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YOU ARE INVITED TO ATTEND THE DEFENSE OF THE DOCTORAL DISSERTATION

"IDENTIFYING DIFFERENCES IN FNIRS MEASURED BRAIN ACTIVITY DURING A RESTING STATE AND UPPER EXTREMITY DUAL TASK FUNCTION DUE TO HEALTHY AGING AND PATHOLOGICAL COGNITIVE IMPAIRMENT"

By

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Thursday, May 14th, 2026
10:00 AM
Stanley S. Bergen Building, 9th Floor, Room 926

Join Zoom Meeting:
https://rutgers.zoom.us/j/98015231381?pwd=QAzzHZMKIP0NpT7bv63vLYeKfec0b5.1

Meeting ID: 980 1523 1381
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Abstract

Shared characteristics between healthy aging and pathological cognitive impairment pose a challenge for dementia screening. Primary care physicians screen only half of older adult populations, and this is usually done after neurodegeneration has become untreatable. It is critical to develop an objective dementia screening technique capable of capturing changes in brain health as early as possible to allow for effective clinical intervention. Our previous work validated an upper extremity function (UEF) dual task (arm flexion and serial subtraction) to differentiate between cognitively healthy and cognitively impaired groups. Functional near-infrared spectroscopy (fNIRS) is a novel, non-invasive, portable technique that measures changes in brain cortical blood oxygenation levels. The central hypothesis of this work was that dementia-related differences in cortical blood oxygenation can be detected in regions involved in pathology using fNIRS under dual task conditions. The first aim of this work was to investigate differences in fNIRS-measured brain activity due to healthy aging to establish a baseline for older adults. The second aim was to explore differences in brain activity between cognitively healthy and cognitively impaired (mild cognitive impairment/ dementia) older adults. For both aims, brain activity was quantified using methods including a general linear model, connectivity, and complexity measures. Finally, for the second aim, outcomes from older adult participants were incorporated into a machine learning model to predict classification of participants as cognitively healthy or cognitively impaired. Findings suggest that healthy aging is associated with inefficient and inflexible information processing, resulting in compensatory increased task-evoked cortical brain activation. In contrast, dementia is characterized by further reduced neural activation and signal complexity, as well as less efficient functional network organization. Based on fNIRS outcomes, classification models were developed to predict cognitive status in older adults. In support of the hypothesis, the findings indicate that some differences in cortical blood oxygenation due to dementia can be identified using fNIRS. Additionally, both resting state and dual task conditions provide meaningful insight to the effects of aging and dementia. These results help to build a more robust understanding of the subtle changes between healthy aging and cognitive impairment, which is necessary for successful dementia screening early in the progression of the disease. This work corroborates the viability of multimodal sensor-based (fNIRS and gyroscope) measurements for use in early identification of pathological cognitive impairment.