Poster Title: Integrating Technologies for Measuring Change in Behavior in Individuals with Intellectual and Developmental Disabilities

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Overview: The efficacy of clinical trials addressing behavioral issues in individuals with intellectual/developmental disabilities (IDD) has traditionally been hampered by lack of objective and sensitive measures. While there are many behavioral observation measures available, most of them either rely on recall of the event or are designed for use by trained professional observers, requiring a third party or extensive training by parents or teachers to use. This poster will describe two potentially overlapping technological solutions to outcome measures for behavior change in individuals with IDD; 1) the use of accelerometers to detect repetitive behaviors; and a parent and teacher smartphone application to identify and measure discrete behaviors in real time.

Method: For the repetitive behavior study, data was collected on 20 subjects in an IRB approved study at the Carolina Institute for Developmental Disabilities (CIDD) in the UNC School of Medicine. All subjects had IDD with history of repetitive behaviors. Data was collected during a 1-hour observation and interaction protocol. Recorded videos were annotated for repetitive behaviors by a trained coder to serve as the ground truth for the automated detection algorithm. 3-axis accelerometers were placed on each wrist via custom wrist band, on the chest, and on the back of the shirt collar. All sensor data was logged and time synched for offline analysis. Rocking and flapping detection algorithms were developed separately using an iterative process of signal analysis and algorithm parameter adjustment to optimize detection reliability.

Results: The repetitive behavior study has yielded positive results with the sensitivity for automated rocking detection at the subject level ranging from 46 -100 % with mean sensitivity of 80%. The positive predictive value (PPV) for rocking detection ranged from 63-94 % with a mean PPV of 84.2 %. The flapping detection algorithm had an overall sensitivity of 93% and a PPV of 55%. However, when using a less strict video annotation of “abnormal repetitive hand movement”, the sensitivity and PPV were 91.2 % and 94.8% respectively.

Discussion: As compared to previous studies that used machine learning approaches to identify stereotypy, an algorithm was developed that directly used the amplitude and frequency characteristics of the accelerometer signal. The algorithm developed in this study appears to be generalizable across individuals with repetitive behaviors, although could be customized to better capture specific personal stereotypy patterns. The approach developed in this pilot study has the potential to provide accurate, objective, quantitative outcome measurement. Further, the approach is easily adapted for use in community settings.

Data will also be presented from a pilot study of the use of the Measuring Outcomes for CHAnge app (MOCHA). MOCHA has been piloted for feasibility and is currently being used as an outcome measure in treatment trials at the CIDD. Results from both studies will be discussed within the context of developing an integrated system for monitoring behaviors in individuals with IDD.

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References:

  *Measuring repetitive behaviors as a treatment endpoint in youth with autism spectrum disorder*