

Cognition, Dementia, and Intervention

M. ROBERTS, C. VANDEWEERD, J. LOWENKRON, A. YALCIN, E. SAPPINGTON. *Evaluating older adult's brain health: preliminary results from a clinical trial using novel EEG technology. Gerontechnology 2018;17(Suppl):74s; <https://doi.org/10.4017/gt.2018.17.s.074.00>* **Purpose** In the United States, more than 5 million people are living with Alzheimer's disease (AD). This number is expected to rise to 16 million by 2050 as the population in the US ages¹. Our present mechanisms for assessing cognitive changes as adults age are inadequate^{2,3}. Conventional imaging techniques like magnetic resonance imaging (MRI's), are expensive, cumbersome and insufficient in quantifying memory, attention, and depression. Brain Network Activation (BNA) is a simple, cost-effective technique that uses well-established electroencephalography (EEG) technology and state-of-the-art machine learning to generate information regarding brain function and health (*Figure 1*). BNA was developed by EIMinda, an innovative technology company based out of Israel. To date, BNA has been used successfully with young adults aged 14-24 to track concussion recovery in the diagnosis and treatment of attention deficit disorder. This particular study is the first-of-its-kind to use BNA with older adults. BNA fills the need for an objective measure to help clinicians better understand the aging brain and identify cognitive changes earlier. Which, in turn, may help the future increased number of older adults with cognitive impairments age successfully and healthily. **Method** Preliminary data is presented from the BNA Reference Database & Longitudinal Registry of the Normal and Pathological Aging Brain: Brain Network Activation Analysis (BNA) for the Adult and Elderly Population Using Evoked Response Potentials project from 8/30/2017-9/27/2017. Research takes place in The Villages, a planned retirement community in Central Florida, home to approximately 120,000 older adults aged 50 and above. Interested participants were recruited from The Villages community. Informed consent was obtained. Participants conducted a standardized EEG test using BNA. Technicians placed a 64-sensor EEG cap on participants and guided them through a battery of neurocognitive tasks. Resting EEG was recorded at the beginning and end. Auditory oddball, delayed-match-to-sample, and Visual-Go-No-Go tasks were completed. EEG signals were cleaned, band pass filtered, cut into epochs, averaged with event related potentials (ERPs) and analyzed using BNA. Additionally, participants underwent an in-person comprehensive health assessment in which standardized and well-developed instruments assessed domains including: mental state, memory, psychological status, physical activity, and nutrition. Participants were stratified based on an initial health assessment across the following study arms: Healthy; Early AD; Depression; Mild Cognitive Impairment (MCI); General (Parkinson's Disease, Multiple Sclerosis, Anxiety). **Results & Discussion** Comprehensive health assessment data is available for 679 participants (Average age=70.5; N=313; Male; N=366 Female). Preliminary analyses indicate that BNA establishes repetitive and stable brain patterns in healthy older adults in the domains of early perceptual processing (ICC=0.77), perceptual processing/selective attention (ICC=0.88), attention orientation (ICC=0.88), attention driven inhibition/attention to memory (ICC=0.79) and pre-activation of the working memory (ICC=0.77) and characterizes significant differentiation between healthy aging brains and those experiencing adverse outcomes such as depression, early AD and MCI. As a result, BNA has the potential for early detection in cognitive changes, such as AD and MCI. Going forward, BNA may give medical professionals the ability to personalize, manage, and treat brain health challenges with maximum patient benefits.

References

1. Alzheimer's Association. Latest Alzheimer's Facts and Figures [Internet]. Alzheimer's Association. 2016 [cited 2018Jan15]. Available from: <https://www.alz.org/facts/overview.as>
2. Freitas C, Farzan F, Pascual-Leone A. Assessing brain plasticity across the lifespan with transcranial magnetic stimulation: why, how, and what is the ultimate goal? *Frontiers in Neuroscience*. 2013 Apr 2;7
3. Miraglia F, Vecchio F, Rossini PM. Searching for signs of aging and dementia in EEG through network analysis. *Behavioral Brain Research*. 2017;317:292-300

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Figure 1. Participant conducting BNA testing