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Evaluating atypical language in autism using automated language measures

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Keywords

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Abstract

Background

Structural and pragmatic language deficits are core symptoms of Autism Spectrum Disorder (ASD) and predict long-term outcomes. Clinical measurement of language proficiency is cumbersome and costly; however, Automated Language Measures (ALMs) can be automatically calculated from language samples.

Objectives

1. examine language differences between three clinical groups (ASD, Attention Deficit Hyperactivity Disorder (ADHD), and Typically Developing (TD)); 2. analyze the convergent validity of these measures by calculating correlations between the ALMs and standardized language measures; 3. investigate the accuracy of each individual ALM in predicting ASD status; and 4. investigate any gains in accuracy obtained by combining all ALMs together to predict ASD status.

Methods

169 participants (96 ASD, 28 TD, 45 ADHD) ages 7 to 17 were evaluated with the Autism Diagnostic Observation Schedule (ADOS-2), module 3. Transcripts of one ADOS task were analyzed with novel software to generate seven ALMs for each participant: Mean Length of Utterance in Morphemes (MLUM), Number of Different Word Roots (NDWR), um proportion, content maze proportion, unintelligible proportion, c-units per minute (CPM), and repetition proportion.

Results

Nonparametric Kruskal-Wallis ANOVAs showed significant group differences ($p<.01$) for all except repetition proportion ($p=.07$). TD and ADHD groups did not differ from each other in post-hoc analyses. The ASD group showed significantly lower language skills. ALMs were correlated with standardized clinical evaluations of ASD. In logistic regression analyses adjusted on age and IQ, four ALMs were found to significantly predict ASD versus non-ASD status with accurate classification ranging from 67.9% to 75.5% and an overall correct classification rate of 82.4% for the combined model.

Conclusions

All seven ALMs show improved accuracy of ASD prediction over a baseline model using only age and IQ; a combined model achieves a highly improved prediction model for ASD diagnosis using easily classifiable language measurements.