Neurobehavior in humans and its role in Alzheimer's Disease

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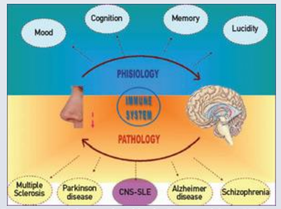
ABSTRACT

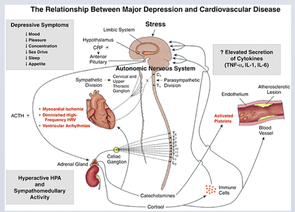
In a neurobehavioral lens, a human is defined as the balance of the mind, body, and brain. These systems function on their own and influence each other in a dynamic equilibrium. Interactions between these systems are observed in every aspect of life. A pathological example of this relationship is that depression, a state of mind, can increase the risk of developing cardiovascular diseases. By studying a neurobehavioral model of health, empirical links between psychology and neurobiology can be uncovered. The basis of this capstone is to understand how neurobehavior works in clinical practice. This capstone project involved observation of seniors with Alzheimer's Disease (AD) who attend a memory fitness center. Their attitudes, interactions, and overall trends in their health and confidence over time were journaled. Adult day cares such as the memory fitness center ease the burden on the caregivers and allows individuals with memory impairment to challenge themselves and develop social skills. The journaling was done to assess satisfaction with the program and self-reported improvements to quality of life by the seniors and staff. Additional research was conducted as part of a pilot study that investigates olfactory neurobehavioral biomarkers of AD. This fieldwork is supplemented with literature that may help to elaborate on the neurobehavioral basis of Alzheimer's Disease.

INTRODUCTION

Neurobehavior informs the neurobiological model of the brain with an empirical model of human behavior. The purpose of this approach is to utilize neurobehavioral assessments in research and medicine. Assessing neurobehavioral baselines can enhance continuity of care by addressing environmental and psychosocial stressors. Without proper intervention, these stressors can become chronic and influence physical health.



Reciprocity of the mind and body. Retrieved from URL http://www.the-rheumatologist.org/article/sense-of-smell/3/



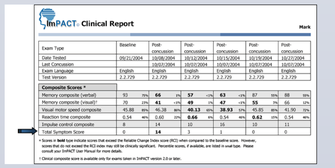
Physiological effects of Depression. Retrieved from URL https://jamanetwork-com.ezproxy.pcom.edu/data/Journals/PSYCH/5056/ynv7202f1.gif

Neurobehavior in Depression and Cardiovascular Disease

- Depression alters catecholamine levels due to sympathoadrenal hyperactivity (Lechin et al, 1995),
- Leads to enhanced platelet response (Musselman et al, 1998), diminished heart rate variability (Carney et al, 2001), and stress-induced myocardial ischemia (Carney et al, 2001).

Neurobehavior in Concussion Management

- Secondary injuries following concussive episode are often fatal
- Secondary injuries trigger widespread glutamate release
- Results in cerebral edema (Van Landeghem et al, 2006).
- Neurobehavioral baselines provide a means to monitor post-concussive patients


ImPACT - Clinical Report

Mark

Exam Type	Baseline	Post-concussion	Post-concussion	Post-concussion	Post-concussion	Post-concussion	Post-concussion
Exam Tested	09/21/2004	10/08/2004	10/12/2004	10/15/2004	10/19/2004	10/22/2004	
Last Concussion		09/21/2004	09/21/2004	09/21/2004	09/21/2004	09/21/2004	
Exam Language	English	English	English	English	English	English	English
Test Version	2.2.729	2.2.729	2.2.729	2.2.729	2.2.729	2.2.729	2.2.729
Composite Scores *							
Memory composite (verbal)	93 -7%	**66** -9%	**57** -13%	**63** -13%	87 -10%	88 -10%	
Memory composite (visual)?	70 -15%	**41** -14%	**49** -1%	**47** -11%	**55** -7%	66 -10%	
Visual motor speed composite	45.88 -8%	46.38 -8%	**40.13** -20%	**39.93** -21%	45.85 -8%	41.90 -15%	
Reaction time composite	0.54 -44%	0.60 -33%	**0.66** -9%	0.54 -44%	**0.62** -33%	0.54 -44%	
Impulse control composite	8	14	10	16	10	11	
Total Symptom Score	0	**14**	3	1	0	0	

* Scores in **bold** type indicate scores that exceed the Reliable Change Index score (RCI) when compared to the baseline score. However, scores that do not exceed the RCI index may still be clinically significant. Percentile scores, if available, are listed in small type. Please consult your ImPACT User Manual for more details.

† Clinical composite score is available only for exams taken in ImPACT version 2.0 or later.

ImPACT is a neurobehavioral assessment for concussion. Retrieved from URL http://www.glasersportsmedicine.com/concussion-management-and-impact-testing/

OBJECTIVES

To review literature that explores Alzheimer's Disease through neurobehavior and observe therapeutic benefits of memory fitness clinics for palliative care in seniors with AD.

METHODS

Literature Review

- AD prognosis with respect to psychosocial factors
- Neurobehavioral tests for AD

Memory Fitness Center

The senior group (n=14) was met once a week over the span of 4 months:

- Morning stretches
- Music Therapy
- Memory intensive games

Journaling of individual and group dynamics during sessions – Mood, participation, interest in activities

DISCUSSION

Morning stretches - 30 minutes

- Purpose - Physical activity and mindfulness with background music
- Group had variable involvement, many stopped participating in group stretches after 15-20 minutes
- Some members would sleep during morning stretches
- Three members did not pay attention to morning stretches but tapped their feet to background music

Music Therapy - 2 hours

- Purpose - Group socialization and mindfulness
- Group was encouraged to sing and each individual was given a lyrics sheet.
- Group members were encouraged to play instruments - the same seven people would use the instruments.
- Members who used instruments were more likely to suggest songs and drove less participating members to sing along

Guess What's in the Box Game - 30 minutes

- Purpose - Inquiry and recall exercise
- Many members lost interest in the game after a few minutes
- There were two members who were routinely involved in the game and were able to guess the object correctly - created distance from other members who did not show interest in the game

Senior A

- Always helped set out lunches, assisted others going to bathroom, offered to play music on ipod
- Did not participate in morning stretches, music therapy, or games
- Often quiet but became very talkative during lunch time.
- Felt that the Memory Fitness Center was a fun place to be, very satisfied with the group, did not feel as though memory was improving (>1 year attendance)

Senior B

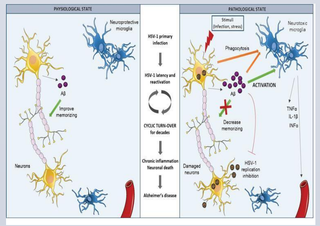
- Very vocal, cognitively more high functioning than the rest of the group
- Driver of activities, often encouraged other individuals to participate and congratulated them for their efforts
- Sat next to a particular friend and conversed with them frequently
- Very satisfied with Memory Fitness Center, felt as though memory was improving (>1 year attendance)

Senior C

- Quiet individual that frequently repeated their previous line of work
- Did not participate in activities or music therapy frequently - May have to do with cultural barriers
- Was often in a rush to leave towards the end of the day, claiming that they saw a loved one's vehicle

Neurobehavior in AD

- Subtle neurobehavioral changes may precede widespread amyloid-β and tau pathology (Devanand et al, 2000).
- Mouse models have shown that infection in the olfactory neuroepithelia can progress to olfactory cortex and limbic structures (Little et al, 2004).
- Several studies have shown that olfactory dysfunction is associated with cognitive impairment (Devanand et al, 2000; Wesson et al, 2010)
- Smell identification tests such as UPSIT may be useful in monitoring AD development (Devanand et al, 2000)
- Memory Fitness Center improves social support and negative behaviors which are two major factors leading to depression and reduced quality of life in AD and caregivers (Schulz & Williamson, 1991)



CONCLUSIONS

The analysis of the neurobehavior literature suggest that there is an association between cognitive impairment and olfactory dysfunction. Assessing olfactory function may be useful in diagnosing AD in research and clinical practice.

The preliminary data from the memory fitness center suggests that the seniors and their caregivers experienced improvements to their lives by attending the center. The seniors had opportunities to socialize and use their brains constantly. The caregivers felt less of the burden of disease when their loved ones with AD experienced mood stabilization.

Future Directions

- Standardized use of neurobehavioral assessments for a wider range of neurologic dysfunction
- Compare the cognitive status and olfactory function of individuals who have AD and attend a memory fitness center with individuals who have AD and do not attend a memory fitness center.
- Perform a longitudinal study of therapeutic benefits of attending a memory fitness center with a yearly follow-up and repeated neurobehavioral assessments.

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