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Objectives: We investigated the feasibility of using physiological biomarkers to predict the onset of aggression in minimally verbal (MV) youth with autism spectrum disorder (ASD).

Methods: Nine MV youth with confirmed ASD wore a wristband-mounted E4 biosensor during repeated unstructured observation periods while they were hospitalized in a specialized child psychiatry unit. Physiological and three axis acceleration data were collected concurrent with coding of aggressive behavior. Physiological arousal was measured by: 1) heart rate and heart rate variability, both derived from blood volume pulse (BVP) and interbeat interval (IBI) via photoplethysmography at 64 Hz; and 2) electrodermal activity (EDA), which reflects autonomic innervation of sweat glands. Advanced signal processing and machine learning algorithms were then applied to predict aggression onset. The area under the curve (AUC) accuracy (based on true/false positive rates) was calculated to predict the onset of aggression in the next one minute from present time (t). The predictions were made through a ridge-regularized logistic regression using: 1) previous t = 3 minutes of motor movement acceleration (ACC) signals; 2) time elapsed since last aggression event; 3) previous t = 3 minutes of BVP, EDA, and IBI signals; and 4) all of the above signals combined.

Results: All youth tolerated the sensor after desensitization, usable data were obtained in all cases, and there was an average of 9.67 (range = 0-44) aggressive episodes per four-hour observation period. Time-synced coding of aggression and concurrent E4 signal data predicted the onset of aggression with AUC ranging from 0.69 to 0.78. Discriminative power increased by seven percent as each additional signal was added.

Conclusions: Our pilot data indicate that it is feasible to obtain physiologic and motor movement data from wearable biosensors in MV youth with ASD and aggression. When all data streams were combined, three minutes of data predicted the occurrence of aggression in the following minute with an AUC of 0.79. This will likely improve after applying more advanced classification algorithms to a larger data set. Developing a biomarker-based predictive system for imminent aggression could open a new window for understanding and intervention in youth with MV-ASD and challenging behaviors.

AGG, ASD

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5.13 DESIGN AND EFFICACY OF A WEARABLE DEVICE FOR SOCIAL AFFECTIVE LEARNING IN CHILDREN WITH AUTISM

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Objectives: Applied behavioral analysis (ABA) is an effective form of therapy for children with autism spectrum disorder (ASD), but it faces criticism for being ungeneralizable, too time intensive, and too dependent on specialists to deliver treatment. Earlier age at onset of therapy is one of the strongest predictors of later success, but waitlists to begin therapies can be as long as 18 months. To combat complications associated with the clinical setting and expedite access to therapy, we have begun development of Autism Glass, a machine-learning-assisted software system that runs on Google Glass and an Android Smartphone; it is designed for use in the child's natural environment during social interactions. This is an exploratory- and co-designed-based study to see how children with ASD respond to our device and examine preliminary data on its effectiveness.

Methods: We sent our Autism Glass home with 14 families (mean age = 9.57 years, SD = 3.37; n = 3 females) and assessed changes from intake to conclusion (after several months using Glass) through the following: 1) evaluations and parental observations, mainly by the Social Responsiveness Scale, Second Edition (SRS-2); 2) an "emotion guessing game" (EGG) to assess how well children correctly labeled emotions in person (of 40 questions); and 3) parent-qualitative reports. We used a repeated-measures one-way ANOVA to analyze changes in both SRS-2 and EGG scores. Participants were also asked to provide feedback on the mobile application (app) interface.

Results: There was a significant decrease over time in SRS-2 total scores by an average of 7.14 points [$F(1,13) = 33.20$, $P \leq 0.001$, higher scores indicate higher ASD severity]. EGG scores also significantly increased by an average of 9.55 correct responses over time [$F(1,10) = 11.89$, $P \leq 0.01$]. Parents reported increases in eye contact and greater social acuity. In addition, participants shared innovative feedback, which led to user experience design changes on the mobile app.

Conclusions: This study established Autism Glass as an accessible prototype for mobile therapy behavioral intervention. Additional research is necessary to further validate Autism Glass as a therapeutic tool, and an RCT is currently underway. This also supports the use of ubiquitous mobile technologies for therapeutic purposes for neuropsychiatric disorders as a whole.

ASD

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5.14 ATTENTION TO EYE IN STILL FACE STRONGLY RELATED TO SOCIALITY COMPARED TO OTHER SOCIAL INFORMATION IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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