Relationship between Pubertal Development and Rates of Anxiety and Depression in Children with Autism Spectrum Disorder

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Background

- Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that impairs an individual's social, communication, and behavioral skills (APA 2000).
- These impairments can significantly impact an individual's mental health (Goodwin 2005).
- Adolescents are especially vulnerable to mental health disruptions during the transition through puberty due to the potential disjunction of physical and cognitive systems maturing at different rates (Steinberg 2005).
- The goal of this study is to investigate patterns in anxiety and depression rates across individuals with ASD during the different stages of puberty.
- We expect to find an increase in anxiety and depression rates in adolescents and individuals who are in the early, mid, late, and post stages of puberty relative to those who are pre-puberty.
- Additionally, we will compare rates of anxiety and depression in children with ASD to their unaffected siblings as an environmental control.
- We expect anxiety and depression severity to be higher in children with ASD compared to their unaffected siblings.

Methods

Participants:

155 children (65 females, 90 males) with a confirmed diagnosis of autism confirmed via ADOS-2 and ADI-R and 55 unaffected siblings (32 females, 23 males) participated in the study. All participants were 8-17 years old and had a verbal IQ over 70.

Participants were categorized based on parental rating of child pubertal 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. Initial categories were based on a modified version of the Crockett 1988 criteria.

| Cohort	Pubertal Group	N	Age (months)	Verbal IQ		
ASD	Pre	46	M = 117.43 SD = 15.94	M = 104.91 SD = 16.06	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.
	Early	24	M = 132.83 SD = 23.65	M = 91.75 SD = 19.69		
	Mid	43	M = 159.56 SD = 20.51	M = 100.91 SD = 20.51		
	Late	29	M = 173.97 SD = 26.21	M = 96.97 SD = 20.43	Medical History Form (National Institutes of Health 2012)	A survey completed by a parent, physician, and/or previous medical records which includes diagnostic, developmental, medication, and mental health history.
	Post	13	M = 193.54 SD = 14.33	M = 111.85 SD = 27.96		
US	Pre	18	M = 106.34 SD = 9.97	M = 111.28 SD = 7.60	Child Behavior Checklist (CBCL) (Achenbach System of Empirically Based Assessment 2001)	A questionnaire completed by a child or their parents used to assess adaptive and maladaptive behavior and overall functioning in individuals.
	Early	12	M = 127.42 SD = 20.92	M = 105.42 SD = 11.77		
	Mid	10	M = 152.10 SD = 18.82	M = 116.10 SD = 8.79		
	Late	12	M = 167.00 SD = 16.05	M = 117.58 SD = 13.29		
	Post	2	M = 201.00 SD = 8.49	M = 126.50 SD = 2.12		

For children with ASD, there was a significant main effect of pubertal group on participant age [$F_{(4,154)}$=48.29, p<0.001] and verbal IQ [$F_{(4,154)}$=3.01, p=0.020]. For unaffected siblings (US), there was a significant main effect of pubertal group on participant age [$F_{(4,53)}$=38.16, p<0.001] and verbal IQ [$F_{(4,53)}$=3.46, p=0.014]. Children in the more developed pubertal groups tended to be older and have higher verbal IQs.

Results

Question 1: Is there a correlation between raw pubertal score and rates of anxiety and depression?

Correlations were run between Pubertal Development Scale Raw Sum Scores and Anxiety and Depression.
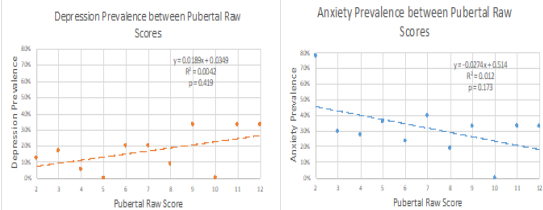
There were no significant effects of pubertal raw scores and prevalence of depression (r=0.065, p=0.42) or anxiety (r=-0.110, p=0.17).

Question 2: Is there a relationship between pubertal groups and prevalence of anxiety and depression in individuals with ASD?

A one-way ANOVA was run comparing pubertal groups on anxiety and depression prevalence using reported diagnoses on the Medical History Form.
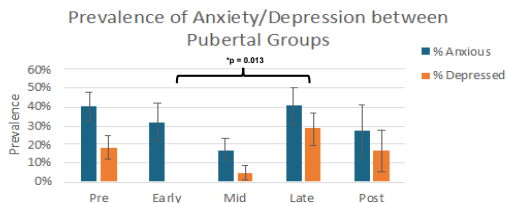
There was a significant main effect of pubertal group on depression prevalence [$F_{(4, 144)}$=3.29, p=0.013], indicating higher prevalence of depression in later stages of pubertal development. The percentage of children in the late-pubertal group who showed signs of depression was significantly higher than that of the children in the early-pubertal group. There were no significant main effects of pubertal group on anxiety.

Question 3: Is there a relationship in anxiety and depression severity between ASD children and unaffected siblings?

Independent T-Tests were run between ASD/US children and Anxiety/Depression Scores on the CBCL within each pubertal group
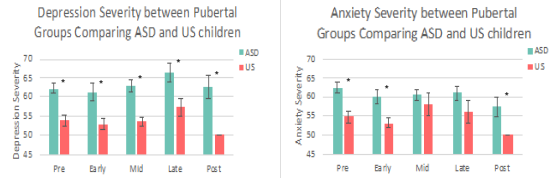
There was a significant difference in depression severity between ASD and US children in all 5 pubertal categories; Pre [$F_{(60,64)}$=3.30, p<0.001], Early [$F_{(30,31)}$=13.35, p=0.001], Mid [$F_{(50,52)}$=19.53, p<0.001], Late [$F_{(39,42)}$=5.77, p=0.021], and Post [$F_{(12,14)}$=1.60, p=0.002] pubertal groups, indicating higher severity of depression in ASD children through every stage of puberty compared to US children. There was also a significant difference in anxiety severity between ASD and US children in the Pre [$F_{(60,64)}$=2.28, p=0.050], Early [$F_{(30,31)}$=3.36, p=0.013], and Post [$F_{(12,14)}$=10.29, p=0.008] pubertal group indicating higher severity of anxiety in ASD children before, in early stages, and after puberty.

*p < 0.05

Discussion

- Children in the late-pubertal group had significantly higher prevalence of depression compared to children in the early-pubertal group, suggesting that as children with ASD develop they may be more susceptible to depression
- Children with ASD had a significantly higher severity of depression than the US group regardless of pubertal stages, suggesting that children with ASD are more susceptible to becoming depressed than their siblings without ASD.
- ASD children in the pre, early, and post pubertal groups also had a significantly greater severity of anxiety compared to US children.
- Taken together, the study suggests partial supports for both of our hypothesis. We expected to find increased rates of anxiety and depression for children going through or have completed puberty compared to individuals in the pre pubertal group. Although we did not find any significant differences in our pre pubertal group, we did find individuals who were in the later stages of puberty to have a higher prevalence of depression than those in the earlier stages of pubertal development. Additionally, we expected to see higher severity of depression and anxiety in ASD children compared to their unaffected siblings. We found that ASD children have significantly higher severity of depression than unaffected siblings in all 5 pubertal categories and higher severity of anxiety in 3 of the 5 pubertal groups.
- Pubertal development was significantly correlated with both age and verbal IQ, meaning the older children tend to have higher verbal IQs and be in the later pubertal stages. Separating the effects of age/experience from the biological effects of puberty is challenging.
- Overall the findings for this study could aid in understanding the relationship between mental health and pubertal development in children with ASD.