Sex Differences in Pragmatic Language Ability in School-Age Children with ASD

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Background

- Autism Spectrum Disorder (ASD) is a developmental disorder in which individuals experience challenges with their behavior, social skills, and communication (DSM-V, 2013).
- Males are 4 times more likely to receive a diagnosis of autism (CDC, 2018), and it has been suggested that females with ASD may be less likely to receive a diagnosis because they are better at "masking" their symptoms. (Rynkiewicz, 2016)
- Pragmatic language refers to an individual's verbal and nonverbal communication, understanding and reciprocation of social cues, and ability to express appropriate social behavior (ASHA, 2019).
- Females with ASD demonstrate enhanced social skills (Head, 2014), increased pragmatic language ability (Parish-Morris, 2017), and higher levels of social motivation compared to males (Harrop, 2018).
- If females with ASD have stronger pragmatic language skills, it may serve as a linguistic camouflage and contribute to their ability to conform.
- The goal of this project is to examine:
  1. Sex differences in pragmatic language in children with ASD,
  2. Factors related to social communication differences,
  3. Whether sex moderates these differences.

Methods

Participants

31 children, including 15 male and 16 female participants with a confirmed diagnosis of ASD between the ages of 8 and 17 participated in this study.

Group	N	PRS Total	Full-scale IQ	Age in Months	Autism Severity
Males	15	M = 11.87 SD = 3.226	M = 101.20 SD = 24.302	M = 139.93 SD = 34.921	M = 7.20 SD = 1.971
Females	16	M = 8.31 SD = 3.071	M = 111.81 SD = 19.651	M = 164.5 SD = 35.340	M = 5.63 SD = 1.628

Measures

All participants completed a recorded conversational interview with a clinician, taken from the Autism Diagnostic Observation Scale (ADOS). Videos were then rated by coders who were blind to diagnosis using the Pragmatic Rating Scale-Modified (PRS-M). IQ scores were measured with the DAS-II.

Definitions

Pragmatic Rating Scale-Modified (Landa et al. 1992, Modified Ruser et al. 2007)	A rating scale measuring emotional communication, gesturing, language, and other behaviors to holistically measure overall pragmatic language ability.
Autism Diagnostic Observation Schedule, Second Edition (Lord et al. 1989)	A clinician-child interaction measure that scores the child's communication, social skills, and restricted or repetitive behavior (RRB). Calibrated severity scores (CSS) were calculated and used in these analyses.
DAS-II: Differential Ability Scales-II (2007)	An in-depth analysis of cognitive ability, or IQ.

Results

Question 1: Are there sex differences in PRS Scores?

A series of independent-samples T-Tests were run, comparing sex differences in all subscales of PRS scores. Then oneway ANOVA tests were run to determine whether sex differences were influenced by PRS scores or other variables.

Average PRS Scores by Sex
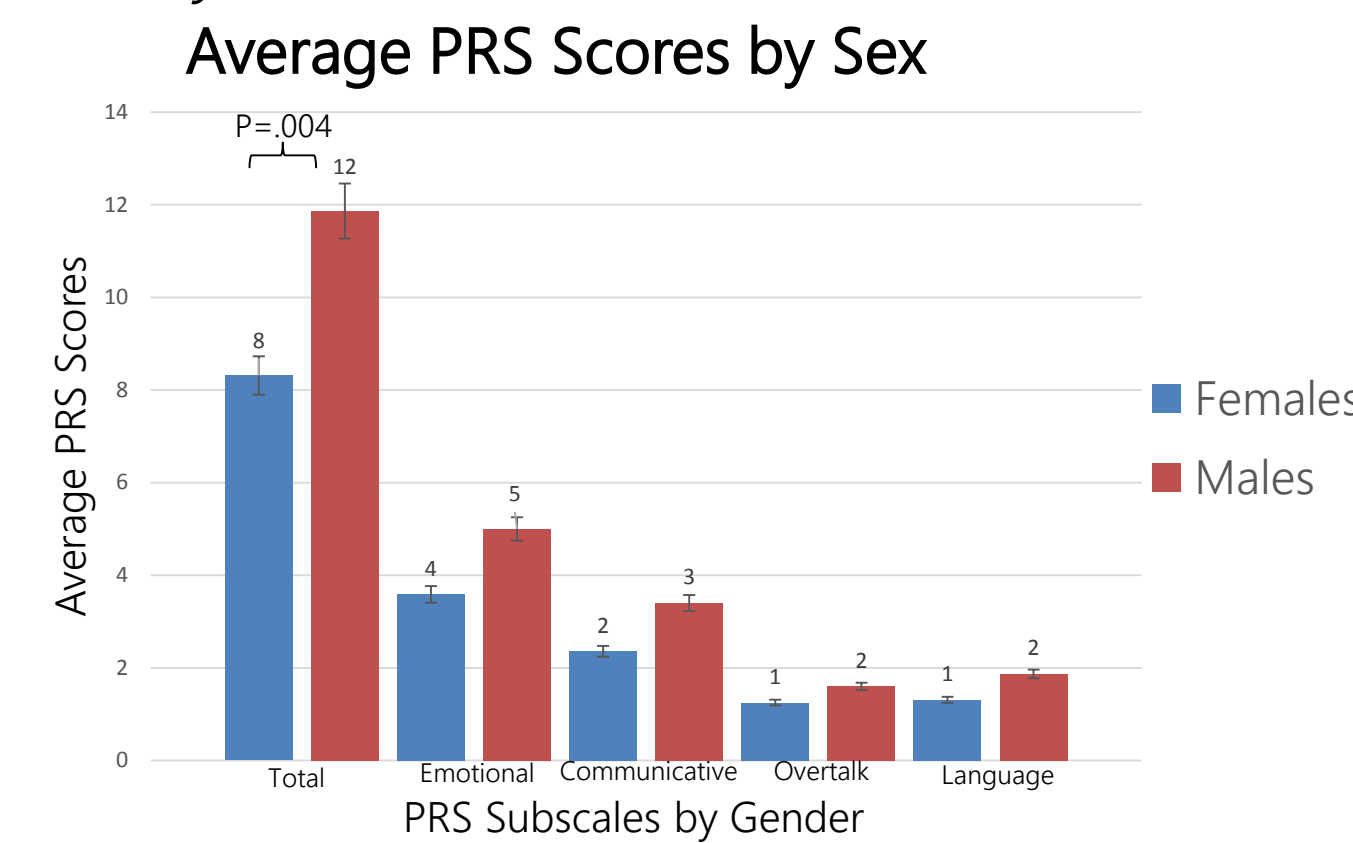
Following t-test analyses, females scored significantly lower (better) than males on PRS total scores (t(31)=3.143, p=.004). Females also scored marginally lower (better) than males on PRS emotional subscale (t(31)=2.002, p=.055). No other comparisons were significant

Effect Sizes by PRS Subscale

Measure	F Score	P-value
Total	9.876	.004**
Emotional	4.009	.055
Communicative	2.785	.106
Overtalk	.469	.499
Language	.756	.392

Total F scores have a main effect (F(1,29)=9.876, p=.004). Emotional PRS subscales have a marginal main effect (F(1,29)=4.009, p=.055). No other subscales have a main effect.

Effect Sizes by Variable

Measure	F Score	P-value
PRS Total	9.876	.004**
Autism Severity	5.915	.021*
Age	3.784	.061
IQ	1.798	.19

A Oneway ANOVA test with PRS total scores, age, IQ, and autism severity as dependent variables shows that with sex as a factor, PRS scores (F(1, 29)=9.876, p=.004) explain additional variability above age (F(1,29)=3.784, p=.061), IQ (F(1,29)=1.798, p=.19), and autism severity (F(1,29)=5.915, p=.021) for these sex differences.

Question 2: Do Age, IQ, Social Motivation, or Autism Severity Predict PRS Scores?

Correlations between all PRS Scores and Age, full-scale IQ, social motivation, and Autism severity were run.
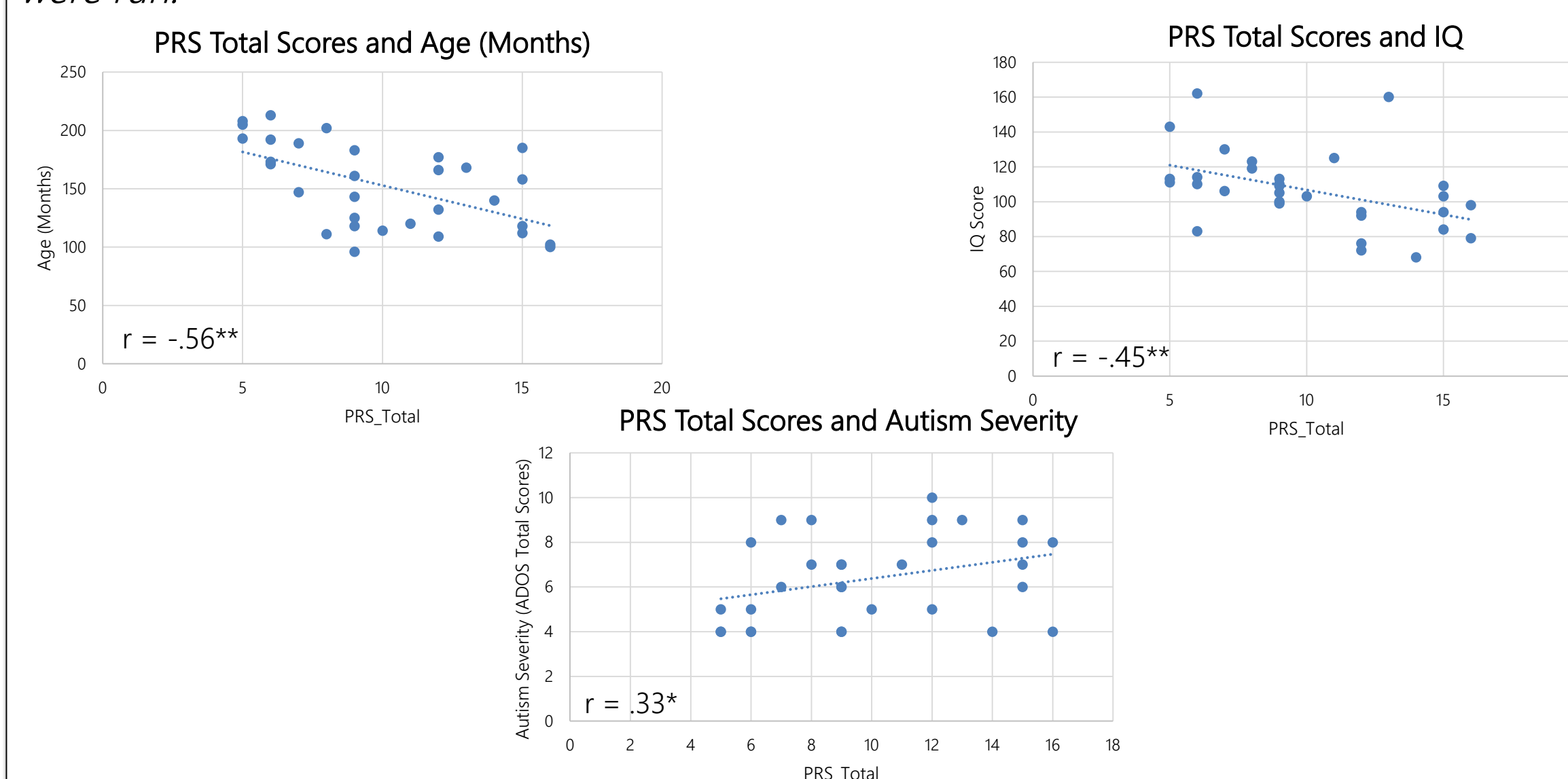
- There was a significant negative correlation between total PRS scores and age (r=-.56, p=.001), meaning older children with ASD demonstrated better pragmatic language ability.
- PRS total scores and IQ were negatively correlated (r=-.454, p=.005), meaning higher IQs were associated with better pragmatic language ability for children with ASD.
- Autism Severity and total PRS scores were positively correlated, meaning higher severity of autism symptoms was associated with having more difficulty with pragmatic language expression (r=.333, p=.033).
- No other significant correlations were found.

Question 3: Is sex a moderator of these relationships?

To determine whether participant sex moderated associations between PRS scores and age, IQ, or autism severity, univariate analysis of variance tests were run. PRS total scores and subscales were set as the dependent variable, and autism severity, age, and IQ were individually tested for interactions and main effects as covariates. Sex was a fixed factor in all cases.
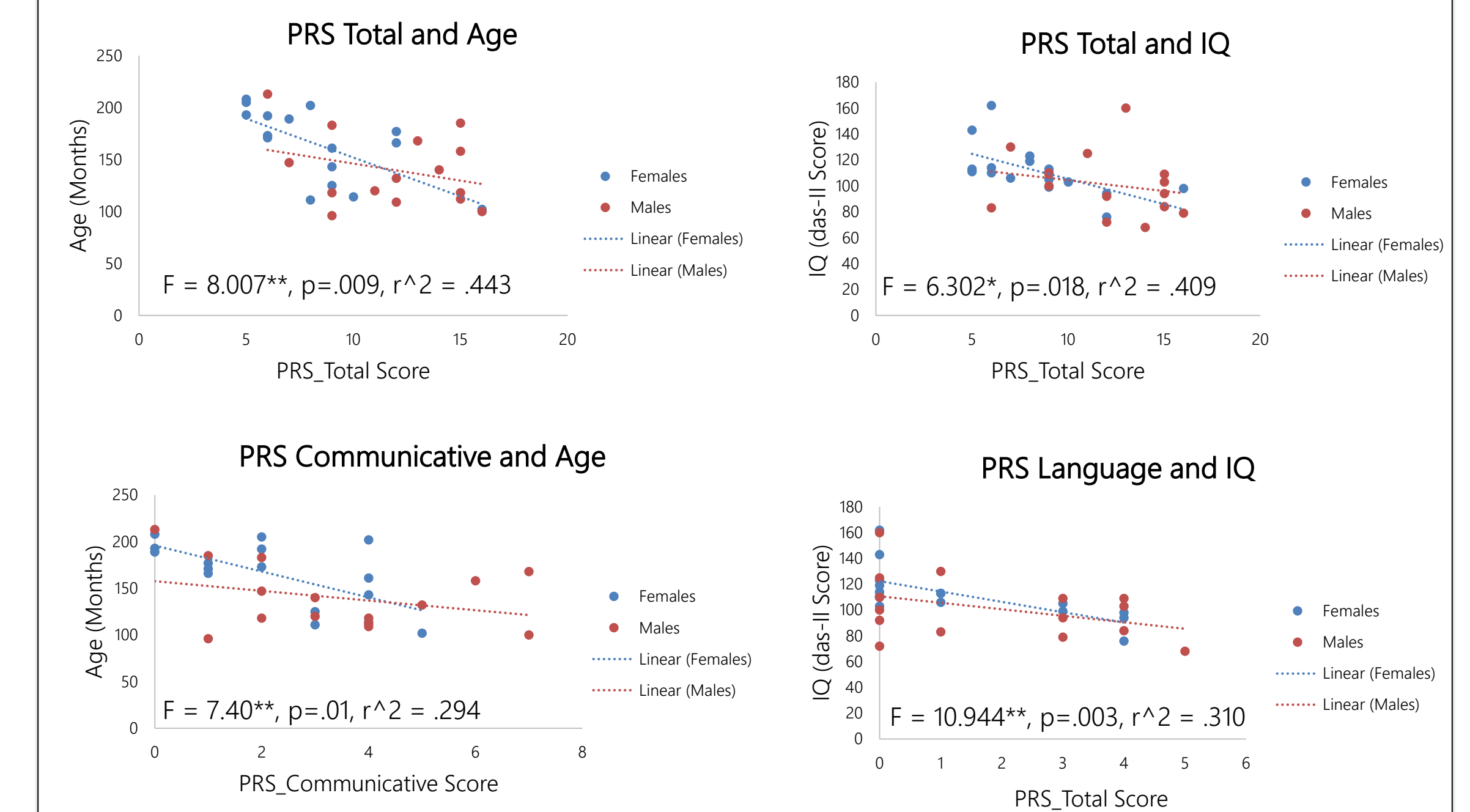
There were main effects, but no interactions, in the following models:
- PRS Total score (DV) and age (F(1,29)=8.007, p=.009)
- PRS Communicative subscale (DV) and age (F(1,29), p=.01)
- PRS Total score (DV) and IQ (F(1,29)=6.302, p=.018)
- PRS Language subscale (DV) and IQ (F(1,29)=10.944, p=.003)

Because no interactions were found, none of these relationships were moderated by sex.

Discussion

Summary
- Based on coding of the conversation part of the ADOS, females with ASD demonstrate better pragmatic language ability than males with ASD.
- This was true for the total PRS scores, but not the subscales. Therefore, there doesn't appear to be a significant factor that results in better pragmatic ability in females with ASD.
- There are factors outside of sex that were related to PRS ability-- age, full-scale IQ, and autism severity were all significantly correlated.
- While sex did not moderate the relationships between PRS scores and age/IQ, these variables had main effects with sex included in the model. Larger sample sizes may result in additional findings.

Limitations
- In our small sample, males did have more severe autism severity scores than females. Thus, future work will need to match the participants to have similar overall severity. We are currently working on coding a larger sample of participants.
- Due to the relatively small sample size, the sex differences that were *almost* significant may reflect low power to detect smaller differences.

Future Directions
- Further research should strive to understand what the underlying reasons exist for sex differences in pragmatic language ability. These may include (but are not limited to) biological differences, socio-cultural differences, or other factors.
- Overall, the findings in this study could aid in understanding sex differences in autism diagnosis, and how sex differences in pragmatic language ability may inform diagnostic practices moving forward.