this work will advance our understanding of apathy in TBI through dissemination and direct our efforts to develop an effective intervention. Given the paucity of research examining the relationship between depression, apathy, and executive dysfunction in neurological samples as a whole, and TBI in particular, and the high incidence of all three of these symptoms in TBI, a complete evaluation of these three symptoms, their behavioral comorbidity and their neurological underpinnings is necessary to advance our understanding of TBI. In addition, a more complete understanding of the constellation of these symptoms and their relationship with one another will shed light on the most efficacious focus for potential intervention, as well as the potential impact of such an intervention on the other symptoms.

Initial analyses of the data collected in the current study examining the prevalence of apathy in persons with TBI finds that 41% of the individuals with TBI have clinically significant apathy according to the Apathy Evaluation Scale (see Figure 1.). These individuals do not differ from the nonapathy participants in age, education, gender, time since injury, or premorbid IQ. They do, however, report significantly higher level of depression than those without apathy.



The first manuscript from this data set is currently in preparation. This manuscript focuses on the examination of differences in health-related quality of life in persons with TBI with and without apathy. Participants were divided into those with apathy (n=21; 41%) and those without apathy (n=30; 59%), according to the Apathy Evaluation Scale. Quality of life was measured with the 2 scales: (1) the mental component summary (MCS) and physical component summary (PCS), of the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) and (2) the Functional Behavior Profile (FBP), which reports performance of daily activities by individuals and significant others in 3 areas: Task Performance, Problem Solving, and Social Interaction. After adjusting for level of depression, the apathy group had significantly lower MCS scores on the SF-36 and significantly lower scores on all the Self areas and Significant Other Social Interaction and Problem Solving on the FBP. These data indicate that apathy has a significant negative effect on quality of life and daily activities of persons with TBI, particularly on their mental health, social interventions and problem solving. This data supports a significant need for an effective intervention to improve apathy in persons with TBI.

Figure 2. Performance on FEIT in persons with TBI and HC (p<.001)



Data collected from this study has served as the foundation for a new line of research examining Emotional Processing in TBI. Our work examined 42 individuals with moderate- severe TBI compared to 14 matched HCs on the Facial Emotion Identification Test (FEIT). The FEIT is a 19-item measure of emotional processing utilizing facial affect recognition where individuals are presented with standardized photographs of people expressing basic emotions, originally developed by Ekman. Results indicated that

individuals with TBI had fewer correct responses compared to HCs (Figure 2, p<.001), indicating impaired emotional processing in TBI group. Performance on the FEIT also significantly correlated with executive measures assessing organizational strategies [CVLT Semantic Clustering (r= -.36, p < .05), Rey Complex Figure Copy (r= -.40, p< .05), switching (DKEFS Design Fluency) (r= -.37, p < .05), Verbal Fluency (r= -.37, p<.05), Trails (r=-.36, p<.05), and abstraction (DKEFS Twenty Questions r=-.45, p<.05)]. These data show that individuals with TBI demonstrate impairments in emotional processing compared to HCs and these deficits correlate with impaired executive function, offering further evidence to study the impact of an emotional processing intervention on cognition. Data from this work was used as pilot data for two grant submittals. The first, "Neural substrates of facial emotion processing in individuals with TBI" was funded by the NJCBIR (CBIR13IRG026). The second, "Treating Emotional Processing Impairments in Individuals with TBI: A Randomized Controlled Trial" was submitted as a Field Initiated application to the National Institute of Disability and Rehabilitation Research (NIDRR). The status of that Field-Initiated grant will be known later this year. A second proposal for a study examining the treatment of apathy following TBI is currently in the planning stages for submittal early next year.

6. List and include a copy of all publications emerging from this research, including those used in preparation.

Papers submitted:

Genova, H., Rajagopalan, V., Chiaravalloti, ND, Binder, A, DeLuca, J, & Lengenfelder, J (accepted). Facial Affect Recognition Linked to Damage in Specific White Matter Tracts in Traumatic Brain Injury. Social Neuroscience.

Lengenfelder, J, Genova, H, Lavrador, SF, Genualdi, & Chiaravalloti, ND (Submitted). "Emotional processing and its correlation with cognition in traumatic brain injury." Journal of Clinical and Experimental Neuropsychology.

Papers in preparation:

"Apathy and quality of life after traumatic brain injury." Lengenfelder, J., Goverover, Y. & Chiaravalloti, ND

"The relationship between apathy and emotional processing in traumatic brain injury." Lengenfelder, J., Genova, H., & Chiaravalloti, N.D.

"A relationship between self- reported cognitive deficits and depression in traumatic brain injury." Santana, E., Lengenfelder, J., Nikelshpur, O. , Strober, L., & Chiaravalloti, N.D.

Presentations:

"Emotional Processing and Cognition in TBI" Lengenfelder, J., Genova, H., Santana, E., Genualdi A., and Chiaravalloti , N.D. Poster presented at the North American Brain Injury Society, October 2013.

“How does white matter damage contribute to emotional processing deficits in Traumatic Brain Injury?” Genova, H., Binder, A., Sacchetti, D.L., Wylie, G., Chiaravalloti, N., & Lengenfelder, J. Poster presented at the North American Brain Injury Society, October 2013.

“Self Report Cognitive Deficits are Correlated with Depression Not Objective Cognitive Performance in Traumatic Brain Injury (TBI)”. Santana E., Lengenfelder J., Persaud U., & Chiaravalloti, N.D. Poster presented at the Social and Affective Neuroscience Society meeting, April 2013

“The relationship between white matter integrity and emotional processing in Traumatic Brain Injury” Binder, A., Genova, H., Lengenfelder, J., Sacchetti, D.L., & Chiaravalloti, N.D. Poster presented at the Social and Affective Neuroscience Society meeting, April 2013

7. Financial summary. (Attached)

612347

New Jersey Department of Health and Senior Services
REPORT OF GRANT EXPENDITURES

Reporting Agency	Grant Number	Reporting Period	Report Number
Kessler Foundation	10-3218-BIR-E-0	FROM 04/1/14 TO: 05/31/14	17
Address	**Grantee Account/Fund Number**	**Budget Period**	**Revision Report No.**
300 Executive Drive - Suite 10	46.00457	FROM: 6-01-10 TO: 5-13-14	
City	**NJDHSS Account Number(s)**	**Basis of Report**	☑ FINAL
West Orange, NJ 07052	4029-457-6140	☐ CASH ☒ ACCRUAL	
Grant Title			
Examining Apathy, Depression and Executive Functions in Individuals with TBI			

ROUND OFF TO NEAREST DOLLAR

BUDGET CATEGORIES	APPROVED BUDGET		PERIOD EXPENDITURES		CUMULATIVE EXPENDITURES	
	Grant Funds	Other Funds	Grant Funds	Other Funds	Grant Funds	Other Funds
A. PERSONNEL COST						
Salaries/Wages	207,075		9,199		248,426	
Fringe Benefits						
Total	207,075		9,199		248,426	
B. CONSULTANT/PROFESSIONAL SERVICES COST	15,000		.00		5,000	
Total	15,000		.00		5,000	
C. OTHER COST CATEGORIES						
Office Expense and Related Cost	3,500		.00		1,492	
Program Expense and Related Cost	84,918		2,945		56,778	
Staff Training and Education Cost	.00		.00		.00	
Travel, Conferences and Meetings	4,500		96		5,404	
Equipment and Other Capital Expenditures	2,500		.00		393	
Facility Cost	.00		.00		.00	
Sub-Grants	.00		.00		.00	
Total	95,418		3,041		64,067	
Total Direct Cost	317,493		12,240		317,493	
Indirect Cost	31,499		1,193		31,499	
Total Cost	348,992		13,433		348,992	
Less Program Income	.00		.00		.00	
NET TOTAL COST	348,992		13,433		348,992	

I certify this report is true and correct and all expenditures reported herein have been made in accordance with the terms and conditions of this grant and are properly reflected in the grantee's accounting records.

Name of Chief Financial Officer: Anne E. Ammons

Title: Sr VP of Finance & CFO

Signature: Anne E. Ammons Date: 07-28-14

Accepted By:

Grants Management Officer	Yes	No
	☐	☐

Signature Date

Status of Funds:

Cash received to date	$335,559
Less: Cash disbursements as of 05-31-14 (Date)	$348,992
Cash Balance as of 05-31-14 (Date)	$(13,433)

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