

Abstract. The heterogeneity of pediatric stroke poses significant challenges for clinicians and researchers alike when attempting to predict outcomes and assess intervention efficacy. Factors including lesion location, onset, and etiology across individuals result in a wide range of observable clinical phenotypes representative of deficits across one or more functional domains. Given that motor-related deficits are most prominent, the development of neuroimaging-based biomarkers to predict motor recovery and treatment response is fast underway in adult stroke. CMC is a well-studied measure in adults and reflects communication between central and peripheral nervous systems based on the synchronization of brain and muscle-generated oscillations. Past work has shown that adults with stroke typically demonstrate reduced CMC compared to age-matched controls and that the degree of symmetry in CMC between affected and less affected upper extremities corresponds to more favorable motor status and motor recovery outcomes. CMC remains underutilized in pediatrics despite encouraging preliminary work in children and adults with unilateral cerebral palsy showing abnormal coupling patterns between neural and muscle signals. This pilot project will determine the feasibility of CMC as a biomarker of motor status and recovery in children with HCP. We will evaluate affected and less affected upper extremity CMC using EEG and EMG during an isometric hand squeezing task.

Our central hypothesis is that CMC is a key potential biomarker in children with HCP. This project spans 24 months. During the first year of our pilot project, we plan to measure CMC in children and adolescents with HCP to ascertain recruitment feasibility (Aim 1a) and measurement feasibility (Aim 1b). During the second year, we will obtain serial CMC measurements in children with hemiplegia participating in a weeklong m-CIMT camp (Aim 2). The ultimate goal of these pilot project aims is the application of CMC as a biomarker in an innovative clinical trial that may entail longitudinal CMC collection in the presence of a standardized upper extremity intervention such as CIMT or Hand Arm Bimanual Intensive Therapy (HABIT) combined with non-invasive neuromodulation targeting brain regions identified during CMC testing. This project will enhance our understanding about motor recovery in HCP and provide the necessary foundation for future work from this research team.

Our research team brings unique expertise for successfully accomplishing the proposed aims. Dr. Cassidy's (PI) research in neuroimaging, neuromodulation, and biomarker development in adult stroke combined with Dr. Surkar's research involving the assessment and intervention of cognitive-motor dysfunction in children with HCP ensures comprehensive analysis and interpretation of neuroimaging data acquired in this study. Co-Investigators Thorpe and Holland built careers on advancing research and clinical practice in CP and advocating for children and adults with HCP. Their involvement in this study will instill confidence in our participants and their families. We anticipate completion of all data collection over three months; data analysis and interpretation in five months; dissemination of findings in five months; and R01 planning and development over three months. Our team will meet monthly to discuss the progress of the study.