

Sex Differences in the Relationship Between Puberty and Social Impairment: A Cross-Sectional Study of Children with Autism

T. Mooney, A. Kresse, M. Santhosh, S. J. Webb

Department of Child Health Behavior and Development, Seattle Children's Research Institute

Background

- Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that impairs an individual's social, communicational, and behavior skills (APA 2000).
- Males are 4.5 times more likely to be diagnosed with ASD compared to females (Christensen et al., 2016).
- A potential cause for differences in diagnostic rates may be that females tend to be more socially focused and so their awareness in social settings may be higher, allowing them to hide their autism symptoms (Tierney 2015).
- Puberty is a period in an adolescent's life where, along with physical and emotional changes, they experience the most changes in social development (Alsaker 1996).
- The goal of this study is to investigate differences in social ability by pubertal stage, to see if the trajectory of social skill across development is related to the physical changes associated with adolescence.
- Based on the hypotheses that increased social development occurs during adolescence and females are more socially focused, we expect an increase in social awareness, motivation, and cognition for females, and in those participants going through or in post puberty stages compared to those who have not yet started puberty. We also expect to find similarities in scores reflecting autism social traits of males and females before puberty but that females will have lower (better) scores compared to males during and after puberty.

Methods

Participants:

155 children (65 females, 90 males) aged 8-17 years with a confirmed diagnosis of autism participated in the study. All participants had an IQ over 70 and have a diagnosis of ASD confirmed via ADOS-2 and ADI-R.

Participants were categorized based on their own or their parents responses to puberty related stages ranging from 1 (not started) to 4 (seems complete). To compute scores for males, the questions about body hair growth, voice change, and facial hair growth were used. To compute scores for females, the questions about body hair growth, breast development, and menarche were used. Answers to these questions were summed, and these totals were used to divide children into pubertal categories. The Puberty Category Scores are as follows:

Sex	Prepubertal	Early Puberty	Midpubertal	Late Puberty	Postpubertal
Males	3	4-5	6-8	9-11	12
Females	2	3 (no menarche)	> 3 (no menarche)	< 8 (menarche)	8

Initial categories were based on a modified version of the Crockett 1988 criteria. Additionally, some groups were too small and Pre & Early groups were collapsed together, as well as Post & Late, forming 3 pubertal groups.

Sex	Pubertal Group	N	General Conceptual Ability	Age (months)
ASD Males	Pre	52	M = 99.29 SD = 16.31	M = 124.81 SD = 20.01
	Mid	27	M = 105.52 SD = 20.71	M = 172.56 SD = 24.32
	Post	11	M = 88.91 SD = 13.08	M = 200.55 SD = 10.38
ASD Females	Pre	18	M = 103.56 SD = 17.45	M = 116.67 SD = 19.92
	Mid	16	M = 94.31 SD = 13.73	M = 137.63 SD = 17.45
	Post	31	M = 104.13 SD = 24.80	M = 172.74 SD = 24.35

ASD males and females did not significantly differ on age or IQ

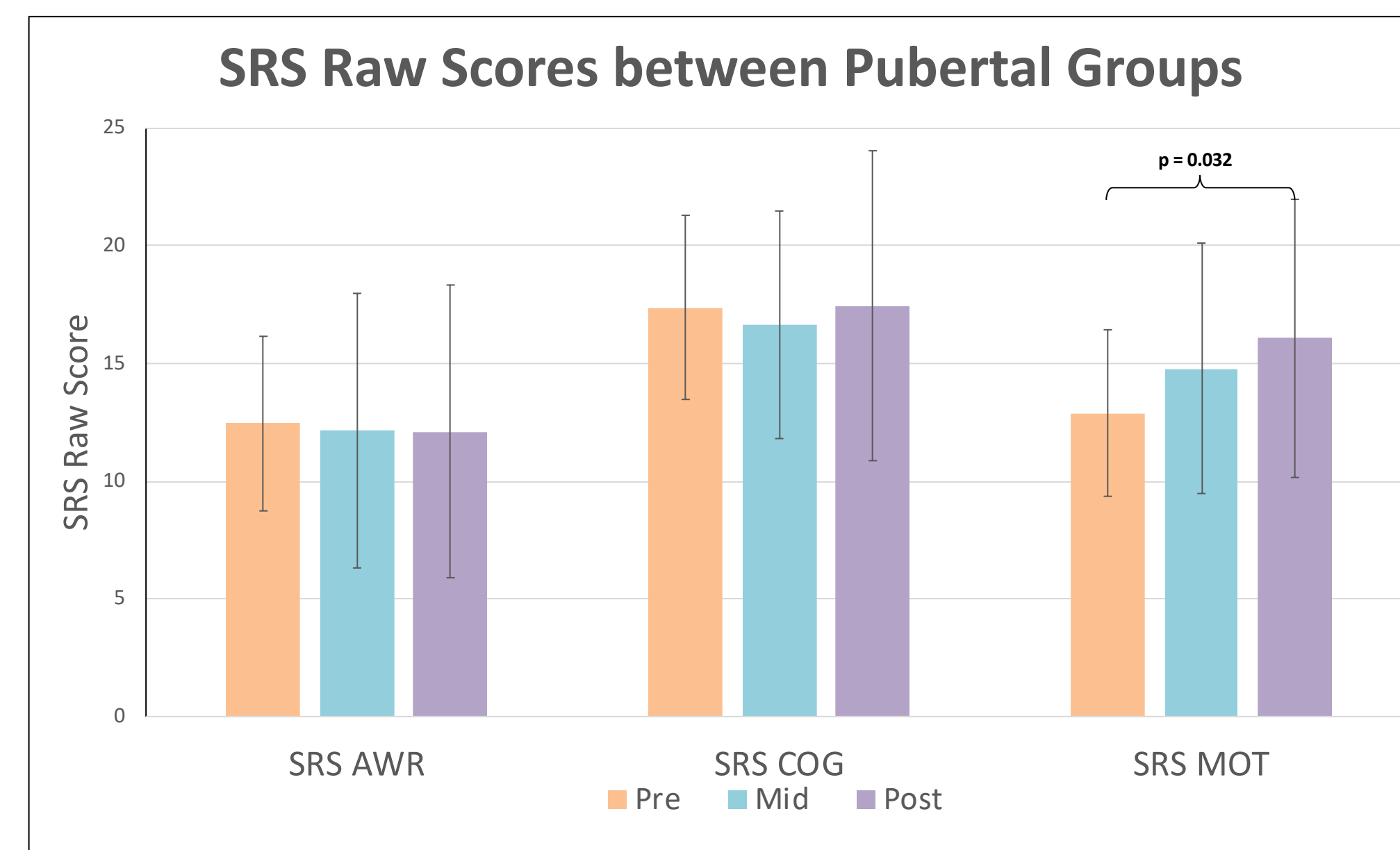
Measures:

Social Responsiveness Scale, Second Edition (SRS-2) (Contantino et al. 2012)	A survey completed by the parent about their child's social and autism-related impairments provides a total score as well as subscale scores for social awareness, social cognition, social communication, social motivation, and restricted interests and repetitive behavior.
Pubertal Development Scale (PDS) (Crockett 1988)	A survey completed by a child or their parent to measure their pubertal development. Scores are then computed into five categories based off a scoring algorithm. Categories include Prepubertal, Early Pubertal, Midpubertal, Late Pubertal and Postpubertal.

Results

Question 1: Are there differences in Social Awareness, Social Motivation, and Social Cognition Raw Scores Scores as measured by the SRS-2 between pubertal groups?

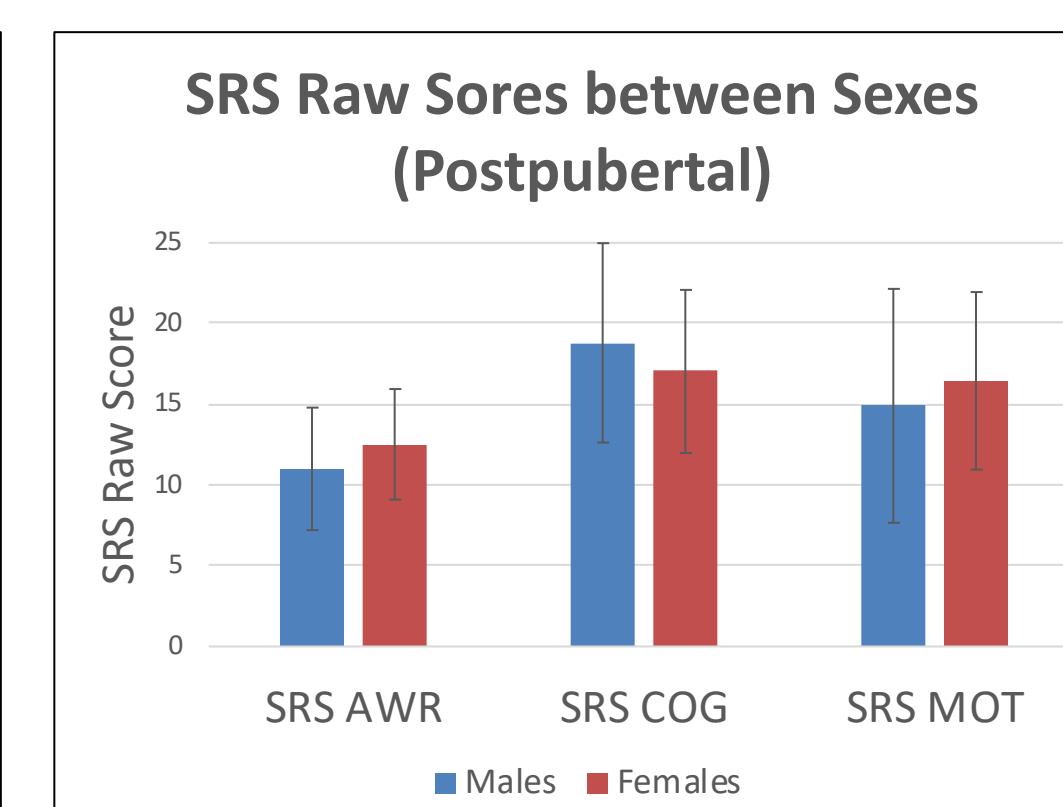
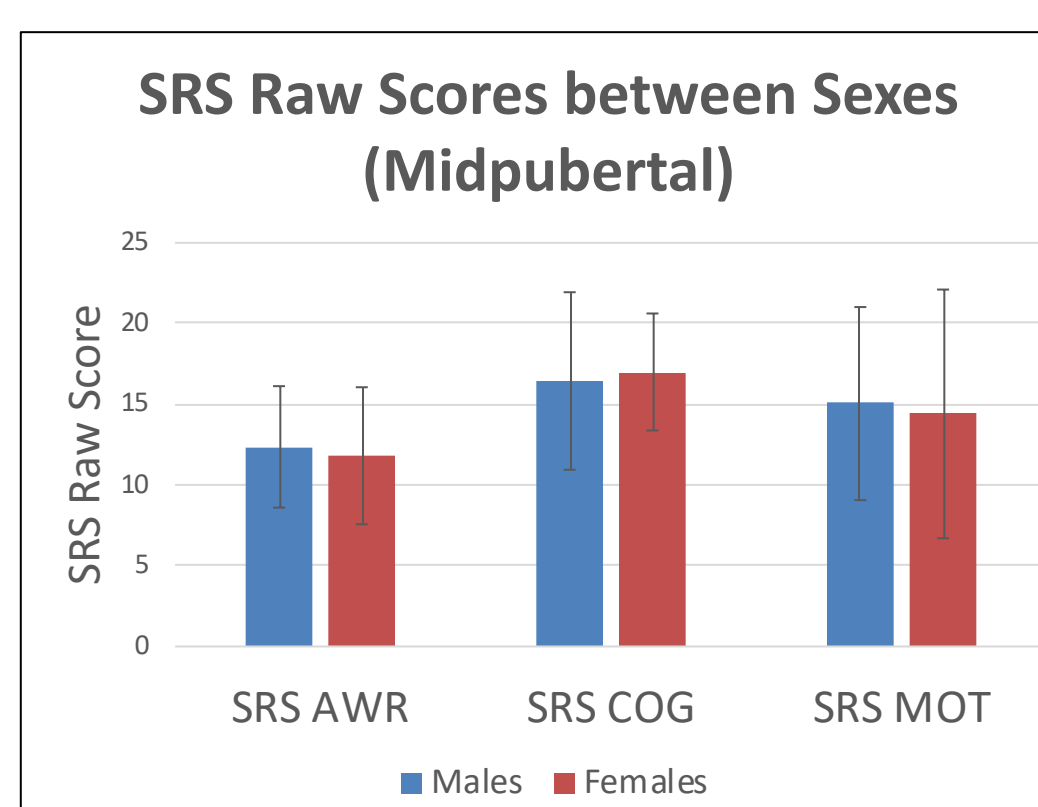
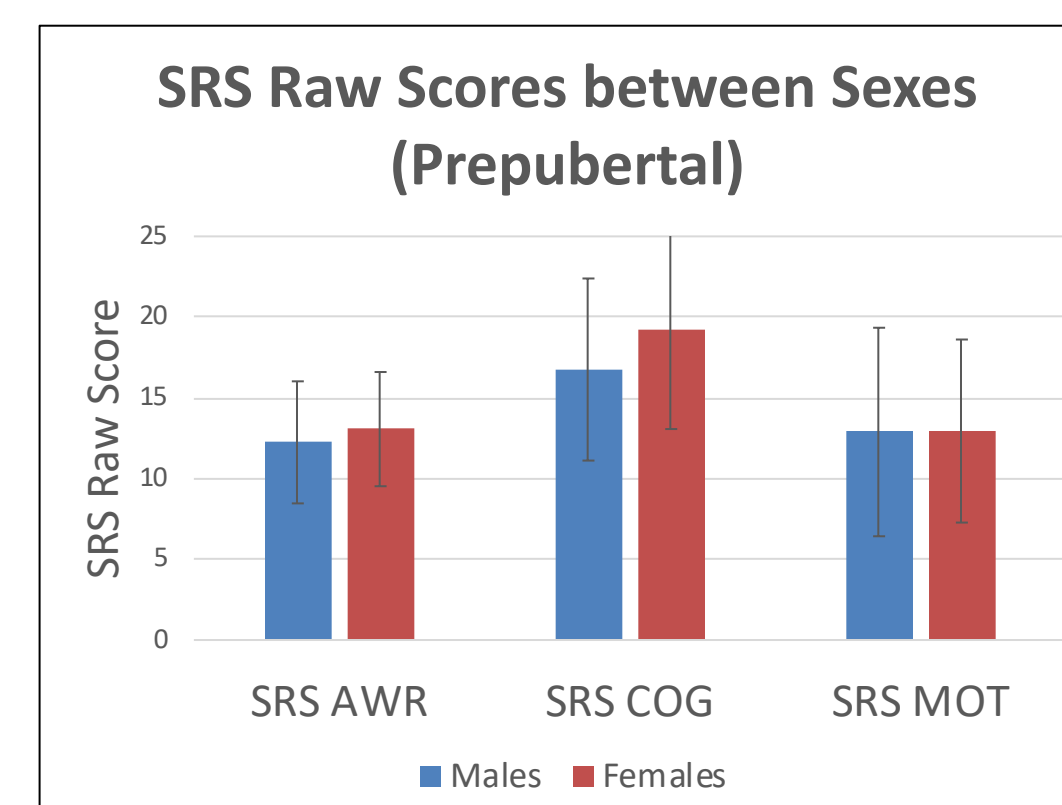
A 1-Way ANOVA was run comparing pubertal groups on SRS-2 subscales (Awareness, Cognition, and Motivation)



There was a significant main effect of pubertal group on autism severity scores for SRS MOT [$F(2,147) = 3.52, p = 0.032$], indicating more impaired social motivation in later pubertal development. Children in the post-pubertal group had significantly greater SRS motivation impairment compared to children in the pre-pubertal group.

Question 2: Are there sex differences in SRS scores within or between each pubertal group?

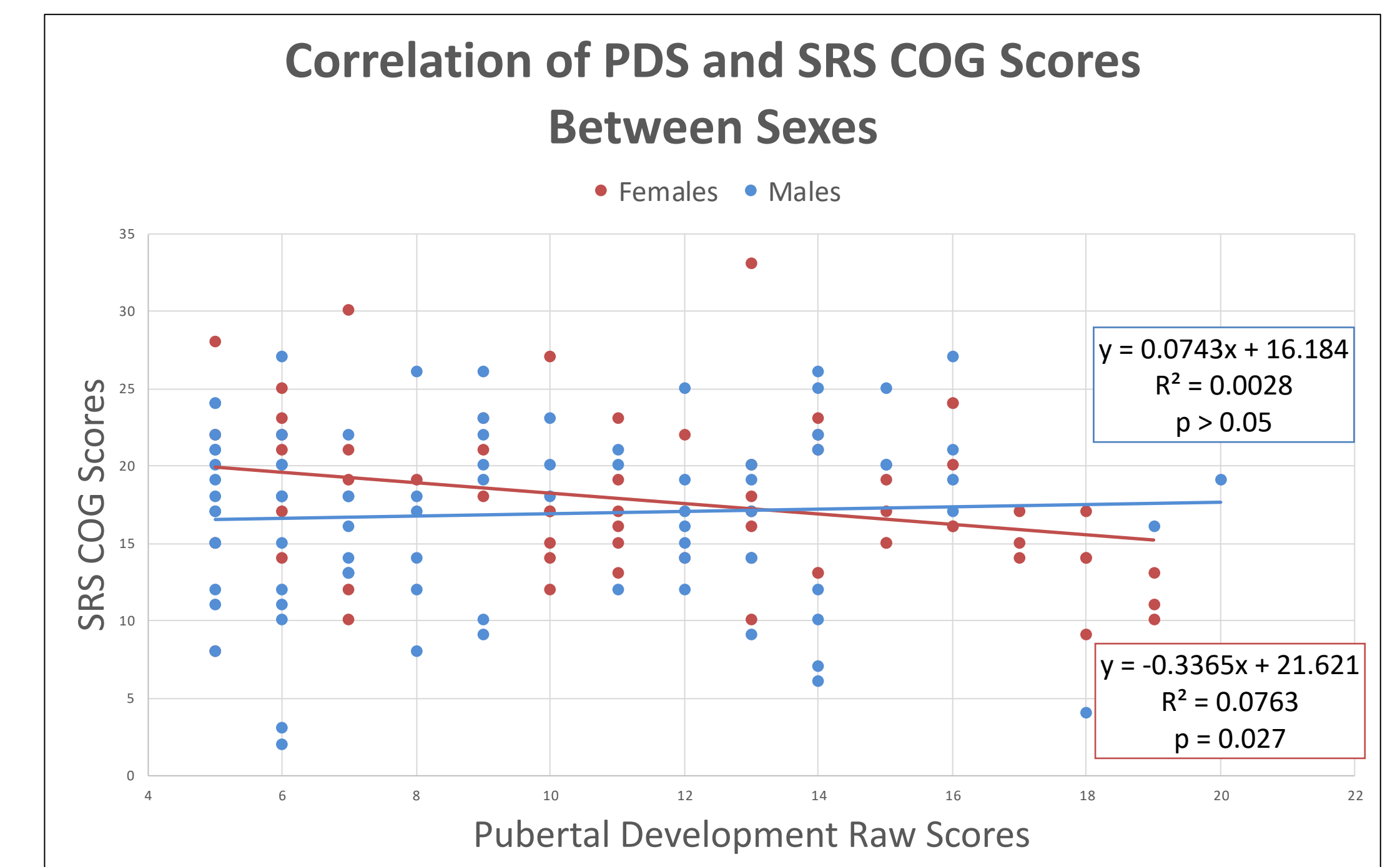
A series of Independent-samples t-tests were run comparing males and females on SRS-2 subscales



No differences in SRS Raw Scores within each pubertal stage for males or for females.

Question 3: Is there a relationship between puberty and the SRS, and does this differ by sex?

Correlations were run between SRS-2 subscales and Pubertal Development Scale Raw Sum Scores.



Higher Pubertal Development Scale Raw Sum Scores (indicating being further along in puberty) is associated with lower SRS COG scores (indicating less impairment; $R = -0.223, p = 0.027$), for females but not males. No other correlations were significant.

Discussion

Children in the postpubertal group had significantly greater SRS motivation impairment compared to children in the prepubertal group, suggesting that as children with ASD may be experiencing increased difficulties with social motivation with pubertal development. These results are the opposite of the hypothesis. These findings suggest that children with ASD may have increased social struggles later in or after puberty.

SRS Cognition was significantly correlated with Pubertal Development Scale Raw Sum Scores for females but not for males. This means that females who are farther through pubertal development were reported as having a better ability to process, store, and apply information in social situations.

Taken together, these findings suggest that the significant differences in prepubertal and postpubertal SRS Motivation scores do not depend on the sex of the child. Although none of the hypotheses are supported by our findings, question 3 results do suggest some sex differences in the relationship between puberty and social development. Additionally, when considering the results of Q1 and Q3 together, females appear to be more socially adept, despite being reported as having less social motivation in later pubertal stages.

One confounding variable may be the influence of age on SRS scores. Age and pubertal groups were significantly correlated, meaning the older children tend to be in the later pubertal stages (as expected), and so separating the effects of age/experience from the biological effects of puberty is challenging.

Additionally, children younger than 11 had their parents fill out the PDS survey, and if they were older than 11 they filled it out themselves. This adds a level of inconsistency related to self vs parent report.

Overall the findings for this study could aid in understanding the relationship between social and pubertal development and help uncover differences in development between males and females.