Title: Effects of Social Anxiety and Autism Severity on Pragmatic Language in Young Adult Males with Fragile X Syndrome

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Introduction: Pragmatic, or social, language competence relies on the integration of multiple social, affective, and cognitive domains that interact with one another over time. Studying pragmatic language in neurodevelopmental disorders, such as fragile X syndrome (FXS), reduces heterogeneity through greater loading of genetic constraints (Fidler, Lunkenheimer, & Hahn, 2011). FXS is often associated with elevated rates of pragmatic language impairments, moderate intellectual disability, and increased symptoms of social anxiety and autism spectrum disorders (ASD; Bailey, Raspa, Olmsted, & Holiday, 2008; Cordeiro, Ballinger, Hagerman, & Hessl, 2011). It is speculated that social anxiety contributes to poor execution of language expression and learning due to social isolation and avoidance of social-interactive contexts. Pragmatic impairments are also a universal feature of ASD, and investigation into the role of autism and social anxiety in FXS on pragmatic language skills helps address the heterogeneity and influence of these behaviors. This is the first study to examine the effects of social anxiety and ASD symptoms on pragmatic language in young adult males with FXS using a semistructured, dynamic, conversational assessment. Dynamic assessments provide greater ecological validity through examining the level of environmental support required for optimal pragmatic performance. It is hypothesized that greater social anxiety and ASD severity will predict poorer pragmatic language performance illustrating the detrimental effects of these behaviors on the growth of fundamental language skills that support reciprocal social interactions in adulthood for males with FXS.

Methods: Participants included 28 young adult males ($M_{age}$ 19.6, $SD$ 2.2) with FXS. The Yale in Vivo Pragmatic Protocol (YiPP; Simmons, 2015) was administered to characterize use of appropriate pragmatic language and the level of contextual scaffolding from the examiner needed to elicit the target skill through error and cue scores. Error scores ranged from 0, appropriate spontaneous, to 2, completely inappropriate responses, and higher error scores are indicative of greater impairment. Cue scores ranged from 0, no response, to 6, spontaneous appropriate answer, and higher cue scores are indicative of better performance and less contextual scaffolding. The socially avoidant subscale from the Anxiety, Depression and Mood Scale (ADAMS) assessed dimensional aspects of social anxiety behaviors. Autism Diagnostic Observation Schedule-2 (ADOS-2) provided an autism severity index. Social anxiety and ASD severity were examined as predictors of language impairment after controlling for expressive vocabulary level.

Results: Participants had a mean error score of 1.31 ($SD$ .46) reflecting language responses that tended to be mildly to completely inappropriate and cue scores of 2.92 ($SD$ 1.38) indicating appropriate responses were elicited after greater scaffolding of conversational probes through nonspecific or specific verbal repetition or cues. Higher rates of social anxiety ($B$=.04, $p=.048$) and ASD severity ($B$=.07, $p=.034$) predicted greater language errors ($R^2=.48$). However, only increased ASD severity was associated with greater need for contextual scaffolding ($B$=-.20, $p=.038$, $R^2=.47$) after co-varying for expressive vocabulary.

Discussion: These findings highlight a complex relationship between social anxiety, ASD severity, and pragmatic language impairments in males with FXS. Results reflect the additive effects of social anxiety and ASD behaviors on poorer pragmatic language performance. Socially avoidant behaviors, associated with social anxiety, likely reduce opportunities for learning and hinder pragmatic language development. Relatedly, core ASD traits appear to account for the inability to pick up on contextual cues from their social-interactive environment. Intensive interventions tailored to reduce anxiety in social contexts may bolster pragmatic language skills in young adult males with FXS.

References: