

## **Abstract**

Neurosurgical planning often utilizes functional magnetic resonance imaging to determine regions of the eloquent cortex and minimize post-neurosurgical functional deficits. However, neuronal causality of the eloquent cortex often is not investigated. The additional information gained from neuronal causality could potentially improve post-neurosurgical outcomes. This work begins initial investigations into the utility of resting state neuronal causality as measured by spectral dynamic causal modeling via three aims. The first demonstrated neuronal causality differences in the default mode network between individuals with and without temporal lobe epilepsy which led to inhibition of the left hippocampal formation. The second demonstrated the effects of two data processing steps, slice timing correction and temporal filtering, on the results of spectral dynamic causal modeling, suggesting optimal processing pipelines differ based on level of analysis. Finally, the third demonstrated neuronal causality differences in both the default mode network and the sensorimotor network between individuals with and without frontal lobe tumors. Notably, causal mechanisms which may lead to motor deficits were found. Numerous paths for future work are given, both with respect to these clinical populations and effects of processing on measures of neuronal causality. This work demonstrates potential group differences which may be exploited in future treatments and why the effects of processing are important on model results.